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Alexa What Have You Done?

Making a Mystery Game With The Virtual Suspect

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I would like to thank my parents for trusting and believing in me, even when things looked dire they still supported me. I want to thank my friends for being there when I needed to vent and when I needed to relax, through thick and thin they were always there. And to my special friend thank you for putting up with me always.

Abstract

The Mystery Genre revolves around a search, either for an answer or, in the case of video games, the resolution of a puzzle. The author places clues that are ambiguous and lead the player in the wrong direction, still so obvious that once they see the answer every clue fits. The Virtual Suspect is an interactive agent that has an interesting property, it can lie. In this work, we use the existing Virtual Suspect Response Model to create a mystery game, utilizing the lying mechanic to create an engaging voice game. We created and adapted a story for the Virtual Suspect, improving its experience to be able to create an engaging game. Through collecting feedback and data from a User Study we understood the impact of our design ideas and changes to the original project.

Keywords

Game Design; Storytelling; Mystery Games; Virtual Suspect; Amazon Alexa

Resumo

O Género Mistério gira em torno de uma busca, de uma resposta ou, no caso dos jogos de vídeo, da resolução de um puzzle. O autor coloca pistas que são ambíguas e levam o jogador na direcção errada, ainda assim tão óbvias que uma vez que vêm a resposta, cada pista encaixa. O Virtual Suspect é um agente interactivo que tem uma propriedade interessante, pode mentir. Neste trabalho, utilizamos o Modelo de Resposta do Virtual Suspect já existente para criar um jogo de mistério, utilizando o mecanismo de mentira para criar um voice game interessante. Criámos e adaptámos uma história para o Suspeito Virtual, melhorando a sua experiência para ser capaz de criar um jogo envolvente. Através da recolha de feedback e dados de um Estudo do Utilizador, compreendemos o impacto das nossas ideias de design, e as suas alterações.

Palavras Chave

Design de Jogos; Narrativa; Jogos de Mistério; Suspeito Virtual; Amazon Alexa

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Acronyms

AWS Amazon Web Services

ASK Alexa Skills Kit

1

Introduction

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The Mystery Genre revolves around a search, either for an answer or, in the case of video games, the resolution of a puzzle. The author places clues that are ambiguous and lead the player in the wrong direction still so obvious that once they see the answer every clue fits.

Interactive Agents are a useful teaching tool and are often used for that purpose. Because they are less expensive, more accessible and offer an increased control of the environment it is a safe approach for training specific skills in professional environments. In the case of The Virtual Suspect, an interactive agent that is capable of lying, we see potential to create an unique experience by integrating the mystery genre.

Combining the realism of an interactive agent with the video game media is an ever-growing concept that companies like Amazon are investing greatly.

1.1 Motivation

Introducing an interactive agent capable of lying to a game is a challenge, but also a great opportunity as it gives the player agency. Though, it has its challenges. We have to understand how to design a game around it, incorporating the Virtual Suspect in a natural way that does not take the player out of the experience whilst creating a good Mystery game. If this combination is well developed the experience on a whole will improve. Considering the Virtual Suspect offers a believable suspect where instead of a streamlined dialogue, it provides a realistic dialogue where the player can ask and say anything whilst always been given a natural response, creating an immersive experience that if done right can maximize the Mystery Game experience. Rato et al. [8] built the lying Virtual Suspect and Baptista et al. [1] improved the model interaction, with the objective of improving the main limitation of Rato's model, the interaction through multiple-choice selection. Using this last iteration, we can develop a game using it, considering the limitations around integrating a model that worked by itself to a Mystery Game, that has as its main focus to engage the player.

1.2 Problem

The problem encountered is creating an engaging game that uses the Virtual Suspect in a natural way, using its strengths to improve the mystery game genre. For this we have to study both the weaknesses and strengths of this system and create an engaging way to interact with it.

1.3 Objective

The objective of this work is to create an engaging and interactive mystery game using the existing Virtual Suspect model developed by Rato et al. [8] with the interface improvements developed by Baptista et al. [1]. We want to use the lying capabilities as a game mechanic, having a spoken natural language conversation, to mimic an actual investigation.

With that objective, we will continue using Amazon Alexa and its services. Developed by Amazon, Alexa is a virtual assistant capable of voice interaction. We will use Skills, which is the feature that allows the creation of third-party apps, provided for free by Amazon.

The goal of this work is for the player to be able to use the natural language conversation with the virtual Suspect, in which he can ask questions related to the investigation, to solve the case. Additionally, after the game experience is created, we would like to improve the system both in interaction and in character depth, to improve the game experience.

1.4 Document Outline

In Chapter 1 we find the motivation and objectives of our work with the Alexa iteration of the Virtual Suspect.

Chapter 2 we show some studies related to our game design, we look through Storytelling, Narrative Techniques in video games, the Mystery Genre in video games, Dialogue and Detective Games, we understand how Voice Games are part of the future of gaming and lastly we look and analyze our greatest inspiration for our game design, Her Story.

In Chapter 3 we look deeply into the previous iterations of the Virtual Suspect, analyzing how it was designed and developed, and how its Alexa iteration improved the interaction, and we explain the limitations of the tool.

Chapter 4 is where we define our Game Design goals and define the Story we will use for our game. In Chapter 5 we show the development of our adaptation of the story created in Chapter 3, and other changes necessary to create the game.

Chapter 6 regards the User Study made after the Development, with a detailed analysis of its results and process.

In Chapter 7 we have a discussion of the limitations we encountered while developing our game with the Virtual Suspect and an analysis of our results.

Chapter 8 comprises of the conclusions and future work for the Virtual Suspect.

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Related Work

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In this section we will look at works from multiple areas. We will study how to create a narrative and story related topics, and understand why Voice Games are increasingly relevant.

2.1 Storytelling

Storytelling has been the main source of entertainment from the beginning of human interaction. Created to transmit emotions and stories from the world, through the centuries has become the main source of human entertainment.

Starting with caveman paintings, developing to word of mouth stories passed through generations, then developing into the written media, and finally, more recently, being developed to the visual medium.

The visual medium I am referring to is all of the contemporary arts, from cinema to video games. Whilst cinema gives the viewer a feeling of being told a story, the video game medium provides a feeling of being part of a story, through interactions and choices presented to the player.

2.1.1 Storytelling in Video Games

Even though the video game medium started with simple concepts like *Pong* (1972), where the player is performing a simple game of ping pong, has later developed into one of the main ways of providing entertainment. It is easy to notice the recent trend of story-driven games, with best sellers like the Naughty Dog's *Uncharted* Series, where the player participates in an action adventure inspired by iconic movies like the *Indiana Jones* series, and even interactive story games like *Her Story* (2015), where the player watches interrogation videos in any order he wishes, using a "simple" word filter system.

