

Don't Open That Door: Designing Gestural Interactions for Interactive Narratives

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ABSTRACT

“Don't Open That Door” is a gesture-based interactive narrative project set in the universe of the TV show *Supernatural*. The project leverages expectations of the horror genre and fan knowledge of the show to elicit expressive interactions and provide satisfying dramatic responses within a seamless scenario in order to create dramatic agency for the interactor. We use verbal, audio-visual, reactive, and mimetic techniques to script the interactor. From our research, design process, and user observations, we gain insight in to designing for dramatic agency and managing user expectations in gesture-based interactive systems.

Author Keywords

Gestural interaction, expressive interaction, interactive narrative, television, genre fiction, dramatic agency.

ACM Classification Keywords

H.5.2 [Information Interfaces and Presentation]: User Interfaces---*input devices and strategies, interaction styles*; K.8 [Personal Computing]: *Games*.

General Terms

Design, human factors.

INTRODUCTION

In interactive narratives, scripting the interactor so that she knows when and how to interact is an important component of creating dramatic agency. Dramatic agency maps the interactor's expectations and actions onto narratively significant actions and state-changes in the world of the narrative [7]. In order to create dramatic agency, an interactive narrative must manage an interactor's expectations by making it clear when she can interact, how to interact, and by providing clear dramatic feedback about

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the success and outcomes of the interaction.

“Don't Open That Door” is a gesture-based interactive narrative set in the world of the TV show *Supernatural*. The interaction design process, implementation techniques, and observations of people interacting with “Don't Open That Door” led to insights about their effect on dramatic agency and managing user expectations in the design of gesture based interactive systems. In “Don't Open That Door”, we use the interactor's prior knowledge of the tropes of the horror genre, as well as verbal, audio-visual, reactive, and mimetic cues to script particular gestural interactions in order to create dramatic agency.

To inform the design of “Don't Open That Door,” we researched elements of genre fiction, interactive narratives, and gestural interaction design techniques. From our research we defined ways that we could script an interactor in a television-like drama. We then designed interactions and dramatic scenarios around these techniques and developed the system for display at a demo showcase.

In this paper we discuss our motivations and design techniques for using gestural interaction in “Don't Open That Door”, our design and development processes, our observations of people interacting with our narrative, and our insights about designing for dramatic agency drawn from this project.

BACKGROUND AND RELATED WORK

The design and implementation of “Don't Open That Door” builds on: (1) an understanding of the stereotypes of genre fiction, horror fiction in particular, (2) interactive narrative systems and the way they use narrative progression and interactions, and (3) the elements of gestural interactions that make them satisfying rather than frustrating.

Genre Fiction

Genre fiction reuses narrative techniques, symbols, and scenes to create certain expectations and reactions from its readers/viewers. For our project, we chose to work in the horror genre because it provides us with stereotypical scenes that do not need to be explained to anyone familiar with the genre. Horror stories have a particular progression

that provides a well-defined framework around which a story can be crafted. Bruce Kawin describes this progression in terms of the disruption of the boundary between the normal world and the world of the threat [5]. Horror tales start in a very typical world, but that world is soon invaded by something completely alien and ultimately threatening to the characters' ways of life and beliefs. This leads to the nightmare, the state of living in madness, or a glimpse of an alternate reality. The threat in these cases is rarely actually seen by the viewers. Keeping it out of view forces the viewer to acknowledge its existence based purely on the events of the story, and deal with the implications of the introduction of the threat in their subconscious. Eventually the threat is neutralized and the world is returned to a state shockingly similar to how it was before the threat, indicating that while the world may not have changed, the threat may still be present [5]. J.P. Telotte describes the effect of the elements of a horror film on its viewers [10]. A familiar setting allows the viewers to immediately understand the world. This makes it easy for their minds to run wild later in the film instead of working to determine the rules of the world. Horror films often reverse the traditional sequence of events in film. For example, they show a reaction shot before showing the source of terror. This allows the viewer's mind to create the terror, without even having to show it. The objectification of victims in horror films makes it possible for the viewer to witness the kinds of terrifying events happening to the characters without empathy. The victims become the personification of deeds and their experiences become the results [10]. For "Don't Open That Door", we were able to use these insights about the progression of horror narrative and the typical elements of horror films as a way to script the interactor and create dramatic agency.

