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Designing Video Games with Social, Physical, and Authorship Gameplay

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Designing Video Games with Social, Physical, and Authorship Gameplay" submitted by Paul Lapides in partial fulfilment of the requirements of the degree of Master of Science.

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Abstract

Today's video games have undergone many changes that have turned them from niche hobbies into ubiquitous and popular activities. Modern games now utilize physical interaction as the primary modality for controlling the game, they have become more casual and social activities, and they have enabled players to express their creativity through the authorship of content. In this thesis, we investigate the use of physical interaction, socialization, and authorship of content in the design of video games. We have created a design framework that can be used as a guide for designing new games and have designed three games to investigate the successes and limitations of each of the three themes: Film Karaoke, Joke's On You, and Social Comics. Through our evaluation of Social Comics, we have come to conclude that physicality, sociability, and authorship are powerful design themes for enhancing the player's experience and for creating new forms of gameplay.

Publications

Materials, ideas, tables, and figures in this thesis have previously appeared in the following publications:

Lapides, P., Sharlin, E., Costa Sousa, M., (2011). "Social Comics: A Casual Authoring Game". In proceedings of the 25th BCS Conference on Human-Computer Interaction, July 2011, Newcastle, UK.

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Chapter One: Introduction

Human beings have been playing games for thousands of years. Games provide us with a structured escape from reality; an activity that allows us to safely compete with each other and to have fun together. There are many different types of games that we play: board games, card games, dice games, sports, video games, etc. Complex games like Go, and Chess have existed for centuries, but simpler, physical based games or "sports" have been played for far longer, well into prehistoric times (Blanchard, 1995).

The fact that physical games have existed for so long is no surprise. Human beings are physical creatures, and we experience the world with our bodies by running, jumping, sitting, grasping, and manipulating objects and artefacts. We are also very social, and have a desire to be connected to the people around us and to form and maintain these relationships. Social interaction between people occurs via many verbal (tone, inflection, volume) and non-verbal (posture, eye contact, touch) means. Lastly, humans have creative ambitions and aspirations. One of the ways we express our thoughts and emotions is by creating new things, whether they are sculptures, paintings, or poems.

Today, video games are a popular pastime and have almost become ubiquitous, appearing on our televisions, computers, and mobile phones. Old stereotypes that video games are only played by adolescent males are changing. The age of the average gamer is now 37 years, and 25% of all gamers are over the age of 50. There are more women over the age of 18 who play games than there are men under the age of 17 who play. In fact, 40% of all gamers are female. The stereotype that games are anti-social, isolating activities is also being negated. Video games are now typically played with other people rather than played solo; 65% of gamers play in person with other gamers (ESA 2011).

One of the major reasons that video games have become so popular and ubiquitous is the ongoing development and evolution being made to physical game interfaces. These interfaces leverage the player's innate knowledge and ability to perform physical tasks, allowing players to control the game by making expressive physical movements.

While video games have always been fairly social activities, recently they have been leveraging the player's movements afforded by the new physical interfaces into performances. These "performances" made by the players create an engaging spectacle that can attract an audience. This encourages socialization among audience members such as praising or cheering for players, making friendly challenges and competition between would-be players in the audience, and general conversation about the game.

Lastly, video games have begun using new types of gameplay mechanics that empower the player's creativity. These "authorship games" focus their gameplay on enabling the player to create some kind of content through the act of playing. Authorship games are not straightforward to design as the player must still be engaged and motivated by the game but also inspired to be creative. This style of gameplay is enabled largely by the user centered approach to the internet that began to occur in 2004 that gave users the ability to share their custom made content with anyone by uploading it to photo and video sharing sites, wikis, and social networks. Games began to combine fun and entertainment with authorship and creativity, encouraging players to author their own custom content that could now be easily shared and distributed using the internet.

It is these three themes in video games, physicality, sociability, and authorship that we would like to make an inquiry into. We believe that these themes can serve as

independent gameplay elements in their own right, or they can be combined to create new and unique gameplay experiences.

1.1 Research Questions

Recognizing that people are physical, social, and creative beings and that we like to play games and be entertained, this thesis explores the following research questions:

1. **What specific gameplay attributes and characteristics are used to create physical, social, and authorship experiences in video games?**
2. **Can we design a set of games that integrate these characteristic to purposefully drive physical, social, or authorship gameplay?**

1.2 Research Approach

These research questions led to the creation of a design framework for video games that attempts to identify specific gameplay attributes necessary for successfully implementing physicality, sociability, and authorship in games. The framework also discusses the combination of these attributes and their effect on gameplay. We brainstormed how these themes can be used in games, and designed three games that include different combinations of physicality, sociability, and authorship.

The design of two games, *Film Karaoke* and *Joke's On You*, emphasized different combinations of these themes. *Film Karaoke* is a game that challenges players to act with each other to recreate famous film scenes and focuses primarily on authorship and socialization. *Joke's On You* pits two players against each other in a match to see who can play the most jokes and embarrass the other player and relies heavily on physicality and socialization. These games were not fully implemented and are presented in this

thesis as low-fidelity prototypes that allowed us to examine, at least preliminarily, the successes and limitations of different gameplay attributes and characteristics.

The third game, *Social Comics*, puts two players into a short comic strip that they create by posing together. We believe that *Social Comics* is a video game instance which combines all three gameplay themes, though by far not the only possible instance of such a combination. Through *Social Comics* we examined how authorship effects group communication, socialization, physical interaction, and audience participation in a formal user-study. We conducted an analysis of the observations and data from the study, which allowed us to suggest possible explanations of how *Social Comics*' gameplay attributes create a unique gaming experience.

1.3 Thesis Contributions

Following the research approach above, this thesis present the following three contributions:

1. **An exploration of physical, social, and authorship gameplay elements in current video games and a design framework that provides guidelines for the design of future video games (chapter three).**
2. **Prototyping and designing two games, Film Karaoke and Joke's On You, based on physical, social, and authorship gameplay themes (chapter four).**
3. **The design, implementation, and evaluation of Social Comics, a game that incorporates all three gameplay themes, and a discussion of how these themes impacted the players' behaviour and gaming experience (chapters five and six).**

1.4 Thesis Overview

The remainder of this thesis is as follows. In chapter two, we discuss the background that has motivated my research, explain how video game interfaces have changed in the past decade, and examine how these changes have impacted the behaviour of gamers. We also present a variety of work, both academic and industrial, related to my research. In chapter three, we present a design framework that attempts to clarify and guide the design of video games that use physical, social, and authorship gameplay themes. In chapter four, we apply this design framework to two video game prototypes, *Film Karaoke* and *Joke's On You*, and explain how their designs incorporate these gameplay themes. In chapter five, we describe a two player game inspired by physical, social, and authorship gameplay called *Social Comics*. We also describe the game's design, implementation, the importance of the gameplay themes, and a description of its gameplay. Chapter six presents a thorough user study we conducted to investigate how *Social Comics's* gameplay impacts player behaviour and if *Social Comics* effectively implements the three gameplay themes. Finally, chapter seven concludes the thesis and we summarize the contributions my research has made and present directions for future research.

Chapter Two: Background and Related Work

This thesis is about the exploration of three different gameplay elements for video games, sociability, physicality, and authorship. While psychologists and sociologists have been studying people and their behaviours for many years, video games and the behaviours that they elicit in players have only recently become the focus of academic research: “The relatively short history of video games is complemented by an even shorter history of research. It is only around the turn of the millennium that video games studies began to come together as a field with its own conferences, journals and organizations.” (Juul, 2005).

In this chapter we provide the reader with insight into how we chose to study video games. We hope to address these questions:

1. What is a video game?
2. How have video game interfaces and controllers changed over the years to support physical gameplay?
3. How do video games elicit new behaviours in gamers?
4. Can video games provide players with a creative outlet?

2.1 The Video Game

Jesper Juul, a video game theorist, gives this definition of a game: “A game is a rule-based formal system with variable and quantifiable outcomes, where different outcomes are assigned different values, where the player exerts effort in order to influence the outcome, the player feels emotionally attached to the outcome, and the consequences of the activity are optional and negotiable.” (Juul, 2005)

There are several key points worth noting in this definition:

1. A game has clearly defined (formal) rules. These rules dictate how the game is played and progresses, what actions the player may take, and what the consequences of these actions are.
2. A game has more than one outcome and the outcomes have different values. A game typically has one outcome (win) that is more desirable than the others (lose), though multiple winning outcomes are possible.
3. The player has the ability to change the state of the game and therefore tries to reach a winning outcome. The player is motivated to do so by an emotional connection that they establish with the game, and with winning the game.
4. A game has consequences, but these are optional and are negotiated prior to joining the game. Many games have no real-world consequences, though some allow players to play with real money and have formal negotiations before the game starts.

This is a broad definition and it encompasses games of all types such as card games, board games, and even sports. A *video* game is more narrowly defined as "an electronic game that involves interaction with a user interface to generate visual feedback on a video device." (Wikipedia) In simpler terms, a video game uses electronics (a microprocessor) to receive input from a user interface (buttons, joysticks, or other controllers) and provides visual feedback on a display. This definition does not attempt to define or specify the type of interface used by the player to give commands to the processor. Today, games are played on many different platforms ranging from personal computers to dedicated game consoles, portable gaming devices, and even mobile

phones. The wide spectrum of devices means that there is an even wider range of interfaces used by the player, and we should take care to understand them if we hope to gain any insight into the types of games that people play in the future.

2.2 Video Game Interfaces

The first games to be marketed to a wide audience used very simple controls developed specifically (and only) for the game they were used for. For example, players of the popular video game *Pong* used only a single dial to control the vertical position of their paddle on the screen (Figure 2.1). The first mass marketed video games were seen mostly in dedicated game arcades that housed many rows of games, each contained inside of a dedicated machine that combined the display, electronics, and game controller into a single unit (Figure 2.1). This allowed the game designer to create a custom interface that would include all of the controls to easily and intuitively control the game (Wikipedia, Arcade Style Controller).

Figure 2.1 Two player *Pong* control and a series of arcade games, all with different buttons and joysticks (Wikipedia, Arcade Style Controller).

Specialized game consoles were soon developed that allowed many different games to be played on the same computer system, and it became infeasible to design and manufacture a dedicated controller for each game. A single *generic* game controller was used that perhaps had several buttons and an analog stick (a type of joystick), and was used to play all of the games on that particular game system. One game may have used only the analog stick, while others may have used only several of the buttons. The size and form factor of this type of controller was lighter and more comfortable to use than arcade controllers. The player could now hold the controller in both hands and use their thumbs to press the buttons and move the analog sticks. This type of controller became known as the gamepad, and nearly all video game consoles used it since its introduction in 1985 with the Nintendo Entertainment System (Wikipedia, Gamepad).

Figure 2.2 Nintendo Entertainment System (NES) gamepad controller with four directional buttons, two function buttons, and two special buttons (Wikipedia, Gamepad).

Newer game consoles brought more advanced gamepad features to the market, such as two analog sticks, several buttons on the rear of the controller, vibration feedback, wireless functionality, and more comfortable form factors (Figure 2.3). Despite these additions, the gamepad controller design remains largely unchanged to this day. It is still held in the hands and used by pushing buttons and joysticks on its face (Wikipedia, Gamepad).

Figure 2.3 PlayStation 3 DualShock 3 and Xbox 360 gamepad controllers, (Wikipedia, Gamepad).

In 2006, Nintendo released the Wii game system, which we believe began to move gaming into a new direction. The controller used to play the Wii, aptly called the Wiimote, was the first physical controller used for a major home game console. Instead of pressing buttons or moving analog sticks, the player holds the Wiimote and moves their hand and even their entire arm to control the game. The controller uses a three-axis

accelerometer to detect its tilt and a “sensor bar” mounted above the television to determine where the controller is pointing. An attachment to the Wiimote called the Nunchuk can be held in the player’s other hand (Figure 2.4). The Nunchuk also has a 3-axis accelerometer, as well as an analog stick. The Wiimote and Nunchuk embody the player, essentially creating a rudimentary system to track the position and orientation of the player’s hands (Wikipedia, Wii).

Figure 2.4 The Wiimote and Nunchuk held in the hands (Wikipedia, Wii).

Many games for the Wii focus on real physical actions or movements that most people are already familiar with. The player controls the game by performing these movements with their hands or arms while holding the Wiimote and Nunchuk.

An example to illustrate this is a game called *Wii Sports* that features five sports: boxing, bowling, golf, tennis, and baseball. These sports use different hand and arm motions to play, all of which can be easily supported with the Wiimote. The players hold the Wiimote/Nunchuk and swing their hand and arm as if they were playing the sport for real, the controller becoming a surrogate for the virtual baseball bat or tennis racquet (Figure 2.5). In the golf game, players make a vertical swinging motion with their arms to hit the ball as if they were really holding a golf club and hitting a ball. Variations on the swing such as the angle, power, and twist are detected by the 3-axis accelerometer in the Wiimote. A similar metaphor exists for baseball, bowling, and tennis. To play the boxing game, players hold the Wiimote and Nunchuk in both hands and make punching and blocking motions to try to strike their virtual opponent.

Figure 2.5 A woman plays Wii Sports by swinging the Wiimote like a real bat (Wikipedia, Wii).

The Wii was exceptionally popular when released, selling more units than its major competitors Xbox 360 and PlayStation 3 combined (Wikipedia, Wii). Its success was likely due to the new physical gameplay that had never been seen in home game consoles. The Wii was also marketed as a casual game system that focused on embodied physical gameplay rather than on impressive visual graphics. In fact, many games for the Wii used simple and cartoonish graphics that create an inviting visual style representing simple and casual gaming to familiar players. Despite the simple graphics and casual gameplay, games for the Wii were more immersive than ever. Players often became so

caught up in the game that some would lose their grip on the Wiimote while playing and send the controller flying through the air, sometimes hitting bystanders or the TV. This turned into a significant safety issue that prompted Nintendo to produce a safety strap that keeps the Wiimote attached to the player's wrist. This speaks greatly to the amount of immersion that can be obtained with a physical controller.

Sony and Microsoft followed suit by introducing their own physical game controllers in 2010. Sony introduced a controller called the PlayStation Move that was similar to the Wiimote. Players hold the Move controller in their hands like the Wiimote and control the game by moving their hands and arms. The Move controller uses accelerometers like the Wiimote but uses a camera system for the majority of its tracking. The PlayStation Move has physically embodied gameplay similar to the Wii.

Microsoft pursued a different direction with their new controller called the Kinect. Instead of holding a controller to track the hands like the Wii and Move do, the Kinect sits above or below the TV and tracks the player's entire body, not requiring the player to hold anything in their hands to play the game.

The Kinect is actually a depth camera device that produces a distance map as raw data. It emits a pattern of IR lasers onto the player and their surroundings, which are imaged with an IR camera on the device. Objects that are near to the Kinect distort the laser pattern differently than far objects, and this distortion reveals an object's relative distance to the Kinect (Wikipedia, Kinect). When pointed at a person, their human form is extracted and mapped to a skeleton system that represents the player's body (Figure 2.6). Gesture recognition is used to extract meaningful motions from the skeleton and these movements

are used to control the game. The Kinect can extract any type of movement or pose such as hitting, kicking, ducking, jumping, and pointing from two different people standing in front of the camera at the same time.

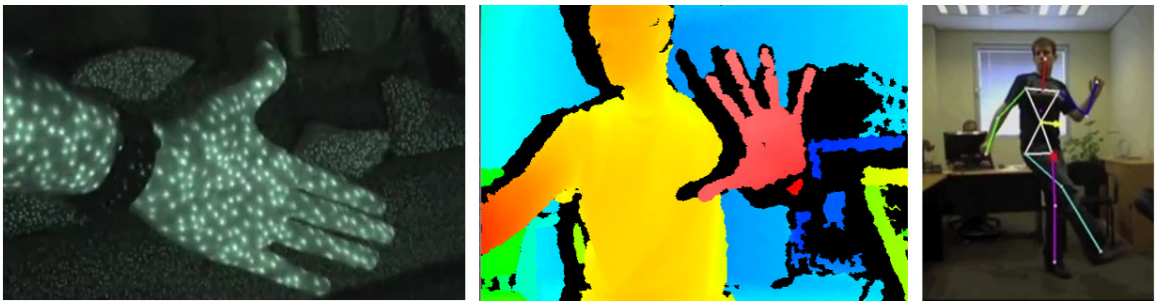


Figure 2.6 The IR laser pattern on the left is used to create depth maps like the false color image in the middle, which allow skeletal mapping to the player (Wikipedia, Kinect).

2.3 New Gaming Behaviours

As games become more physically oriented, they are starting to be more intuitive and easier to learn. Unfamiliar players don't need spend time learning or practicing what buttons to push on the gamepad, they can just start moving their own bodies instead. The recent ease of entry to games has made them a more casual and also a more social activity. By controlling games with the entire body, playing a game has become a performance that other people may be interested to watch.

Dance Dance Revolution (*DDR*), an arcade *rhythm game* first released in 1998, challenged players to "dance" by pushing four buttons on the floor with their feet in time to musical and visual cues. Having to pushing the buttons in specific patterns and made the players appear to be dancing. The original arcade version had two dance platforms next to each other, intended for a pair of players to dance simultaneously. By using an

interface that fosters expressive gestures and movements, *DDR* encouraged friendly social exchanges and competition between the players, some of whom became very accomplished at the game. An audience would sometimes form to admire the skills that advanced *DDR* players demonstrated while dancing to very difficult songs (Figure 2.7). This turned *DDR* into a social activity based on dancing, something that could engage both the players and the audience.

Figure 2.7 Two players drawing a crowd while playing *DDR*.

There have been social and physical themes in video games for many years, but a third theme, content creation, has recently begun to emerge in video games. We believe that authorship in video games is a result of the changes that occurred in the usage of the World Wide Web over the last five or six years.

Prior to 2004, users of the Internet mostly accessed data passively. Content was created for the user and served to them via a static website, an information model referred to as

Web 1.0. In around 2004 to 2006, the World Wide Web began to undergo a major change in the way that software developers and end users accessed data on the Internet. Static webpages were replaced by wikis, social networking sites, blogs, video sharing sites, and web applications (Wikipedia). Users were no longer passively viewing the internet but could add or change the information being served to them through any computer using a web browser, which by then had become ubiquitous.

Websites began to emerge specifically to enable the sharing of user created content like photos (Flickr), videos (Youtube), art (deviantART), animation (Newgrounds), and music (MySpace). Gamers began to record videos of their gaming sessions and to share them with others using Youtube, often to show their gaming skill or to share funny and unique situations that happened to them while playing. The technique of using a real-time game engine for filmmaking is known as machinima, and was used in the production of *Red vs Blue*, a series of short films parodying the *Halo* game franchise and its characters. *Red vs. Blue* was very successful and became one of the first productions to bring machinima to the mainstream, even enjoying an audience of non-gamers.

The creation of user generated content in video games is typically not part of the designed gameplay experience of most games. If players want to create content from the game, they have to use special software to record and edit their gameplay. Some games, however, have recently begun to integrate content creation and authorship as primary goals of their gameplay. *Yoostar*, a game that combines karaoke with movies, has authorship at its center. *Yoostar* lets players recreate popular film scenes by digitally replacing the actors that appear in the original scene with the players. The game uses a

camera mounted on the TV to record a video of players acting the role of a character from a film. The game presents players with short scenes from popular films that have a dialogue between two actors. The player chooses which of the two actors in the scene they will replace and positions themselves in front of the camera so that their body closely matches the chosen actor's pose in the scene (Figure 2.8). *Yoostar* isolates the player from the background and inserts them into the film scene in place of the actor in real-time. The scene begins to play, showing the player and the other original actor as the camera cuts between the two, while the scene's dialogue is shown on top of the screen. The player tries to deliver their actor's dialogue while the scene is played.

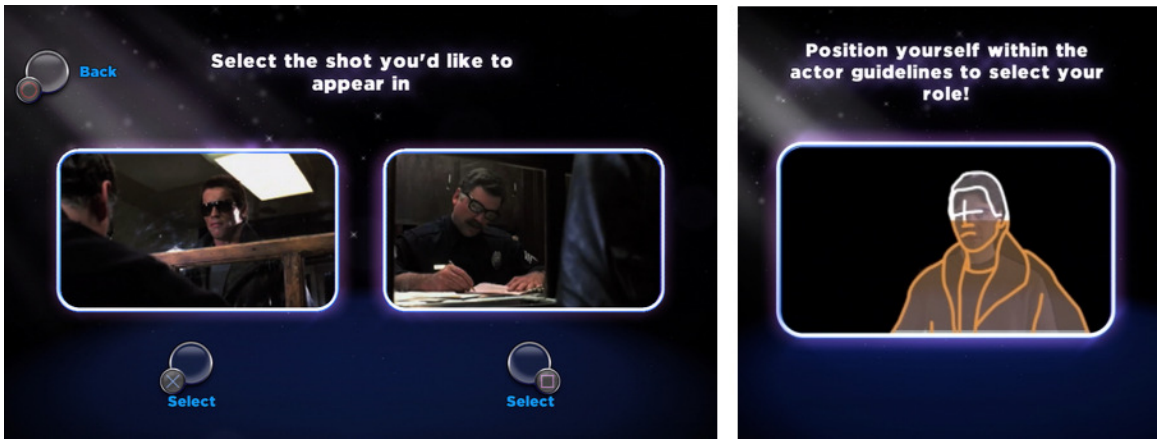


Figure 2.8 A player selects the character he wants to play and uses the guide to position himself (Wikipedia, Yoostar).

Yoostar has two modes of play. In the first mode, the player delivers the scene's original dialogue in the correct order and time as it appears in the original scene. The game analyses the player's voice and scores them for good line delivery, while penalizing them for speaking the lines out of turn. The second mode lets the player change the dialogue in the scene by saying whatever they want, creating an entirely new scene with different

dialogue and context. The player's performance is recorded and a video of the customized scene can be shared online and ranked by other players. *Yoostar's* gameplay is focused solely on the creation and authorship of new content using film and video media.

New and never before seen behaviours and rituals emerge as players are given different tools to play games with. Game interfaces and controllers have changed from simplistic buttons and joysticks to embody players and their bodies, giving us rich physical control for video games. Physical controllers have impacted the social atmosphere surrounding games, making them group activities and even spectacles that audiences can enjoy. Games have become creative activities that let players create custom content that can then be shared online in same way as photos and videos.

The themes of physicality, sociability, and authorship are major research topics and are frequently referred to in the rest of this thesis.

2.4 Socialization in Video Games

Social interaction in games has been investigated by several researchers, each arguing that it plays an important role in the enjoyment of video games.

Attempting to understand what makes video games "fun", Lazarro (2004) investigated the behaviours of thirty participants as they played their favourite games and reports four "keys" that contribute to players' enjoyment: hard fun (overcoming difficult challenges), soft fun (immersion and curiosity), altered states (escapism and relief from stress), and the people factor (socialization and bonding with other players). While each of these keys

is interesting on their own, the latter is the most relevant to the theme of socialization in games. Lazarro reports that “Players in groups emote more frequently and with more intensity than those who play on their own. Group play adds new behaviours, rituals, and emotions that make games more exciting.” Participants in the study say that they “it’s the people that are addictive, not the game,” and that they “want an excuse to invite friends over.” Some participants report playing games they don’t like just to spend time with their friends, while others don’t like playing at all but participate in the activity by watching their friends play. It would seem that video games are effective at mediating social interaction between players, and Lazarro asserts that socialization in games “creates opportunities for player competition, cooperation, performance, and spectacle.”

