The TViews Table Role-Playing Game

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Abstract

The TViews Table Role-Playing Game (TTRPG) is a digital tabletop role-playing game that runs on the TViews table, bridging the separate worlds of traditional role-playing games with the growing area of massively multiplayer online role-playing games. The TViews table is an interactive tabletop media platform that can track the location of multiple tagged objects in real-time as they are moved around its surface, providing a simultaneous and coincident graphical display. In this paper we present the implementation of the first version of TTRPG, with a content set based on the traditional *Dungeons & Dragons* rule-set. We also discuss the results of a user study that used TTRPG to explore the possible social context of digital tabletop role-playing games.

Keywords: Tabletop platform, tangible interaction, role-playing games, social interaction, game design

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1 Introduction

People across all cultures and age groups engage in different forms of gameplay and storytelling, in both analog and digital form. As pastimes, games and storytelling offer various kinds of benefits, such as entertainment, relaxation, skill building, and competitive challenges. Many games incorporate storytelling elements, and certain stories also unfold in a game-like form.

One form of storytelling gameplay that has gained appeal since the 1970s are role-playing games, commonly referred to as RPGs. In RPGs, the players take on the roles of fictional characters that they themselves have created, and work together to tell a story within a given system of rules. In traditional role-playing games that are played face-to-face in small groups, the activity is guided by a game master, who helps to steer and shape the unfolding story, for example by setting challenges for the players to overcome. Story building happens in an improvisational manner, as participants determine the actions of their characters within the framework of the game, and collectively weave the fragments of the story into a coherent whole.

With the growth of personal computing and the internet, role-playing games have spread to the digital networked realm. These digital RPGs make extensive use of emerging computer technologies to enhance gameplay by immersing viewers into virtual worlds with stunning graphics and complex artificial intelligence based rule engines. Using the internet as a medium for play, massively multi-player online role-playing games (MMORPGs) operate in a networked mode and can engage thousands of players at a time. In these games, the face-to-face social interaction that is central to traditional role-playing games that take

Figure 1: Two players at the TTRPG game table

place in shared physical space has been replaced with remote interaction in shared virtual spaces online. Despite the rapid growth in popularity of digital and online games, market research conducted by traditional RPG manufacturer Wizards of the Coast indicates that there are still significant numbers of people who enjoy non-digital role-playing games (˜2.25 million regular players in 2000, with an additional ˜3.25 million occasional players) [Dan00]. The research also indicates that this form of gameplay is generally a complementary rather than conflicting pursuit to electronic gaming, and many players engage in both.

As new computer interaction methods such as tangible and mobile interfaces begin to make their way into the gaming and entertainment realm, the benefits of these separate worlds can be combined. In particular, digitally-augmented tabletops provide an ideal setting for new kinds of game experiences. Digital games on tabletop combine a traditional form of face-to-face around-the-table gaming, with the enhanced forms of gameplay supported by digital technologies, for example using computationally-driven rule-engines and a rich space of dynamically changing digital game content. Building on the emerging area of digital media tables for game play, TTRPG (TViews Table Role-Playing Game) is a digital tabletop role-playing game (RPG) that runs on the TViews table, a digital/tangible media table that uses an integrated display and computer to mediate multi-player interactions with the game through physical playing pieces (see Figure 1). TTRPG demonstrates how a fully realized tabletop digital RPG can engage players in face-to-face social gameplay by making use of a combination of digital and tangible game elements, and a human gamemaster who orchestrates a lively context for the unfolding game through improvised storytelling.

In this paper, we examine the context of tabletop RPGs and discuss related work on digital tabletop technologies and games. We then present our implementation of the first TTRPG system based on the *Dungeons & Dragons* rule-set and discuss the informal player feedback as well as the results of a user evaluation that explored the possible social context of digital tabletop RPGs.

2 Background Context

Narrative role-playing has been around in the performing arts for centuries, and can be seen as a precursor to today's tabletop RPGs. For example, from its origins in ancient Greece, theatre evolved as a storytelling form in which actors take on the roles of characters and perform them in front of a live audience. While most stage plays are tightly scripted, an improvisational form of theatre known as Commedia dell'arte gained prominence in 16th century Europe, making use of a basic set of characters and situations to create different stories at each show.

In addition to performance traditions, tabletop RPGs also stem from a long history of various game forms that incorporate aspects of character role-play, including certain table or board games, parlor games and children's improvised "make believe" games. While not necessarily geared towards storytelling, many board games are based on a simple narrative structure, such as a battle between opposing camps. More realistic versions of tabletop wargames and military simulations have also been used as a form of military training and planning, and require the players to put themselves in the mindset or role of the characters on the battle-field. A common feature of these wargames is the use of miniature figurines and tabletop terrain maps to illustrate the action. On the lighter side, children have been role-playing for centuries, making use of dolls, miniature figurines and other toys as characters and props in imaginary worlds. In the 1960s, wargames were combined with elements of fantasy fiction to form the first (traditional) tabletop RPGs as they are known today [Ril94]. The first commercially available tabletop RPG, *Dungeons & Dragons*, was created by Gary Gygax and Dave Arneson and published in 1974 by TSR (Tactical Studies Rules) Inc.