Interactive Narratives

In television and film narratives, parallel action creates suspense. Many characters perform different tasks in different locations at the same time. Each character has a different perspective on the situation and the success or failure of one character can depend on the actions of another character, even though neither is aware of that fact. This form of narrative progression requires that each character experiences time in the same way, which is something that viewers take for granted when watching a television show. Similarly, in games and interactive narratives, players take the controller, and all its affordances and limitations, as a given. Both of these aspects affect dramatic agency in an interactive narrative.

The games *Mass Effect* [6] and *Heavy Rain* [4], both noted for their excellent narratives, handle narrative progression in very different ways. In *Mass Effect*, the player navigates dialog trees to direct the course of conversations with non-player characters, which affect the way the narrative unfolds. While the player is engaged in a conversation, nothing else happens in the world of the game. The

narrative only progresses when the player completes certain tasks, but how long he spends in between the tasks does not affect the narrative at all. Pausing narrative progression reduces the dramatic possibilities of the narrative by forcing the narrative to only exist from a single point of view.

On the other hand, *Heavy Rain* employs Quick Time Events (QTEs), in which the player must respond at the to icons representing sequences of button presses that are displayed at particular moments during the game. QTEs allow the narrative to move forward without stopping time in other parts of the game world; however, the button sequences often seem arbitrary, which masks what the outcome of completing the sequence will be. In this case, the lack of clarity of outcome can reduce a player's sense of dramatic agency.

Emerging interactive platforms can address these limitations in ways that serve dramatic agency. ARFaçade [2] uses augmented reality and gesture and voice interaction to enable interaction with two autonomous agents. The action takes place at a dinner party in a couple's apartment and focuses on the couple's relationship. The progression of the story is driven by the interactions the player has with the other characters. Augmented reality and natural language processing allow the interactor to enter the story world and interact with it by moving and speaking, as he would if the event took place in real life. The story unfolds for the player and the non-player characters at the same time, and the characters' reactions make sense based on the interactor's input.

The Reading Glove [9] uses a glove interface to allow interactors to hear bits of a story by picking up different physical objects. The story is experienced in whatever order the interactor picks up the objects and unravels gradually as more information is revealed. The physical objects serve to blur the boundary between the world of the story and the world of the interactor. Using a glove interface to pick up objects provides a simple interaction method that fulfills user expectations and makes sense in the context of the story.

Tangible Comics [8] uses computer vision based full-body tracking to create a narrative performance and storytelling environment. The interactor in Tangible Comics plays the role of a female's egg moving through the reproductive system. She uses full-body, computer vision based, embodied interaction to jump from the ovary to the fallopian tube and to choose to or avoid being fertilized. Tangible Comics scripts the interactor using visual techniques and the presence of real world objects, but does not contain any interaction between different characters. The iconic visual elements and a one-to-one mapping between the interactor's body and the virtual body, provide clear goals and straightforward ways to achieve them.

“Don’t Open That Door” extends this research in order to merge TV-like narrative progression with clearly scripted gestural interactions.

Gestural Interaction

The interaction design for “Don’t Open That Door” takes in to consideration two major elements: the elements of a satisfying gestural interaction, and relevance to a horror scenario. We saw gestural interaction as an opportunity to enhance dramatic agency in our design, but in order to create a pleasing experience, we first had to understand what makes a satisfying gesture and what can cause gestures to be infuriating. Recent research has investigated this question. Grandhi, et al. showed that people prefer to enact gestures as if they are holding a tool as opposed to using part of their hand to represent the tool [3]. Tholander, et al. advocate providing multi-modal feedback about the execution of the gesture and allowing users to interpret that feedback for themselves [11].

Since we intended to use Microsoft Kinect for body tracking, we reviewed currently implemented gestures in Kinect games. The game *Dance Central* [1] provides examples of both bad and good gestural interactions. Selecting items from menus proved to be extremely frustrating. In *Dance Central*, the player moves his hand up and down to highlight the correct menu. Then he swipes his hand across his body to open the menu. The graphical elements that represent the menus are too small and the Kinect sensor too imprecise for a player to easily highlight a menu and swipe it open without accidentally opening the wrong menu. On the other hand, dancing is a well thought out interaction. It rewards, but does not particularly require precision, and the game makes it clear what is expected of the player, i.e. it shows an animated dancer making the movements. The more the player matches the beat and body position, the more points he gets, but imperfection does not lead to failure, and the various difficulties in the game make it possible for everyone to succeed. From this analysis, we learned that the interactions we used in our scenario needed to account for the limitations of the Kinect and to clearly express how the interactor can interact.