The need for player socialization is also reported in a study by Sall and Grinter (2007) where ten participants used a physical game such as DDR in the home for at least a year. The researchers suggest the notion of a division among people when it comes to video games: an “inner gaming circle” and an “outer gaming circle”. People in the inner circle are engaged by the game and are actively playing or watching the gameplay like a spectator. Most participants expressed that a “gaming circle reinforced enjoyable play,” and that sometimes “the gaming experience was only complete when other players were involved.” Participants referred to their physical gaming experiences as “performances” and the presence of spectators was necessary to transform the player into a performer. An absence of spectators made the experience feel “incomplete” and “weird”. However, the presence of people may not always enhance the game experience. Some participants feel that people who do not play games may not understand or appreciate them, and these

people are part of the outer gaming circle. Players may feel too self-conscious to play games in front of these people, highlighting the idea that merely watching a game is not the same as spectating. We consider spectator engagement an important element in the design of a game that can enhance or deteriorate the gaming experience. A game's ability to catch the attention and create interest in non-gamers (or people in the "outer circle") may make it easier for regular gamers to introduce the game to the outer circle group.

Voida and Greenberg (2009) observed twelve groups of gamers as they played console games together in their home. Similarly to Sall and Grinter, Voida reports that gamers feel "lonely" when playing alone, writing "The primary motivation for group console gaming was not the games themselves, but the social interactions afforded by the collocated gameplay. The most important part of group console gaming was, very simply, 'the sociability of it.'"

2.5 Physical Gaming

Earlier, we argued that physicality fosters socialization between players and may even give rise to the idea of the gameplay becoming a performance that spectators or an audience can watch.

Mueller et al. (2003) conducted a study measuring the socialization of players in physical and non-physical game situations. The researchers argue that physical activity in games and sports have been helpful in creating socialization between humans for thousands of years and introduce the idea of "exertion interfaces". These interfaces "require intense physical effort" and hopefully create social bonds between remote users by allowing

them to interact with each other physically. Two remote users play *Breakout for Two*, a version of the popular arcade game *Breakout*, where players must destroy tiles by bouncing a ball into them (Figure 2.9).

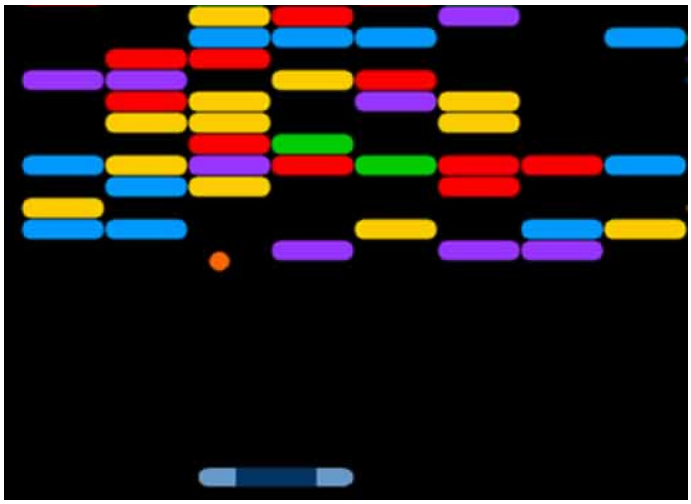


Figure 2.9 In *Breakout*, the player moves the paddle on the bottom to bounce the ball into the color rectangles to destroy them (Wikipedia, Breakout).

In Mueller's version, each player stands in a separate room and faces a wall with a camera mounted at the top (pointed at the player) and a projector mounted on the ceiling projecting an image onto the wall. A real-time video image of the opponent (in a different room) is projected onto the wall. A grid of tiles is overlaid above the opponent, making it appear as if the opponent is behind a wall of tiles (Figure 2.10). Each player is given an ordinary ball that thrown at the wall and "breaks" the virtual tiles. Both players must throw or kick the ball and try to destroy more tiles than their opponent. When a player breaks a tile, it disappears from both players' walls, creating the illusion that the players are breaking through the wall to reach their opponent. The player who destroys the most tiles wins the match.

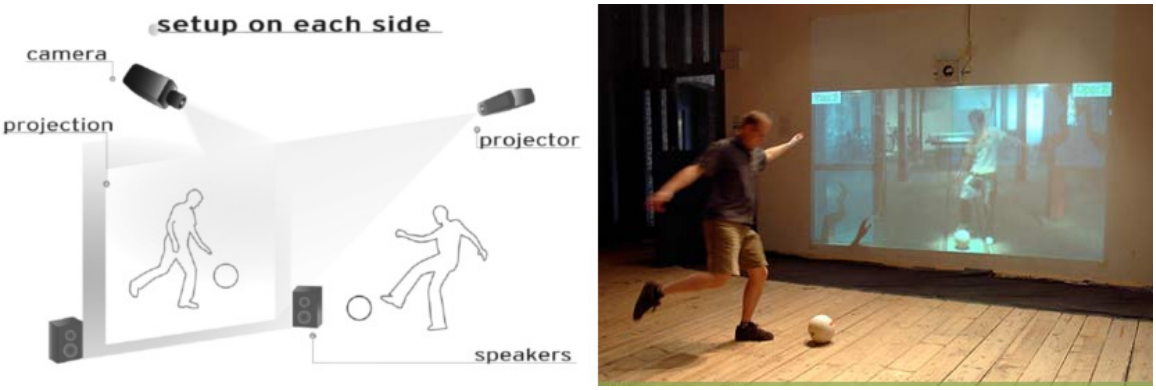


Figure 2.10 *Breakout for Two* uses a camera and projector to connect two remote players (Mueller).

Fifty six participants were divided into two groups and asked to play two versions of the game: one group used a real ball (exertion condition) and the other group used a keyboard and mouse to control a virtual ball (non-exertion condition). Both participants were given questionnaires and interviewed together after each trial. Mueller reports that players in the exertion condition got to know the other player more, had more fun, and had a more positive experience than those in the non-exertion condition. The exertion pairs played more matches than non-exertion pairs, and their interviews were longer despite the same questions being asked for both groups. These findings suggest that the exertion participants were more comfortable with each other than non-exertion participants, demonstrating that physical interaction creates social bonds between people.

The role of physical movements in socialization is also investigated by Lindley et al (2008). In their study, two participants play *Donkey Konga* together, a rhythm game where players must play drums in time with music. The game is played with two conditions: using the physical bongo (drum) controller and using the GameCube

gamepad controller. The participants play the game next to each other for eight songs using each controller, completing a questionnaire after each session. The participants were observed speaking, making utterances like laughter or groans, and gesturing during the experiment. All of these actions occurred with more frequency when using the physical bongo drum rather than the gamepad controller. Lindley speculates that "social interaction with observers might increase when body movements are required by a game, as there is more scope for communicating through the device," and concludes, saying that "social behaviour is more fully afforded and levels of engagement increased through the use of a controller that supports natural movements."

2.6 Authorship in Games

Games have been used as a medium for artistic expression for many years. Customization and modification of games has occurred as early as 1993 when users began creating custom levels for first person shooter games (FPS) like *Doom*. Players could share custom levels and maps on community websites and bulletin board systems, releasing custom "map packs" that extending the playability of the game. One of the most successful modifications to a video game was *Counter Strike*, a customization for the game *Half-Life* that changed it from a science fiction game with monsters into a tactical war simulation. While content creation using video games is not new, games that focus entirely on authorship have only recently begun to emerge.

It is important to distinguish authorship from customization. Many games give the player the ability to customize certain elements in the game such as the character's appearance. However, customization like this does not fundamentally impact the gameplay. The fact

that a player can choose the color of their car in a racing game doesn't change the main focus of the game, which is still racing. The car will drive the same way if it is blue or red. Instead, authorship is the specific inclusion of gameplay features that make content creation the fundamental goal of the game, either through direct or indirect challenges presented to the player.

Little Big Planet (*LBP*), released in 2007, is a 2D platform game that challenges users to solve puzzles by dragging, lifting, and manipulating in-game objects. It has a major content creation component using an open sandbox concept that allows players to design their own puzzles using complex in-game systems involving gears, levers, ropes, switches, etc (Wikipedia, Little Big Planet). These creations can be challenging new puzzles or impressive and complex machines and are shared via a social network made specifically for players of *LBP* (Figure 2.11).

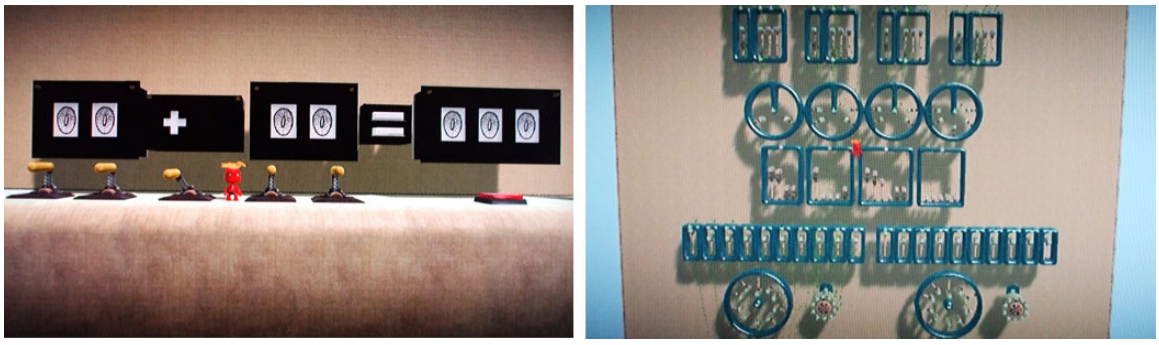


Figure 2.11 Player showing a working calculator controlled by levers. The inner workings of the machine include many dials and levers connected with strings.

While the content created in *LBP* may be similar to the custom levels and modifications created for first person shooters described earlier, there is a big difference in the gameplay goals of these games. In FPS games, the main gameplay objective is to shoot

enemies and to pass each level without dying. To create a new level, for example, users must use computer aided design tools whose goal is to make building level as simple and efficient as possible. While some of the gameplay in *LBP* involves solving puzzles and advancing through levels like in FPS games, a major component of the gameplay is focused on the creation of custom puzzles. To make a level, the player still uses their in-game character to build each of the components. The character is still bound by rules like gravity and must drag objects into place and connect them together by using special items like glue or nails. Unlike CAD tools that attempt to remove as much of the challenge from level design, *LBP* specifically infuses challenges into the authorship gameplay. The player is motivated to overcome these challenges by their desire to be creative and to build new puzzles.

Minecraft, a first person shooter game similar to *LBP*, puts the player into an open sandbox world where they can use world materials to construct different objects. The world of *Minecraft* is presented to the player as a fixed grid of cubic blocks that can be manipulated. The player starts the game with no tools but can fashion many different types of items from just the materials available, such as wood, stone, gravel, and water. The player uses different combinations of tools and materials to make more complex tools items (Wikipedia, Minecraft). For example, they player can use a wooden hammer to mine gravel, extra ore from the gravel to create a metal pick and hammer which can now break apart stone.

The player has only a single goal: to stay alive during the night cycle, when monsters come out and attack the player. To survive, they must use the materials and tools that

they create to build a shelter. The game has a simple physics engine and electrical switches and logic gates that open doors or move blocks. Players of *Minecraft* spend a considerable amount of time creating elaborate and complex structures like rollercoasters or complex machines like binary adders. *Minecraft* has can be played in multiplayer mode, allowing players to collaborate on their creations. Like in *LBP*, the player controls an in-game character who builds the structures by lifting, moving, and mining the different materials in the game.

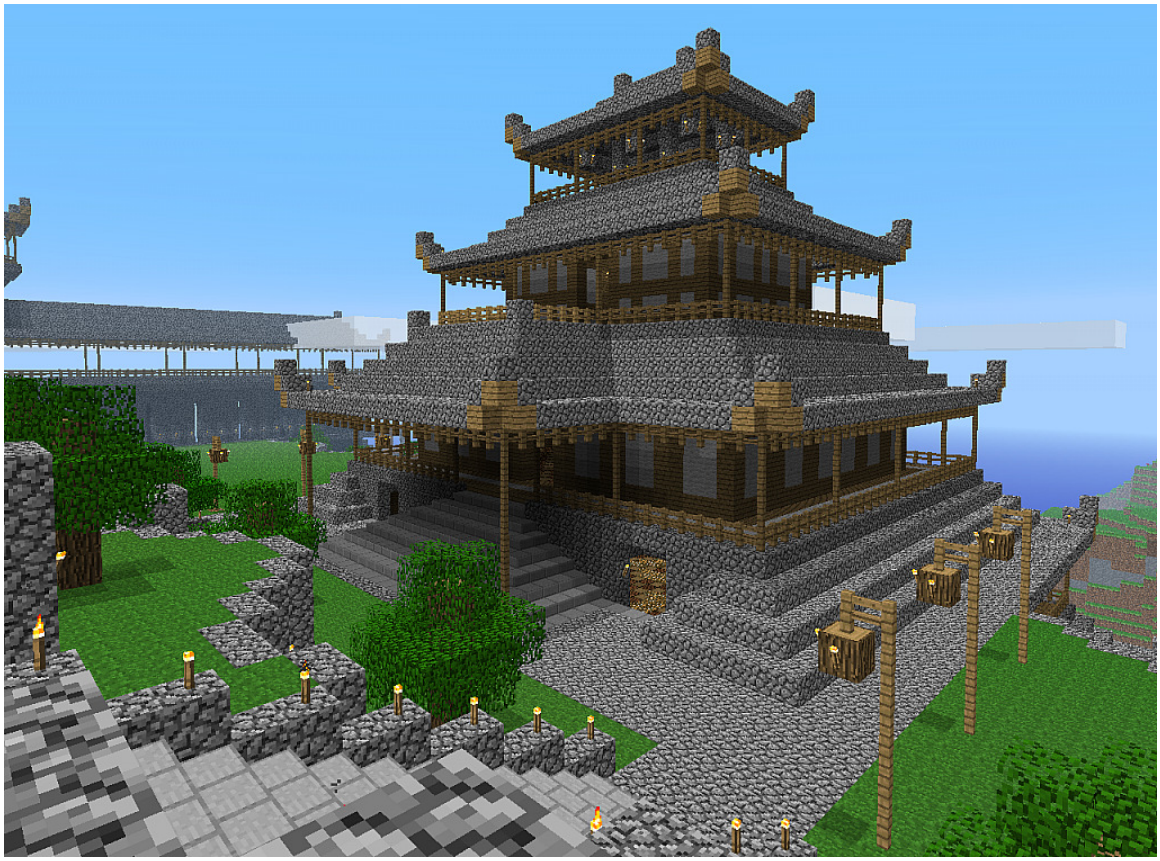


Figure 2.12 *Minecraft* players can create elaborate structures from raw materials like wood and stone.

Authorship in games is not a trivial feature that can be added without significant forethought. Simply allowing the player to customize game elements is not enough. There must a reason for the player to want to keep making new content, and inherent challenges that must be overcome for the player to achieve their creative goals.

2.7 Summary

In this chapter we have presented a discussion of the background of video games, including the evolution of physical interfaces, social behaviours among gamers and audiences, and the role of authorship and content creation in games. These concepts were illustrated by previous academic work and examples from the games industry.

In the follow chapter, we will present a design framework that is based on the themes presented here: physicality, sociability, and authorship.

Chapter Three: Framework for Designing Social, Physical, and Authorship Games

In this chapter we will present a design framework consisting of three general gameplay themes for video games: physicality, sociability, authorship. We will define each of these themes and give the typical characteristics that they bring to gameplay in video games, illustrated by examples from academic research and real games. These themes are related to each another, and often more than one theme is present in the design of games today.

3.1 Framework Origins

In the early stages of our research, we brainstormed the specific design traits present in modern video games. We believe that some of these design traits, or themes, are responsible for the drastic changes in the demographics of gamers over the last five to ten years. Video games are played by more adults, women, and the elderly than before. The average age of a gamer is now 37 years, 40% of gamers are female, and there are more adult women playing games than men younger than 17 years. (ESA 2011).

While familiarizing ourselves with the background and related work presented in chapter two, and while brainstorming the games that will be presented in the following chapters, we began to realize the importance of physicality as a new modality for game interfaces. Physical interfaces made games easier to learn and more intuitive to play, and consequently made them less time committing and more casual.

Physical games were embraced by casual gamers; non-serious players who play games in short sessions, often during other social activities with their friends. Video games had soon become the centers of social gatherings, and were being used to foster socialization between players. The physical actions expressed through games started to be recognized

as performances and began to draw small audiences. Games were now centers of socialization, creating social bonds between players and spectators.

At about the same time that physical games began to emerge, the World Wide Web began experiencing major changes of its own. The internet was no longer just serving information to users via static webpages but allowing them to customize and modify the websites they visited. Many new services suddenly emerged such as photo and video sharing websites, social networking sites, and blogs, all giving users the ability to share their own content and ideas with others. Some people began using video games to author their own content that could now be easily shared with their friends. Authorship in video games is a new gameplay technique that can motivate and incentivise players by harnessing their creativity and providing them with fun tools to achieve their creative vision.

These three elements, sociability, physicality, and authorship, are the basis of our design framework for video games. We believe that these elements can create more engaging and fun collaborative games and allow players to express their creativity. In this chapter we will examine how these three elements can be combined and used in defining a design framework for future games. By choosing to incorporate various amounts of each element in a game, we can design games for different settings and possibly different demographics of gamers, as we will do in a set of examples presented later in this thesis.

3.2 Physicality

Games were traditionally played with a gamepad controller that has many buttons. This interface can be overwhelming to new players because they have to invest a large amount

of time (at least several minutes and possibly hours) to learn the mappings of buttons to gameplay actions. This steep learning curve was removed when games started using physical controllers that embodied the player. These interfaces made games more intriguing and accessible to non-gamers who would otherwise be intimidated to try the game. Many games for the Wii can be learned very quickly just by watching another person play for a few minutes. The expressive physical motions made with the body are easier to notice, understand, and to mimic by new players.

Physical games may create more immersion for the player. Games where players embody their on-screen character may create a one-to-one mapping of the interaction space and visualization space, causing the player feel connected to their game character. Any action that happens to the character is also experienced by the player, to some extent. This immersion can motivate players to exert themselves more as they control their character to achieve certain goals in the game. Physical games leverage this immersion and are used for exercise and physical rehabilitation (Nitz et al. 2010, Ramchandani et al. 2008). Several accidents have occurred when Wii players lose the grip on their Wiimote caused by sweaty hands.

One of the side-effects of using physical interfaces are that some players may only be able to play for short periods of time before needing to rest, due to the high physical exertion required by the game. Games that use physicality must be able to encompass a complete gaming experience in a short amount of time, perhaps only several minutes. The player should be able to identify the goal, understand the obstacles or challenges, and overcome these and reach the goal before they get too tired. This short gaming style is quite different in nature from longer games that are typically played for hours and contain

many goals and types of challenges. Many games for the Wii and Kinect are short games that don't require extended periods of exertion, or they provide players with opportunities to rest or switch players. There are several instances of people playing *Dance Dance Revolution* with such intensity that they sweat profusely, lose their breath, and in rare cases over-exert themselves to the point of temporarily losing consciousness.

Short games that have simple goals and obstacles, called casual games, require very little commitment from the player. Casual and physical games may be an ideal combination because they can be learned quickly, the physical controls don't require much practice, they have short and simple gameplay, but still manage to motivate the player by creating a one-to-one mapping between their body and game character.

We envision ordinary physical objects being used as game entities. Most regular physical artefacts have affordances that make them intuitive for people to use. In the same way that intuitive physical expression became a modality for game control, so too can the intuitive affordances of these objects. For example, a physical ball can be represented as an entity in the game. The real ball can be tossed, bounced, and thrown to another player and it may exhibit different actions in the game depending on how it is being used. This type of interaction is being investigated with different motion tracking systems like the Microsoft Kinect.

While physicality can allow players to intuitively control games and provides rich expression in movements and actions, it is not suited for all scenarios.

As previously mentioned, physical games may tire the player quickly and would not be suitable for long game sessions. The current physical tracking systems used in games

consoles like the Wii, Kinect, and Move are also poorly suited for games that require precise control or that have many features and commands. Also, expressive physical actions such as jumping may appear odd to non-gamers or in non-gaming situations. It is important for the players to feel comfortable in the social setting they are playing in so that they can make these physical gestures and movements without feeling anxious or self-conscious (Sall, Grinter). If the players are strangers, or if non-participating observers are present, the players may be embarrassed to play the game openly.

We envision a spectrum of physical interaction that can be used to customize the level of immersion and interactivity experienced by the player. This spectrum can range from very little physical gameplay, to full body physical gameplay that we see in many video games today (Figure 3.1). By choosing the level of physical engagement experienced by the player, game designers can create varying degrees of immersion and select moments in the gameplay to either ramp up physical gameplay or to diminish it.

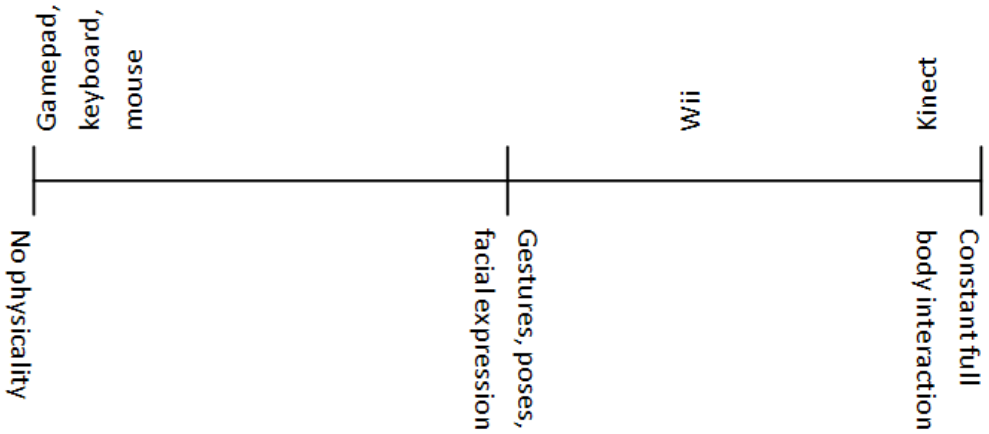


Figure 3.1 Degree of physical interaction and where different game systems lie on the spectrum.

3.2.1 No Physical Gameplay

On one side, there is no physical interaction, and this type of gameplay is reminiscent of games played with a gamepad or similar controller. This gameplay style is well suited for games that require very precise control of game elements, or many different game features that must be controlled simultaneously.

Also, this style does not require as much physical exertion on behalf of the player, allowing them to play for longer periods of time.