Traditional RPGs are conducted as small social

gatherings, where players typically sit around a table and play the game through voice interaction, slipping in and out of their character roles as they alternate between character dialogue, descriptions of character actions, and discussion of game mechanics. Game play often involves tangible props, such as dice, figurines, maps, and sheets of paper for describing players' characters (see Figure 2). The game is played according to a game system - a set of game mechanics or rules that are extensively described in the manuals for the game. For example, the d20 system which is based on the original *Dungeons & Dragons* game is used in many modern games. Frequently, the game system used is tied to a particular genre of game, such as combat-focused fantasy games.

Figure 2: The *Dungeons & Dragons* Basic Game set from Wizards of the Coast, including props such as maps, handbooks and miniature figurines

Each game is set in a fictional world where different adventures can take place. One participant acts as a gamemaster, who sets goals or challenges for the other players, describes the settings and actions of non-player characters (NPCs), and moderates or guides the overall flow of the gameplay and story. Before gameplay can begin, players must first create the character they will play in the game. RPG manuals provide guidance for how to develop a character for the given genre, which can be as richly described as the player desires. Characters are usually represented by statistics that provide a measure of how successful a character is likely to be at the tasks they will face during the unfolding game. The main types of statistics typically consist of attributes shared by all characters (e.g. intelligence, strength) and skills possessed only by certain characters (e.g. sword fighting). Dice rolls or a distribution of points are often used to assign character statistics. Once the play begins, dice rolls are also used to select from different actions that a character might take in a given situation. The success or failure of the character's actions depends on the combination of the outcome of the dice roll and the character's attributes and skills.

While face-to-face social interaction and tangible game elements have been lost in MMORPGs, some of the complexities and tedious aspects involved in the traditional form of game-play (e.g. keeping track of character statistics, evaluating moves, etc.) are offloaded to the computational game engine. Hybrid physical/digital RPGs that are played on digital media tables can combine the benefits of both worlds. In the following section, we look at the related work in the area of digital tabletop technologies and games.

3 Related Work

As the technologies for supporting multi-player interactions on shared tabletop displays have progressed over recent years, there have been an increasing number of research projects exploring the space of digital tabletop games. This section provides a brief overview of different technical approaches for digital tabletop interactions, as well as some notable work on digital tabletop games.

3.1 Digital Tabletop Technologies

Digital tabletops provide multi-user interaction around a shared horizontal display. Typically, interaction on the display surface happens either through finger touches, manipulation of tracked tangible objects, or a combination of the two. Sensing technologies range across optical, electromagnetic and acoustic approaches.

Many optical-based tabletop systems make use of computer vision algorithms for object and/or finger tracking. Examples of optical-based tangible tabletop displays include the metaDESK [UI97], I/O Bulb [UI99], the game table from the STARS platform [MMES04], PlayAnywhere [Wil05], the ReacTable [KB07] and the Microsoft Surface (http://www.microsoft.com/surface/). A touch-only example is the infrared frustrated total internal reflection (FTIR) based Multi-Touch [Han05]. In these systems, the vision-based sensing and coincident display are accomplished either from the front or from the rear. In most cases, rear-based systems are preferable, since both the projector and camera can be housed inside the table. These systems can more easily they avoid sensing/display occlusion from interfering objects, how-

ever the tables tend to be considerably bulkier since the projector and camera need to be placed at a sufficient distance below the surface. Another optical approach seen in the Philips Entertaible [LBB+07] makes use of a series of LEDs and photodiodes mounted around the perimeter of an LCD screen. This enables a thinner surface, which could be advantageous for traditional sitting tables, where users might place their legs underneath the table surface.

Other tangible object tracking approaches make use of electromagnetically actuable tags. For example, the Sensetable [PIHP01] is based on Wacom's tablet and pen technology that uses an antenna grid within the sensor board to track pens containing coil-and-capacitor resonant circuits. While a typical Wacom tablet can track only two pens at a time, the Sensetable modified the system using a duty cycling approach in order to allow a greater number of objects to be tracked at once. For multi-user touch interaction, the DiamondTouch [DL01] is a front-projected table that makes use of an array of antennas that transmit unique signals embedded in the sensing surface. Each user is capacitively connected to the surface through a separate receiver, allowing the system to distinguish their touches from those of another user.

In acoustic-based systems, tangible objects can be located by embedding ultrasonic transmitters inside them. Ultrasonic receivers placed around the sensing area pick up the short acoustic signals emitted by the objects and triangulate the object's location based on the time-of-flight of the signal from the transmitter to each receiver. The acoustic signal is typically transmitted through the air, which can result in errors if there are objects in the way between a transmitter and receiver. This approach has been used in a number of electronic whiteboard systems, such as Mimio by Virtual Ink (http://www.mimio.com). The TViews acoustic-based system [MRD06] avoids these problems by transmitting the signals through a glass display surface, and also places the receivers inside the objects rather than the table, allowing many more objects to be tracked on the table at once, since they can all listen to signals transmitted through the glass surface at the same time.