There are two sides, one is to follow the story created by the author and the other one is to follow the story the player creates through their choices. We will follow the latter.

2.1.2 Dramatic Arcs

To connect the players to the game emotionally, the game designer creates a dramatic context for the interaction that overlays the Formal System. the **Formal System** being how the system works behind the scenes, which is *data* and *values*, without an abstract concept the player does not connect emotionally and forgets the experience as soon as it is over.

Quoting Martinho [6]: "*Fiction brings players into the Game. Gameplay keeps players in*".

In a *Classic Dramatic Arc* the story follows the following structure:

1. Story begins with exposition, which introduces the settings, characters, and concepts important for the rest of the action;

2. Conflict is introduced when the protagonist has a goal that is opposed by the environment, an antagonist, or both;
3. The conflict and the protagonist's attempt to resolve it, causes a series of events that lead to a rising action;
4. The rising action leads to a climax, in which some sort of deciding factor or event is introduced;
5. The rising action leads to a climax, in which some sort of deciding factor or event is introduced;
6. What happens in the climax determines the outcome of the drama;
7. The climax is followed by a period of falling action in which the conflict begins to resolve, and the *dénouement* in which it is finally resolved;

There are other Dramatic Arcs that have gained popularity in storytelling that help the story teller to create an engaging story, for example **The Monomyth**, also known as the **Hero's Journey**, which is a common guide for stories that involve a hero that goes in a adventure.

Recently Harmon, creator of popular TV Series like Community (2009) and Rick and Morty (2013) showed his version of the *Hero's Journey*, which he believes to be easier to apply to a wider range of stories. **The Story Circle** follows the following structure:

1. The character is in a zone of comfort;
2. But they want something (desire);
3. The character enters an unfamiliar situation;
4. The character adapts to it;
5. The character gets what they desired;
6. But they pay a heavy price for it;
7. The character returns to their familiar situation (zone of comfort);
8. The character changed;

The Story Circle is a modern rendition of the **Hero's Journey**, that like the name implies works in a circle, although this story is over, a new one can commence.

It is important to say that Dramatic Arcs are not formulas, they are **guidelines** for creating a coherent story.

2.1.3 Dialogue in Video Games

To deliver a storytelling experience it is common to use dialogue. Which has become an increasingly relevant topic, due to the trend of story-driven games. To achieve believable dialogue, it is important to understand the existing types of dialogue and how they impact the provided game experience. We will delve into the world of dialogue system in the next section.

There are two distinct types of dialogue present in video games, Non-Branching Dialogue and Branching Dialogue. Both are useful and acceptable depending on the intention of the developer.

Non-branching dialogue is the simplest form of interaction in a video game environment. It consists in approaching an NPC and initiating a conversation, the only decision-making¹ present is the choice of talking with the NPC.

The NPC has a set of dialogue which is delivered, where there is no choice from the player. It can change by progression or triggering certain events, this will change the dialogue delivered by the NPC to a different conversation but maintaining the format of line delivering existing before. Modern games commonly use this system in the format of a cut scene, where the player's avatar and the NPC have a non-interactive dialogue.

This type of interaction is commonplace in narrative driven games, due to the cinematic effect it has, creating a dialogue similar to a film, AAA games like *God of War* (2018) and *The Last of Us* (2013) used this type of interaction to immerse the player in the narrative offered. Although this type of interaction has interesting effects in narrative focused video games, the main reason for using it is the easiness to both implement and developing it.

The alternative to Non-Branching Dialogue is, like the name suggests, Branching Dialogue.

Branching Dialogue is a more interactive approach to conversation, giving the player the ability to take different paths. The player partakes in the story flow by choosing between a limited set of options given by the game. Usually conversation moves forward, not giving the option of going back on the chosen option. *Life is Strange* (2015) is an interesting deviation from the norm, where the main mechanic given to the player is the ability of turning back time and repeating conversations, it is important to mention that this "time travel" influences the dialogue given to the player, so technically the conversation moves forward.

Using this simple framework, a conversation could have a straightforward yes or no question or be as intricate as the multiple ending massacre that *Doki Doki Literature Club* is. With this framework player choices can affect NPC's attitudes towards the player in the moment, changing the dialogue presented or influence the story later on.

In games where the goal of the interaction is to change the player's relationship with the NPC, whilst not every choice changes the course of the dialogue, each choice might have "mood points" given to it, changing the relationship of the player with the specific NPC, or in some cases, with a group of NPCs.

Quantic Dream has developed multiple video games, where systems like this exists, player choices in dialogue influence how characters relationships and the progression of the story.

A technique commonplace to create an illusion of freedom, is to have multiple, if not all, choices lead to the same path. Branching dialogue curves back in on itself, in a way where an individual choice can create a unique response, but the remaining conversation is the same as other choices. This technique is useful to cut on the amount of dialogue that must be produced for the game, cutting cost and development time. A company infamous for using this technique was *Telltale* games, where each game presented a big amount of choices, in each of its conversation, that had no apparent effect on the overall story and the current dialogue.

2.1.4 Characters Relationships

In a more conventional method of storytelling, characters relationships have a structure, are planned, and have a direct forward progression, which is not as simple in the videogame format.

The main difference between the conventional and video games is unpredictability, if you consider that a player has free will to interact with an NPC, whenever he wants, this structure can easily collapse. This creates a problem, where a developer has to predict every way a player can possibly interact with the story. The easiest way to fight this problem is to control the environment, forcing a player to do what the developer planned, loosing the free will games so desperately want to offer. On the other hand a developer can give complete free will to the player and create a response to any sequence the player tries, what most often happens with this approach is not believable characters and more importantly undeveloped relationships.

Looking at contemporary games a great example is *The Witcher 3* (2015), a story-driven Role Playing Game, it is easily noticeable that the important characters that influence the story are only interactive inside missions, where the flow is controlled, making it easier for the writers to hit their so desired story beats (points of action which you hang your basic story). This approach results to a great effect for the main characters, leaving the NPCs the player can choose to interact whenever to a simple “how do you do?”, “fine, you?” relationship. The opposite of the spectrum is indie games like *Life is Strange* (2015) where talking with NPCs is rewarded with both a new relationship, and also new ways to progress the story, it is worth mentioning that this way of developing relationships can be frustrating for players that don't notice a certain character, loosing interesting gameplay options.

For this studies goals, we must give almost total freedom to the player.

2.2 Narrative Techniques in Video Games

Ip et al. [5] examines the use of narrative in Computer and Video Games, providing an overview and discussion of the definitions and representation of stories, plots, and narratives.