3.2.2 Gestures, Poses, and Facial Expression

As we begin introducing more physical action in the game, players are able to control some game elements by creating gestures with their hands or arms. These gestures are used for more general and less precise actions and may include manipulating game objects by holding, moving, and rotating them with hand movements. The player may also use their hands to draw objects in the game, or to select options in a small scale menu system. This may remove the need for a gamepad or other handheld controller, while still retaining an acceptable degree of precision when controlling game elements. Players will experience more fatigue and exertion than with a gamepad, but it is an amount that is manageable with medium length game sessions.

A slightly more engaging style of physical gameplay is when players use their bodies to pose or act while playing the game. This may require the player to use only part of their body (such as the torso, arms, and head) or even their entire body to create poses for short periods of time. Additionally, the game may require that the player pose with a specific

part of their body, such as their hand or their arm (to make different shadow puppets, for example).

This style of physical gameplay is not restricted to just the body. Humans possess the ability to create a multitude of emotions and expressions with their face. Games can rely on the player's facial expressions to either control some game elements, or to just allow players to act and pose in the game with their face.

Posing and facial expressions require slightly more physical exertion from the player and are less precise than gamepads and hand gestures. However, they offer a much higher level of immersion for the player. To mitigate exertion, this style of gameplay can include rounds of posing and facial expression that follow a short planning session on how the player will pose.

3.2.3 Full Physical Gameplay and Action

The furthest end of the physical gameplay spectrum includes uninterrupted physical control of the game with the player's entire body. This may include all of the previously discussed physical modalities as well as jumping, ducking, leaning, in conjunction with constant gesturing and posing. The players must keep moving to control the game, unlike posing. This style of gameplay creates the most immersion for the player and is the most fatiguing, requiring constant exertion. It is likely that players will only endure shorter and more intense game sessions.

3.3 Sociability

Human beings are very social individuals, so it should come as no surprise that sociability has existed in video games since their inception. The first games ever created

were two player games like *Pong* that spurred competition between players. Video arcades were popular places among youth to visit with their friends, and game consoles have support for up to four simultaneous players.

However, there are various intricacies that exist regarding social gameplay. The most obvious is that players do not have to be collocated to play video games together. Many games have an online multi-player mode that can be used to connect with remote players. Often times, single player games will include this feature so that gamers can continue to enjoy the game after completing it. Other games are designed to be played online exclusively. What is interesting is that these games usually do not make any provisions for a *collocated* multi-player mode. That is, only one player can be using the game system at one time. Online players use screen chatting tools (and recently voice-chat) for communication, which may hinder socialization rather than foster it. Screen chatting tools (where messages are typed) can be slow and do not convey non-verbal cues like voice tone or inflection. While voice chat allows these cues to be communicated, it fails at transmitting important physical cues between players. These tools may impose anonymity and separation between users that can lead to aggressive behaviour, trolling, and spamming, often with no consequences. Abusive behaviour was once a problem for players of *World of Warcraft*, a massive multi-player game. Players now face repercussions for disrespectful behaviour and may be banned from the game (.

Playing games together with collocated people has many benefits over online gaming, such as more natural and non-verbal communication between people and creating a healthy social atmosphere between the players. Physical contact may even occur as

gamers express praise, joy, frustration, and other emotions towards one another. When describing social interaction between gamers, we are focusing only on collocated gaming.

For socialization to exist between people in the context of video games, it is important for all of the social participants to be engaged in the game. Social interaction may exist between one person who is playing a game and another who is doing some other task, but it is not social *gaming*. For a game to mediate sociability, both people should be almost equally engaged by the game.

We identify and focus on three main social traits in video games: spectator engagement, cooperation and competition. We believe that these traits form the basis of other social interactions between players such as joking and laughing, storytelling, teamwork, antagonism (taunting), and general conversation.

3.3.1 Spectator Engagement

When considering the game participants, we look beyond the explicit players themselves. While all the game participants should be engaged in the gameplay, they do not need to be directly playing and can be members of an audience that is watching the game or the players. Socialization often exists between the spectators and may occur between spectators and players, especially if the audience is not very large. Large gaming events exists that are watched by hundreds and sometimes thousands of spectators, not unlike organized sporting events. Physical gameplay is especially successful drawing an audience because the expressive motions made by the players are seen as a performance.

3.3.2 Competition and Cooperation

Video games have a wide range of gameplay styles that are reflected in the social atmosphere they create. Competitive games can create competition between players and even alliances may form between players who have a common opponent. These usually involve friendly jokes and insults between players and could even form into long-term rivalries. Cooperative games typically create camaraderie between players and can even build trust. In good cooperative gameplay, players must listen to each other and be team-oriented if they are to win the game. In some games, a strong player may lead the team and not rely very much on the others. This "take-over" can be frustrating for weaker players and they may not enjoy the experience. A popular cooperative game is *Left4Dead*, a first person shooter where four players must survive a zombie outbreak. The game is played by four players (either online or in collocated split-screen mode) and teamwork plays a crucial role in surviving the hordes of zombies that attack the team (Booth, 2009). Communication between the team is very important and the game specifically creates situations that require players to work as a team if they are to succeed, such as rescuing players and sharing resources like ammunition and health.

This type of social interaction is not limited to just the players. The audience may cheer, praise, or mock the players when they succeed or fail. Spectators may challenge the players and claim that they can perform better when their turn to play comes.

Socialization is an important part of human nature and has great purpose in video games. The goal of social interaction should be to make the game more fun. Audiences should be engaged and can be entertained by the players when their gameplay becomes a

"performance" or a spectacle, perhaps through the use of physical interfaces. There should be chances for all participants (players and audience members) to play the game so they do not feel left out. Short, simple (casual) games provide a good opportunity for this. Cooperative games should attempt to create situations where team cohesion and trust is valued more than individual goals. There are times when socialization can negatively impact games, such as with abusive online partners, or people who are not participating in the gameplay.

3.4 Authorship of Content

Prior to 2004, the model for exchanging information on the internet was decidedly a one-way street: users could download data from a static website but could not edit or modify that data. This seems like a reasonable restriction, but if the user wants to share some of their content with others on the internet (be it photos or video) they must start their own website, and doing so may be difficult and expensive.

Web 2.0 is a term that describes the shift in information exchange that allows users to upload their data to a stranger's website, making the information editable and fluid. Websites like Flickr (launched in 2001) and Youtube (2005) made it simple for users to upload and share their photos and videos with anyone on the internet. Other services began to emerge like social networking websites (MySpace, Facebook), blogging sites (Blogspot), and wikis (Wikipedia). Publishing and sharing custom content became something anyone could do with just an internet connection and a browser, which had become ubiquitous. It should come as no surprise that users began using video games to create content and share it online.

As discussed in chapter two, gamers created custom levels and modifications for their favourite games, and even used the game's 3D engine to create films. While these activities certainly qualify as authorship, they are not necessarily related to the gameplay, which should be intended to create fun and entertainment for the player. Using a game to create content can be as simple as making a screenshot or recording a video while playing. In fact, gameplay videos are very popular and are uploaded to the video sharing Youtube regularly. The authors typically wish to share an unusual or humorous situation with their friends, or to show off their skill in the game. We find these examples of authorship weak, and consider that there are many more subtleties that can make authorship a fun and engaging gameplay technique, rather than a mechanical recording activity.

In this framework, authorship is a method or apparatus that motivates the player to create sharable content while still *playing* the game and having fun. This definition does not attempt to define what "content" is, and leaves it purposefully vague. Conceptually, "content" can be anything worthwhile for the player to create, for example: photos, screenshots, videos, 3D models, sounds, music, animations, etc. An important consideration is that whatever content the player creates through authorship gameplay should persist once the game is over and ideally be sharable with others.

Before we talk more about authorship, we should try to define the types of content that can be created in the hopes that it will help us understand how to design fun and effective

gameplay. We propose that there are two main types of content that can be authored by games:

1. performance based content, which is created by players somehow performing in the context of the game
2. goal oriented content, which is something the player creates that helps them succeed in the game.

3.4.1 Performance Based Content

As its name suggest, performance based content is something that includes or involves humans performing in some way. The term "performance" identifies the large variety of activities that people do to communicate and socialize with each other, and can include singing, dancing, acting, storytelling, playing music, to name a few.

Performances like these have been used throughout human history to share information and ideas, teach and enlighten, and to provide us with entertainment. Traditionally, these performances had to be done live such as in a theatre or a music concert, but new recording and broadcasting technologies made it possible to deliver performances to a large, distributed audience, for example via radio and television. Today, the internet and Web 2.0 technology have enabled almost everybody to create, record, and share their performances with the entire world, in some sense as a way to address the human need for socialization.

Performances address several basic human desires. They allow us to creatively express our ideas and emotions, often using physical embodiment, and to share these expressions with other people. Video games can be used to satisfy these needs by creating an environment that encourages players to make creative performances. We will use *Yoostar*

as a case study to see how authorship gameplay can be used to create performance based content.

Yoostar, presented in chapter two, challenges players to act in short scenes from popular films, similar to karaoke where players have to sing the lyrics of popular songs. Players act as one of the characters in the scene and their performance is digitally inserted into the chosen film scene alongside the other real actor. Players are given points for delivering the correct lines of dialogue at the proper time or they may change the scene's dialogue entirely. The performance is recorded and the video can be shared by uploading it to YouTube or Facebook.

Yoostar is in fact a single-player game (only player can act at a time), but we believe that socialization plays a major role in its gameplay and that *Yoostar* is most fun when played with a group of people. Earlier we discussed the likelihood of physical gameplay to be interpreted as a "performance" and to draw an audience. In many physical games, a player's "performance" may emerge as an indirect result of them trying to overcome obstacles and win the game (as with *DDR*). In *Yoostar*, however, there is no mistake that an acting performance is the one and only goal for the player and it isn't something that will emerge on its own. Players must somehow be motivated to give "good" performances, either through expressive acting or by creatively changing the context of the scene. *Yoostar* attempts to create this motivation with a scoring system that judges the player's acting and line delivery, but we think that this is weak motivational tool. People don't play *Yoostar* to get a high score, they play it to express themselves creatively

through acting, and to entertain their friends who are watching. We believe that this is the primary incentive for participation in *Yoostar*: to entertain the audience either through acting or improvisational skills.

Yoostar approaches authorship very carefully, striving to create an experience that gives players the chance to explore their creativity while still providing structure and direction. *Yoostar* uses a well known medium to generate and record content. Film is widely recognized and understood by the general public, and players don't need to be educated about how it is created, watched, and where it is used. *Yoostar* focuses entirely on films with human performances, conveying to the player that they will need to physically act when playing.

While *Yoostar* tries to elicit creative performances from the player, it provides guidance during this process. Only famous or well known film scenes are used in the game, which can provide players with an example they can use to base their own performance on. The scene's dialogue is shown to the player with the correct timing, so that players can still act even if they don't know or remember the details of the scene. In the creative mode of the game where the goal is to improvise new dialogue, players are still aware of the scene's context from the actions of the original actors and the scene's location. Not every player has the same level of creativity or self-confidence and some players may feel overwhelmed with the task of acting, especially if being watched by the audience. Providing these types of guidance may help to alleviate feelings of anxiety or self-consciousness that some players may experience, while not imposing any restrictions on their performance.

Film conveys a lot of visual and auditory information to the viewer very quickly, and watching short video clips requires very little time-commitment for the viewer. Yoostar carefully selects only short film scenes so that they can be watched quickly and not lose the viewer's attention. This also ensures that players do not lose interest in the scene from having to perform for too long. Audience members are also more engaged because players rotate quickly and it will be their turn to soon.

3.4.2 Goal Oriented Content

At their core, video games create challenges and obstacles that the player must overcome to reach a goal. The obstacles and their solutions are carefully designed by the game developer to be fun and to motivate the player to solve them. Goal oriented content leaves the solution in the hands of the player, and the content that they create helps them overcome the game's obstacles.

This type of authorship gives the player a series of in-game tools that can be used to make several possible solutions, and it is up to the player to decide what path they will take. Once again, we will use case studies to gain insight into how goal oriented content authorship is designed in two games: *Spore* and *Minecraft*.

Spore is a role-playing game that challenges the player to guide an organism through different stages of its evolution (Wikipedia, Spore). The player controls an individual member of their in-game species and must guide that creature to catch food, evade predators, and to find a mate. At various stages in the game, the player decides how their

organism will evolve by choosing to add or modify different physical adaptations to the creature's body (Figure 3.2).

Figure 3.2 A player selecting a skin texture in *Spore's Creature Creator*.

The player can express their aesthetic creativity and values through the organism's appearance and adaptations. For example, the player can add sharp teeth or claws to their creature for more lethal attacks, or they can decide to make its legs longer for greater manoeuvrability. The teeth and claws may reflect aggression values for some players, and the longer legs may reflect non-confrontation values in others.

Only small changes in the physical form of the creature are permitted during each "evolution" stage. *Spore* gives players a detailed preview of what the different adaptations will look and behave like when they are editing the creature. The player must

carefully consider each adaptation and choose the ones they most identify with (e.g. sharp teeth or longer legs). Poor or careless choices at the start of the creature's development can drastically impact how it will look and behave later in the game. These decisions create a challenge for the player and force them to try to balance their creative aspirations with the practicalities of creating a "successful" organism that can survive well in the game.

Spore's environment tries to simulate a working ecosystem in which the player's creature lives and competes to survive. The other creatures in the environment are downloaded from a centralized database with many different creatures that are created by other players of *Spore*. This means that as the player incrementally authors their own creature, snapshots of its design are sent to the central database and may be used to populate the environments of other players of *Spore*.

The authorship of creatures became a popular activity in its own right in led the developers of *Spore* to release a stand-alone *Creature Creator* game that gives the player unlimited freedom to design any organism they want. The *Creature Creator* lets players export their creations to share with others. Videos of creatures are frequently uploaded to YouTube.

Minecraft is an open ended sandbox game that takes place in a simple world made up of cubes that represent different materials like earth, stone, wood, or water. The player can walk around the environment and interact with objects by hitting them and collecting the broken pieces. The pieces can be combined to create tools and other implements to aid

the player in collecting more raw materials. *Minecraft* has a working day-night cycle and enemies such as zombies, skeletons, and spiders come out during the night to attack the player who must survive by using their tools to build a shelter that will protect them from the monsters.

Once players have established a dwelling and guaranteed security for themselves during the night, they can begin to focus on other tasks like exploring the environment, creating better tools, finding and mining rare materials (like diamond), and expanding their shelter.

Minecraft imposes no restrictions on the player and does not attempt to guide them through any meaningful plot or storyline. While there is no explicit goal or ending to *Minecraft*, the player's curiosity and creativity can motivate them to keep playing. The player may be inspired to create a complex structure, but may not have the means to do so. They must explore the game to discover new materials and tools that can be used to realize their creative ambitions. This is the basis of the challenges that help create authorship gameplay in *Minecraft*: the players has creative aspirations and must embrace their curiosity to explore the game to gain the means to realize their ambitions.

Minecraft allows players to save their "world" to share with others. Third-party social networking websites now exist that are dedicated to sharing and rating user created worlds. Players also record videos of their world and share them on YouTube, similar to the machinima examples discussed at the start of this section. The fundamental difference between machinima and *Minecraft* is that *Minecraft's* gameplay is designed to encourage and enable the creation of new content, whereas games traditionally used in machinima make no provisions for authorship.

Games focused on goal oriented content, like *Spore* and *Minecraft*, tackle authorship in similar ways. Apart from the basic rules of the game (like gravity, movement, health), the game makes very little provisions for guiding the player along a set course or plot. Instead, the player is encouraged to make their own choices that ultimately influence their success in the game. The freedom of making choices manifests two essential qualities in the player: curiosity and creativity.

Making a decision that results in a specific outcome may make the player wonder what other outcomes could occur had a different decision been made. The player's curiosity drives them explore the game and to make different decisions when choices are presented. Players in *Spore* could wonder what effect does adding longer arms have on their creature, or adding more than two arms.

The exploration of the game may reveal new goals to the player that can be achieved by overcoming new obstacles. It is the obstacles that encourage the authorship of new content and start a problem solving process that uses the player creativity to devise solutions. In *Minecraft*, the player may need to fashion a specific tool to be able to mine a new material.

The player's creativity and solutions to the obstacles is what ultimately creates immersion and an emotional connection to the game. A player becomes invested in the game when they spend time thinking about the obstacles to their goal, and then devising and creating their own solution.

These games also share several specific gameplay features that make it easier for the player to author new content. The games use simple rules and components that can be

combined to create more complex entities. For example, *Minecraft* players can convert wood into sticks, but then the sticks can be combined with other materials like stone or metal for different tools. The game also gives a live preview of the player's creation, showing the short-term results of the choices available.

These games also require a longer time-commitment from the player to be able to learn the game mechanics and to immerse themselves in the game's challenges to begin making meaningful creations. Players also need to have explicit control over many different game entities to be able to make the content that they envision. For these reasons, game oriented content authorship typically does not use physical interfaces.

Also, socialization must be handled carefully for these games. While there is a possibility of successful collaboration between two or more players, there also exists the possibility of disagreement and clashing when the players have significantly different ideas. We would argue that sociability does not always increase the enjoyment of goal oriented content authorship, and should be avoided in the gameplay.

3.5 Summary

In this chapter we have presented a framework that describes the importance of physicality, sociability, and authorship in video games. These themes can be used on their own or in combination to make the game more fun and entertaining. However, care must be taken when designing the gameplay, as each theme requires that specific attributes be present for the gameplay theme to enhance the gaming experience.

In the next chapters, we will use these themes to design three games that have various combinations of physicality, sociability, and authorship components.

Chapter Four: Prototyping *Film Karaoke* and *Joke's On You*

After the creation of the design framework, we began thinking of new game ideas that would incorporate the elements of physicality, sociability, and authorship together. Our goal was to find instances that would demonstrate the potential of the design framework, and that will empower future game designers to follow suit and design more games along the same conception. Specifically, our goal was to demonstrate and highlight the authorship game design element from the framework. We were interested to see what impact authorship would make on games with strong social or physical components.

The first two games we designed, called *Film Karaoke* and *Joke's On You*, are discussed in this chapter. These two games were designed as concepts and as early low-fidelity prototypes, but were never fully implemented or tested. The third game, called *Social Comics*, was fully implemented and evaluated, and will be discussed in chapters five and six.

4.1 *Film Karaoke*

Film Karaoke is a concept game and low-fidelity prototype based on the popular karaoke social activity. In normal karaoke, one or two people sing a popular song to their friends as the instrumental track plays in the background and the lyrics of the song are shown to the singers on a display like a television screen.

Film Karaoke attempts to map the same kind of mechanics to films, rather than songs. Two players act out the dialogue of a scene from a popular motion picture film while the scene is played to them on a display with the dialogue shown underneath the film. The players' faces are motion-tracked in real-time and digitally inserted into the scene as it plays on the screen, replacing the original actors' faces (Figure 4.1). The players' voices

and faces are recorded to create a customized version of the scene. This new scene can be replayed afterwards or shared online.

Film Karaoke focuses on short scenes that have very well known dialogue between two actors. The players can decide to ignore the scene's original dialogue and instead improvise a new script that changes the scene's meaning or context, usually turning a serious or dramatic situation into a comedic one.

Figure 4.1 Artist's impression of *Film Karaoke* being played with a scene from the film *Avatar*.

4.1.1 Physicality

Film Karaoke has an element of physical gameplay even though it doesn't call for players to make large gestures or body movements. We argue that the physicality in *Film Karaoke*, while confined and restricted to the face, gives the player very powerful channels to interact with the game.

The game focuses entirely on the player's face and voice, two things that people use on a regular basis to convey a very large spectrum of emotions and expressions. Just like other games that use physicality, *Film Karaoke* is easy to play and new players can start playing almost instantly.

The player's speech gives them a large amount of freedom to express their creativity while acting by changing their vocal inflection, tone, speaking volume, etc. The player's face is also extremely expressive and is used together with their voice for additional impact, such as making a startled expression while screaming, or a quizzical face while questioning.

We also believe that the player will experience a level of immersion in the game due to the direct mapping of their face to the actor's body. This mapping, similar to a mirror, may elicit reactions from the player if something happens to their character in the scene. For example, the player could express surprise or pain if their character is punched.

While *Film Karaoke's* gameplay is focused entirely on the player's face, we argue that this is still physical gameplay as it falls in the middle of the physical gameplay spectrum defined in section 3.2.2.

4.1.2 Sociability

Film Karaoke is designed to have a strong social gameplay component, taking advantage of the presence of other players, the friends who are watching, the popular nature of the film scenes, and finally the immersion in these scenes that enables the performance-like nature of the game.

Though *Film Karaoke* is played by just two people at one time, we envision it to be a group game, and for there to be an audience. Acting in a film scene is an activity intended to be a performance that the audience finds engaging. *Film Karaoke* is designed to be a casual game that can be started and ended quickly, not committing players to lengthy gaming sessions.

The scenes used are very short, only one or two minutes long, meaning that individual players are less likely to "hog" the game for a long time. The quick pace of the game means that the audience members can have a turn playing the game without having to wait as long, and may even encourage people who are not engaging with the game to participate.

The players need to cooperate with each other by deciding how the scene will be acted and maintaining proper rhythm and synchronization with their line deliveries if they hope to make a quality recreation of a scene. The new scene may look odd if one of the players is much less energetic than the other, or if there are big pauses between each player's dialogues. Conversely, *Film Karaoke* may also encourage uncooperative gameplay, such as a situation where one of the players decides they will ignore the scene's original dialogue and change it to their own improvisation, catching the other player off guard.

The video clips created from playing *Film Karaoke* also have social value. Players and

audience members can show the video to other acquaintances and share laughter or critique at the performance.

Film Karaoke ultimately attempts to create a welcoming atmosphere for players. Acting or pretending to be in a movie is a personal activity and some people may feel anxious or self-conscious when having to perform in front of other people. They may feel unsure that their performance will be entertaining and could feel embarrassed. The game creates a situation where acting and performing is considered normal, and provides shy players with a "safety net" that implicitly reassures them that no matter how they act, they will be entertaining. Audience participation can also have a big effect on the atmosphere, and audiences can cheer for players and provide encouragement.

Film Karaoke incorporates all three social traits defined in section 3.3: spectator engagement, competition and cooperation.

4.1.3 Authorship

We believe that authorship of *performance based content* is *Film Karaoke's* strongest gameplay component. *Film Karaoke* uses the well known medium of film to motivate players to create performances for the entertainment of the audience, and to share afterwards.

The player's goal in the game is to make a convincing recreation of a film scenes, or to improvise and change the context or meaning of the scene. The challenge for the player then becomes to act and appropriately convey the emotions of their character, or to use their creativity to change the scene. In both of these scenarios, the player is striving to make an entertaining performance for the audience, as well as for the viewers of the authored video clip once it is shared.

Film Karaoke leverages film's appeal and presence in popular culture to create a guide for the players. By using well known, iconic scenes from film, the game can engage players by evoking feelings, thoughts, and reflections that are associated to the scene and its characters. This gives players a artistic baseline, a starting point from which they can begin to explore their creativity. It is much easier for players to build upon a scene they are familiar with than one that is known poorly.