DESIGN AND IMPLEMENTATION

In “Don’t Open That Door,” we match interaction and narrative elements to support the following design goals:

- Story-driven Physical Reactions
- Persistent and Uninterrupted Narrative
- Scripting of the Interactor by Narrative Expectations

We developed this list of goals because fulfilling them in a TV-like interactive narrative could illustrate possibilities for the future of interactive narratives. Similarly, failing to fulfill the goals could provide insight into the design requirements of TV-like interactive narratives and of gestural interactions.

The first goal, story-driven physical reactions, aims to show that feedback about the outcomes and success of an interaction can be part of the narrative, and that game-like elements (e.g. points) are not necessary for providing feedback to an interactor. Meeting the second goal, persistent and uninterrupted narrative, can show that interactive narratives can indeed be TV-like in that they can use parallel action to create dramatic tension and that time in the diegetic world does not have to stop and wait for the interactor to perform an action. The third goal, scripting the interactor by narrative expectations, aims to show that the expectations interactors bring to the experience, whether as fans of a show or as an understanding of broader genre conventions, can be leveraged to reduce confusion, motivate particular interactions and ultimately enhance dramatic agency. The interaction design, visual design, and implementation decisions made during the production of “Don’t Open That Door” all serve to fulfill these design goals in a way that creates dramatic agency for the interactor.

Interaction Design

We began the interaction design process by thinking about the elements of a television-like drama that we have control over and the ways that characters and the environment can engage the interactor. We developed the following list of techniques for scripting the interactor:

- Verbal - A character verbally directs the interactor to perform an action.
- Audio-visual - The setting and soundscape indicate that some action can be taken.
- Reactive - A sudden change in the drama causes the interactor to perform an action without thinking about it.
- Mimetic - The interactor performs an action after first seeing it performed by a character.

For example, the character Sam saying, “Draw a circle and stand in it,” is a verbally directed interaction. A knock on a door is an example of an audio-visual cue that could script the interactor to reach out and open a door. An example of a reactive interaction is a flaming flowerpot flying towards the screen that causes the interactor to move out of the way. Seeing a character covering and then uncovering her face and then prompting the interactor to do the same thing is an example of a mimetic gesture.

By thinking about these scripting techniques in the context of our research about the elements of the horror genre, we came up with a list of possible narratively-rich interactions that we could detect using the Kinect. This list included things like open a trunk, draw a sigil, scream, and open a door.

The design of the scenario for “Don’t Open That Door” required us to consider the interactions in terms of both how to motivate them from within the drama, as well as how



Figure 1: Take Hand Interaction

they would affect the narrative when performed. The possible scenarios that we designed started with three basic premises:

- The interactor is not the protagonist.
- The scenario cannot affect the canon of the *Supernatural* universe.
- The narrative must continue while the interactor is deciding what to do and whether or not she interacts.

The first criteria meant that the interactor could feel free to explore the narrative possibilities without the burden of saving other characters from damnation. The second allowed us to leverage the rules of the show without worrying about disrupting a fan’s immersion with an incongruent story element. The third, a persistent moving narrative, is an important element in making “Don’t Open That Door” more like a television drama and less like a game. It gives the story a sense of urgency and connects the interactor to the broader universe that is established by *Supernatural* and well understood by its fans.

We designed multiple scenarios that used different sets of interactions and worked through them with each other until we had written a dramatic arc that made sense in the context of the show and that properly motivated the interactor to perform or not perform certain actions. The scenario we ultimately developed contained the following interactions: draw a circle, open a door, take a hand, play peek-a-boo, and dodge.

Each of these interactions corresponds to a specific action to be made by the interactor and one or more of the cueing techniques we designed. Drawing a circle is cued verbally by a character saying “Draw a circle with the salt and stand in it.” The interactor is then expected to move his arm in a circular motion in front of him or to spin around as if he were pouring salt on the floor in a circle.