Before diving to the Narrative Techniques used in both old and modern interactive media, it is important to define the meaning draw a clear distinction between *Story*, *Plot*, and *Narrative*, especially as these terms are often used to refer to "Story".

A *Story* is defined as: "(...) a sequence of events involving entities. A story is bound by the laws of time; it goes in one direction, starting at the beginning, moving through the middle, and arriving at the end (...) the only time involved is the time it takes to read [the story], and the only order is that of the structure of the essay" (Abbot, 2002).

Plot is defined as: "(...) the organisation of events. The events, i.e., the plot, are what tragedy [serious dramas] is there for, and that is the most important thing of all" (Heath, 1996), and "The chain of causation which dictates that these events [in the story] are somehow linked and that they are therefore to be depicted in relation to each other" (Cobley, 2001).

Lastly a *Narrative* is defined as: "(...) the representation of an event or a series of events. (...) when we read a narrative, we are aware of, on the one hand, the time of reading and the order in which things are read, and on the other hand, the time the story events are supposed to take and the order in which they are supposed to occur" (Abbott, 2002).

Based on these definitions, Narrative can be regarded as the more **malleable** of the three.

These **Techniques** are often used to strike a balance between prescribed narrative and interaction:

Back Stories is one of the most basic methods, providing a simple description of a game's setting, key characters, and the main objectives. Back Stories are usually presented just before a game begins or seen written on the back of game packaging or in its instruction manual to capture a player's attention as well as set the scene for the entire game. Even though this technique is simple and low effort, for an older game it works perfectly, or even simple games of the present, like *Leo's Fortune* (2014) or *Limbo* (2010), two games that thrive because of their simplistic *Story*.

The most common method for narration is the **Cut Scene**, which is a pre-rendered piece of video, normally during playback, player's interaction is suspended, becoming a passive audience member through the scene. This ever increasing popular technique is used with three purposes in mind: Explain the story or events taking place; Initiate a transition in story or gameplay, or show the consequences of a player's actions. Story driven games use this technique aplenty as it creates a movie like experience, *Hellblade*, *Senua's Sacrifice* (2017) is a great example as it innovated the cut scene using real videos Superimposed in real time with the game's Cut Scenes.

With the increasing concern with the use of Back Stories and Cut Scenes, techniques more sophisticated are being developed, a important example is the evolution of **Game Structures**. Traditionally

games would be presented in a *linear structure*, in the form of sequential levels, though, quoting Ip et al. [5], "games that purport to contain more advanced narratives strive toward nonlinear or branching structures (...)". Greater *Freedom* is the main advantage of the nonlinear approach, giving the impression that a greater degree of control is possible through the progression of the game's story than what is actually possible. **Interactive Cut Scenes** are an example of this structure, offering the player a choice to *influence the story*. The great limitation of this approach is the insane amount of content that need to be produced for each possibility you give the player.

These limitations open the way for *emerging techniques*. There is a need for human emotions to play a bigger role in the experience, linking character's emotions to the specific requirements of game levels in terms of ambience, lighting, animation and audio techniques (O'Luanaigh, 2006). **The portrayal of emotion** play an essential role in developing more convincing and richer narratives. An emerging effort has been made, through the last few years, to portray emotion in a richer way, with games like *The Last of Us Part II* (2020), *God of War* (2018), and *Red Dead Redemption 2* (2018), making the portrayal of human emotion a core element of their experience.

With these techniques in mind we can more easily **plan** and **structure** the game.

2.3 The Mystery Genre in Video Games

Every story can be said to be either *mystery* or *suspense* [12]. Neither is a genre, merely ways of handling information. As the great Alfred Hitchcock once said, "*mystery is when you don't know if there's a bomb under the table, suspense is when you lift the tablecloth and see it but can't leave the table.*"

Whilst in *suspense* the player has the information and knows how to execute, in *mystery* the player is searching for the information that will lead to the correct solution. Mystery is a search, suspense is a way to execute.

Mystery is the *solving* of puzzles; suspense is the *resolution* of the puzzles. In mystery the author **place clues** that are ambiguous and lead the viewer in the wrong direction yet so clear that once they see the solution every clue makes sense.

Knowing how and when to apply mystery makes a game viable in the long run. In a *mystery centred game*, like the game we intend to design, you want a *solvable* game. You want the player to use the given set of clues to figure out the optimal strategy. The important part in a mystery centred game is the *puzzle* not the execution.

Great examples of mystery in the video game platform are **Her Story** and **What Remains of Edith Finch**. Both have a similarity, they withhold important information that create the *mystery*, which we talk about later.

2.4 Dialogue and Detective Games

Game Maker's Tool Kit is a YouTube creator that takes a deep dive into game design, level design and game production. Mark Brown is known for his professionalism and research which make him a credible source for aspiring game designers to learn from various games and techniques.

In his video Essay "**Can We Make Talking as Much Fun as Shooting?**" [2], Brown talks about games that give you an option to either talk or fight like Deus Ex: Human Revolution (2011) and games that only have the option to talk your way through conflict like Life is Strange (2015). The key to make a "talking" fun is to make it interesting, to achieve this the developer has to give the player stakes to create tension, this can be done through making failure devolve into combat or in the case of Life is Strange into catastrophic consequences like suicide. To make it interesting the developer also has to make "talking" engaging, which is even harder when you give the player multiple options, because the developer has to make all options viable and the "right" one has to have some player effort, like remembering what a character told you or, in the case of L.A. Noir (2011) giving visual queues through how the character reacts or what their demeanour tells you. To summarize the developer has to create a tension in "talking" whilst engaging the player, which requires a lot more effort than creating a run of the mill shooting sequence.

In the Video Essay "**What Makes a Good Detective Game**" [3], Brown takes a deep dive into what makes a Detective Game work, like the title implies. Brown starts by analysing how other medias portray the detective work, breaking it down to steps. These steps are Gather Information, Expose Lies, Follow Leads, Find Connections, Make Deductions, and finally Make an Accusation. For a medium like Cinema, you must make these steps cinematic and fast whilst giving an understandable depiction. In the video game medium developers have an advantage which is the ability to let the player preform these steps. To demonstrate this Brown shows examples both from detective games and other genres, like the deduction scene in Life is Strange. For the purpose of this study we can look at each of these steps and understand how to make them "good", whilst diving deeper into the Expose Lies step.

2.5 Voice Games Are Part of the Future of Gaming

As Alexa has become more and more integrated in our daily lives, we notice the importance to acknowledge there are other ways outside of utilities that **voice** can add power. In the gaming industry developers are exploring how voice can add enhance the gaming experience, re imagining their game as a *voice-first experience*.