Sharing is a large component of *Film Karaoke*. One of the motivating factors to play the game is that you can share the video clips of your performance with other friends who weren't there when you were playing. These video clips are stored in a media library and can be opened and watched at any time. The players can also choose what video clips to upload to video sharing sites like YouTube or Vimeo, and if the uploaded video should be shared on social networks like Facebook or personal blogs.

4.1.4 Similarity to Yoostar

While we were exploring the themes presented earlier and developing the low-fidelity prototype of *Film Karaoke*, we discovered a commercial game, Yoostar, that very closely resembles our design for *Film Karaoke*. While Yoostar does not completely match the vision and gameplay of *Film Karaoke*, it incorporates many key elements used in our design. For this reason, we decided not to pursue developing *Film Karaoke* into a working prototype as it would no longer be a new or exploratory work.

The main difference between *Film Karaoke* and Yoostar is that the latter is single-player game. Only a single a player can act in Yoostar at a time, which we believe limits the sociability of the game. First, it removes any notion of cooperation from the game, which one of the main sources of socialization in *Film Karaoke*. We believe that the

improvisation component of the game is also impacted by this limitation. Improvisation requires unpredictable stimulus from another participant who is not present in the case of Yoostar.

4.2 *Joke's On You*

Joke's On You is a concept game and low-fidelity prototype we designed that is loosely based on side scroller fighting games where two players control game characters who fight each other. In *Joke's On You*, the players themselves become the in-game characters and the goal of the game is not to fight the opponent but to embarrass them by using special props and actions. *Joke's On You* allows the player to portray and control their character with their body while socially engaging their opponent, drawing upon the social and physical gameplay elements described in Chapter 3.

4.2.1 Joke's On You Game Space

Joke's On You is played in a setting very similar to Film Karaoke. A camera is mounted on top of a large wall mounted display that points forward. Two players stand in front of the display and have a large green screen fabric hung a few feet behind them. A three dimensional motion tracking system tracks each player's position in real-time. The players wear hats and gloves that have special markers fixed to them that are detected by the tracking system. The markers are also attached to the props allowing them to be tracked as well.

4.2.2 Gameplay

In *Joke's On You*, players square off against one another like in popular side-scroller fighting games such as Street Fighter and Mortal Combat. In these games, the goal of the players is to kill their opponent's fighter while keeping their character alive. *Joke's On*

You focuses less on physical violence (or simulated physical violence) and instead motivates the players to make fun of their opponent, to make jokes about them, and to playfully embarrass them in front of their friends through the use of special props and situations.

Two players stand in the game space and each put on a special hat and pair of gloves. These wearable items are used by *Joke's On You* to track the poses and locations of each player, namely their head and hands, in real-time. The players can choose to use several props during the match, also being tracked in real-time. A green screen behind the players allows *Joke's On You* to show any kind of background behind the players, which may include static images, animations, and elements that the players can interact with. Players select a setting for the match, which may be a real or fictitious location such as outer space, snowy mountains, or underwater. The match setting will dictate what type of attacks or "jokes" the players may use and how each of the props will behave.

The match begins and the players try to win by playing "jokes" on the opponent that embarrass them in front of the audience. Each joke is actually a clever way to decorate the opponent's virtual body that is displayed on the screen. Each match lasts one or two minutes, and the player whose body is decorated the most loses; they had the most jokes played on them. There is no actual physical contact between the players that is part of the gameplay, though players are free to interact physically if they choose to.

The jokes in each match are specific to the setting and are invoked by holding or using a prop in a special way. The props have specific actions assigned to them that change depending on what setting is used. Many of the prop actions involve something flying or moving through the air at the player. We apply two different motion stylizations to

moving props and in-game effects to create a greater sense of immersion, to draw the attention of the player to the prop, and to mimic the visual style of side-scroller fighter games (Figure 4.2). We render effects that convey the speed and direction of a prop, as well as those that accentuate a collision between a prop and the player (Masuch, 1999). The motion stylization implementation and algorithm is presented in appendix A.

Figure 4.2 Motion stylization is used to accentuate the speed and motion of in-game effects.

4.2.3 Example Game Scenario

An example match is described between two players, John and Mary. Both players are wearing a hat and a pair of gloves, and they have selected to play the match in a farm setting. John picks up the bucket prop and pretends to throw the contents of the bucket onto Mary. On the display, his character is shown making this action but virtual water comes out of the bucket and splashes onto Mary. Mary's character is now dripping wet with water. While John was doing this, Mary picks up the basket prop and pretends to

grasp objects in the basket and throw them at John (Figure 4.3). With each grasping and throwing motion, the game shows her character throwing eggs at John, virtual eggs that break when they hit him. Both John's and Mary's characters are now covered with egg and water, respectively (Figure 4.4). John can use another prop to throw mud or hay onto Mary's character which will now stick to her because she is wet. If Mary uses the bucket to throw water on John, the eggs that were previously on his character will be washed off.

Figure 4.3 An artist's impression of *Joke's On You*.

Figure 4.4 An artist's impression of John and Mary using props to play "jokes" on each other. The egg flying through the air has motion stylization in the form of speedlines. A green screen is used to superimpose the players in front of a background.

Interactive elements from the background can be used by the players. A flock of birds may fly overhead in the background that John can disturb either with a prop or with his body, causing the birds to release excrement onto Mary. Other props and background elements can be used to make jokes, and often these jokes can be combined or cancel one another out (such as eggs and water). The audience can cheer for the players and suggest different combinations of jokes to use. At the end of the match, the player whose character is covered in the most embarrassing way loses. Such a loss is a subjective

measure, though *Joke's On You* can keep track of the players' statuses by using a "health" meter or scoring system to evaluate how much a player's character is embarrassed.

This gameplay example describes just some of the jokes and prop uses specific to the farm setting.

4.2.4 Physicality

Physicality is the central gameplay theme in *Joke's On You*. The ability for the game to track the poses and locations of the players creates a very expressive physical experience. Movements like jumping, ducking, waving, throwing, etc, are represented directly by the player's character, and these physical movements are compounded by the use of props that have specific uses and virtual representations. *Joke's On You* uses full physical gameplay and action (section 3.2.3).

Each prop is an easily recognizable object that has obvious physical affordances, allowing players to pick up the item and start using it, learning about how the prop works as they use it. A player can hold more than one prop, or they can use a prop in more than one way, often by combining it with a body movement like waving or throwing. This allows the players to recognize that the props are more than just plain physical items but are real life game artefacts.

Immersion also plays a large role in *Joke's On You*. Like in *Film Karaoke*, the player has a direct mapping to their character in the game. The physical immersion is even more profound in *Joke's On You* because the game is focused entirely on physical interaction between players and less on dialogue and verbal interaction.

4.2.5 Sociability

Like in Film Karaoke, sociability is large element of *Joke's On You* gameplay. However, instead of cooperating, the players in *Joke's On You* are competing against one another, trying to make their opponent lose. The gameplay in *Joke's On You* is much less of a performance than in Film Karaoke, and so the players are not as pressured with trying to win the approval of the audience. Players could feel more relaxed in *Joke's On You* because their gameplay is not being recorded and reviewed, allowing the players to make mistakes without any perceived "penalty". The audience participates in the gameplay by giving suggestions to the players on what props to use and what jokes to combine, as well as cheering for players or laughing at humorous situations created during a match. While competition is the main social trait present while playing *Joke's On You*, the game engages the spectators by the performance and spectacle nature of its gameplay.

4.2.6 Authorship

Joke's On You has little or none authorship components in its gameplay. The goal of the game is not to create any sharable content but just to compete and win against the opponent. The players can of course record their game session and share it online, but this recording does not change the goals or dynamics of the game, and so we do not consider *Joke's On You* gameplay to support authorship.

4.2.7 Similarity to Bam! Pow!

The authors recently discovered a project called *Bam! Pow!* (Irvine et al., 2011) that is somewhat similar to *Joke's On You*. *Bam! Pow!* encourages players to pretend to fight each other by their actions with cartoon styled effects. *Bam! Pow!* uses the Kinect to track two players and whenever the players strikes each other, stylized text expressing a

hitting sound flashes at the point of impact surrounded by several graphics emphasizing the strike (Figure 4.5).

Figure 4.5 Two players fighting in *Bam! Pow!* with a stylized effect appearing.

The use of physicality in *Bam! Pow!* is similar to *Joke's On You*. The player's movements are expressed perfectly by the game, giving them the options of jumping, ducking, hitting, or kicking in any way possible. Though *Bam! Pow!* does differ from *Joke's On You* (no props or background), the element of physicality is demonstrated very effectively.

Joke's On You was never developed into a working game and remains as a low-fidelity prototype used to explore sociability and physicality in video games. We chose not to implement *Joke's On You* because its current design is missing a strong authorship component.

4.3 Summary

In this chapter we have presented two games that were designed as concepts and low-fidelity prototypes following our design framework from Chapter 3.

Film Karaoke is a two player game based on karaoke that challenges players to recreate popular film scenes by acting together. The game digitally inserts the player's faces into the film scene, replacing the original actors. *Film Karaoke* has strong authorship and sociability gameplay themes, though arguably weaker physical gameplay. We did not implement this game due to its similarity to *Yoostar*.

Joke's On You is also a two player game that invites players to play virtual "jokes" on each other to try to embarrass their opponent. It is a physical game with a socialization component, but provides little authorship gameplay, which is ultimately the reason it was not implemented.

These games have given us insights into the possible successes and limitations of physicality, sociability, and authorship. In the next two chapters, we will introduce *Social Comics*, a fully implemented game that includes all three gameplay themes, followed by a formal user study and discussion of *Social Comics'* gameplay successes and limitations.

Chapter Five: *Social Comics*

Following *Film Karaoke* and *Joke's On You* described in the previous chapter, we set out to create a game that combines gameplay features from both designs. We wanted the game to encourage creativity and allow players to improvise a story like in *Film Karaoke*. The gameplay will rely heavily on physical actions between the players, like in *Joke's On You*, and combining this with improvisation will organically create social interaction between the players. As the players improvise a story with physical actions, they will be creating a performance that will engage the audience and encourage their participation in the creative process. This game will include all three gameplay elements: sociability, physicality, and authorship.

We wanted the game to be friendly to naturally creative players as well as methodical and less impulsive ones. This meant that we had to think about a new medium for the game that would challenge both players. *Film Karaoke* used video to capture and share the stories created by the players. While this is an effective medium for sharing, but it may pose problems to players in the authorship stage of the game. *Film Karaoke* allows players to modify popular film scenes, and many of the players may know the scene as soon as they see the first few seconds. The creative players may decide how they will improvise the scene from start to finish in a few brief moments of creativity right at the start. The rest of the gameplay could potentially be devoid of creativity, as all that is left for the players to do is to perform. Conversely, methodical players may find it overwhelming to improvise in real-time, as they would need to match the scene's dialog with their own very quickly, and they may prefer to plan their dialog. The film medium presents problems to both types of players. Those who are creative may find that they are

not being challenged enough during the performance, and those that are methodical may be too overwhelmed to create their new film scene properly. One could argue to use only unfamiliar film scenes in the game, but this could leave the methodical players even more overwhelmed. Also, one of the major elements of the game is that players recreate or change *familiar* scenes. This is similar to karaoke performers choosing to sing songs that they already know, rather than strange songs.

We wanted this new game to be more energetic and for players to be constantly improvising the story while not feeling overwhelmed and unable to perform from the pressure. We decided to use still images to tell the story because it retains the graphical nature of film (useful if the players will perform physically) while removing the real-time aspect that may overwhelm players. One of the simplest mediums for storytelling with images is comic strips and this game will allow players to create comic strips with physical performances. We called the game *Social Comics*. In this chapter we will present the design and implementation of the full prototype of *Social Comics*, as well the revised prototype used in the evaluation of the game, and its gameplay.

5.1 Game Overview

Social Comics is played in a home theatre setting, similar to the setting in which console games are played today, as well as the setting used for *Film Karaoke* and *Joke's On You*. *Social Comics* is designed to be played by a group of people and allows players to create and participate in interactive comic strips, physically acting in each panel of the comic strips, and in the process becoming the strips' main characters (Figure 5.1).

Figure 5.1 ***Social Comics*** **being played by two people, with an audience picture far right.**

Each comic strip is made up of a number panels, each contains speech bubbles for each player and a background that conveys the setting of the comic strip. Each strip has its own textual story that is told through speech bubbles shown on the screen above the player's heads. These bubbles contain text prepared by the game designer that links each panel together into a simple plot (Figure 5.2). The text used in the bubbles is purposefully vague so that the players themselves can choose how to interpret the story. The goal of the speech bubbles is to guide the player's creativity, not to give them instructions on how to pose. Each strip also has a background image that provides context to its story. The background image is usually related to the text in the speech bubbles. For example, if the comic story is about sports, the background image is of a sports arena.

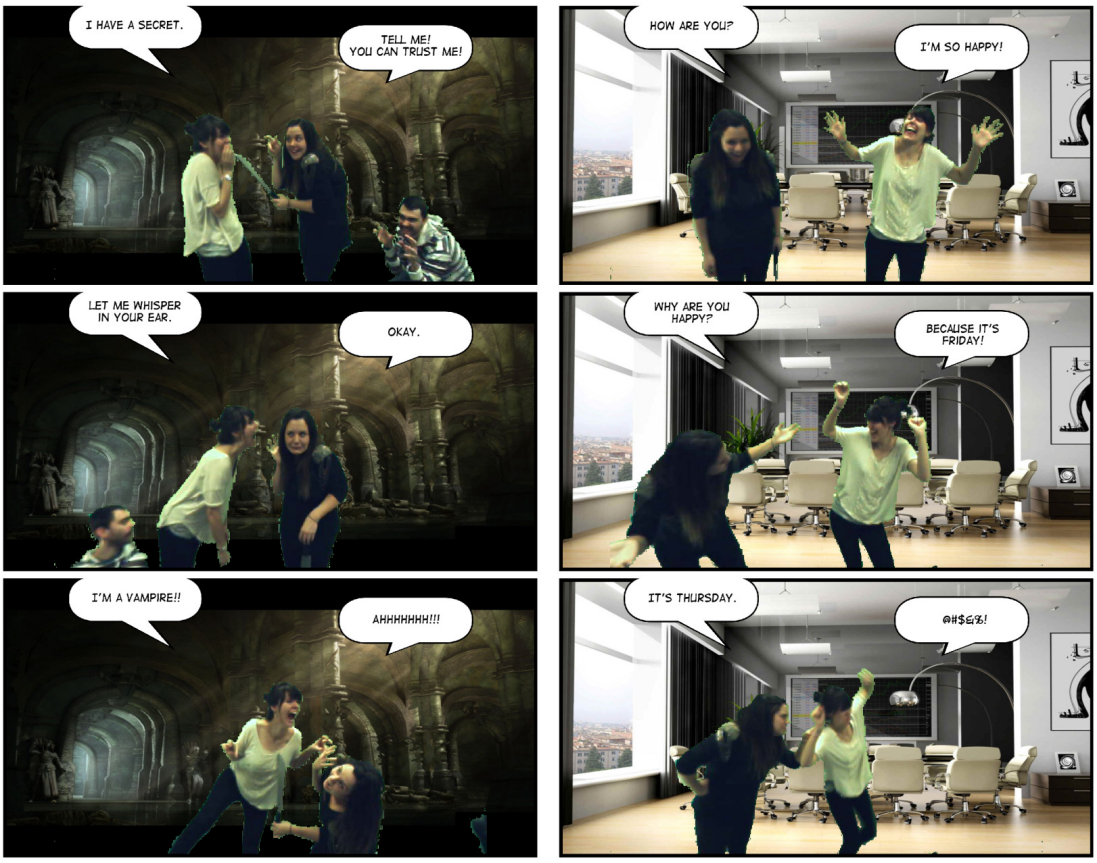


Figure 5.2 Two comics showing speech and bubbles and background images.

Players must interpret the story told by the speech bubbles and background image. They are given a short amount of time to pose together to give visual context to each panel in the comic. They may also use ordinary props to help give more expression to their poses (Figure 5.5). *Social Comics* takes a photograph of the players representing each panel in the comic, and these photos are assembled into a single comic strip. From start to finish, each comic strip takes about one minute to create.

5.2 Complete Prototype

The first prototype of *Social Comics*, the Complete Prototype, differs from the prototype used to evaluate the game, the Evaluation Prototype. The Complete Prototype includes all

of the features implemented for the game, described below. Some of these features were ultimately removed after the game underwent several rounds of testing. *Social Comics* was developed from scratch in C# and uses several freely available libraries for graphics, sound, and webcam functionality.

5.2.1 Game Space

Players stand in an open space in front of a display that may be a wall-mounted television, a computer monitor or a laptop. Above the display is a webcam pointed directly at the players. The video image from the camera is horizontally flipped and displayed to the players, who now see a mirror image of themselves and their surroundings on the display in real-time. Behind the players is a large green fabric hanging on a wall or from the ceiling that acts as a green screen. The area directly between the display and green screen is referred to as the acting space, the place where players pose for the comic. The image from the camera is processed using a chroma-key filter so that the green screen is digitally replaced with a background image (Chaplin, 1993). In our implementation, the display is a large wall-mounted television, and a large green screen fabric is hung four meters away from the display, creating a spacious acting space enclosure (Figure 5.3).

Figure 5.3 The space used to play *Social Comics*, resembling the living room in an average home.

5.2.2 Gameplay Overview

The game is played by at least two players who create a comic strip one panel at a time in serial succession. First panel one is created, then two, then three, etc. The panels have two speech bubbles each with a short line of text that are currently prepared a priori by the game designer. These speech bubbles are overlaid above the image of the players, near the top of the display. The speech bubbles are statically positioned, and each has a short arrow that descends slightly, as in a real comic strip (Figure 5.2). The players have a limited amount of time to create each panel (20 seconds) shown on the display by a timer that counts down to zero (Figure 5.4). The game starts with the first panel of the comic appearing on the display, and with commencing of the timer countdown.

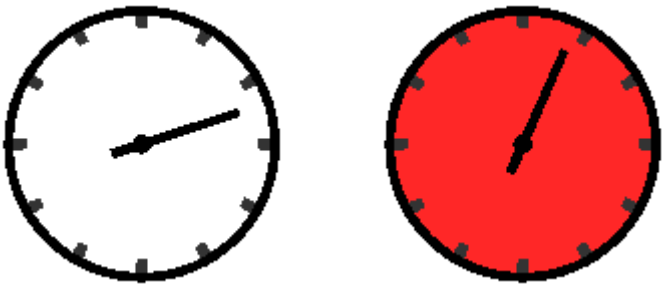


Figure 5.4 The timer starts blinking red when there is less than 5 seconds left.

Before the timer reaches zero the players must read the text in the speech bubbles, select any props they want to use and with them together. When the timer reaches zero, an image of the players and props is made and digitally combined with the speech bubbles and background image to form one of the panels in the comic. The timer is reset and the next panel is immediately started, including new text appearing in the speech bubbles. When the final panel is finished, all of the panels are combined together into a single comic strip image that is saved to the hard drive. The players can review the final comic strip outcome and move on to playing a new comic when they are finished.

The players are free to pose in any way they like, ask the spectators for suggestions or even include their friends in the comic strip. *Social Comics* uses no controllers and players must only act and use props to play the game, making it extremely simple to learn and to play.

Figure 5.5 Several of the props used in *Social Comics*.

5.2.3 Capturing the Scene

The primary input device for *Social Comics* is a camera above the display that points at the players in the game space. There are three important processing steps that the camera image undergoes before it is shown on the screen. The image is flipped and resized to conform to the properties of the display, scanned for 2D fiducial markers used to display special postcards (described in a following section and omitted here), and finally processed using a chroma-key filter to remove the greenscreen behind the players.

The camera used is a webcam with a wide-angle lens that captures as much of the game space as possible so players have more freedom to move around the space (Figure 5.6).

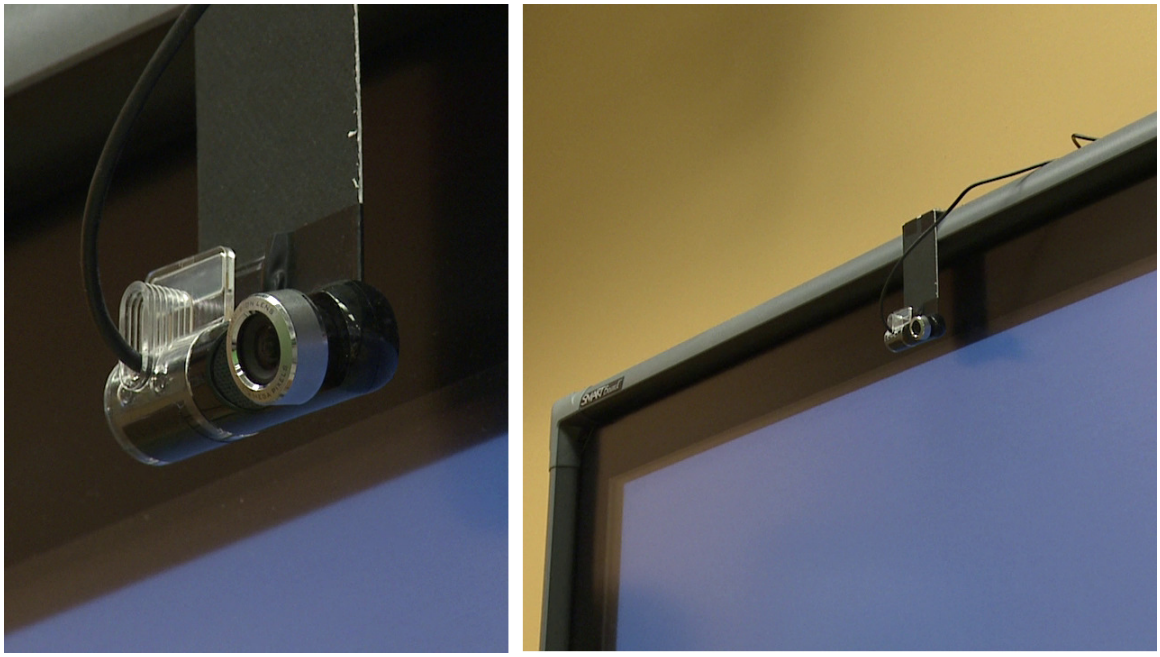


Figure 5.6 Webcam used in *Social Comics*.

First, the images collected by the camera are flipped horizontally so that the game mirrors the player's motions. The image is then processed using a chroma-key filter that removes any green from the image. This leaves only the players and their props in the image, and combined with the background layer creates the illusion that the players are in a setting different than their living room. This procedure has been used for many years in the broadcast and film industries and many chroma-key filters exist. The filter compares the color of each pixel in the image to the *chroma-key*, a color, typically green or blue, that will be removed from the image. The goal of the filter is to preserve the human subject's appearance and since human skin tones contain almost no green or blue components, these colors are chosen to be keyed out. This is why the fabric behind the players is a bright green color. A side-effect of this procedure is that any green clothes that the players wear will also be keyed out, and the player may appear see-through (Figure 5.7).