3.2 Digital Tabletop Games

Digital tabletops such as those described above are an ideal platform creating digital games that combine the tangible and social aspects of traditional board games with computational engines and digital graphics.

In some digital tabletop games, tangible playing pieces, such as pawns or pucks, serve as the primary means of navigation within the virtual game spaces. For example, False Prophets [MMI02] is a hybrid board/video game in which players make use of tangible playing pieces to move around a shared map, as well as handheld computers for private communication. The sensing surface is custom designed from a grid of infrared phototransistors that can detect a playing piece at each cell. Since the sensing is not continuous but limits the detection of pieces to specific locations on the surface, the projected gameboard display is designed so that each sensing location corresponds to a site on the map that a playing piece can occupy. The game itself was designed to enhance and explore player interaction. Players are separated into two unknown teams, and their goal is to discover which team each player belongs to by gathering clues and making observations. Wizard's Apprentice [PBJ06] is another game designed for research purposes, in this case to explore different player interaction styles based on their level and frequency of participation in an unfolding game. The sensing technology was custom designed using RFID technology to detect tangible playing pieces at specific locations on the board, and players work together to defend a kingdom against evil forces.

The STARS platform has also been used for tangible tabletop games, such as the role-playing game KnightMage [MMES04], in which players explore a dungeon filled with treasure, equipment and monsters. The game provides a combination of cooperative and competitive play, in which players must work together to survive against the monsters, while at the same time competing for individual riches. The main focus of KnightMage was to demonstrate the capabilities of the STARS platform, including its dynamically changing large game boards and sound system. Similar to False Prophets, the STARS platform also supports player interactions through Personal Digital Assistants (PDAs). These serve to display and administer private character information, and to send private message between players during gameplay.

On the Philips Entertaible, researchers have developed digital board games such as Yellow Cab [LBB+07] and Weathergods [BVH+07]. In Yellow Cab, players use tangible pieces representing taxi cabs to pick up and deliver virtual passengers. The game was designed to showcase how computation can en-

hance tabletop gameplay, for example through dynamic sounds and algorithmic simulations. In contrast, Weathergods was developed not for the sake of the gameplay, but as a vehicle to explore the effects of symbolic vs. iconic playing pieces on player interactions.

Some digital tabletop games have been created on multi-user touch-based surfaces, such as the games SpaceBalls [EW05] and SIDES [POMW06], both developed for the DiamondTouch table. In SpaceBalls, players use their fingers to delete colorful balls that appear on the screen. SIDES (Shared Interfaces to Develop Effective Social Skills) is a four-player cooperative puzzle game that was designed specifically to help adolescents with Asperger's Syndrome practice effective group work skills. Also on the DiamondTouch, researchers have implemented multiplayer multimodal wrappers for the existing commercial games Warcraft III and The Sims [TGSF06] in order to explore how workspace awareness through gestures, speech and gaze is a behavioral foundation that underlies collaborative tabletop interaction. In all of these examples, since the DiamondTouch supports interaction through touch only, the games do not support tangible playing pieces like traditional board games. Players instead use their fingers to interact with virtual information displayed on the table's surface.

Finally, there has also been research work on table-based Augmented Reality (AR) [NL05] and Tangible Augmented Reality (TAR) [US03, LWL05] systems for digital gameplay. In these cases, optically-tracked AR markers on a tabletop are associated with virtual game objects. Unlike the previously mentioned tabletop systems which provide coincident display on the table's surface, in tabletop AR systems the players need to wear see-through head-mounted displays (HMDs) to view the virtual objects.

4 TTRPG: TViews Table Role-Playing Game

The TViews Table Role-Playing Game (TTRPG) is a digital tabletop role-playing game that runs on the TViews table. TViews is an interactive tabletop media platform that can simultaneously track the location of multiple tagged objects in real-time as they are moved around its surface, providing a coincident graphical display. The shared display surface and object tracking capabilities make TViews table well suited for multi-player tabletop and board games with tangible interaction, e.g. using small figurines and playing pieces. The current implementation of TTRPG runs on a prototype of the TViews table, which uses an embedded electromagnetic tracking technology and overhead projected display. Future versions will run on an acoustic-based TViews implementation with embedded LCD screen.

Implemented in Java, TTRPG is based on the *Dungeons & Dragons* rule-set [Gyg78] and follows the traditional form of play, in which a gamemaster helps to coordinate the gameplay for multiple players and also provides an improvised narrative as the game unfolds. The players at the table manipulate tangible objects that represent their characters (fighter, wizard or rogue) and other game objects such as a selection tool and options circle. Play on the tabletop environment consists of three different modes: character selection, free play and fight.

In this section, we provide a brief overview of the TViews Table platform, and describe the different aspects of the TTRPG system. These include the gamemaster interface, the physical and digital game elements, the plot and content, and the different modes of play.

4.1 TViews Table

The TViews Table research prototype on which TTRPG currently runs is a tangible display platform that supports user interaction through the manipulation of tangible objects that are tracked on a horizontal sensing surface. The prototype was constructed using an inductive sensing technology that provides nine electromagnetically actuated tags and a sensing surface in the form of a loosely wound grid of antenna wires [MDI02]. With two antenna grids tiled together, the surface size is 18.5x14.5 inches. The tags are embedded in the base of the game objects, which consist of character pawns, options circle and selection tool (described below).