With the intent to understand why, Williams et al. [11] explores how voice is part of the future of gaming and how to jump on board.

Artificial intelligence and **machine learning** have been the forefront of technical news. **Ambient**

intelligence is artificial intelligence integrated into things we integrate with in our daily activities, it should feel intuitive and be seamlessly integrated with our surroundings.

With **Alexa** we see this routinely when customers ask **Alexa** to simplify tasks that normally cut into our routine, improving customer engagement.

In gaming we see the progression into **ambient games**. Noticeable, for example, when your controller vibrates when hit in combat, the Playstation 5 *DualSense wireless controller* is a great progression in the commercial gaming experience.

The future of gaming will fully immerse each of our senses in the comfort of our homes. We notice this recently where games are, for example, integrating social components to be able to talk with your teammates during gameplay, added in an innovative way in Apex Legends (2019), where players communicate in game seamlessly with premade dialogue.

Voice fits into this narrative, a future where you can directly communicate with other characters in the game unrestricted from the game mechanics. Alexa Skills Kit lets you accomplish this, you are able to develop skills with account linking to your game that is connected to the same database, the customer can interact with the web application and Alexa Skill seamlessly. A Great example of this is "PAC-MAN™ WAKA WAKA" (2020), which brings the Pac-Man™ experience to the *Voice First* genre , developed by **Doppio Games** and available for Amazon Alexa.

2.6 Her Story

Her Story (2015) is an interactive film video game written and directed by Sam Barlow. The concept resolves around a video search engine that works by searching key words to solve a mystery. Barlow's main goal was to depict police interrogations in a realistic way.

What makes Her Story interesting is how little the game gives the player in terms of both plot and direction. From the beginning the player has only information on how the search engine works, and no apparent objective. What engages the player is the mystery. As discussed previously, mystery is a great way to engage an audience in all types of story telling. As the game unfolds, the player realises that what he is unveiling is no crime or murder but actually he is understanding the life of the characters, where the character the player is portraying is included.

The genius game design present is how the player flows through the story in a guided freedom.

2.6.1 Surrendering Control

In a discussion with Cameron [4] for **Gamasutra**, Barlow delves into how he created the story and how he **trusted the players** to solve his puzzle.

Starting with a unique concept of investigating a murder from two decades past, the player has access to an archive of police, only being able to search by keyword. Making Her Story a game of curiosity, as the player tries to find the right keyword based on what they heard and solve the mystery. As the player has complete freedom, the story emerges out of order and in fits and spurts.

Barlow explains, *"I had the confidence that people would be able to give shape to the story, even if the pieces were coming at them in a different order."*, believing the story has enough complexity to only break one thing at a time. This confidence comes from the fact that if the audience hits the payoff of a story in the wrong order, there are still details and context to keep them engaged. This was the biggest lesson Barlow learned whilst developing Her Story, **Trust the players and do not try to control things too much, *surrender control***.

In a game like we intend to develop this is a lesson to be taken to heart, even though it is scary, we have to trust the player enough to solve the puzzle at their own pace.

2.6.2 Sculpting Dialogue

Instead of controlling what the player does, it was all about making sure that what the player wants to do was supported as best as possible, having relevant videos show up and shifting the importance to the words spoken throughout the videos.

Barlow looked at every single word used in dialogue, how frequently each word appears, and making sure that some clips would appear in a search, using synonyms to trim it into shape. All this helped making the **play experience** almost completely singular, it is not about the idea that the mystery might be solved quickly, it is about the investigation, and uncovering the layers of the story. This confidence lies in the ability of the player to read the subtext of everything that is said.

3

Virtual Suspect

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The purpose of this section is to describe the current state of the Virtual Suspect project we will use and improve in our work, developed by Rato et al. [7] and continued by Baptista et al. [1] in their respective master's Thesis. We will focus on Baptista's iteration as it is more interaction centred.

3.1 Story Representation

The Virtual Suspect has an internal memory of everything that happens in the story. The story consists of a collection of events, each containing entities.

The Agent keeps a timeline of all the actual events (what actually happened), also keeping a timeline of what he tells the interrogator, keeping the lies he manufactured, and most importantly where he omitted the incriminatory details.

An entity is defined by the tuple (Identifier; Type; Value):

- **Identifier:** Every single entity has an unique identifier with the purpose of each event being able to associate entities with their fields;
- **Type:** The entity can have any type, with a classification to group similar entities. The type Time Period is unique as it has a begin value and an end value, being both required;
- **Value:** Represents the value of the entity, it can be of any format: integer, float or string. It is possible to be a combination of multiple values;

These entities are added before the interaction starts, and cannot be deleted after being stored in the agent's memory. They can be associated and unlinked with events after.

A flexible frame represents an event as an association of multiple entities, without many constrains, and an action. These way, the author can create a narrative with freedom, whilst also holding the semantics needed for the agent to create alternative stories. An event is defined by the tuple (*Identifier; Real; Incriminatory; Action; Time; Location; Agent; Theme; Reason; Manner*), where:

- **Identifier** is a unique identifier for each event;
- **Real** is a flag that indicates if the event actually happened or not;
- **Incriminatory** is a value from 0 to 100 which indicates how compromising the event is;
- **Action** is a verb that represents the action corresponding to the event;
- **Time** is a entity that represents the time frame in which the event took place;
- **Location** is an entity that represents the location where the event took place;
- **Agent** is optional and it represents people involved in the event, can contain multiple entities;

- **Theme** is optional and it represents the target of the action, can contain multiple entities;
- **Reason** is optional and represents the reason for the action to occur, can contain multiple entities;
- **Manner** is optional and represents how the action occurred, can contain multiple entities.

The **Real** and **Incriminary** elements are unique to the rest, because they describe the event instead of describing the event's content. These two fields are assigned by the author when creating the story, although if they are generated by the agent, the **Real** value will be *false* without exception and the **Incriminary** value will be calculated in function of the entities' values.

The author can add events to the story that are *false* with the objective of influencing the agent's process to create an alternative event.

The original story is created by the author before the interaction starts, the content will not be modified during the conversation and its events are persistent, these events will never be deleted.

The parallel story will be greatly modified during the conversation, events will be created, modified and swapped. The agent will gather new information about the user's knowledge, being stored in a collection of tuples, where:

- **Entity**: The reference to the entity known by the user;
- **Event**: Identifies the context related with the Entity;
- **Known**: Is a boolean value that states if this belief was identified by the agent;

To create the story, the author specifies the real sequence of events, identifying the compromising information and then uploads it to the agent's memory.