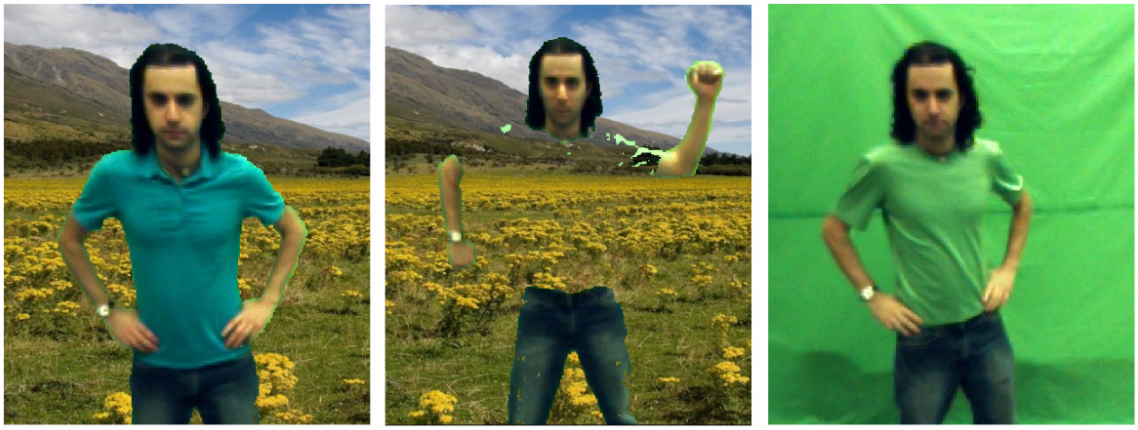


Figure 5.7 Two examples of the chroma-key filter. The subject in the middle image is wearing a green shirt. The right image is the original image.

A common approach to implementing a chroma-key filter is to first convert the *red*, *green*, and *blue* (RGB) color components of each pixel to a different color space called *hue*, *saturation*, and *value* (HSV). In HSV, the *hue* (represented in degrees from 0° to 360°) can be thought of as the frequency of a color, similar to the spectrum of a rainbow (but not identical). A hue of 120° is the color green, and the frequency of the color is not affected by the *saturation* or *value*. In the RGB system, green is represented by values of [*red*:0, *green*:1, *blue*:0], each component ranging from 0 to 1. This representation relies heavily on all three color components matching a specific pattern: in this case the *red* and *blue* components should be identical and much smaller than the *green* component. If the *blue* component is changed to 0.5, the color will experience a significant change, from green to cyan (Figure 5.8). HSV is resistant to such spectral changes when manipulating the *saturation* and *value* components, which change the tint and brightness of the color (Figure 5.9).

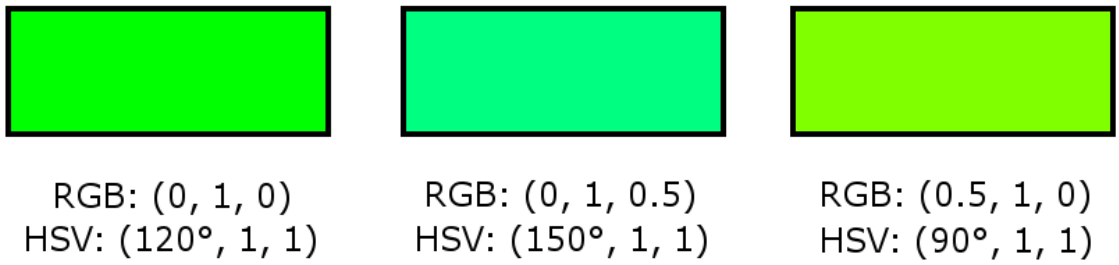


Figure 5.8 Three colors demonstrating how changes in the blue and red components significantly alter the hue (or frequency) of a color.

Once a pixel's color is represented in HSV, comparing it to the chroma-key color, in our case green, is as simple as checking if the pixel's *hue* component is within a certain range of 120° (perhaps +/- 10°). If the *hue* satisfies the match, the *saturation* and *value* are also checked, as this ensures we are only keying bright green and not lime or dark green colors. If a pixel matches all three criteria, it is keyed out and becomes transparent.

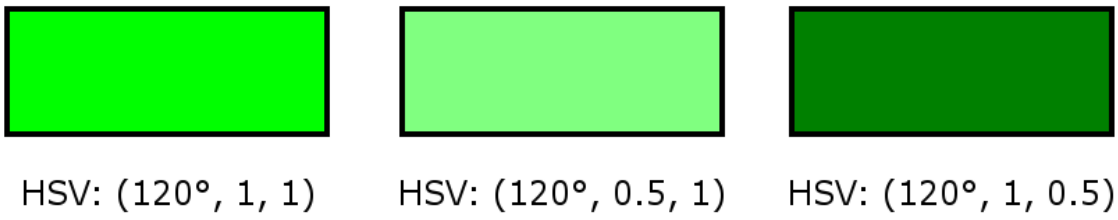


Figure 5.9 The saturation and value components do not alter the "shade" of a color. All three colors are different shades of green.

5.2.4 Comic Stories

Each comic strip is comprised of several panels that have speech bubbles and a background image, which make up the comic story. There is no limit to how many panels a strip may have, but the longest story written for the game has eight panels (Figure

5.10). Each panel could have several speech bubbles, though only two bubbles were used for the stories, one for each player. This keeps the minimum number of players for *Social Comics* to two. Stories with too many bubbles (e.g. too many characters) were difficult to write and could be confusing.

Figure 5.10 An example of a comic story with eight panels.

Each speech bubble (including its text) is stored as an image on the hard drive, so there are two speech bubble images for each panel in the story. The arrow of each bubble is rendered using lines and triangles, and it can point to any position below the bubble while maintaining the proper proportions and style (Figure 5.11).

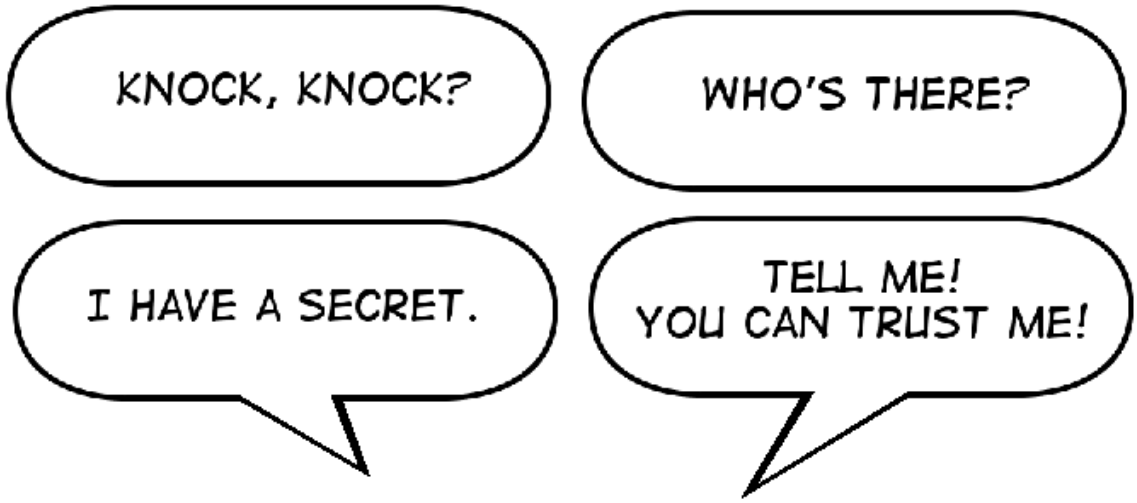


Figure 5.11 Raw speech bubbles images and bubbles with arrows.

There are both advantages and disadvantages to storing the speech bubbles as images. One disadvantage is that the text for each bubble not stored as plain-text but as an image. Therefore, it becomes difficult to create new speech bubbles because each speech bubble has to be created by an image manipulation application. Editing a bubble must also be done by such an application. The advantage to storing the bubbles as images is that any kind of style or font of text can be used in the bubbles without having to install the font or style into the game. Pictures and colors can be used inside of the bubbles to augment the text or to completely replace it. Different bubble styles are also possible (Figure 5.12). It was felt that because the stories written for *Social Comics* were unlikely to be edited once they were written, it was more advantageous to use the image based system for

storing comic stories as it offered more artistic flexibility, especially when customizing bubbles.

Figure 5.12 Speech bubbles are easily customizable when stored as images. Text, images, and colors can easily be combined. The shape of the bubble can also be changed.

Latin languages such as English used in comic strips are read from left to right and top to bottom. Comic artists take this convention into account when designing the layout of their strips, especially when dialogue between two characters takes place. The first character to speak should be on the left side of the panel and the second character to speak should be on the right. The first character's speech bubble should also be above the second characters'. This way, the left character's bubble is read first and the right character's bubble next, following the left-to-right, top-to-bottom convention used in English. If this convention is broken, readers may find the comic difficult to understand and may need to rely on the context of the speech bubbles to determine which character speaks first (Figure 5.13). This is taken into account in *Social Comics*, and the comic story has information about where speech bubbles should appear in the panel.

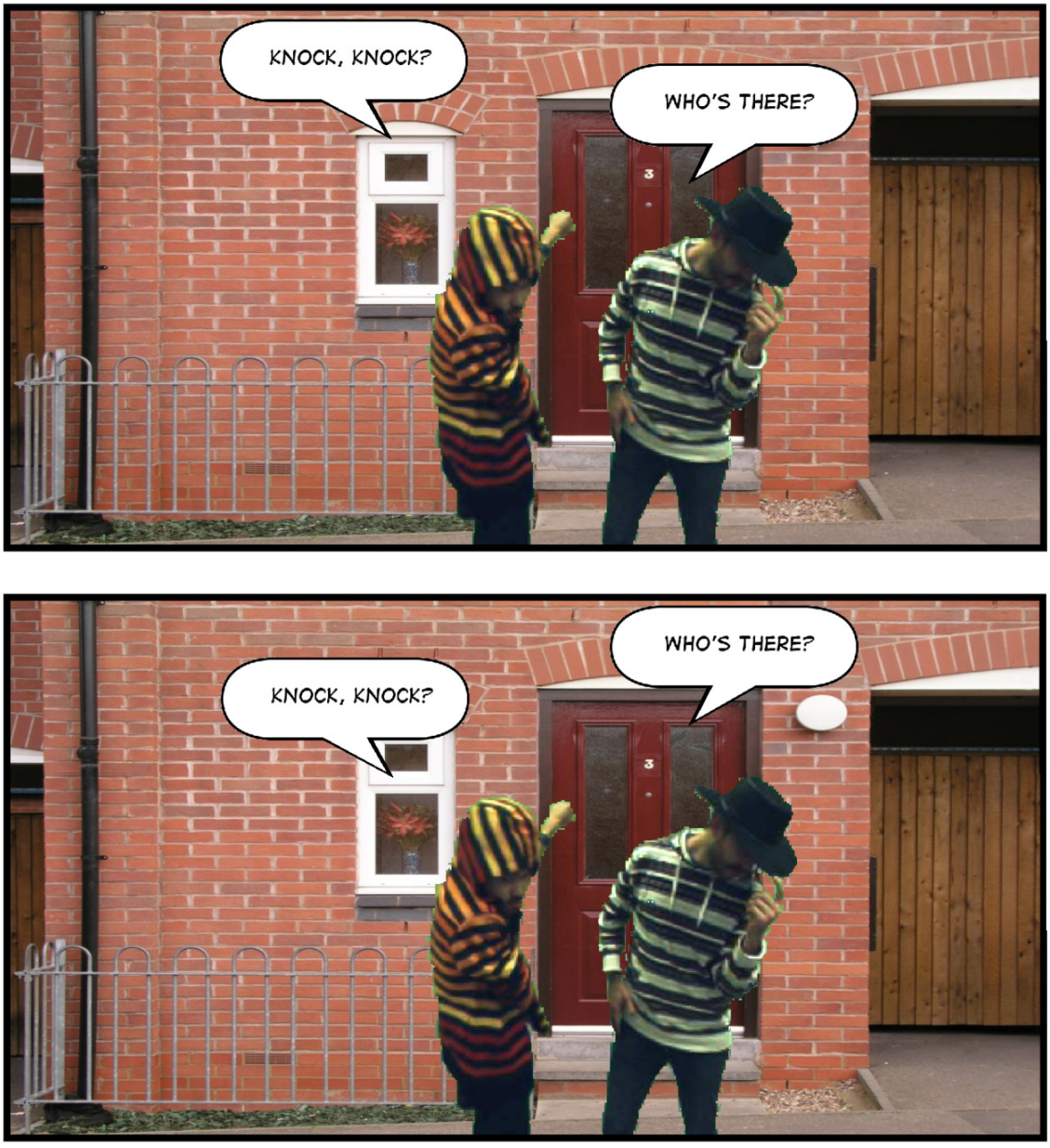


Figure 5.13 In this panel, the left speech bubble should be read first. Possible confusion can arise if it is lower than the right bubble.

Finally, each panel includes a static background image that conveys a setting for the story. Each panel may have a unique image, giving the story the flexibility to change locations. Early in the design process it was brainstormed to have video backgrounds

(such as an ocean with moving waves), but this was never implemented primarily because the motion of the background could not captured in a still comic strip.

5.2.5 Panel Customization

Social Comics allows players to customize each panel by selecting a background image of their choice. This gives players more creative freedom to create their comic story than only posing. Players may want to change the story setting for many reasons. They may wish to make the comic harder to improvise, they may think of a new meaning to the speech bubble text when a different setting is used, or they may simply be bored with the image used for the comic they are creating. Including the background selection with the improvisation process, rather than casually picking a different image after the comic is created, gives players a feeling of immediacy and commitment with their choice. Changing the background takes several seconds, and players may not have enough time to make more than one change in the time given.

Social Comics does not rely on any pointing device or a graphical interface to receive input from the user, using only the camera to record the players' physical actions. Keeping with this modality, we chose to use a tangible interface that the player must physically hold in their hands to change the background image. We used a postcard metaphor to accomplish this.

Every background image the players may use in the game is printed on a large piece of stiff paper or cardboard, just like a regular postcard. Each postcard also has a unique fiducial marker printed on its reverse, which *Social Comics* uses to identify one postcard from another (Figure 5.14). A player can change the background by holding a postcard up to the camera, with the image of the postcard facing the player (so they can see what the

background will change to) and the fiducial marker facing the camera. A free library called ARToolKitPlus is used to scan the camera image for the markers. The player has to hold the postcard for two seconds before the background will change. This delay prevents situations where a player accidentally exposes the fiducial marker to the camera for a short moment, without actually intending to use the postcard. The background will change when only one postcard is being shown to the camera. This avoids ambiguous situations like when both players hold up a postcard at the same time.

Figure 5.14 The front of a postcard is the background image and the reverse is a fiducial marker.

When a player holds up a postcard to the camera, the game will show the fiducial marker on the screen since it is a natural part of the captured image. It could be distracting or unsightly for the players and audience to see the marker during their comic story since it looks very out of place. If a player holds up a postcard as the panel's timer reaches zero, the fiducial marker will be part of the comic and will certainly look out of place. We superimposed a picture of the background image above the fiducial marker to hide and make the postcard appear as it does to the players (Figure 5.15). In addition to identifying

the markers, ARToolKitPlus can estimate the position and orientation of each marker in relation to the camera. This information is used to render the augmented reality postcard so that it accurately overlays above the postcard.

Figure 5.15 The fiducial marker is hidden by the image an augmented reality version of the postcard image.

5.2.6 Speech Bubble Positioning

Comic strip authors use many subtle techniques to make their comics easier and faster to read. One of these techniques is to position the speech bubbles so that they clearly point to each character (Figure 5.16). This may involve extending the arrow of the bubble or to entirely repositioning the bubble closer to the character's head or mouth (cite McCloud).We wanted to emulate this technique in *Social Comics* and implemented a system that would track the position of each player's head and adjust the speech bubble accordingly.

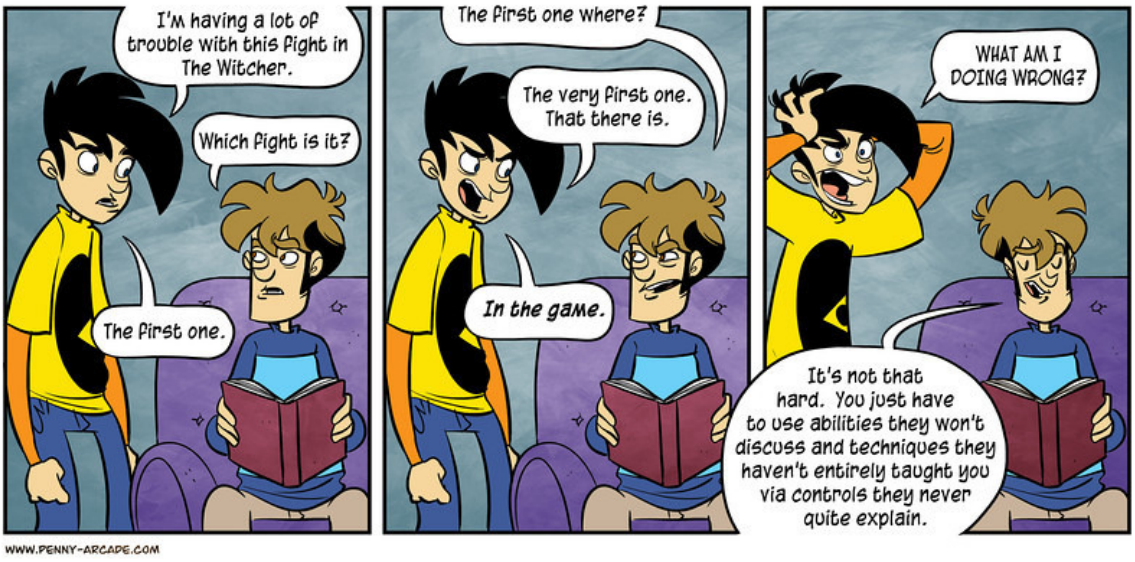


Figure 5.16 Comic strip demonstrating a variety of speech bubble placements.

We used the Vicon Motion Capture System™ to track the players' heads in real-time. The tracking system uses several infrared cameras arranged around the game space at varying angles; from the sides, the top, the rear, and even from below (Figure 5.17). The cameras are tracking spherical markers affixed to a hat worn by each player. The markers have a retro-reflective coating that reflects light back to its source with minimum scattering (Figure 5.18). The cameras emit infrared light in the direction the camera is pointing that is reflected off each marker and returns to the camera's sensors. The raw images from the cameras are processed using an triangulation algorithm that extracts the position of each marker relative to the cameras. The resolution of the tracking system is approximately 1mm and it has a scanning rate of 120Hz.

Figure 5.17 Individual Vicon camera and arrangement of cameras mounted on the ceiling around the game space.

Figure 5.18 Three sizes of spherical retro-reflective markers.

Both players must wear a hat for the tracking to work properly. Each hat is identified by affixing the retro-reflective markers in a unique pattern. One hat positions three markers a line, while the second hat positions four markers in a cross (Figure 5.19). These patterns are non-scalar duplicates and are chiral in relation to each other, so they cannot be mistaken for one another no matter how they are oriented. The tracking system is able to

group several markers together based on these predetermined patterns and therefore identify each hat individually.

Figure 5.19 The hats used for tracking have a different number of markers in unique patterns.

Once the three-dimensional (3D) position of each player's head is determined, it is transformed into a two-dimensional (2D) location inside of the panel. This transformation requires the game to have information about the webcam's viewing frustum (its viewing angle and the direction it's pointing in). A simple calibration utility was created that asks the user to specify the location of five points in 3D space by holding up a single retro-reflective marker up to the webcam's lens and then four corners of its viewing frustum (Figure 5.20). The 3D position of each hat is then projected onto a virtual plane representing the comic panel, acquiring the 2D location. The speech bubbles can now be repositioned using two methods.

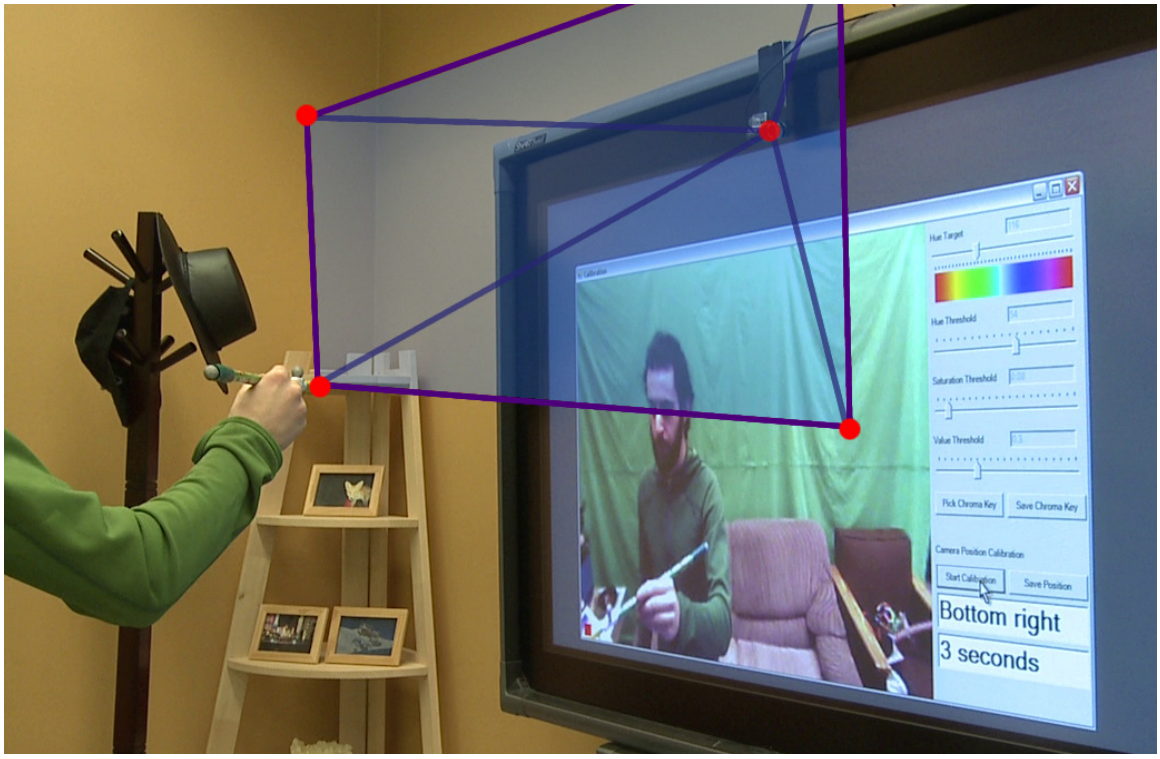


Figure 5.20 A user calibrates the tracking system by specifying the position of the camera and the four corners of its viewing frustum.