The coincident display of graphics on the interaction surface is provided by an overhead projector that is housed in a specially-constructed stand that resides behind the platform. A mirror is used to direct the image onto the interaction surface. With this arrangement, the entire setup is transportable and can be easily moved to different locations, however the projector stand restricts access to the surface from three sides only. This limitation will be overcome when the application is ported to a more recent implementation of

the TViews Table, which uses an acoustic-based sensing system that operates through a glass surface placed above a large flat-panel display [MRD06]. In this case, the entire sensing and display system is housed inside the table itself. Digital tabletop games could thus be played in the home on an ordinary-looking coffee table, much the way non-digital board games are played today.

4.2 Gamemaster Interface

The TTRPG gamemaster guides the playout of the game as it unfolds betwen multiple players at the TViews table, and acts as a dynamic narrator for the story. In order to coordinate the gameplay and keep the plot moving forward, the game master can adjust various elements of the game through the Gamemaster Interface (GMI), which runs on a computer monitor adjacent to the TViews table (see Figure 3). The GMI allows the gamemaster to monitor statistics and control the behavior of various in-game entities, including both non-player characters (NPCs) and inanimate or magical objects.

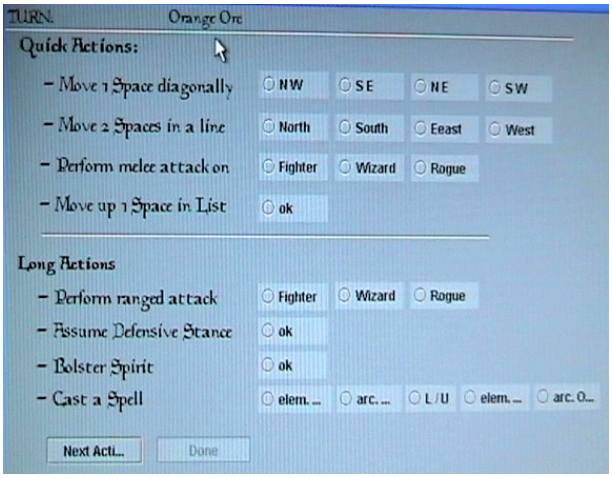

Figure 3: The Gamemaster Interface for controlling the behavior of non-player characters

For example, the gamemaster can adjust the behavior of Orcs and other monsters that the players must battle, including their movements, attacks, and defensive tactics. If the players attack in return, the gamemaster can monitor the hit points of the monsters and adjust their responses to suit the particular story situation. In addition to NPCs, the gamemaster can use the GMI to control the behavior of other objects that the players encounter during gameplay, such as doors or treasure chests. For example, the gamemaster might adjust how easily a lock can be picked or a door can be entered.

Through improvised narration, the gamemaster can also make the NPCs come alive during gameplay. This allows for more realistic interactions between the real players and the virtual world than is usually possible with algorithmically controlled NPCs. By providing fine-grained control over the different elements in the game space, the GMI supports a spontaneous and improvisational style of play and enables a variety of different stories/games to be created within a single setting.

Currently, the GMI is displayed on a separate monitor due to the limited amount of space available on the existing tabletop prototype. As the physical table setup continues to evolve, the GMI might eventually be incorporated into the tabletop interface itself. It could also be implemented as a separate module running on a networked handheld device. A similar approach was used for communicating private information on the STARS platform [MMES04].

4.3 Physical and Digital Game Elements

Market research from Wizards of the Coast has indicated that a majority of traditional RPG players make use of detailed tables and charts during gameplay, as well as miniature figurines to represent their characters [Dan00]. The combination of physical and digital elements used in TTRPG provides a comparable setup, allowing role-players to easily transition their gaming methods and preferences to the hybrid physical/digital space.

In addition to the gamemaster, the current TTRPG setup can accommodate up to three players, who interact using tangible pieces on the tabletop sensing and display surface. The current set of tangible interaction objects consists of character pawns, an options circle for traversing menus, and a selection tool to validate menu choices. Other game elements, such as maps, enemies and changing menus, take the form of virtual objects that are graphically displayed on table's surface. The tangible and virtual game components are described below.

4.3.1 Character Pawns

The player's characters in the game are represented by tangible character pawns that can be moved around the maps that are displayed on the table, and placed

Figure 4: Players use tagged physical pawns to move their characters around the virtual space

at the appropriate locations to trigger desired actions. The current system includes three color-coded character pawns, i.e. one for each player. These pawns can be picked up and set down anywhere on the tabletop. The unique identification number and (x,y) position of each pawn on the table's surface are tracked by the TTRPG system in real-time.

At the beginning of a campaign (i.e. a continuing set of adventures, typically played over multiple sessions), each player chooses a pawn that will represent their character on the table. This is analogous to the way traditional board game players choose a colored piece to represent themselves on the gameboard during the unfolding game. The players use their pawns to represent the position and movement of their characters in the virtual world (see Figure 4). A player moves their character in virtual space by dragging the physical pawn along the table's surface.