3.2 The State of the Interaction

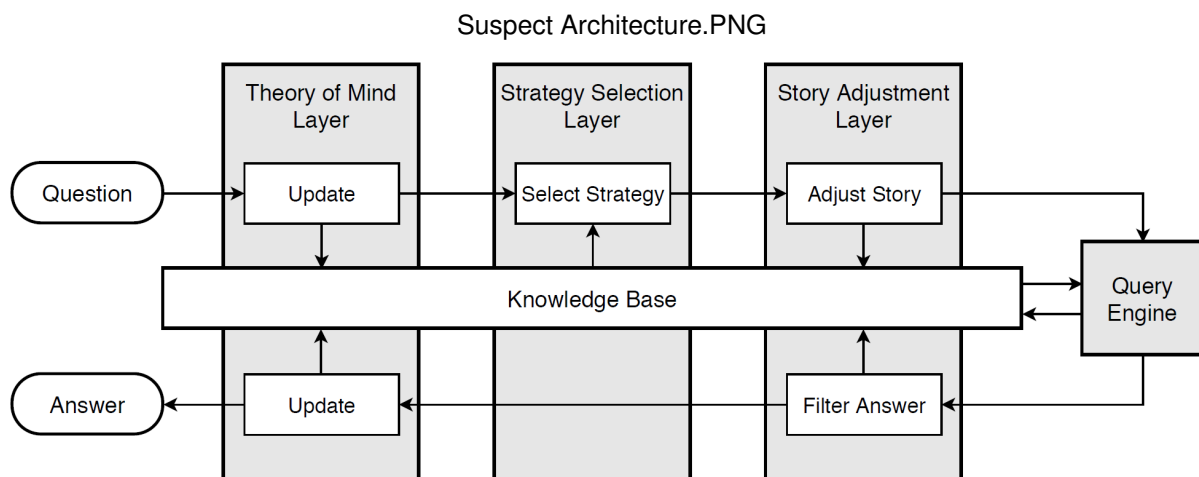
The purpose of Baptista's iteration was to improve how the user interacts with the Virtual Suspect. Since one of the great steps in this improvement was the incorporation of Amazon's Alexa we will explore how Alexa's introduction improved the interaction.

The Interaction Model changed a lot since Rato's iteration. Some of these changes were in service of other improvements, but this were the changes concentrated on just the Interaction Model. In Figure 3.1 we show the current Virtual Suspect Architecture.

Namely, new *intents* were added, some simple ("Hello" for Greeting, "How are you?" for Introspection) and the rest were in service of the new types of question: Action Focus questions, Knowledge questions and Manner Focus questions. Here is a brief explanation of each of this questions:

- **Action Focus Questions:** Retrieves the Action field from an event. Works in a similar manner to the existing focuses in Rato et al. [8] iteration. For example, questions like "What were you doing on November 7th at 2am?" is a Action Focus Question.
- **Knowledge Questions:** Information regarding a specific *entity* rather than an *event*. For example, questions like "Who is Luke?" "How do you know Miss White?", or "What key?" are knowledge questions.
- **Manner Focus Question:** Information regarding how something happened (in what manner). For example "How did you meet James?" or "How did Jesse find the key?".

Figure 3.1: Virtual Suspect Architecture



A lot more *utterances* were added, one particular aspect to note are the questions with Time slots, since the team had to add a lot more different combination to cover for more possibilities.

In the *slot values*, more synonyms were added to the different slot values, adding also possible pronouns that represent the individual slot.

Before diving into the Alexa additions it is important to understand how a user asks a question to Alexa, quoting Baptista et al. [1]:

"The user asks Alexa a question, which is interpreted by the **Interaction Model**, which sends a **Skill Request** to the **Skill Service**, which transforms it into a query and sends it to the **Virtual Suspect Response Model**, which computes the query results, sends it to the **Natural Language Generator**, which then sends the answer back to the **Skill Service** so it can be transmitted back to the user."

About the **Skill Service** additions, many filters were added to safeguard the users from going astray and to improve the experience. For example, a filter was added to check if an answer does not contain any results and generate a simple answer in return, in the case of a question with a time focus, "Never".

To increase the realism of the agent other changes were added, the addition of *Context and Pronoun* functionality, where a record of the context was stored to support direct pronoun and contextual questions, this was a great step in making the interaction flow better. Other changes with this goal were the ability to use times of day during a conversation and support for the new intents, the Greeting, Introspection and Thanks (which are self explanatory).

An important change was the decision to give better **feedback** to the user, in case of any of the steps going wrong, for example explaining that a word is not recognized or that a question does not contain enough information, the user can readjust their question so to be better understood by the agent.

These new changes are important to use the Virtual Suspect as a mechanic in our game.

3.3 Limitations

Through Baptista's work the team managed to make many changes and improvements to the interaction with the Virtual Suspect. Still there are constraints that limited the further improvement of the interaction. These constraints were centered around the Alexa Skills Kit and the structure of the Interaction Model, the organization of the agent's memory and the Virtual Suspect Architecture, and the implementation of the lying algorithm.

The **Alexa Skills Kit** is strong at building simple skills with specific functions and more limited domains, unfortunately the interaction of the Virtual Suspect is more conversational, requiring more nuance. A more non-deterministic, grammar-like approach could be beneficial for improving the interaction. According to Baptista, a solution where there could have been a better understanding and control of the selection process would have lead to a better interaction.

In terms of the **Virtual Suspect Architecture**, Baptista describes the limitations more in terms of what the user expects versus what the machine offers. For example if the agent is capable of understanding certain questions very well, the users expect it to understand other questions that are, in the eyes of a human, just as complex. Unfortunately the way that the agent's memory is structured, and the kinds of questions it can answer, do not always correspond to the users expectations. Quoting Baptista: "*All these limitations and the way that the agent's memory is structured makes it impossible to write a realistic story*", although if the memory was restructured so that events could be organized in a timeline, and reasons and motives reworked, it would facilitate the creation of a more believable story.

Regarding the **Lying Algorithm**, because Baptista's objective was to improve the interaction, the lying algorithm was not changed. Currently the lying algorithm works by *creating new fake events to substitute Incriminatory events, keeping the action and replacing the entities that have not been marked as known. Selecting new entities by searching through all entities and then identifying the most similar ones.*

Concerning the **Story Creation**, the system is quite obtuse, being really hard to adapt a original story to the system. The only way to make this step a bit easier is to plan every part of the story as well as possible. It would be a considerable improvement to facilitate this process.

A problem to take into account is that the entities described before have to be updated in the Skill Developer Console, which complicates the **Story Creation** further.

4

Game Design and Story

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4.1 Implementation Plan

Our goal is to use the work started by Rato et al. [8] improved and adapted to a Amazon Web Services (AWS)'s Alexa Skill by Baptista et al. [1] and make an interesting experience by creating a new story and gamifying the experience to tailor to our goals.