One method is to move the entire speech bubble and to keep its arrow static. Both bubbles can be moved independently, and this method typically does cause the bubbles to block or hide any important player actions since they will always hover above the players' heads. The one problem with this method is that it may break the top-to-bottom reading convention discussed in the previous section on Comic Stories. If the left player makes a pose where his head is below the right player, their bubble will follow and appear below the right player's bubble. This could make the comic confusing and more difficult to read (Figure 5.22). Similarly, if the left player stood very close to the right player, the bubbles would overlap and one bubble would have to block the other (Figure

5.22). The readers of the comic wouldn't be able to read the text and not understand the story.

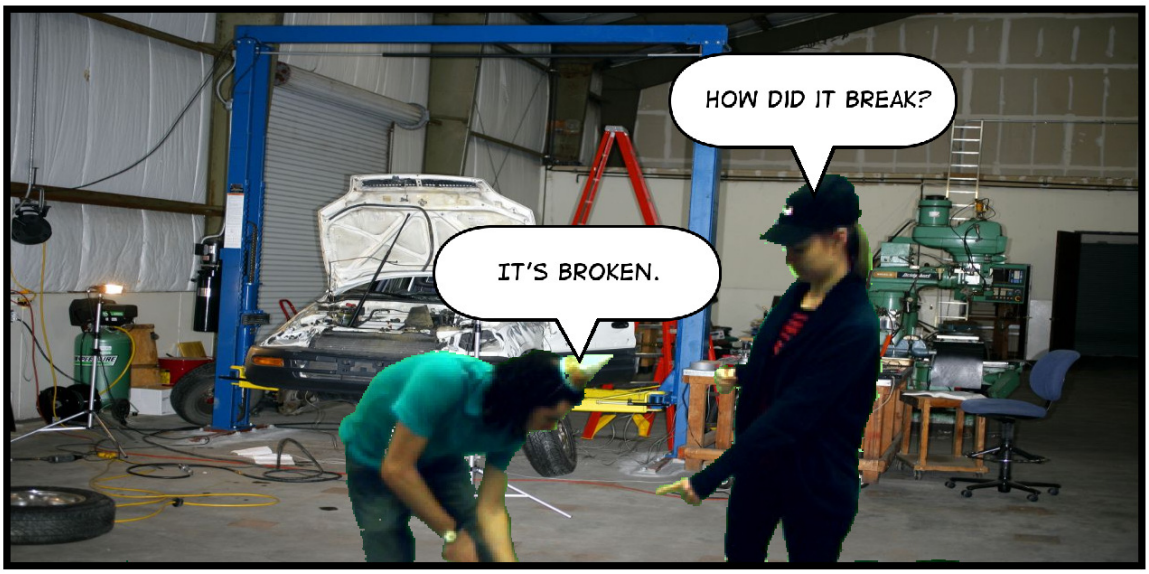


Figure 5.21 The speech bubbles appear in the wrong reading order. The left bubble should be read first, but it will be read after the right bubble because it is lower.

Figure 5.22 When the players get too close, one of the speech bubbles may overlap the other.

A possible solution is to push the right bubble down when the left bubble starts to go low, effectively putting a ceiling on the vertical position of the right bubble. As well, the right bubble would be pushed to the right if the left bubble got to close. In this solution, the right player was still free to move their head and have their bubble follow them, but now their bubble would always be below and to the right of the left player's bubble. The problem with this was that if the left player got very low to the ground or very far to the right, the right player's bubble would be pushed down and right and would block or hide the right player (Figure 5.23).

Figure 5.23 This is an extreme blocking situation where the right player's speech bubble is pushed down by the low position of the left bubble.

The second method for positioning the bubbles that avoids these problems is to fix both bubbles at the top of the panel and to stretch the arrows from the bubble to each player's head (Figure 5.24). This method avoids the problems described above of the bubbles blocking the players, and it was the method used in the game.

Figure 5.24 The speech bubbles are stationary and only the arrow follows the players' heads.

5.2.7 Putting It Together

While *Social Comics* is a 2D game, it is rendered in a series of layers using OpenGL. A layer is merely an abstract way to render all of the graphical elements, from the webcam image to the speech bubbles in a modular and flexible way.

First, the background image for each panel is rendered. The webcam image is rendered next. This image has transparent areas (from the chroma-key filter), so the background image will be visible through this layer. These layers show the players and props in front of the panel's setting (Figure 5.25).

The next layer is the augmented reality postcards that will help hide the fiducial markers. This layer will be empty if the players are not holding any postcards. Next, the speech bubbles are rendered as two separate layers so that one bubble may slightly overlap the other. The in-game timer is rendered last (Figure 5.25).

Figure 5.25 A complete rendering of *Social Comics*, showing the background, webcam, postcard, speech bubble, and timer layers.

5.3 Pilot Studies

Once the complete prototype of the game was implemented and tested, we began to think about possible user studies to explore how well *Social Comics* includes the social, physical, and gameplay themes describes at the beginning of the chapter.

During the implementation and testing phase, the game was played by about 20 people. This included playing with my supervisors, colleagues, friends, lab guests, and even playing *Social Comics* during a lab party. The interactions made with ordinary players (and not a designer like myself or my supervisors) shed light on several gameplay problems and possible improvements that could help a full user study run much more smoothly, discussed in Chapter 6.

Before Social Comics was evaluated with a full study, two structured pilot studies were first conducted. These studies helped to find and fix software bugs, test technical and gameplay features, and refine the overall design of the game.

5.3.1 Unstructured Pilot Studies

The unstructured pilots consisted of several public demonstrations to visitors of the Interactions Lab, playing the game with colleagues for testing purposes, as well as playing the game during a lab holiday party. While these were not directed at gaining explicit measures, they served to initially verify different game play elements and that the game was fun to play. The lead researcher was present at all of these events and made qualitative observations that guided the design of *Social Comics*.

During the public demonstrations, volunteers from the audience were given the chance to play the game first with the researcher, and then with each other. In all instances except one, the audience volunteers participated enthusiastically and attempted to make humorous poses in order for the comic to be entertaining. One volunteer who participated was much more reserved than the others and did not play the game enthusiastically. This occurred during the first public demonstration of the game and we believe that the researcher did not explain or motivate the game adequately.

5.3.2 Structured Pilot Studies

Two structured pilot studies were conducted to evaluate different aspects of the *Social Comics* evaluation approach. The first pilot involved four participants (three female, one male) and addressed gameplay issues such as the benefits of 3D motion tracking, the time allotted per panel, the position of the comic bubbles and green screen, the comic text and stories, the comic review features, the dynamics of four people playing the game and

language issues in the questionnaire and interview questions. The second pilot involved two participants (one female, one male) and mostly explored the speech bubble text and their fitting to the background images.

Several issues were identified from the first pilot. The participants sat on a large couch that was situated in the middle of the acting space, regardless of who was actively playing (Figure 5.26). This resulted in difficulties distinguishing between players and spectators and gave the players little space for posing. Following this pilot session the couch was replaced with chairs that were placed at the side of the acting space to give the active players more room to move around while posing. This change also helped distinguish between players and spectators, as there was now a physical separation between the two. The time allotted for each panel was found to be too long and was reduced from 20 seconds in the pilot to 15 seconds in the full study.

Figure 5.26 The space used to conduct the first pilot study.

A variety of comic stories and backgrounds were tested. The comics were primarily three panels long, but several six and eight panel comics were tested. The comic stories were written by the researchers and varied from simple dialogue, to popular culture references (including quotes from movies and internet memes), to excerpts from theatre productions such as Romeo and Juliet. The backgrounds were images found on the internet that were of a setting or scene without any subjects in the foreground. The backgrounds were matched to the theme of each comic story. For example, an image of an operating theatre was used as the background of a story about surgery.

The participants from both pilots enjoyed the stories with simple dialogues but rejected the stories that they did not understand or that were deemed less fun. Many popular culture references were not relevant to the participants and were removed. Participants explained that stories longer than three or four panels “felt too long” and were “boring” and were also removed or modified to be shorter. Stories containing excerpts from theatre were also negatively rated and were modified or removed. The backgrounds were generally accepted and left unchanged.

The variety of props was reported to be limited in both pilots. Many props could not be used because they had reflective plastic components that interfered with the 3D motion tracking by creating unpredictable reflections. This created noise that temporarily broke the tracking system and correct rendering of the comic bubbles. The participants in the second pilot played half of the comics with the tracking system and half without. In this latter case, the speech bubble and arrow was stationary and did not follow the players. The participants explained that this enhanced their gameplay because now they were free

to use more props and did not have to swap the tracked hats if they wanted to change places in the comic. The tracking system was not used for the full study.

5.4 Evaluation Prototype

The version of *Social Comics* used in the full study, called the evaluation prototype, was based on the complete prototype but had several features removed. These changes were made largely after conducting the pilot studies previous discussed. The motivations behind these changes, discussed next, were to make the authorship components of Social Comics simple and easy to use.

5.4.1 Changing the Game Space

Social Comics was implemented and tested in a special area of the lab called the Home Space. This was an area that resembled a small living room that might be seen in an average household. The Home Space included a wall mounted television, a couch, several chairs, and small tables and other furniture.

The interaction between players and the audience was identified as a key gameplay element early in the design phase. All of the players would share the couch and chairs while playing the game. This meant that the two players had to stand in front of the couch to play the game, while the audience would remain seated. We noticed that this created several problems.

The couch would appear in every panel of the comic strip, potentially ruining the setting that the background images were attempting to create. The audience members, sitting on the couch, would also appear in the comic strip even though they were only observers. We also wished for there to be a differentiation between players and audience members, which is not very apparent if both share the same space all the time.

The couch was moved to the side of the game space and would no longer appear in the comic strip. Also, a clear definition was created between the game space where players posed and the space for the audience to watch the game.

5.4.2 Shorter Comic Stories

Social Comic can support comics with any number of panels. For the complete prototype, comic stories with three, four, six, and eight panels were written. When play-testing, we found that shorter comics were received more positively than longer comics. We believe that there are two reasons for this.

First, an eight panel comic strip has inherently a more complex plot than a three panel strip. This becomes an issue if the speech bubbles have only vague text. On the one hand, the strip is trying to encourage player creativity, but on the other hand, it is imposing a lengthy narrative onto players who may choose an entirely different story.

Second, longer comic strips take away the fast paced energy of the game. Instead of creating a strip in less than a minute, the players now have to play for possibly two or three minutes. This is intimidating for the players because it puts more pressure on them to create a humorous comic, and it may become less interesting for the audience who must now wait longer.

For these reasons, all of the comic stories in the game were changed to have only three panels.

5.4.3 Problems with the Tracking System

While play-testing the game, we noticed several problems related to the tracking system that was used to reposition the speech bubbles' arrows.

First, the tracking system would often break for short periods of time, only one or two seconds. The infrared light emitted by the IR cameras that was used to illuminate the retro-reflective markers was also reflecting from other items. Objects like jewellery, watches, glasses, shiny clothing, and shoes easily reflected light. Worst of all, some of the props used for the game were also reflective. These additional reflections would create a large amount of noise that the tracking system would incorrectly recognize as markers. This noise would sporadically break the head tracking for one or two seconds at a time. When the tracking system was affected by noise, the speech bubble arrows started to behave erratically by moving off the screen and flickering (Figure 5.27). This typically interrupted the players and ruined the comic strip by rendering the speech bubbles incorrectly.

Figure 5.27 The speech bubble arrows don't appear correctly when the tracking system is affected by noise.

Second, the game required that both players each wear a hat. This created some complications each time a new player entered the game space, as they had to get the hat from the old player and put it on before starting the new comic. A separate complication was that each hat was linked to one of the speech bubbles in the comic. This meant that a hat linked to the left bubble should be worn by the player on the left, and similarly for the right hat. When players entered the game space, they sometimes ignored or forgot to stand on the "correct" side of the panel. The arrows of the bubbles would be crossed if the players stood on the opposite side of the game space as their bubble, and while this didn't affect the flow of the game, it made the comic strips less aesthetic and confusing (Figure 5.28).

Figure 5.28 The speech bubble arrows will cross if the players do not stand on the correct side of the game space.

The solution that addressed all of these problems was to simply remove the tracking system and make the speech bubbles static entities. During the pilot studies for the study,

several subjects were shown both static and dynamic bubbles and asked if they preferred the dynamic version. All of the subjects said that they did not care if the speech bubbles were dynamic, and preferred not wearing a hat for the reasons described earlier. Removing the tracking system also allows players to use a larger variety of props that would have been previously unusable due to their reflective surfaces.

5.4.4 Disuse of Postcards

The postcard feature of *Social Comics* was working without any problems but was ultimately removed from the evaluation prototype. We noticed that the postcards were seldom used during play-testing. Often players would create a story using the background image already provided. In the cases when players did use the postcard, it was only done during the first panel of a story and never for the second or third panels.

Furthermore, we felt that allowing players to change the backgrounds of the panels could complicate a controlled user study. We were interested in examining how the participants behaved when shown the same comic stories trial to trial. Allowing the backgrounds to be changed would compromise this goal.

5.5 Gameplay Examples

Here we present two examples of *Social Comics* being played by five adults, three women and two men. These players were invited to play the game as part of a casual video shoot using the evaluation prototype. For the purpose of these examples, the players will be known as Emily, Jonathon, Monica, Mark, and Jessica.

5.5.1 Example 1

In this example, Emily (white shirt) and Jessica (black shirt) make a comic that takes place in a dungeon setting. The game begins and both players read the first speech

bubbles and Emily poses as if she is whispering something into Jessica's ear, who points a sword prop at her. Mark gets up from the couch and crouches in the corner of the panel just as the timer reaches zero and the photo is taken (Figure 5.29).

Figure 5.29 Emily and Jessica pose for the first panel as Mark sneaks in at the last second.

Emily only notices that Mark is part of the comic after the first panel is completed. Mark now moves to the other side of the panel and Emily now poses as if she is shouting at Jessica (Figure 5.30).

Figure 5.30 Emily and Jessica continue posing and Mark moves to the other side of the panel.

The last panel of the comic reveals that Emily's character is actually a vampire who is luring Jessica's character to move closer to her. Emily plays the part and poses as a

vampire by holding out her arms and trying to bite Jessica, who uses the sword to try to defend herself (Figure 5.31).

Figure 5.31 Emily poses as a vampire as Jessica pretends to stab her with a prop.

The comic is now finished and Emily points out Mark's poses in the first two panels (Figure 5.36) during its review, exclaiming "Look at this guy!" Everyone is laughing and Jonathan says "Too good!" (Figure 5.32)

Figure 5.32 The audience and players share a laugh while reviewing the finished comic.

5.5.2 Example 2

Jonathan (hat) and Mark pose for a simple comic story that involves the players laughing in a dentist's office for an unknown reason. It is revealed in the last panel that they are under the effects of laughing gas. The two players, unsure of how to pose for the first panel, smile and make gestures (Figure 5.33).

Figure 5.33 Not sure how to pose, Jonathan and Mark smile and gesture to the camera.

As the second panel begins, Jonathan suggests to Mark that they both jump as the timer reaches zero. They both wait until five seconds are left, and the audience begins counting down “Five, four, three, two, one!” Both players jump on the last count as their photo is taken (Figure 5.34).

Figure 5.34 Jonathan suggests to Mark that they coordinate a jump when their photo is taken.

Laughter erupts as Mark unexpectedly lifts his shirt in mid-air. Once Jonathan and Mark make grandiose poses once they read the last panel and understand why their characters are laughing. Everyone erupts in laughter again while reviewing (Figure 5.36) the comic when they see Jonathan and Mark in mid-air in the second panel (Figure 5.35).

Figure 5.35 The players and audience react with laughter when they see the finished comic.

Figure 5.36 Both of the comics created by Emily, Jessica, Mark, and Jonathan.

5.6 Summary

In this chapter we have introduced and presented *Social Comics*, a game that allows a group of players to create their own comic strips. We believe that *Social Comics* incorporates each of the gameplay elements presented in chapter three and re-motivated at the beginning of this chapter as design goals.

At its center, *Social Comics* is a social game that relies on player communication and cooperation. The players' goal is to create humorous or entertaining comic stories. The audience of the game adds a further social dynamic to the gameplay, motivating the players to entertain their friends as they try to create expressive poses. The audience is also engaged in the comic creation process and can make suggestions to the players. *Social Comics* is played without a controller, instead challenging players to pose and act physically with one another. Players can use props to further express their poses and convey their story visually. The poses made by the players can often be unusual or bizarre, and this creates an implicit performance that the players are making for the audience. The physical and social components of the game are heavily intertwined. Players can respond to each others' poses and even mimic audience members' poses. Authorship plays a big role in *Social Comics*; the entire goal of the game is to create comic strips. Players are encouraged to be creative and improvise the stories told by the strips. The game provides players with vague textual stories that are given further context with background images. These help players by giving them a starting point from which they can further elaborate using their own creative ideas.

Similar to *Film Karaoke*, the authorship in *Social Comics* uses performance based content. Players are encouraged to pose unusually in order to realize their creative vision for the comic they are making.

While *Social Comics* has been played by several dozen people during development, testing, and demos, we were interested to more closely investigate the players' behaviour and the various patterns that could emerge during a structured gaming session. In the following chapter, we present a formal user study where groups of four participants played *Social Comics*, answered a questionnaire, and were interviewed. The study revealed several different behaviours that were previously unobserved, as well as limitations that exist in the current design.

Chapter Six: Evaluation of *Social Comics*

After implementing and testing *Social Comics* with colleagues, friends, and guests, we wished to make a formal evaluation to examine how groups of friends played *Social Comics* together in a structured setting. We were primarily interested to verify if *Social Comics* is a fun game, and if emerging gameplay behaviours can be attributed to the gameplay elements that guided our design. Specifically we wished to evaluate if and how the new authoring element impacts the game experience. We were also interested in observing whether any social patterns would emerge during our evaluation, to see how the groups interpreted the comic text and props and to examine if people who do not normally play video games have fun playing *Social Comics*.

The main study investigates how a group of four friends play *Social Comics*. The group plays through several comics in pairs following a round-robin arrangement ensuring that each group member plays two comics with every other member. In this study, we wished to observe the behaviour a group of friends exhibits while playing the game and also while watching their friends play. We conducted two structured pilot sessions (Section 5.3) before commencing the full study.

A second study was piloted where two groups of strangers play the game together. Each group has two members who are friends, but neither of them knows the people in the other group, and vice versa. This study aims at discovering how *Social Comics* is played in a more realistic party situation where not everyone may be acquaintances. We wished to observe how the participants behaved when introduced to each other, how the groups behaved when playing and spectating, and if any cooperation or tension arises.

6.1.1 Stranger Pilot Study

This pilot study aimed at discovering the feasibility of performing an additional study with two groups of strangers playing *Social Comics*. This pilot was conducted after the main study had been completed, and it used the same study space and apparatus.

The study procedure was altered to accommodate two separate groups. The study began with both groups being introduced and then immediately being separated. One group was taken to a separate and isolated office while the other remained in the main game space. Each group completed the first portion of a written questionnaire in isolation. When both groups had completed the questionnaire, the group in the main game space began to familiarize itself with the game and played through several of the comic stories. Once the first group finished playing, the groups switched; the first group waited in the office while the second group played the game. The group in the office was asked to complete a jigsaw puzzle while it waited for the other to finish playing. This separation was done so as to not prime either group about the game or the other group's playing style. It also allowed each group to familiarize itself with the game without an audience of strangers, which could potentially lead to anxiety and a poor familiarization of the game.

Once each group was familiarized with the game, both groups were rejoined and played through the remaining comic stories together. A round-robin pairing was used so that each participant played with each other participant at least once. From the point of view of each player, this tested the cases of playing with a friend while two strangers are spectating and playing with a spectator while a friend and stranger are spectating.

Once the comic stories were finished, the groups were again separated and asked to complete the remaining portion of the questionnaire. Each group was also interviewed by

the researcher separately. The interview (combined with the videotaped game sessions) was the main source of data collection for this study, as it allowed the groups to report on phenomenon unforeseen by the researcher, and therefore possibly not addressed by the questionnaire. The researcher made it clear that the other group could not hear the interview, as very direct questions were asked about the opinions of the other group. These questions often break social etiquette and the participants may be uncomfortable to answer them genuinely, especially as they ask to judge and rate a stranger in the context of a research study that is being videotaped.

This study was not pursued further than the pilot study because we felt that it was too difficult to elicit honest and genuine responses to the interview questions. After the pilot study, the participants explained to me privately that they did not feel comfortable answering questions about the other group to a stranger (the study administrator), and not while being videotaped. It is therefore likely that participants in a full study would exhibit the same inhibitions during the interview session.

6.2 Study Design

The study was conducted in an isolated room. This ensured that the sessions would not be disturbed by passersby and that it would not be disruptive to others, as the study was often noisy from laughter and conversation among the participants. The isolation of the participants helped ensure that they were free to play *Social Comics* uninhibited and would reduce any potential anxiety that may stem from strangers observing the study. We wished to emulate a friendly and casual party atmosphere during the study similar to a real life gathering of friends. Each session was conducted with a group of four friends. We did not organise the participants into groups but instead asked each participant to

recruit three of their acquaintances on our behalf. This would ensure that all members of the group were friends and were comfortable with one another.

The game was played on a Pentium 4 Windows PC and a Sony 60” LCD display facing a large green screen fixed to the opposing wall. The display and wall formed the boundaries of the acting space (Figure 6.3). Props were placed on either side of the display, easily accessible to the players but out of view of the webcam. The props included large handheld toys like a knife, shovel, baseball, and frying pan, smaller toys such as a stethoscope, frying pan, plastic drill, spatula, and ketchup bottle, as well as a variety of wearable hats. The hats were placed on a coat rack on the left of the acting space, and the handheld props were placed in a box on the right side of the acting space. The participants each sat in chairs placed to one side of the acting area so that the display was visible from each chair. The study administrator would sit several feet away and behind the chairs to minimise their impact on the gameplay (Figure 6.1).