Opening a door uses audio-visual cues like knocking on the door and cutting in to a close up of the doorknob. To open the door, the interactor reaches his arm forward so that the dot representing his hand touches the doorknob. He then pulls his arm back towards his body. Take hand, shown in



Figure 2: Peek-a-boo Interaction

Figure 1, is cued verbally, audio-visually, and mimetically by showing a character reaching her hand towards the screen while saying, “Come play with me.” To take the hand, the interactor simply reaches forward so that the representation of his hand touches the character’s hand.

Peek-a-boo, shown in Figure 2, is a mimetic interaction. The character covers her face with her hands and then removes them while saying, “Just do what I do. Peek-a-boo.” Peek-a-boo is a traditional mimicry game played with small children, so it also leverages cultural knowledge brought to the experience by the interactor. To perform peek-a-boo, the interactor covers his face with his hands and removes them.

Dodge is a reactive interaction. A character throws an object at the screen, and the interactor moves to the left or right to avoid being hit by it. A strong sense of agency should be all that is required for the interactor to know what to do in this case.

We created a flowchart from the final scenario to communicate the interactions and their effect on the narrative and used it as the foundation for creating other documents necessary for the production. A simplified version of the flowchart is shown in Figure 3.

Visual Design

The visual design of “Don’t Open That Door” served two main goals: placing the interactor in a role, and representing the interactor’s body. Satisfactorily fulfilling these goals would enhance immersion in the experience by making clear the interactor’s position, physically and as a character, in the diegetic world. In order to keep the scenario from disrupting the larger narrative of *Supernatural*, it was important that the interactor would not play a character from the show. If that character died in the scenario but not in the show, then many of the positive effects of the immersion created by dramatic agency would be lost.

Therefore, we used the first person perspective to avoid having to show a particular body. By not showing a body, the drama can create a role for the interactor to play as himself. He can enter the diegetic world and form a

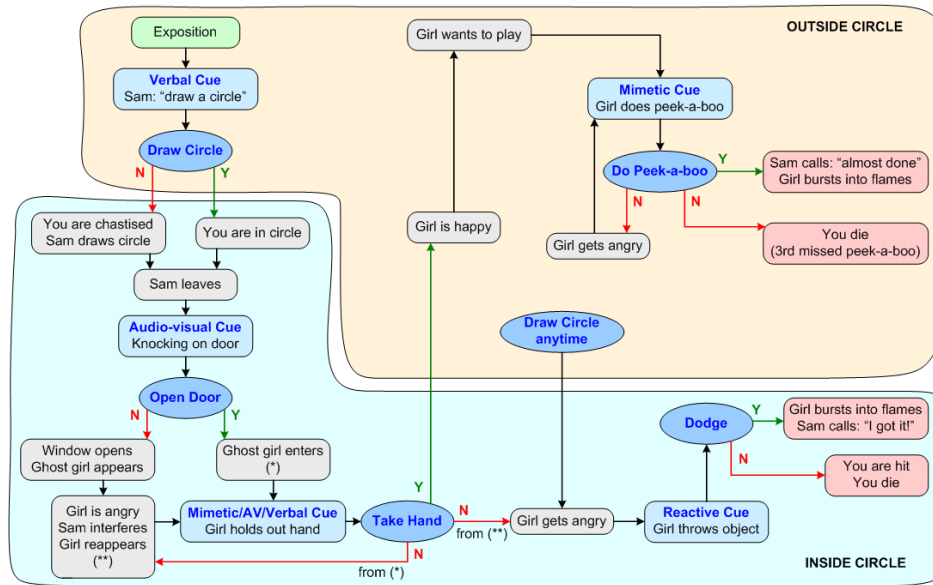


Figure 3: “Don’t Open That Door” Scenario Flow Diagram

memory of his engagement with a particular location or event in that world without associating his memory with a particular character in the world whose actions may or may not conform to his memories.

However, not having an avatar also means that the interactor requires some other way to know how his body relates to the interactive space. We chose to represent the interactor’s head and hands as faint, glowing, grey dots on the screen. The dots changed from grey to red when the interactor’s hands moved over an interactive element or when he performed a gesture. Changing the dots from a subtle color to something more obvious helped us provide feedback without distracting from the onscreen action.

Another visual technique we used was to move the video left and right on the screen when the interactor moved his head. This provides an illusion of the kind of parallax we experience in the real world when we move left or right. We used this technique to provide feedback to the interactor about his movements in order to increase immersion and enhance agency. By using minimal visual elements and providing feedback about the interactor’s body movements we were able to cast the interactor in a role as himself and clearly indicate the interactor’s physical relationship to the world of the narrative and provide feedback about the effects of his actions in the diegetic world.