We will start by defining the goals of our design, where we will define our objectives for the game and the gameplay we expect to achieve by the end of development. After defining our design, we will create a story compatible with the system, with a description of the characters to facilitate the process.

From there we will start adapting the story into the system so the agent can understand it, whilst being attentive to keep the story coherent.

To finalize the project we will change the simpler responses created to direct the player to learn more about the plot in a natural way.

4.2 Game Design

An important step in game making is to document your initial objectives and ideas for the gameplay, with the objective of keeping a consistent image of what the developers want to achieve throughout production.

4.2.1 Gameplay

The main gameplay idea is interrogating a character. Through this the player is able to grasp the plot and understand if the narrative given by the agent is real. We will focus on making a coherent voice game, whilst giving the players an immersive experience of embodying a detective investigating a crime.

Like the game *Her Story*, mentioned and discussed in Chapter 2.6, we intend to give the players an unique experience where *control will be surrendered* to the players, giving them only enough information to play the game, and letting them explore at their own pace. An important aspect, present in *Her Story* that we want to explore, is not giving an ending to the game, letting the players choose when they have enough information to end their story.

An important part of the gameplay to take in mind, is giving the player a believable and decipherable mystery that will interest the player since the beginning of the game.

The core game-loop and how we intend the player to progress through the game will be described in Chapter 4.5, where we already have described the story and understand how we want the player to progress.

4.2.2 Mechanics

Talking is the main mechanic. Using the Virtual Suspect previous work, we can have a semi natural conversation with characters. The experience the Virtual Suspect offers at this moment is a semi natural conversation, where the players can ask anything they desire, but if the system does not recognize that question it will give a pre-made answer that shows the player the question is not recognized by the system, giving the option of rephrasing or move on.

The lying mechanic is fundamental for the game to work. Right now we can define what the suspect lies about. To achieve the planned gameplay, we have to use this mechanic in a smart way, defining the lies whilst planning the story so as to create a coherent story and experience. It is important to also take into account that this mechanic has another facet, which is the **Incriminary** value, that represents how compromising the event is. We can consider this still the lying mechanic, having to be careful when giving these values to each event.

4.2.3 Levels

It is hard to define what a level will consist. We can call the conversation with the agent a single level, although there will be acts to the story, this will be hard to show the players in order, so we will try to "*manipulate*" the players into following the path we intend whilst giving them the option to do whatever they might want to do.

4.3 Story

Our story is based on the book by Agatha Christie "*Peril at End House*", being a work of Detective Fiction we think it is the perfect reference for our story. The greatness of Agatha Christie's work is the mystery surrounding each case. In the Peril at End house the objective is reversed, Poirot (the main character of the story) has to discover who the culprit is before the crime happens, the big plot twist of the book is that nobody is trying to kill Nick (the woman who claims someone is trying to kill her), the truth is that Nick created this plot to get the inheritance of Michael (a rich friend of Nick). We think this is a perfect idea for our story as the game focuses on interrogating a suspect capable of lying.

Understanding the main idea of our reference we can begin to create our story, taking into account that the player enters the story after the events have happened, which constricts us, but if done right allows for a unique experience.

The story starts when **Joanna Brando** and **Sarah Weisz** lose the house where they live together, and their friend **Alex Larsson** invites them to live in his manor, right outside of their town **Nomansland**. Although Joanna likes her friend Sarah, she always was envious of her, not because Sarah provoked

this envy, because Sarah had everything Joanna wanted, starting with loving parents, and a degree in fashion design that Joanna could not accomplish, because, as Joanna says, she is not good at the studying business. But now she had the opportunity to have something that Sarah does not have, a rich beautiful husband, and her work was cut out for her. She already was living with a man like that, Alex an accomplished military pilot with a great family inheritance. So Joanna starts making her moves, whilst Sarah is just friendly and thankful towards Alex, Joanna thinks she is winning him little by little.

Although Joanna plans to marry Alex eventually, she still likes to live her nightlife, going out until the late hours of the day, taking every designer drug (a structural or functional analog of a controlled substance that has been designed to mimic the pharmacological effects of the original drug) she can have. She does not do all this alone, she has her trusty school friend, **Christian Speedwagon**, an artist without a job, that makes ends meet by selling the aforementioned designer drugs and other substances, which is amazing for Joanna as he is so kind as to offer her as much as she wants in exchange for company and a strong relationship. This deal was never discussed or mentioned out loud but Joanna believes that if she stopped going out so many times a week suddenly Chris would not be so kind to her.

As time passes the three housemates become closer, Joanna's friendship with Sarah is as tight as it has ever been, Sarah and Alex enjoy having company when they wake up early in the morning, and when Alex is called up for his military service, he believes Sarah is responsible enough to keep his manor safe, and lastly, Joanna feels like she is really close to her goal, making Alex fall for her and finally marry him.

It was all going according to plan, until the fateful night when Joanna decided to go out with Christian once again to **End House's Envy**, the famous Nomansland's discotheque. This night in specific Chris had a great amount of "stock" to sell so he was consuming a lot, whilst selling as much as he could, and Joanna was consuming just as much as him. By the end of the night, Chris decided to make a move on Joanna, and Joanna was so consumed by what she took, she didn't think about the consequences of her actions, accepting Chris' idea.

To keep it short Joanna woke up the next day in Christian's flat a long time after tea time, and panicked and took a taxi home. When she arrived home she finally discovered what was truly developing in Alex's manor, Sarah and Alex embraced her and shouted as loud, as they could, that they just got married, but they were only telling her because they didn't want to deal with all the attention Alex would get as was a known person in the town. Joanna was flabbergasted, confused and angry, but she couldn't show it so she just said "congratulations my dear friends, I am so happy for you", but deep inside she raged as Sarah finally got everything Joanna ever wanted.

Joanna had thought of killing her friend before. Foolish thoughts, she said to herself she would never do something like that to her dear friend, it was just nonsense her brain created to deal with the envy. But this time she lost all reasons to not do it. In her head this was a personal attack against her, destroying

her life. She found that the only recorded proof of their marriage was a simple paper that she knew Chris could forge one exactly the same with her name instead of Sarah's. So she conceived the full plan, created the concept that someone is trying to kill her, and make Chris kill Sarah somehow and later kill Alex, to receive the enormous inheritance of her beloved husband. It was so simple nobody had any idea that they got married.