4.3.2 Options Circle

TTRPG players can manipulate a tangible options circle to pull up different menus during gameplay and traverse the options. The system can detect both the position and orientation of the options circle on the tabletop.

The options circle is used by any player during their turn. A player who wishes to access a menu or option for their character can do so by putting the options circle in the area directly in front of them. This causes a graphical menu to appear, displaying context relevant choices that relate to the character's current situation. For example, if the player's character is currently standing next to a locked door, the player might have the option to try to pick the lock. Once the menu is displayed, the player can rotate the options circle, either clockwise or counter-clockwise, in order to highlight the desired choice.

In traditional role-playing games, the options that a player has available at any given time are not immediately apparent, especially to inexperienced players. The options circle helps by providing a context-sensitive representation of the actions a player might want to take at a given time. In the current prototype however, the player must always choose from the list of available actions. Future extensions of the system might provide a means for the player or gamemaster to define new actions on the fly. Allowing players to choose actions that are not displayed in the menu would give the players more freedom and enable a higher degree of variation in the gameplay.

4.3.3 Selection Tool

In the current implementation, a selection tool is used by the player who is in control of the options circle. Once the player highlights their desired menu option, they must validate their choice using the selection tool. This is done by first placing it near the center of the board. Once the selection tool is placed on the table, it is highlighted with a red circle. This tells the player that the board is waiting to validate the menu option. The player can validate their desired menu option by dragging the selection tool to one of the hotspots on the board, located in the two corners between the three players. Once the selection tool is dragged to one of the hotspots, its highlight turns from red to green, indicating that the menu choice has been validated and the selection is complete. In future implementations, validating menu choices might be accomplishing by pressing a button on the options circle itself.

4.3.4 Graphical Elements

The graphical elements displayed on the table consist primarily of maps (with doors, enemies, and other objects), menus, and character statistics. These elements change based on player interactions with the tangible objects. The tangible objects are highlighted by graphical sprites that give feedback about their current state and provide visual confirmation that they are being properly tracked. The sprites of the character pawns are color-coded to represent the different characters: red for the fighter, blue for the wizard and yellow for the rogue. The options circle is highlighted in white,

and the selection tool changes between red and green based on its current state.

The maps are representations of the world in which the players interact and have a dungeon aesthetic in keeping with the style of the traditional *Dungeons & Dragons* fantasy role-playing games. The current content set includes maps for four rooms. Players can move between rooms by entering through doorways, which are either open passages or locked doors. Enemies are displayed on the map as different colored Orcs, and can be located in any of the rooms. Furniture and other objects that players interact with can also be displayed on the map. For example, a graphically displayed wooden dinner table can be used as cover by the characters.

Panels along three sides of the table in front of each player are used to display character statistics and menu options. The text in this panel is oriented to face the player on that side of the table, as is common in board game layouts. The menu panels are rendered with a papyrus aesthetic to fit with the dungeon aesthetic of the maps.

4.4 Plot and Content

To date, we have implemented one set of game content for the TTRPG system. The game takes place in a secluded dungeon, where a local clan of Orcs has oppressed the neighboring town and its citizens. The leaders have decided to search far and wide for heroes to defeat the Orcs and put an end to their mischief. Luckily, three heroes of differing skills have been located. These heroes have prepared to wage an attack on the dungeon where the Orcs keep their home. The game begins in the first room of this dungeon.

The three heroes controlled by the players at the table are of three different classes (fighter, wizard and rogue), which are based on traditional *Dungeons & Dragons* character classes. The fighter is represented by the color red and their primary statistics include exceptional strength, constitution and dexterity. The fighter's main attack is a melee attack but can be executed with any weapon in their arsenal. The wizard is represented by the color blue and their primary statistics include intelligence, wisdom and charisma. The wizard's main attack involves casting of arcane spells. Lastly, the rogue is represented by the color yellow and their primary statistics include strength, dexterity and constitution. The rogue can attack in a variety of ways and can acquire special abilities through their skills.

4.5 Modes of Play

Play on the tabletop platform consists of three modes - Character Selection, Free Play, and Fight, as follows.

4.5.1 Character Selection

When the gamemaster starts the program, the Character Selection screen is displayed on the table. The players seat themselves at three sides of the table, and choose which pawn they would like to use to represent their character. Using their pawn, they select from the character options displayed in front of them. Character statistics are generated automatically based on the current story content, but future implementations will allow players to adjust their own character statistics before gameplay, analogous to the self-directed distribution of points across character attributes and skills in traditional RPGs.