Implementation

Implementing our design for “Don’t Open That Door” required us to produce the video for the narrative, and develop the interactive system. For the video production, we used our scenario flow chart to create scripts, storyboards, and shot lists. We filmed the interactive sequences of the ghost in a living room. We filmed green screen footage to create special effects, and we recorded voiceover content. We also cut footage from *Supernatural*

episodes. We edited all the footage in to a single long video file, and added the voiceover and other sound design elements. Each branch of the narrative started at a different timestamp. This allows us to preload a single long video clip instead of selecting and loading many different clips over the course of the experience.

We used HTML5, CSS3 and Javascript to develop the scenario. The video is displayed on a webpage running a script that gets the Kinect data from a local server using websockets and Javascript. The representation of the hands and head are drawn as HTML elements, and the movement of the video is accomplished by changing the x and y coordinates of the video element based on the data returned by the Kinect. We developed a very basic set of gesture recognition algorithms using Javascript. Our gesture recognizer only looks for gestures when they are relevant to the scenario. For example, it does not check for an “open the door” gesture when that gesture is not possible to perform. It checks for a gesture by recording sets of x and y coordinates and checking the inter-coordinate distances and directions. If the coordinates match a certain pattern, it sets a Boolean for that type of gesture to true. When an applicable gesture is detected, a Javascript method jumps the video to the appropriate timestamp to begin a new branch of the story.

WALKTHROUGH

In “Don’t Open That Door,” the interactor is waiting inside a haunted house for the main characters of *Supernatural* to find the ghost’s bones and burn them. Burning bones is one of the main ways to get rid of a ghost once and for all in the *Supernatural* universe.

The scenario opens with an establishing shot of the haunted house and cuts to a shot of Sam, one of the main characters in the show, telling the interactor to draw a circle around

himself with salt, because it will keep him safe. Sam and his brother Dean pour salt under the doors and windows.

If the interactor draws the circle, Sam says good job and tells the interactor that he is going to find the bones to burn them, but if the interactor does not draw the circle, Sam chastises him, draws the circle and tells him not to die.

Sam tells the interactor that he and Dean are going to look for the bones, and the scenario cuts to a shot of Sam and Dean looking around in an attic with flashlights. The scene returns to the first person shot in the living room, and the wind begins to blow loudly, and someone knocks on the door. The voice of a young girl calls from outside, “Let me in. It’s scary out here.” The door begins to shake, and the camera cuts in closer and closer to the doorknob.

If he does not open the door, the wind gets progressively louder and the cries get more aggressive, until the salt under the window that has been keeping the ghost out blows away, and the ghost comes in screaming demonically about how mean the interactor is. In this case, Sam hears the ghost screaming and runs back from the attic to save the interactor. He hits the ghost with an iron fireplace poker, another *Supernatural* standard, and she disappears. Sam chastises the interactor again and leaves to look for the bones elsewhere.

If the interactor opens the door, the ghost comes in happy and asks the interactor to play a game with her. She holds out her hand and says, “Come play with me.” The interactor can take her hand to play a game or resist.

If the interactor takes her hand, she walks to the couch, sits down and covers her face with her hands. She removes them saying, “Peek-a-boo! Now it’s your turn.”

If the interactor plays peek-a-boo, the ghost is happy and mentions that they will play peek-a-boo together forever. If he is unsuccessful or chooses not to play the game, or does not take the ghost’s hand, she gets angry and begins throwing things at him. He can dodge the objects, but if he is hit by two of them he falls on the floor dead.

If the interactor plays peek-a-boo or successfully dodges the objects, the ghost eventually bursts in to flames, and the video cuts to a shot of Sam and Dean in a cemetery burning the bones. This scene returns the interactor to the larger world and reconnects him with the plot of the show that he has just taken part in.