So she threatened Chris with calling the cops on him as she knew every transaction he had ever done, to which, Chris accepted as easily as she thought he would, being a paranoid addict with little to lose. After having Sarah's executor she needed a way to get rid of her, so she spiked her own food with cocaine which created a strong reaction, that she knew would not be fatal, Sarah quickly drove her to the hospital as planned whilst Sarah waited for her best friend, Chris cut her breaks. Joanna waited for Chris' signal before asking Sarah to go sleep in the manor, as Alex was out in the war, fighting for the British army, Sarah accepted the idea and went home but never arriving as she died in a so-called accident.

Part one of her plan was done, now she had to think of a way to get rid of Alex right as soon as he arrived, but now she didn't have Chris as he ran away as soon as he understood Sarah had actually died. As she was stressing not figuring a way to get rid of him, she received a call.

Her luck was finally changing, Alex Larsson, had died in the war, the plan was complete.

The interrogation starts the week after Alex Larsson was found killed in action.

4.4 Characters Description

The Detective: The player, an empty shell, no description necessary.

Joanna Brando: Someone wants to murder her, at least according to Joanna. Joanna is young in her late twenties, comes from a dubious family, where the father died whilst she was young, and the mother died recently, having Joanna inherit the little she had.

Joanna lives in the house of a friend, a mansion that her friend Alex inherited when both of his parents died in a plane crash, Because Alex hates to be alone he invited both Joanna and her friend Sarah to live with him rent free.

165cm, slim, a classic eye candy character.

Alex Larsson: Is in his early thirties, a pilot for the military, rich and successful at the right age to start a family.

Alex lives with his friends Joanna and Sarah, he is really close with both. Joanna mentions that Alex and her relationship became quite close whilst living together, ending up marrying her.

Alex was killed in action, fighting for the British army.

175cm, muscular, a gentleman through and through.

Sarah Weisz: Is young in the beginning of her late twenties, had a happy childhood where both her parents showed affection and encouraged her dream to be a fashion designer.

Died recently in a car crash after driving Joanna to the hospital, police suspect no foul play. This event made Joanna more paranoid, as she believes she was supposed to die instead of Sarah.

168cm, a tall and strong woman.

Christian Speedwagon: A friend of Joanna, from the art world, even though he does not have a job he lives comfortably. The police suspect he sells some kind of stimulant but have not caught him with anything or in the action of selling yet. Christian seems close to Joanna, but even though Joanna says Sarah was a good friend of Christian, there is no evidence of that, on the contrary it seems like they did not get along at all.

165cm, a small man, with little weight on him.

4.5 Gameplay Progression

Here we will define what progression we want the player to follow.

Through the introduction of the game, a small text when the game is opened, the players learn that there are four characters involved, one of them being Joanna, the agent they will interrogate, the rest being the characters that participated in the story. In addition they learn the plot of the story (Someone is trying to kill Joanna), and finally they are taught what questions the agent understands, starting with “who is...?”, which drives the player to ask who each character is.

Through asking who each character is, the players understand that Sarah died in a weird accident, Alex died whilst fighting for the British military, and Christian is missing, this is where the player will start thinking about Chris as a possible suspect. Some other elements of the story are presented here, what each character does for a living and small hints that Sarah has more success in life than Joanna, and finally that Joanna is married with Chris.

Now that the players know who each character is they now have an interest in knowing more, which they can through asking where each character lives, which will mention important places, like the city “Nomansland”, “Alex’s Manor”, and “Christian’s Flat”.

The next tip the players are given is to ask about Joanna’s relationship with each character, giving the player a bit more context about the characters dynamics, showing that Joanna really cared about Sarah but giving a small hint that Joanna is being ironic and corny, cementing the idea there was a marriage between Joanna and Alex, and finally that Christian has been weird lately.

From this point onwards the player starts gathering information about specific events, like the wedding, Sarah’s death and Alex’s death, which to an attentive player will create inconsistencies in Joanna’s story.

The rest of the game is up to the players, trying to match dates, trying to get Joanna to tell the truth and finally understanding that Joanna was the mastermind behind the events.

In Figure 4.1 we can see the gameplay loop we intend to achieve, which consists on giving the players enough information to be able to explore freely the events and characters that consist the story.

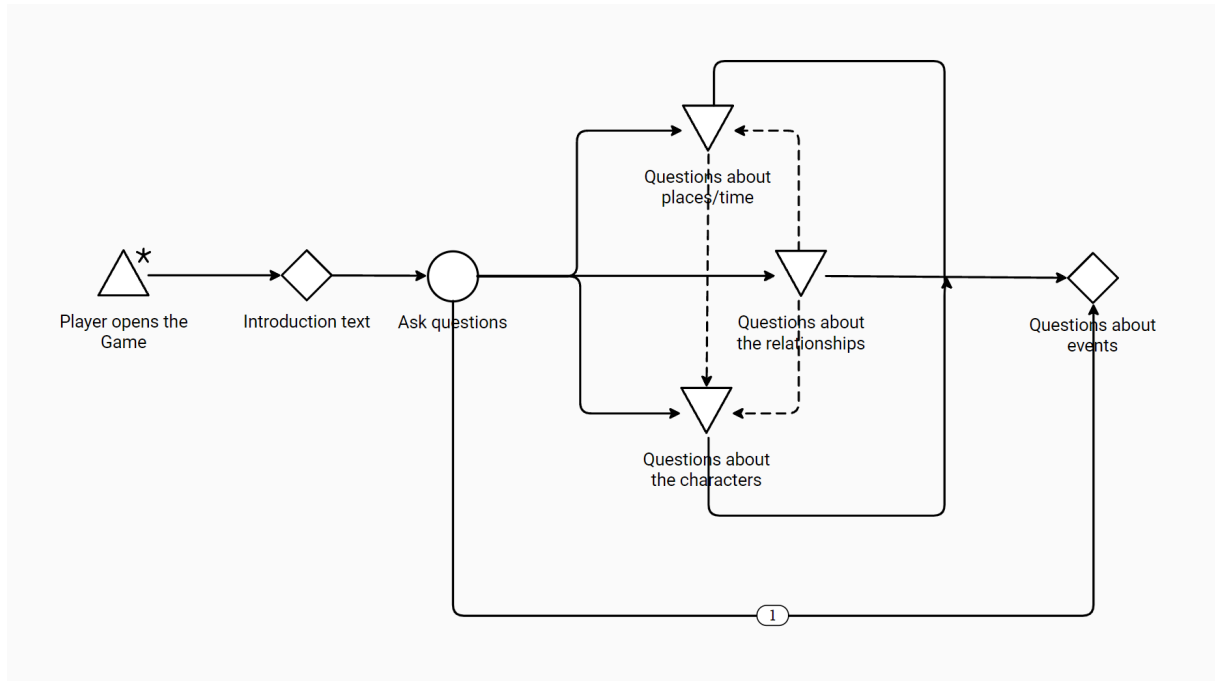


Figure 4.1: Gameplay Loop

5

Development

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5.1 Adapting the Story for the virtual Suspect

Before thinking about improving the Virtual Suspect, we have to adapt the story we created to format the system accepts.