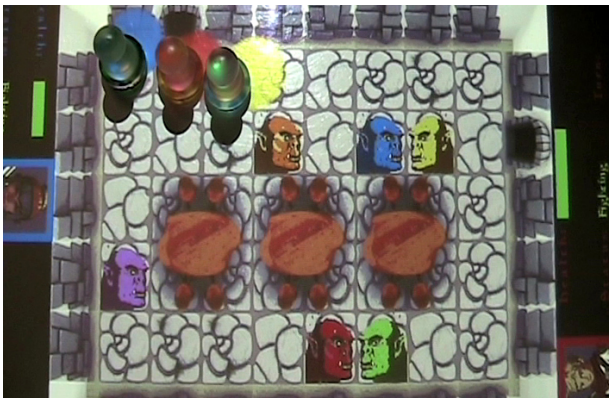

Figure 5: Character pawns are placed at their starting positions when the players enter a new dungeon room

4.5.2 Free Play

After the players have selected their characters, they are sent to the first room in the dungeon. At this point, they are in Free Play mode and must first move their characters to the starting positions in the room, indicated by three color-defined areas (see Figure 5). Starting positions are displayed each time the players enter a new room, enabling synchronization of the physical pawns with the location of their corresponding characters in the virtual space.

Once all three pawns have been placed at the starting positions, Free Play in the new room officially begins. Players can move their respective characters as they please, and can use the options circle to bring up

their personal character menu. During Free Play, a turn-based approach is not required, however coordinating moves between the players can help to move the game forward and facilitates face-to-face storytelling and interaction during gameplay.

During Free Play, the options circle displays menu options that reflect the current game situation and the abilities of the character in question, which is detected based on where on the table the options circle is placed (e.g. if it is placed in the panel in front of the wizard, it will display menu options appropriate for that character). Menu options for Free Play include viewing of story, statistics or equipment, or performing of actions.

If a player chooses to view the story, they will see a summary of their character's profile and experience displayed on the panel in front of them. Each character has its own story and background. The player can also view their character's statistics, including strength, dexterity, constitution, intelligence, wisdom, charisma and various special skills and abilities (see Figure 6). These statistics change over the course of the game depending on the actions taken by the player. The player can also be reminded of their equipment, which includes any tools or items that they hold at a given time, such as backpack, pouch, rope, clothing, food, weapons and healing potions.

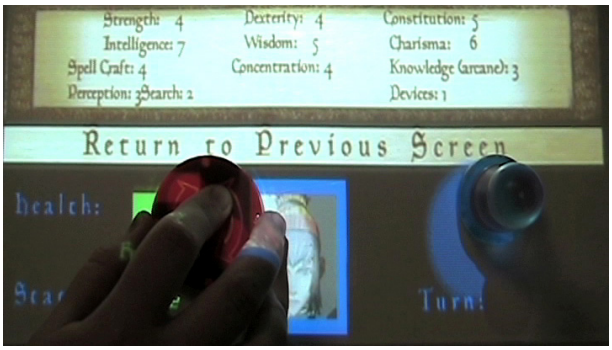

Figure 6: A user makes use of the options circle to view their character's statistics

The actions a player can take depend on their character. For example, a fighter can open doors, heal other characters and search, a wizard can open doors, cast unlock spells and search, while a rogue can open doors, pick locks and sneak. While the set of actions in the current prototype is limited, this could be extended to a greater variety of situation-dependent or player-customized actions.

4.5.3 Fight

The players initiate Fight mode by telling the gamemaster that they want to attack one of the Orcs; proximity and ability are taken into account to validate this decision. A player can choose to initiate fight mode spontaneously, or can first discuss the decision with the other players.

In Fight mode, the game transitions from free play to turn-based play, similar to traditional *Dungeons & Dragons*. Fight mode restricts players to certain actions depending on the story situation. Each player uses the options circle to bring up the fight menu and choose from a variety of actions based on their characters' abilities (see Figure 7).

There are two main types of action: quick actions and long actions. The options for each differ depending on the character class. Quick actions include space movement, melee attack, and move up one initiative. Long actions include range attack (for the rogue and wizard), bolster spirit, take defensive stance, and cast spell (for the wizard). After a player makes their move, it is up to the gamemaster to control the enemies. The gamemaster can either move the Orcs or attack with them. Currently, the attack options for the Orcs include the same quick actions and long actions as the player characters, excluding cast spell.

In traditional RPGs, dice rolls are typically used to resolve actions. TTRPG currently uses a diceless system inspired by the *Amber Diceless Roleplaying Game* [Wuj91], in which character abilities and improvisational narrative description of actions by the players and gamemaster determine how situations are resolved. In future versions of the system, we plan to experiment with different kinds of physical/digital dice for action resolution.

5 User Evaluation

TTRPG was developed using an iterative process of design, development and user testing. In the early design and development stages, we tested the game during open houses and demo sessions in our laboratory. The feedback gathered at these events informed each successive phase of the project. In addition to this informal testing, we also conducted a laboratory experiment with three groups of three players in order to evaluate the TTRPG system in context.