OBSERVATIONS AND DISCUSSION

We displayed the first completed version of “Don’t Open That Door” at a demo showcase in April of 2012. Over the course of the day about 30 people interacted with the piece. We made observations about the effects on dramatic agency experienced by the participants and determined the element of the experience that created the particular effect. The elements that affected dramatic agency fell in to three main categories: narrative design, interaction design, and

technical limitations. Narrative design issues occur when dramatic motivations or events are not clear to the interactor. Interaction design issues occur when what the interactor is supposed to do is not clear. Limitations of current detection hardware cause technical issues, which also affect the experience. The results of our successes and failures in these categories all affected the agency of the interactor in different ways. By observing the effects and finding their root causes, we were able to revise “Don’t Open That Door” so that it provides a more seamless experience of dramatic agency.

Narrative Design

Since we were attempting to script the interactor using dramatic techniques, it was important for the narrative scenario we designed to be completely clear. If the motivations of the characters or the events occurring in the story seemed arbitrary or were unbelievable, we risked disrupting the dramatic agency of the interactor. We first observed this disruption when Sam asks the interactor to draw a circle with salt. Many of our participants had not seen *Supernatural* before, so they did not know why they would want to do that. Instead of just drawing a circle, they stopped to wonder about Sam’s intentions and missed the opportunity to draw the circle. When Sam chastised them for not drawing the circle, they felt frustrated and confused instead of empowered in the world of the story.

We also failed to coherently set up the scenario, so instead of being immersed in the story quickly and wanting to interact with it, participants would stop paying attention and ask us what was going on. In our first version, it was not clear that there was a ghost in the house or that she was dangerous. It was also not clear what role the interactor played in the scenario. During the showcase, we solved this problem by verbally explaining the scenario to participants before they started. In our second version, we recorded additional voice over material to provide the necessary exposition.

The use of cut scenes also caused a disruption of agency. The scene that showed Sam and Dean hunting in an attic was not only long and boring for interactors; it also seemed to remove them from the state of agency that we had created. They essentially forgot that they were using an interactive system, so when we returned agency to them, they often missed the next opportunity to interact, because they were no longer primed to look for those opportunities. While cutting to parallel action is normal in a television show, in an interactive scenario that relies on perspective to create agency, cutting away from that perspective seems to be disruptive. We removed cut scenes from the second version and replaced them with voiceovers that appear to come from a physical prop placed in the interactor’s space: a walkie-talkie. In the set up, Sam says that he will communicate with the interactor through the walkie-talkie, and we use the prop to provide the interactor with information about what is going on elsewhere in the world

without removing the interactor from the location of agency.

We also added visual transitions between moments when the interactor has agency and does not. When the interactor can interact, we used full screen video and made the hand and head dots visible. When interaction was not possible, we letter boxed the video and removed the hand and head dots from the screen. This reinforced the first person perspective as the location of player agency in the scenario.

Even though cutting back and forth between locations in the diegetic world disrupted agency, it was still important to place the scenario in the context of the show and within the larger world. To accomplish this, we used scenes from *Supernatural* at the beginning and the end of the scenario to bring the interactor in to the world of the story and to return him to the story as a viewer. By managing the transitions from viewer to interactor and back to viewer, we designed a self-contained story beat that can work within the context of a larger narrative.

Interaction Design

With respect to specific interactions, the narrative can only do so much to make it clear what exactly the interactor is supposed to do. For example, even when participants understood that they were supposed to draw a circle, the specific movements they made to draw a circle varied wildly. While we had accounted for many different ways to draw a circle in our gesture recognition algorithm, participants still found ways that we had not considered, and the dramatic tools we had available at that point in the scenario to instruct them about what exactly was expected were too limited to illicit a single consistent gesture that was understood as drawing a circle with salt. For that reason and because the motivation for drawing the circle at all was not clear to interactors, we removed that interaction entirely from our second version.

We observed similar issues with the scripting of the open the door interaction. Some people tried to simply touch the doorknob, while others made the gesture we expected but without respect to the position of the door on the screen. To solve this problem, we made the dots representing the hands change color when they contacted the interactive element. This reinforced the fact that the interactor's body corresponded to the on screen environment, but did not help script the particular movement required to open the door.

The reactive gesture, dodge, worked for many of our participants. Almost everyone understood that he had to do something to avoid being hit by the objects; however, instead of moving out of the way, some participants tried to use their hands to block the flying objects, which caused them to get hit anyway. Blocking the objects, a clarinet case; a flower pot; and a lunch box, was a reasonable way to avoid being hit, so we needed to redesign the cues to make it clear that the objects had to be dodged. In the

revised version, we added flames to the objects to show that touching them at all will hurt the interactor.