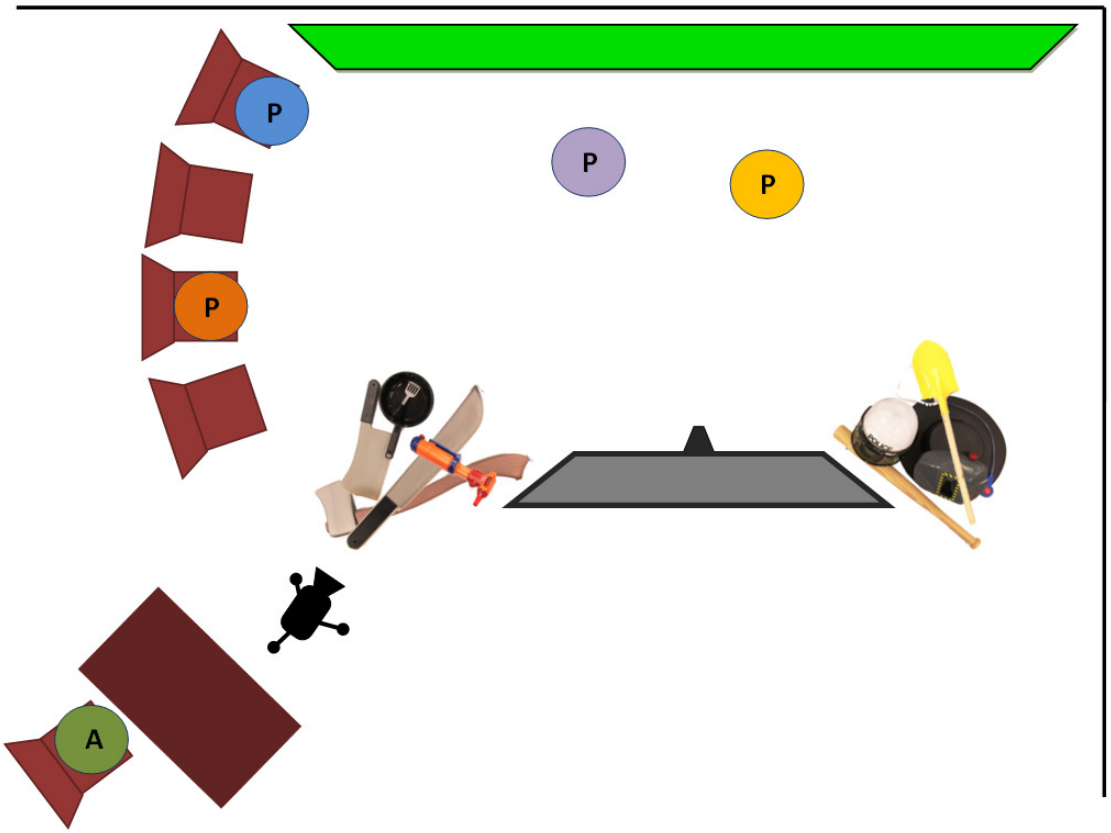


Figure 6.1 Birds eye view of the study layout. Circles marked a 'P' are study participants and the circle marked 'A' is the study administrator. Props were placed on both sides of the television.

6.3 Full study

We recruited 32 participants with posted adverts and an email delivered to the electrical, computer, and software engineering email list. Each participant was paid $15 for participation in the study.

The study began by the participants signing consent forms and completing a questionnaire about how long they know their friends and how much time they spend

playing video games with other people. *Social Comics* was then explained to the group and demonstrated by the administrator together with a volunteer from the group.

The group was then asked to play through fourteen unique comics together and each participant playing through seven comics. Each comic had three panels and 15 seconds were given to pose for each panel. Pairings were made randomly between the players in a round-robin fashion so that each player played through at least two comics with every other player. The administrator would explain the assigned pairings by giving directions about who was to play what comics at what time, but gave no further instructions on how the game should be played.

Once playing the comics was over, the participants completed another questionnaire about their enjoyment of the game, how they perceived the group behaved, as well as any additional comments about the study. Finally, an interview was conducted between the administrator and all the participants to address specific questions the administrator had after observing the session and to allow the participants to give their unstructured feedback about the study. The game sessions and interviews were filmed for transcription purposes.

6.4 Results

Eight groups performed the study. All of the participants were students whose ages ranged from 17 to 31 years (M=21.2, SD=3.2). Overall, 28 per cent of the participants were female, and five groups had at least one female member, three groups being all male. Ninety three per cent of the participants reported that they knew all the other members in their group for at least six months. Seventy two per cent of the participants reported using a computer to play games (not exclusively), 62.5 per cent did not use a

computer but only a console (Wii, Xbox, or PlayStation). Ninety three per cent of the participants reported using Facebook and check the website on average at least five times a day, as well as upload on average at least 25 photos to the site each month, mostly of social events and trips.

Several different qualitative gameplay patterns were observed regarding aspects of the game such as the use of props, backgrounds, poses, spectator involvement, and overall comic interpretations. Many of these patterns were explored during the interview portion of the study when the participants provided reflections and explanations of their behaviour.

In the discussion that flows, participants who are actively playing the game will be referred to as players (and their partners) and those who are sitting on the side and watching the players at a given time will be referred to as spectators. Direct quotes from a participant are shown in quotation marks a link to the participant identity is provided in parenthesis, for example (P7D) refers to participant D from group 7.

6.4.1 Time Restriction

Most players expressed concern during the demonstration round when they were told that each panel should be completed in 15 seconds. Players often initially felt that it wasn't enough time. "At first I [thought] 'it's only 15 seconds?' but once you got into it and understood the concept then it was quite good." (P6D) Players and spectators warned each other when time was running out and they felt a pose or prop hadn't been properly selected. "Five seconds!" (P3B, spectating, and P3C, posing)

Some players felt that the time limit encouraged more creative gameplay, explaining that the game should be played rapidly and that the time restriction forced you to think and act

quickly. “I think it was good, because part of the game was to think on your feet, so it never gave you too much time, but it was intentionally rushed.” (P4B) “I thought the time was perfect, any longer and you over think it.” (P7B)

One behaviour that was observed was players who would act their pose very quickly, during the first few seconds of a new panel being shown, and as a result they had to hold this pose while waiting for the timer to reach zero. “We have awkward moments. You know when we were trying to act the scene, and we have to hold the position, and then we can’t stop laughing.” (P1D) Several participant (P4A) broke their pose while they waited, returning to their pose just before the timer reached zero (Figure 6.2).

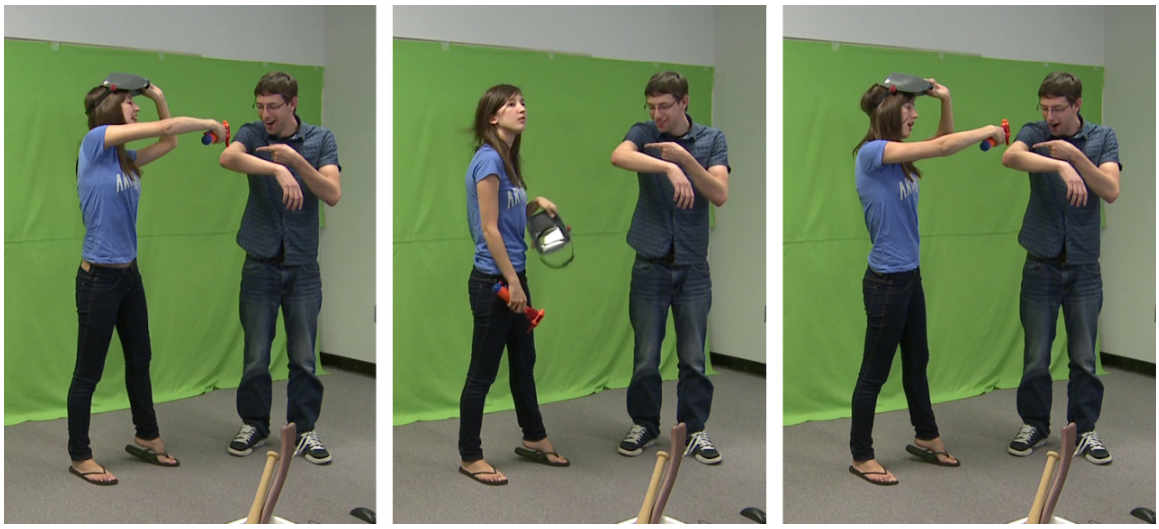


Figure 6.2 Participant P4C first makes a pose, then breaks it, then poses again the same way seconds before the timer reaches zero.

While many players did not feel constrained by the time limit, some raised concerns and said that they did not have enough time to create the kind of comic they had in mind. “It doesn’t give us enough time to really set up a scene, if you have something in mind...” (P3A)

6.4.2 Props

After being introduced to the props in the demonstration round, the majority of participants incorporated props into every comic they acted in. Most of the props used by participants in the study were large toys like the shovel or baseball bat, as well as all of the hats. Many of these props had violent connotations and uses, and as a result the players often used them to simulate violence in the comics by posing as if they were fighting (Figure 6.3). “On the violent side.” (P7A) Participants explained that the larger props were used more because they were easier to select and pick up due to their size, especially when the players were rushed for time. “The big ones are easier to use because you see them a lot better.” (P4B) “Maybe if you laid them out instead of having them in the basket, [it] would be easier to see them all.” (P4D)

Figure 6.3 Many of the participants simulated violence with the props.

Several players made sound effects related to the prop they were using, such as a crashing sound when swinging the baseball bat, or a chewing sound when holding the frying pan. Most of the participants selected their props after the comic began, allowing them to read the speech bubbles in an attempt to match the prop to the text. Three of the groups (G4, G6, and G7) consistently selected their props before starting each new comic. These players would elaborately select their prop and hats, conferring with each other in order for their props to match one another's. "Alright, what are you picking?" (P7D asks P7A) When asked why they chose their props before the comic started, all three groups gave similar responses. "Sometimes it's funnier if you choose something and it doesn't work at all and you try to make it work." (P6C) If the players realised that the props they had selected did not match the text or background of the comic, they would often elect to keep the prop and to improvise a new use for it rather than try to find a different prop. "Since it's a game, and we're not trying to be serious actors, it's funnier to just keep going with what you started with [rather] than to try to make it look good." (P7C) Three participants were observed using their own personal artefacts as props. P2D used his

wallet, P5D used his mobile phone, and P7A used a piece of paper and pen (Figure 6.4). Many participants expressed disappointment with the small variety of props but recognised the limitations of using too many different items. “Maybe a better variety [of props] would be good.” (P7C) “But if you have more props, with 15 seconds time you have to search for them.” (P2A)

Figure 6.4 Participants P2D, P5D, and P7A used their own possessions as props (wallet, mobile phone, paper and pen).

Furthermore, the use of props was not intuitive to all players immediately. Several participants weren’t sure exactly how they should be used in conjunction with the panel text and backgrounds, if at all. “Well as we progress and play along, then we try to figure out what we can use the props for, but not at the beginning. It was the first time I played the game, so I was still trying to figure out which way is more entertaining.” (P1D)

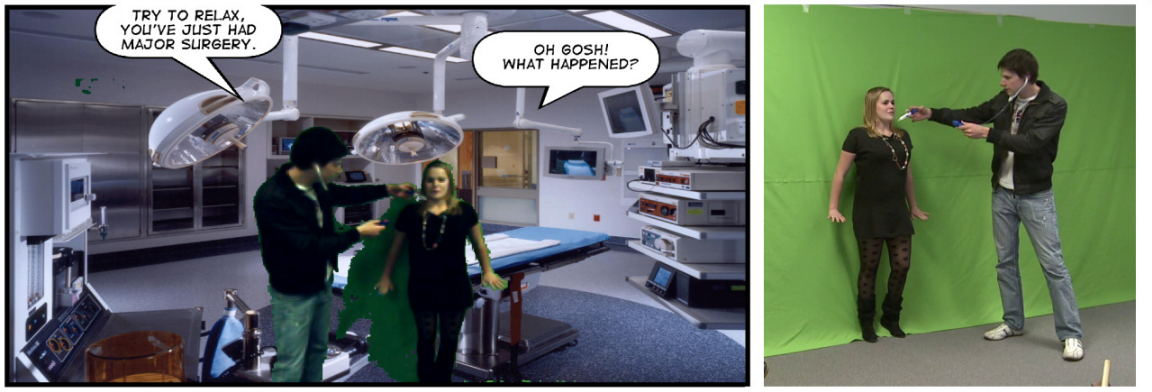
6.4.3 Speech Bubbles and Backgrounds

While opinions on the contents of the speech bubble text varied, participants generally agreed that they were very helpful and gave them an initial idea of how to interpret the comic story. “It gives you a guideline on what you’re supposed to do.” (P3C) One group

explained that a critical element to the enjoyment from the game was that the text was already prepared for the players. “I think a game is more fun when you’re following something, as opposed to making something up from scratch.” (P3A) When the text appeared on the screen for the first time, the players (and also spectators) quickly read the text aloud, including their text and their partner’s text. As the players posed for each panel, they read the lines as if reciting a play.

Participants explained that the textual story was given further context with the presence of a background and that it helped create a setting for the comic or to give the players an idea of the props they could use. “If there is a blank screen, we can’t do anything.” (P2A) “They [the backgrounds] kind of set the scene. And it makes it feel like what you’re doing makes sense.” (P3A) Players posed in specific locations so that their bodies would match and align with features in the background (Figure 6.5). For example, players made sitting poses in front of the green screen so that they appear to be sitting on chairs or tables in the comic, or pointing to items in the background. Players also aligned props with the background images, for example digging into the ground (background) with a shovel (prop), or repairing a car (background) with a drill (prop).


HOW COME YOU'RE ALWAYS WORKING?
I HAVE A LOT OF THINGS TO DO.


TRY TO RELAX, YOU'VE JUST HAD MAJOR SURGERY.
OH GOSH! WHAT HAPPENED?


WHAT NICE WEATHER!
YES, ISN'T IT GREAT?

Figure 6.5 These are various instances of participants attempting to match their pose with elements in the background.

Participants were asked after the study if they wanted to jump into the game to join the players while they were spectators. Two common responses were reported. Some participants explained that they wanted to join in, but were afraid they would break the rules of the study or ruin the study. “I felt like I might ruin something in the study. [But] at a party, I’m pretty sure within the first two rounds, someone would join in.” (P4C) “I didn’t jump in because I thought it was the rules.” (P7B) Other spectators pointed to the fact that there were only two speech bubbles shown in the comic strips, and that they didn’t think they could find a place for themselves in the panel which was already occupied by two players. “Because there were only two speech bubbles, you could join in

if there were more speech bubbles." (P4C) "But I don't think you automatically want to jump in, because you see two text bubbles and you assume there's just two people in that scene. So I think even if you haven't made it structured, I don't think I would have jumped in. I would have just laughed, but I wouldn't have found a place in there." (P6B) Finally, some reflected that they could have embraced the lack of speech bubbles for themselves and could have treated the situation as a creative opportunity. "But actually, if you had said 'have three people' I would have definitely gone in. You could do some funny stuff with one person without a bubble." (P6C)

6.4.4 Social Interaction

We observed constant interpersonal interaction between all the participants (both players and spectators) for the duration of the game sessions. When the comic started, one of the players would usually take on a directing role to varying degrees. In the least assertive case, non-verbal suggestions were used. For example, if the dominant player motioned that they were hitting or pushing, their partner would react accordingly. More assertive dominant players would select props quickly and give verbal suggestions or explicit commands to their partner about their props and how to pose. "Here, use the stethoscope." (P7C hands prop to P7A) "Hold it out and point to it." (P4D to P4A) The most assertive dominant players sometimes motioned to their partner how to pose, or even physically moved the other player. "Swing it at me!" (P3D demonstrates swinging their arm to P3C who is holding a prop) "No, move closer to me P7A!" (P7D grabs and moves P7A) There were instances when both players were either dominant or non-dominant. In the former case, the least observed, both dominant players would disregard the others' commands and pose how they wished. "You should hold it [a prop]." (P3A)

"I'm going to do something else." (P3B) In the latter case, instances of two non-dominant players would sometimes result in lack of interaction between the players and even uncertainty to pose for the comic.

Generally, players displayed a range of implicit social behaviour such as mimicking the poses of their partner or spectators or reacting to the props their partner had chosen (P6C pretended their arm was missing when P6A picked up an axe prop). Players positioned themselves so that they are visible, facing the camera, and not blocking their partner, unless intentionally doing so. Players also verbalised their actions when it was unclear to their partner or to the spectators what they were trying to portray. "I'm coming at you with my vampire teeth!" (P7B simulates fangs with their fingers) (Figure 6.6)

Figure 6.6 Participant P7B uses her fingers to simulate vampire fangs.

The participants were asked if they felt engaged while being a spectator and not actively playing the game. Many reported that they were happy to take turns sitting out and that they felt like they were part of the game. "It's pretty funny to look at them acting." (P1A)

"It gave you a chance to laugh at them. They're busy posing and trying to make it make sense, whereas you're just absorbing the final product." (P6D)

The spectators frequently gave suggestions to the players while they were creating their comic. This was usually in the form of simple suggestions about prop usage or positioning. "You're holding the drill upside down." (P7C) In other cases, the spectators gave explicit directions to the players. "You gotta bash the car." (P7D) "Yeah, bash!" (P7B) This was followed by praise when the players followed the commands. "Well done, that was a good action shot!" (P7B) On some occasions, the spectators realised that they were directing the players. "Be like this." (P4D motions to P4A and P4B) "Look at you, 'director'!" (P4C)

Players often set challenges to the spectators when the two groups were switching roles, after the players finished their comic. This was usually in response to a joke or criticism made by the spectators while the players were making their comic. "Ok, be my guest." (P6C to P6A) "Let's see you guys take it up a notch." (P7D to P7B and P7C)

Socialisation occurred between the players and spectators after the comic was finished and while the complete strip was being reviewed on the screen. The creation of the comic and the associated entertaining moments were re-lived through re-reading the text or calling attention to humorous situations or actions the players created, with the spectators often praising the players for their efforts.

The participants were asked if they would consider playing *Social Comics* remotely with other players, if an internet multiplayer option was possible, for example. The participants reported that this type of game would not be fun to play online, citing the lack of social interaction as the primary reason. "No. This is a group thing!" (P3D) "I

think the social aspect is the fun part, with your friends doing stuff. Online it wouldn't be the same." (P6A) "The social aspect is definitely one of the big points." (P7C)

6.4.5 Playing with Strangers

During the interview, participants were asked how they would approach this game if they were playing with strangers instead of their friends. Almost universally, the response was that the game may be very awkward at first but that the situation may become friendlier after a few comics were played together. "At the start it could be awkward, but at the end of the game it could be more friendly." (P2B) "I think it would be more reserved, because you'd be less comfortable with them in the beginning especially." (P6B) "I think if you'd really wanted to play, you'd eventually work with a stranger. Eventually you'd become comfortable enough to work together." (P6D) "It would probably be a little more awkward if we didn't know each other as well as we do." (P7C)

6.4.6 Sharing the Comics

Finally, the participants were asked if they would share the comics with their friends by uploading them to blogs or social networking sites. Many participants were open to this, but specified that they would only share the comics that they liked or thought were entertaining. "It just depends on how funny it was. If it was something that you didn't feel good about, or was kind of stupid, you could leave it out. But if you got a laugh out of it, for sure [upload it]." (P4B) "Some of the funnier ones where we're making those faces and being silly. That's funny, people would like to see that. It's good entertainment." (P7C) "I see it [uploading] as a big benefit of the game, so you can share whatever funny thing that you came up with, to include more people." (P3A)

6.5 Discussion

The results of our study reflected on the social, physical, and authorship gameplay elements in *Social Comics*, verified their value and strengths, as well as revealed some of the current design limitations and points for improvement. We were glad to see that the gameplay observations demonstrated strong social interaction among all the participants, both spectators and players. The participants generally made extensive use of the props and created unique and creative poses for the comics.

We also noticed variations in the style of gameplay and attributed this to how the participants treated *Social Comics*. Some saw it as a rapid fire game that makes you think on your feet and emphasizes improvisation and quick reactive playing. This approach favoured bizarre poses and prop selections, often disregarding the contents of the speech bubbles and even backgrounds. Players tried to be as entertaining as they could to themselves and their spectators. Others approached the game like a creative tool that lets you build a comic with your friends. These players appeared to incorporate relevant props and attempted to create poses that carefully matched the comic story and background. However, the social, physical, and authoring qualities of the game generally did not change between the two gameplay styles, demonstrating that *Social Comics* can be played in more than one style while still being fun.

We were pleasantly surprised to learn that the participants believed *Social Comics* could be played successfully with strangers. This inspired a current and future exploratory study involving two groups of two participants. While the two participants in each group are friends, they do not know the people in the other group. We are curious to learn if this condition would still be fun to play, and whether the groups would complete the study

with a closer and more intimate insight of the players they did not know before playing *Social Comics*.

Participants provided many suggestions on how to improve the game. The most popular request was the ability to customize the comic by writing your own text, creating your own backgrounds, and downloading stories that other players have created to keep the game spontaneous. Playing the game with blank speech bubbles and writing into them after the comic was complete was also requested, as well as moving the speech bubbles around. Players wanted a larger variety of props and comic stories, including stories with three speech bubbles. Non-static and interactive background images were requested several times, as well as chairs or tables that were green, so that players could sit and align themselves with the background. We are hoping to explore these features further in future prototypes of *Social Comics*.

Social Comics incorporates a mix of gesturing, posing, facial expression, and also full body physical gameplay. While the players' main objective and interaction with the game is certainly posing, facial expressions are also captured. As well, the players use their entire body to select adequate props and to arrange their poses together. Audience members also deliver suggestions to the players by gesturing. We also observed significant spectator engagement during the study, as well as cooperation between the players themselves and the audience. Finally, some groups approached the game competitively, challenges to each other to create comics more funny than before. By incorporating and supporting so many physical and social traits, *Social Comics* allows the players to choose their own pace of the game and their gameplay style.

Chapter Seven: Conclusion and Future Work

In this thesis we have presented our exploration of physical, social, and authorship gameplay themes in video games. We believe that each of these elements brings a unique and valuable contribution to a video game that influence the behaviour and gameplay experience of the players. We created a design framework to help guide the design of games that would help us investigate how the three gameplay themes can be used together, as well as their limitations. We then designed two games as low-fidelity prototypes, *Film Karaoke, Joke's On You*, as well as a fully implemented game, *Social Comics*, that we evaluated with a formal user study.

7.1 Thesis Contributions, Revisited

4. **An exploration of physical, social, and authorship gameplay elements in current video games and a design framework that provides guidelines for the design of future video games:** In chapter three we presented our design framework based on the observations we made of several games that exhibit physical, social, or authorship gameplay elements. The framework identified several important gameplay attributes for each of these elements and helped to guide the design of our three games.
5. **Prototyping and designing two games, *Film Karaoke* and *Joke's On You*, based on physical, social, and authorship gameplay themes:** Using the design framework that we created in chapter three, we designed two games as low-fidelity prototypes to investigate how various gameplay characteristics associated with each theme could affect the games. Chapter four introduces *Film Karaoke*,

an adaptation of karaoke for films and relies on authorship and sociability, and *Joke's On You,* a playful fighting game that uses physicality and sociability.

6. **The design, implementation, and evaluation of *Social Comics*, a game that incorporates all three gameplay themes, and a discussion of how these themes impacted the players' behaviour and gaming experience:** In chapter five we present *Social Comics*, a fully implemented game that challenges players to act and pose in comic strips that they create together. *Social Comics* incorporates all three gameplay themes: physicality, sociability, and authorship. We conducted a formal user study of the game and discovered that players embraced the gaming experiences created by all three themes. Players choreographed expressive physical poses with each other, they conversed, laughed, gave suggestions, even directed each other, and finally, they used their creativity to improvise and give unique meanings to the comic strips.

7.2 Future Work

Our initial investigation into the significance of physical, social, and creative gameplay in video games hinted at the large amount of exploration still left to do. We acknowledge that physicality and authorship in games are relatively new domains, both in the academic and industry research domains. Here we present a variety of research directions that we would like to explore in the future.