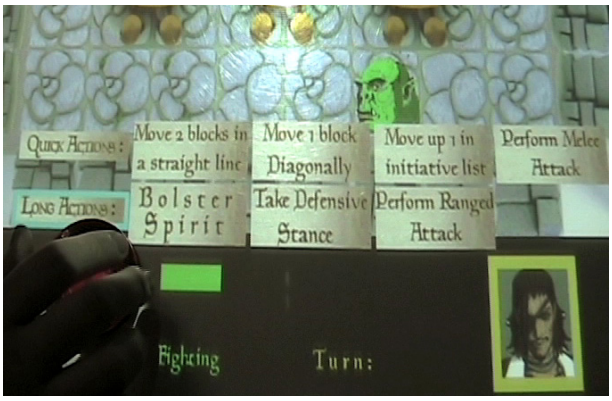

Figure 7: A player selects from the actions menu for the rogue character during an attack on an Orc

5.1 Informal Testing

Throughout the project, we have presented TTRPG to a large number of game players, students and professionals from high tech and games industries. The feedback gathered at these events was generally positive, as attendees were excited by the potential offered by emerging tabletop interaction platforms for a face-to-face and social form of digital gaming. They enjoyed trying it out themselves on our role-playing game, and frequently provided suggestions on the interactions or look-and-feel of the system. While most visitors were generally not familiar with *Dungeons and Dragons*, those who were often provided suggestions for particular characters or scenarios they would like to see implemented on the platform, usually inspired by their own favorite recollected RPG campaigns.

The discussions we had with users during these demo sessions served as a means to uncover bugs in our design thinking and to identify potential solutions that were feasible given the TViews platform specifications and constraints. One significant question in the early stages of the design was how to enable a group of players to move around a space consisting of several dungeon rooms that could not all be displayed on the surface at once given the table's size and resolution. In traditional board games, there is only one graphical map for game play, often divided into specific spots on which players can place their pieces. In computer games, the screen can act as a window onto a vast playing field, of which only a small portion is seen at any given time. When a single player navigates onscreen, they can always see themselves at their current location in the virtual world. In contrast, on a shared surface, if two players' characters move apart in the virtual world, it might not be possible to see both of them on the display screen at once. This could be confusing for players. Feedback from users thus led us to a design in which players move from one room to the next as a group. In each room, start positions are displayed where the players must place their pawns to begin play in that room. However we also realized that eventual versions of TTRPG could explore more complex navigation methods for shared game worlds on a tabletop display. For example, the game table might provide different navigation modes. In a coordinated mode, the pawns could be used as physical constraints that would affect the map display. In this case, the view would automatically adjust (e.g. by zooming or rotating as needed) to accommodate the physical locations of the pawns on the table and relate them to their locations in the virtual game world. In another mode, certain pawns might become activated only when their current location is display on the portion of the map currently visible on the table display. In this case, a miniature world overview in the corners of the table could be used to show the location of other characters, and players might press a button on their own pawn in order to call its corresponding portion of the map into view at their turn.

One of the drawbacks of informal testing during open houses is the limited amount of time that players get to spend at the table. During short interactions, many visitors get excited over the novelty of the platform, and it becomes difficult to isolate their feedback about the application design and gameplay itself. This incited us to conduct a more structured and in-depth laboratory experiment with experienced RPG players.

5.2 Laboratory Experiment

The goal of the TTRPG user study was two-fold. First, we wanted to examine whether a tangible tabletop digital interface would enhance the gaming experience of dungeon type RPGs compared with traditional analog or online digital forms. Second, we hoped to gather feedback about the TTRPG gameplay and interaction in order to inform future enhancements or redesigns of the system. The experimental setup and results are described below.

5.2.1 Experimental Setup

For the study, we recruited people with prior role-playing experience in traditional analog or online digital form. The experimental subjects were thus rep-

resentative of expected typical users of our system: young adults who enjoy playing games. Each group of players was observed and video-recorded during one gaming session. After the game, players participated in a semi-structured discussion and were able to provide insight on usability, functionality and desires for the TTRPG system. Overall, the experiment took about one hour per group.

The subjects took roughly forty minutes to play out one campaign session on the tabletop. During gameplay, we acted as the gamemaster for the session, while the subjects took the roles of the three characters. We observed their physical interaction with the tangible pieces, as well as the ways in which they interacted with each other to progress through the game.

After gameplay, we held a semi-structured discussion with the subjects. This lasted roughly twenty minutes per group and there were three main topic areas discussed. First, we asked whether the players found role-playing on the digital tabletop entertaining. Second, we discussed whether players felt that role-playing in digital tabletop form increased interaction between members of the role-playing group in comparison to their past role-playing experiences. Third, we discussed the advantages and disadvantages they perceived when playing on the tabletop platform.

5.3 Experimental Results

Overall, we received positive feedback from all of the subjects. Some aspects of gameplay that were observed on the tabletop system included: teamwork and group interaction, a positive response to the tabletop environment, some dissatisfaction with some of the methods of movement and menu selection.

As the players wandered through the dungeon they encountered objects and virtual enemies, and as expected they tried to interact with them. In the current game scenario, this primarily included opening doors, picking locks and fighting Orcs. Players found fighting the Orcs to be fairly straightforward, and as a result were able to successfully and quickly defeat them. Picking locks and opening doors took longer, since players needed to first discuss a plan of action. If one player failed to pick a lock, the group would discuss whether another player should try, or if they should think of a different approach for getting into the next room. A few times during gameplay, participants experienced technical glitches, where the table would stop tracking a certain playing piece.