The take hand gesture worked almost too well. Take hand combined verbal, audio-visual, and mimetic cues to script the interactor to reach out and grab the ghost's hand. Taking a hand is a very human action and interactors found it hard to resist the ghost's request. One participant wanted to play through a second time to see what happened if she did not take the ghost's hand, but when the scene came up the second time, she, without thinking, reached her hand out and touched the ghost's hand. The expected gesture for performing this interaction is simple and clear because the drama was able to reinforce it using multiple different cues and because the action it expects is something that is iconic and understood well by everyone who we saw encounter it.

Technical Limitations

We observed two main technical issues that disrupted agency in "Don't Open That Door". The first was the fidelity of the Kinect. In the case of the open the door interaction, people often wanted to rotate the doorknob. Since the Kinect does not track fingers or wrist rotation, we could not provide any feedback about that action. This frustrated interactors who expected to see the doorknob turn and caused them to focus on the specifics of the interaction as opposed to the story. Lag due to the large file size of the video also disrupted player agency. Interactors require immediate feedback about their actions in systems like this and any lag causes them to question whether they performed the correct action. We solved this issue by compressing the video and optimizing the server side code.

LESSONS LEARNED

From our research, design process, observations, and updates, we have been able to draw several conclusions about the effect on dramatic agency of managing expectations and scripting the interactor in gesture-based interactive narratives. Specifically, we have developed and analyzed our techniques with respect to their effect on agency. Our conclusions fall in to three main categories: users, interaction design, and visual design.

Users

Leveraging prior knowledge is a powerful way to script interactors, but it is important to keep in mind what all interactors know and what only some of them know. In our case we used elements from the horror genre and from *Supernatural*; however, not all of our users knew the elements of the show. When they encountered moments in which knowledge of *Supernatural* was required to understand the scenario, it disrupted their agency. Leveraging knowledge of a specific group can lead to a more enjoyable experience for that group, but it should not be done in a way that alienates other potential users.

People also have different understandings of how to enact a particular action. In "Don't Open That Door", people

performed drawing a circle and opening a door in ways that we could not have anticipated. However, by scripting the interactor with multiple different cues at the same time, we were able to create interactions that everyone performed in the same way. Using iconic movements and providing cues through multiple channels can help script the interactor and minimize the frustrations caused when a gesture is enacted in an unexpected way.

Interaction Design

In order to maintain agency, gesture-based interactive narratives should provide immediate, clear feedback about when a gesture has been performed successfully and when it has not. Our system uses character reactions and dramatic events to indicate successful interactions; however even brief delays due to technical problems cause disruptions of agency. If latency is not an issue, focusing design on short interactive beats can help designers provide feedback. Instead of long, drawn-out sequences of gestures, each gesture can accomplish a single specific thing, which can build up to the completion of a more complex goal. Providing feedback about each interaction helps enhance agency.

Visual Design

Finally, it is important to create a point of view in which an interactor has agency and to provide clear indications of when he can and cannot interact. Removing the interactor from this point of view disrupts agency in such a way that returning agency to the interactor cannot be accomplished simply by returning to that point of view. In "Don't Open That Door," we used a first person perspective throughout the scenario and eliminated cut scenes based on our observations. We use visual elements to represent the interactor's body and move the viewport along with his head. We turn on and off the visual elements and movement and change the size of the video to indicate when interaction is and is not possible, but we do not change the point of view of the interactor. When information from another point of view is required we provide it through an alternate channel. In gesture-based and embodied systems, point of view is important to the maintenance of agency.

CONCLUSION AND FUTURE DIRECTIONS

Through our research, design process, implementation, and observations, we have shown the effect on dramatic agency of the narrative, interaction and technical decisions we made when implementing an interactive narrative that: (1) is TV-like in its narrative progression, (2) scripts interactors using dramatic elements and genre conventions, and (3) provides appropriate responses from characters and the diegetic world.

Future directions for this research can look for better ways to close the loop between the scenario and the interactor. User defined freehand gestures can be implemented to ensure that both the scenario and the interactor understand

each other [12, 13]. More refined visual feedback, for example directly manipulable 3D rendered environments, could make the effect of an interaction more clear, and different interfaces, like tangible controllers with haptic feedback capabilities and analog inputs, could give interactors a more nuanced understanding of their place in and their effect on the narrative.

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