7.2.1 Short Term

1. **A more robust motion tracking system in *Social Comics*:** We would like to fix the problems with the motion tracking system to allow the speech bubbles to dynamically follow the player's head. There are three problems with the current

implementation of the head tracking that caused us to remove it from the evaluation prototype of *Social Comics*: infrared noise from jewellery and clothes, IR noise from reflective plastic props, and players having to wear and swap hats while playing. Instead of using the Vicon Motion Capture system that is currently used in the complete prototype of the game, we would like to use the Microsoft Kinect to track the players' bodies. The Kinect can provide our software with a skeletal representation of both players that will allow us to track the position of their heads without the use of any hats. Also, the Kinect would not put any limitations on the props that could be used, and noise from jewellery or clothes would not be a hindrance. Another benefit of using the Kinect is that *Social Comics* would no longer need to use a greenscreen to isolate the player's bodies in front of the background. Our software would be able to isolate their bodies from the rest of the background by using the Kinect's raw depth information and skeletal representations of the players.

2. **Customization of comics:** One of the features most frequently requested by the study participants was the ability to customize the finished comic strips. Giving players the ability to write their own comic stories would greatly enhance the authorship component of the game. Players could choose the background image and write their own speech bubbles to create new comic stories that can be emailed to their friends to play. This also includes variations such as changing the speech bubbles or background after the comic is finished, or playing without speech bubbles entirely as a new challenge (and adding them afterwards).

3. **Implement *Joke's On You* and incorporate authorship into the game:** *Joke's On You* is currently only a game concept and low-fidelity prototype. Unlike *Film Karaoke* and Yoostar, there are no games similar to *Joke's On You* on the market that we know of. We would like to create an implementation of the game because we believe it has the potential to create a very fun physical game experience, and we would like to modify the game's design to include some form of authorship. We will use the Kinect to track the player's bodies, which could provide more robust tracking than the Vicon Motion Capture system that currently only tracks the player's head and hands. We envision several possibilities to incorporate authorship as part of the gameplay in *Joke's On You*. The game could take a snapshot photo of the players the instant they have a "joke" played on them (like being egged) that would capture both player's expressions. The snapshot mechanism can be used as a gameplay feature in the game: players must take embarrassing "photos" of their opponent by using a camera prop, and the game will record how many virtual decorations (or jokes) that opponent has on their body at that time. The player with the most damaging photographic evidence of their opponent wins the game. This mechanism motivates the player to create content by first having the player play jokes on their opponent and then taking a photo in order to win the game.

7.2.2 Medium Term

1. **Further investigation of *Social Comics* with strangers:** We conducted a preliminary pilot study to see if *Social Comics* can be used to introduce strangers and to help create new friendships. This study was ultimately not pursued because

we felt that participants would not feel comfortable answering critical questions about the other participants in a formal research setting. We would like to investigate this phenomenon by conducting informal studies of *Social Comics* by installing the game at private social events like parties, or in public places where many people go to socialize such as night clubs or bars. Players could answer an optional short questionnaire after the game is over. This approach may elicit more honest responses from participants as the situation is far less formal and the participants have a greater degree of anonymity, which may elicit more honest responses.

7.2.3 Long Term

We believe that physical interaction will become richer and more ubiquitous in the coming years. The Nintendo Wii, PlayStation Move, and Microsoft Kinect are only the first generation of physical sensors and already they have brought about a revolution in video games. Physicality has only just started to open the door to new games and gameplay techniques. As game developers demand richer physical controls for games, we envision that motion tracking sensors will become smaller, faster, more accurate, and more robust. These sensors may become embedded in our homes, workplaces, and even public or outdoor spaces. Physical video games may no longer need to be restricted to the home but could be played almost anywhere there is physical tracking.

Virtual reality technology like head-mounted displays could be combined with physical interaction and allow people to play virtual sports. Virtual reality could also change how people socialize with one another. We already rely on email, text messages, and social networks to maintain a social presence with dozens, even hundreds of people

simultaneously. While we have defined socialization in games to be between collated participants, virtual reality technology may provide the verbal and non-verbal affordances that exist in face-to-face socialization, but between remote participants.

As humans create new technology, we also create new mediums for expressing our creativity. Bead jewellery, cave paintings, sculptures, tapestries, symphonies, photographs, and film are all artistic mediums that were created from the various technological advancements throughout human history. Presently, video games allow us to create content in well established mediums like photos or videos, but as we create better physical sensors and virtual reality technology, we may begin to use different media for our authorship. Players may begin creating virtual sculptures or three-dimensional objects that can be manufactured with 3D printers. We believe that authorship in games will continue to grow in popularity and will incorporate new mediums.

7.3 Final Words

In this thesis we have emphasized the importance of physicality, sociability, and authorship themes in video games and have made an inquiry into their merits and limitations. We have created a design framework that we used to design three original games and have shown that each of the themes create unique gameplay experiences that can be combined.

As human beings, we experience the world with our bodies, physically interacting with and manipulating artefacts around us. We also strive to create social connections with other people that give us a sense of community and belonging. And lastly, we possess

creativity, seeking inspiration and the chance to share our insights with others. Video games have the ability to address all three needs while entertaining us.

I hope that these explorations into physicality, socialization, and authorship have demonstrated the value of these elements to video games and encouraged the pursuit of future research in this domain.

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Appendix A: Real-Time Interactive Motion Stylization

The algorithm presented here renders speed line and vibration stylization in real-time. The motion of the object is interactively controlled by the user with a tangible interface that is tracked in 3D. Our proposed approach allows a direct mapping from the user's motion to expressive animations. Following, our method does not require predefining the motion or the stylization rendered or illustrated together with the animation, and allows the stylization to be generated in real-time according to the user's unrestricted input. To the best of our knowledge, this is the first time that real-time speed line and vibrations stylization are generated and mapped online following interactive input based on motion tracking of the user actions. Our stylization algorithm runs in real-time and is controlled by the user. We use a Vicon motion capture system to track the position of a "wand" being moved by a user. The tip of the wand represents the position of the object and we obtain the velocity and acceleration of the object using the Euler forward method.

Speed lines

We begin the generation of our interactive speed lines with a mesh moving through space with some velocity. The normal of each face is pointing either in the direction of motion (leading) or away from it (trailing). Leading faces are not considered. Additionally, the normal of a trailing face must be at a sufficiently small angle to the velocity; faces that are nearly parallel are not considered. Each trailing face of the model has a certain number of speed lines coming from it, based on the density parameter. Each line being drawn is actually a truncated cone, wide end near to the face. Speed lines emanate from each trailing face in the negative direction of the motion.

The length of a line, thickness, as well as the distance, or gap. between the start of a line and the face is controlled by the speed. Fast moving objects have longer and thicker lines and larger gaps than slow moving objects. Minimum and maximum speeds must be specified to define a range of speeds where speed lines are drawn. The relationship between speed and line properties is non-linear. Small increases in speed map to large increases in line properties, generating a perceived exaggeration in the motion of the object (Figure 1b, 1c). Each line has a random length and originates from a random location on a face. To maintain frame-to-frame coherency, a list of random numbers is generated a priori and accessed consistently during each frame render.

Vibrations

A visual vibration is generated when the object experiences a large change in velocity. The vibration is a new instance of the mesh moving from the same position and with the same velocity as the object was when the vibration was triggered. Once triggered, the vibration is independent of the object's position and velocity.

Only leading faces of the vibration's mesh are rendered. The vibration mesh is transparent, and faces that are parallel with the velocity are more transparent than perpendicular faces. The vibration is rendered for a very short time and it becomes more transparent as it nears the end of its lifespan, until it is invisible and is destroyed (Figure 1d).

Algorithm for generating speed lines and vibrations for 3D models

In this implementation the model is defined by triangle faces, but this algorithm can easily be extended to support polygon faced models.

Models are loaded from Wavefront Object files.

Speedlines explicit parameters
Density – this is the density of speed lines per unit area of model surface. Higher density means more lines are drawn. Positive real number.
Edge cutoff – this is the maximum angle a face may be pointing away from the direction of the object's motion for lines to still be drawn on this face. Positive real number between 0 and 1.
Speed – the object's speed (scalar) modifies how long the lines are. Positive real number.
There are several implicit parameters that are controlled by the speed and size of the model.

High-level procedure
Each triangle (face) of the model has a certain number of speed lines coming from it, based on the density. Some faces do not have any speed lines because they are not trailing faces (they are on the front of the object in relation to its motion), or they fail the edge cutoff restriction.

Each line that is drawn is actually a 3D tapered cylinder (or a cone missing the tip). The radius of the cylinders is determined by the size of the object. Large objects have thicker lines and vice versa.

Lines are emanating from the face in the opposite direction of motion (negative of the velocity vector). There is a gap between the start of the line and the face. This is an implicit parameter controlled by the speed. Fast moving objects have large gaps and slow moving objects have no gaps (the lines appear to come directly from the object).

A list of random numbers is generated offline that acts as a generator (about 10000 numbers). For each frame, the numbers are fetched in order, starting from the first number in the list. This ensures that there is frame-to-frame coherency while giving the appearance of randomization in the lines.

Algorithm

For each face (triangle) in the model:
Initialize numLines to 0. Initialize *padding* by multiplying the object's size with its speed.
Calculate area of face and multiply the area with the density of lines per unit area.
Add this to *numLines*. *numLines* is initialized to 0 at the start of each frame.

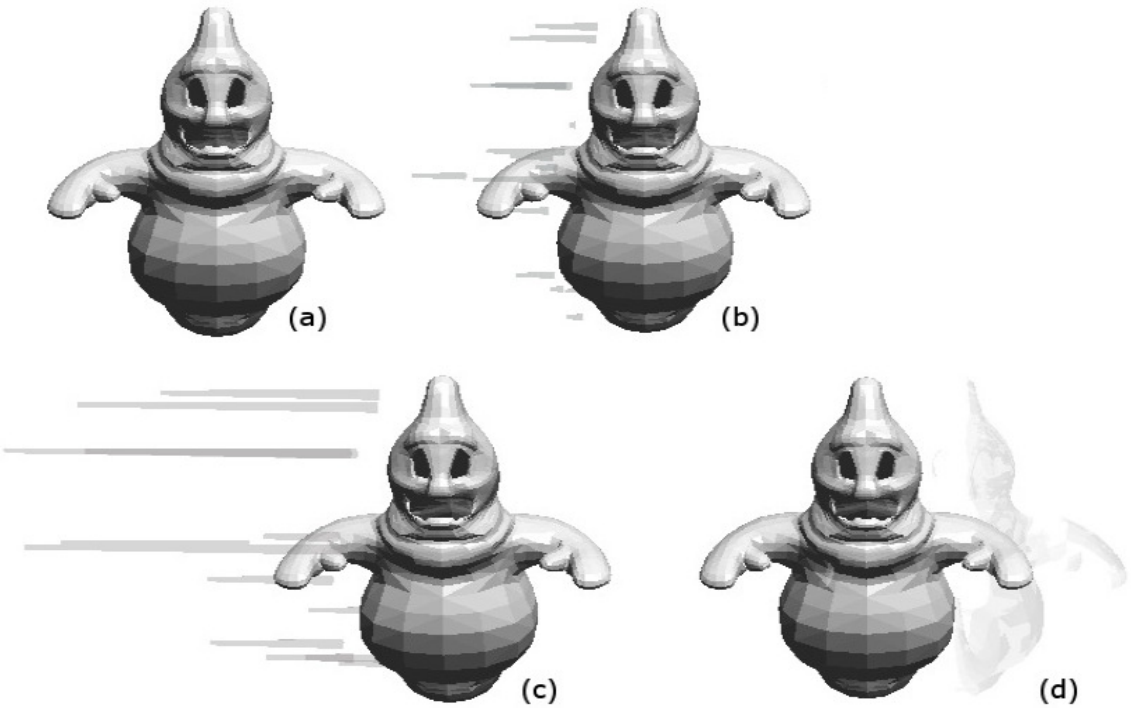
If the model is very detailed, all of the faces will have small areas and no lines will be drawn. E.g. *area* = 0.63, *density* = 0.8. *numLines* = 0.504. This means that 0 lines are drawn for this face.
For this reason, there is a running sum of the number of drawn lines. If there are 3 faces with *areas* 0.63, 0.73, and 0.43, the number of lines drawn with a *density* of 0.8 will be:]
0.504 for face 1 (0 actual lines)
1.088 for face 2 (1 actual line)
0.432 for face 3 (0 actual lines) ([1.088 – 1] + [0.43 * 0.8] = 0.432)
Compute the dot product of the object's velocity vector and the face's normal. Multiply the result by -1 and store in *dotProd*. If this is less than *edgeCut* (the edge cutoff threshold) then disregard this face and continue to the next face.
Either this is not a trailing face or it is at too shallow of an angle to the object's velocity.
If this face is disregarded, get 3 random from the list to maintain frame coherency.
Temporarily convert *numLines* to an integer. This will control how many lines will be drawn. If *numLines* is 0, no lines are drawn.
Compute two random numbers *t1* and *t2*. Compute *t3* = 1 – *t1* – *t2*.
t1 + *t2* + *t3* = 1
Using *t1*, *t2*, and *t3*, compute a weighted average from the corners of the face's triangle. This will be a random point somewhere on the surface of the face.
Compute *length* by multiplying the object's speed, *dotProd*, a random number. This is the length of the line.
Draw a line *length* long, *padding* distance away from the face.
Repeat *numLines* loop.
Repeat loop for faces in the mesh.

Vibrations
A second effect is when an object vibrates at certain events in its motion such as collisions or large changes in its velocity. This is an adaptation of the vibration stylizations shown in cartoon illustrations.

When the object experiences a collision or rapidly changes its velocity, a vibration is created. A vibration is a copy of the object's mesh that moves with the previous velocity of the object before the vibration event. The mesh is only partially displayed. No trailing faces are displayed; only the faces oriented in the direction of the vibration's motion are shown. The vibration mesh is also partially transparent.

The vibration mesh is displayed for only a fraction of a second so the effect is non intrusive and very subtle.

Results



No speed lines are rendered in (a) and the motion of the object is ambiguous.
The object has moderate speed in (b) and high speed in (c). The object comes to an abrupt stop and a vibration effect is shown in (d).

Appendix B: *Social Comics* Materials

Original ethics approval

UNIVERSITY OF CALGARY

MEMO

CONJOINT FACULTIES RESEARCH ETHICS BOARD
c/o Research Services
Main Floor, Energy Resources Research Building
3512 - 33 Street N.W., Calgary, Alberta T2L 1Y7
Telephone: (403) 220-3782
Fax: (403) 289 0693
Email: csjahrau@ucalgary.ca
Monday, May 10, 2010

To: **Ehud Sharlin**
Computer Science

From: Dr. Kathleen Oberle, Chair
Conjoint Faculties Research Ethics Board (CFREB)

Re: **Certification of Institutional Ethics Review:** Sociable Comics

The above named research protocol has been granted ethical approval by the Conjoint Faculties Research Ethics Board for the University of Calgary. Enclosed are the original, and one copy, of a signed **Certification of Institutional Ethics Review**. Please note the terms and conditions that apply to your Certification. If the research is funded, the sponsor should be notified, and the original certificate sent to them for their files. The copy is for your records. The Conjoint Faculties Research Ethics Board will retain a copy of the Certification on your file.

Please note, an annual/progress/final report must be filed with the CFREB twelve months from the date on your ethics clearance. A form for this purpose has been created, and may be found on the "Ethics" website, http://www.ucalgary.ca/research/compliance/ethics/renewal

In closing let me take this opportunity to wish you the best of luck in your research endeavor.

Sincerely,

Cari Jahraus
For:
Kathleen Oberle, Ph.D., and
Chair, Conjoint Faculties Research Ethics Board

Enclosures(2)

UNIVERSITY OF CALGARY

CERTIFICATION OF INSTITUTIONAL ETHICS REVIEW

This is to certify that the Conjoint Faculties Research Ethics Board at the University of Calgary has examined the following research proposal and found the proposed research involving human subjects to be in accordance with University of Calgary Guidelines and the Tri-Council Policy Statement on *"Ethical Conduct in Research Using Human Subjects"*. This form and accompanying letter constitute the Certification of Institutional Ethics Review.

File no:	**6463**
Applicant(s):	**Ehud Sharlin** Paul Lapides Mario Costa Sousa
Department:	**Computer Science**
Project Title:	**Sociable Comics**
Sponsor (if applicable):	

Restrictions:

This Certification is subject to the following conditions:

1. Approval is granted only for the project and purposes described in the application.
2. Any modifications to the authorized protocol must be submitted to the Chair, Conjoint Faculties Research Ethics Board for approval.
3. A progress report must be submitted 12 months from the date of this Certification, and should provide the expected completion date for the project.
4. Written notification must be sent to the Board when the project is complete or terminated.

Kathleen Oberle

MAY 1 0 2010

Kathleen Oberle, Ph.D,
Chair
Conjoint Faculties Research Ethics Board

Date:

Distribution: (1) Applicant, (2) Supervisor (if applicable), (3) Chair, Department/Faculty Research Ethics Committee, (4) Sponsor, (5) Conjoint Faculties Research Ethics Board (6) Research Services.

Ethics approval of modification to questionnaire

UNIVERSITY OF CALGARY

MEMO

Conjoint Faculties Research Ethics Board (CFREB)
Research Services Office
Main Floor, Energy Resources Research Building
Research Park
Telephone: (403) 220-3782 or (403) 210-9863
Fax: (403) 289-0693
Email: csjahrau@ucalgary.ca or rburrows@ucalgary.ca

To: Dr. Ehud Sharlin
Department of Computer Science

Date: September 15, 2010

From: Dr. Glen Bodner, Acting Chair
Conjoint Faculties Research Ethics Board

Re: Approval of Modification for: Sociable Comics
Original Approval Date: May 10th 2010
File No: 6463

The Certificate of Institutional Ethics Review issued on May 10th 2010 continues in force and extends to the modifications as set out in your email/memo dated September 15th 2010. Your request to (i) expand your recruitment strategy to include the posting of an approved notice at various locations around the University campus, and (ii) to expand the questionnaire instrument to include questions rating individual and group levels of entertainment, enthusiasm and social interaction during gameplay, is approved as described.

You should attach a copy of the documentation you provided in order to request the modification, together with a copy of this memorandum, to the original Certification in your files.

Sincerely,

Glen Bodner, PhD
Acting Chair, Conjoint Faculties Research Ethics Board

Cc: Paul Lapides & Mario Costa Souza (co-applicants)

Questionnaire form

Name: _____

Occupation: _____

Age: _____

Gender

Male Female

Please circle the most appropriate answer.

How long have you known the other participants, on average?

0 – 1 month 1 – 2 months 2 – 6 months 6 – 12 months More than 12 months

How many hours per week do you play video games (computer, console, etc):

0 – 1 1 – 2 2 – 5 5 – 10 10 – 20 More than 20

Which of the following game systems do you regularly play video games on? You may choose more than one:

Wii Xbox PlayStation Portable Game System Computer None

Other:

You play games with other players online:

Very rarely			Neither rarely nor frequently			Very frequently
•	•	•	•	•	•	•
-3	-2	-1	0	1	2	3

You play video games with other players in person:

Very rarely			Neither rarely nor frequently			Very frequently
•	•	•	•	•	•	•
-3	-2	-1	0	1	2	3

What social networking sites do you use, if any? You may circle more than one:

Facebook Twitter Myspace Flickr Blogs

Other:

Approximately how many times do you check social networking sites per day:

0 – 1 1 – 5 5 – 10 10 – 20 20 – 50 More than 50

Approximately how many photos do you share with social networking sites, photo sites, or blogs per month:

0 – 10 10 – 25 25 – 50 50 – 100 100 – 200 More than 200

Rank the type of photos you normally upload or share in descending order:

___ Trips ___ Social events ___ Scenic or artistic ___ Portraits

___ Other:

Please rate your level of comfort during the experiment:

Very anxious			Neither relaxed nor anxious			Very relaxed
•	•	•	•	•	•	•
-3	-2	-1	0	1	2	3

Please rate your level of entertainment during the experiment:

Very bored			Neither entertained nor bored			Very entertained
•	•	•	•	•	•	•
-3	-2	-1	0	1	2	3

Please rate your level of participation in the game when you were not directly playing:

Very isolated			Neither engaged nor isolated			Very engaged
•	•	•	•	•	•	•
-3	-2	-1	0	1	2	3

Please rate your group's enthusiasm during the experiment, as perceived by you:

Very unenthusiastic			Neither enthusiastic nor unenthusiastic			Very enthusiastic
•	•	•	•	•	•	•
-3	-2	-1	0	1	2	3

Please rate the group's level of entertainment during the experiment, as perceived by you:

Very bored			Neither entertained nor bored			Very entertained
•	•	•	•	•	•	•
-3	-2	-1	0	1	2	3

Please rate your group's social interaction during the experiment, as perceived by you:

Very antisocial			Neither social nor antisocial			Very social
•	•	•	•	•	•	•
-3	-2	-1	0	1	2	3

Please rate the amount of time given to complete each comic panel:

Very rushed			Neither slow nor rushed			Very slow
•	•	•	•	•	•	•
-3	-2	-1	0	1	2	3

Please rate the your ability to interpret and improvise the individual comic panels:

Very difficult			Neither straightforward nor difficult			Very straightforward
•	•	•	•	•	•	•
-3	-2	-1	0	1	2	3

Please rate the inclusion of props during the game:

Very useless			Neither useful nor useless			Very useful
•	•	•	•	•	•	•
-3	-2	-1	0	1	2	3

Did you perceive your group to have a leader, or a person who appeared to be "in charge"? If so, who?

Did you perceive your group to have conflict? If so, between what players? What was the conflict about?

If you have any other comments, you may write them on the reverse of this page.

Sample interview questions

1. What are your overall thoughts about the game.
2. What parts of the game, if any, were not fun? Why?
3. What did you enjoy the most?
4. Would you consider playing this type of game alone? Would you consider playing if there was an internet multi-player option?
5. How well do you know your game partners? How would you play differently if you knew them less?
6. Describe your experience playing the game.
    a. Was there enough time to make each comic, or too much?
    b. Did you feel nervous or anxious?
    c. Did these feeling go away after playing for a few sessions?
    d. Was this because you were playing in front of peers, or because the game pushed you to be creative while under time pressure?
    e. Was the text in the bubbles helpful? How so? Would you prefer more text or less text?
7. Describe your experience regarding spectating the game sessions. Did you feel you could participate adequately as a spectator?

Comics created from the study


IT'S BROKEN.
HOW DID IT BREAK?
WOAH, THAT'S A FULL RAINBOW, ALL THE WAY!
DOUBLE RAINBOW, OH MY GOD, OH MY GOD!
HERE, I'LL SHOW YOU.
YOU'RE DOING IT WRONG!
IT'S STARTING TO LOOK LIKE A TRIPLE RAINBOW!!
IT'S FULL ON! ALL THE WAY, ACROSS THE SKY!
WHAT DO YOU MEAN?
YOU HAVE TO HOLD IT LIKE THIS.
IT'S SO BRIGHT AND VIVID!
WHAT DOES THIS MEAN?
DID YOU ORDER THE CODE RED?
I'M NOT GOING TO ANSWER THAT.
HAHA!
HEHE!
I WANT SOME ANSWERS.
YOU WANT ANSWERS?!
WHOOO!!! HAHA!
HA! HA! HA!
I WANT THE TRUTH!
YOU CAN'T HANDLE THE TRUTH!
LAUGHING GAS IS GREAT!
HAHAHAHAHA!