In general, participants found the possibility of role-playing on a digital tabletop to be very exciting. They said the interaction with other players was both engaging and entertaining. They commented that playing with real people at the table was more enjoyable than playing on a desktop computer with other players they cannot see. In terms of player interaction, subjects commented that the tabletop format made them work together and that verbal and physical interaction were necessary to move the game forward. For example, in a situation where they had to find their way out of the room, participants had to talk with each other and discuss a plan of action. In online computer-based RPGs, this is typically done through a text-based chat console. All participants felt that face-to-face verbal communication around the tabletop was preferable, and that it made it easier to collaboratively decide on a course of action and keep the game spontaneous and fun.

Players found the system to be intuitive and reflected upon the idea that one does not need to have much knowledge to play on a digital tabletop. Compared with traditional RPGs which have extensive rule-books and require a great deal of manual setup, the digital tabletop implementation decreases the learning curve for the game. Market research from Wizards of the Coast has indicated that a majority of traditional RPG players prefer to use a simplified set of rules during gameplay [Dan00]. A computationally enhanced tabletop version of the game can make use of more elaborate rule-sets without adding tedious complexity for players. On the other hand, our subjects also commented that in comparison to online RPGs, the tabletop version seemed more intuitive, since they could apply their experiences of playing other non-digital tabletop games.

Participants also felt that exploring the space on the tabletop was more fun than exploring aspects of their characters. One area where they were somewhat disappointed was with the implementation of the options circle, since they felt that traversing menus should be done differently, possibly with the pawns themselves, or with some type of player wand. Another aspect of the game that participants felt should be improved was feedback. In particular, they would have liked stronger audiovisual feedback to indicate success or failure when their character had completed an action. They would also have liked to see more interactive elements around the pawns themselves, as well as more visual cues to give them hints about what they should

do in the environment. A suggested alternative to the idea of a player taking an action based on their discretion was the idea of options popping up and becoming available as the pawns were moved to different locations on the board. This could provide an interesting form of free play, in which players would move their pawns around different parts of the map to discover available options and hidden secrets. Negotiation and coordination among players would still be required to select actions that would be beneficial to the group's progress in the game.

5.4 Conclusions

While it is difficult to conclude without hesitation that digital gameplay on a tabletop would be enjoyable for the majority of the gamer population, it is safe to say based on this particular study that players would accept the idea of gaming on a digital media table.

The TViews table and environment increased interaction between the role-players. The combination of a face-to-face setting around the table and the collaborative game system and story scenario required players to use verbal communication in order to move the game forward. This allowed them to work together to achieve game objectives and created a positive experience for all.

The tangible playing pieces proved to be effective and easy to use for gameplay, since the concept is familiar from traditional board games. However the playing pieces need to be re-designed for smoother gameplay, in particular the implementation of action selection through the physical pieces. The options circle could be taken out of the game, and replaced with a more effective way of traversing menus. It is probably not necessary to create a new tangible piece for this task, and it might be more practical to merge menu traversal with an existing piece such as the pawns themselves. In this case, the players would rotate the pawns to cycle through available menu options. A button could be added to the pawns for validating menu selections. However, while it would certainly be useful to get orientation as well as position information from the physical pawns, there are other ways in which this information could be used. For example, from a story perspective it might be interesting to allow virtual characters to face in different directions (e.g. they might then see objects in front of them but not behind), which could be controlled by rotating the physical pawns. In this case, menu selection would need to be done through an alternative means, or perhaps by enabling the pawns to operate in different modes (e.g. move vs. act).

Also, the pawns could be re-designed to mimic the physical characteristics of their virtual characters. This would allow players to more easily associate physical pawns to different characters, and would help them keep track of their position on the map. It would also be in keeping with recent studies which have shown that tangible objects that are custom designed to fit the theme of the game are appreciated by players over more generic objects [HE04].

6 Future Directions

In this paper, we presented the TViews Table Role-Playing Game (TTRPG) project for multi-player digital tabletop role-playing. The first implementation of the system is based on the *Dungeons & Dragons* ruleset and includes a dungeon-style fantasy content-set that is played with a gamemaster and three player characters. Our user evaluation confirms that players enjoy the face-to-face social interaction that takes place around the table during gameplay. Players had fun and were able to overcome game challenges by working together and using an improvisational style of storytelling play.

We found some areas for improvement in the interaction design of the physical objects with respect to the digital content space. Future versions of the system will include improved action selection and audiovisual feedback, and more dynamic in-game visuals. Additionally, the system's flexible rule-structure can allow us to extend the content set to a larger set of story settings and character classes. We also plan to include a means by which players could generate their own content for the system, such as extended character profiles. We are currently developing a set of Gamemaster Authoring Tools that run on the tabletop, and allow gamemasters to design new game scenarios and settings that run in the TTRPG system. We also imagine that in future versions, players might customize their physical pawns, as is often seen in traditional RPGs.

Longer term extensions include a networked mode for gameplay across remotely located TViews tables. This would allow for more people to play a single campaign and could provide a richer and more complex gaming experience. Finally, we imagine that the system could benefit from compatibility with mobile devices. For example, players could save character in-

formation on a cell phone, and then monitor and update their character's profiles and statistics while away from the table.

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