5.1.1 The Format Accepted

To Adapt the story created in Chapter 4 we have to break down everything to the format the Virtual Suspect accepts. First we have to think about the entities as explained in Chapter 3 (*Identifier; Real; Incriminatory; Action; Time; Location; Agent; Theme; Reason; Manner*) that define an event, where:

- **Time** has two types, Time Instants are used to represent a moment in time, for example an action like poisoning someone, and Time Spans are used to represent an interval of time, for example a doctor's appointment;
- **Location** represents like the name says a location, having a type, for example a city, and having the option to have details and a parent (parent is for example the street where a coffee house resides);
- **Agent** represents the characters, having two types, Subject is the character you can talk with, and Agents are normal characters present in the story;
- **Theme** is like the name suggests what the events represent;
- **Reason** describe the reason of the event;
- **Manner** represents how the action occurred, for example taking a *taxi* to go somewhere.

These entities are later used to describe the events, it is important to mention that each one of these has an unique *speech*, which is a phrase the agent will say if triggered, We will influence the player through each of these interactions.

After finishing the previously described entities, we can start creating the events. The events have a predetermined format with optional additions, (*Identifier; Real; Incriminatory; Action*), the previously described entities being the optional additions.

5.1.2 The Adaptation

Having all this in mind we can start deconstructing the story into the format described. As mentioned before, we have to start by giving the agent the entities that we will later use in the events. In Tables 5.1 we show a description of each Entity.

Entities (Persons and Locations)		Entities (Themes)	
Entity	Type	Entity	Type
Joanna Brando (The Agent)	Person	Marriage	Theme
Sarah Weisz	Person	Doctor's Appointment	Theme
Christian Speedwagon	Person	Someone is trying to kill Joanna	Theme
Alex Larsson	Person	Joanna sleeps with Christian	Theme
Nomansland	Location	Going to End House's Envy	Theme
Alex's Manor	Location	Christian's Blackmail	Theme
End House's Envy	Location	End House's Envy	Theme
Nomansland's Hospital	Location	Sarah's Death	Theme
Nomansland's Police Station	Location	Alex's Death	Theme
Nomansland's Coffee Shop	Location	Started living in Alex's Manor	Theme
Christian's Flat	Location	Affair with Chris	Theme
Ireland	Location	Murder Sarah	Theme

Entities (Reasons)	
Entity	Type
Get Alex's Money	Reason
Talk about going out that day	Reason
Discover if pregnant	Reason
Blackmail Christian	Reason
Party with Christian	Reason
Alex's Manor	Reason
End House's Envy	Reason
Go home from Christian's flat	Reason
Go to Flat	Reason
Marry Alex	Reason
Moving to Alex's house	Reason
Sleep with Chris	Reason
Kill Sarah	Reason
Killed in Action	Reason
Poisoned	Reason
Died in an Accident	Reason

Table 5.1: Entities to describe the events

After defining these entities we can finally make the events, remembering that these entities are pivotal for the events to work and be interactable. To make this adaptation, we have to think of the story as checkpoints, where at a certain *time*, in a certain *location*, for a certain *reason*, etc., a event happened. These entities mentioned are what make this event a part of the story given to the agent

In Figure 5.1 we can see an example of an event, that regards the marriage between Joanna Brando and Alex Larsson, a fake event.

ID: 10
Real: False
IncrimINARY: 0
Action: Marry Alex
Location: Alex's Manor
Agent: Joanna Brando
Subject: Alex Larsson
Reason: Marry Alex
Theme: Marriage

Figure 5.1: Event Example

5.2 The Interaction

Having adapted the story to the format accepted by the Virtual Subject, we can start editing how *Joanna* answers the questions.

We started by changing the previous voice given for *Peter Sanders* (the agent created for the previous iterations) and giving it a new voice that AWS(Amazon Web Services) luckily calls "Joanna", and we added the "*disappointed*" emotion to each answer, using Amazon Voice Effects, which gives an unique emotion if desired. This change had the intent of adding character to how the agent speaks. It would be interesting to add different emotions depending on the question in further iterations as it would add to the game immersion.

After changing the voice we edited the basic answers to not only give a bit more context on the character but also progress the story. These answers had to do with basic interactions like "Hello", "How are you?" and "Say your name?", instead of giving a simple answer we added hints of the character and the plot, with answers like "Hello, I'm a bit scared could you ask your questions quickly?" and "My name is Joanna Brando, and I would appreciate if we did this quickly".

The last change to the interaction was the responses. Changing them to fit our intended game

progression, comparing to the previous iteration, we changed the idea of the agent giving simple and direct answers. For example if asked "who is X character?" the agent would respond "He is my friend" which limits the exposition we are able to deliver from the get-go, so giving a similar example if the player asked "Who is Alex Larsson?" the answer is "He *was in the best part of his life*, already 32 but still such a young soul, I always *told him to quit the army* it was not worth it, I would run away with him if he went into legal trouble. Don't get me started on his looks, he was gorgeous and such a kind soul, ever *since me and Sarah went to live with him* we became so close. *I wish we could have the happy life we deserved*. You know all this death around me makes me even more sure that *someone is trying to kill me*", from a simple question we are able to give exposition about many themes, in this particular answer the player can understand that:

- **Alex died in the war** from "*was in the best part of his life*" and "*told him to quit the army*";
- **Joanna and Sarah started living with Alex** from "*since me and Sarah went to live with him*";
- **Joanna and Alex were in a relationship** from "*I wish we could have the happy life we deserved*";
- **Someone is trying to kill Joanna** from "*someone is trying to kill me*";

We had to be careful to give this amount of detail consistently so the pacing of the story does not feel inconsistent and incoherent, whilst having to take into account that the players could miss any dialogue, which would mean they could potentially miss important plot points.

5.3 Prototype

The prototype was created to finally test with players. Having integrated our design ideas and improved the Virtual Suspect we were ready to have feedback to understand what went well and what is still missing from the Virtual Suspect tool in order to be able to host a full game experience.

Two informal user tests were conducted before implementing the extended responses, improving the slot types synonyms and fixing story inconsistencies, the tests took on average 30 minutes. These user tests had the objective of understanding how the tool was functioning with a different perspective than the developer's. From these tests we learned that it was hard to interact with the agent as the entities were still underdeveloped adding that the agents responses were still basic answers it was hard to flow through the story without getting lost. We could conclude there were still properties to improve by letting the two players play with little direction, and in the end having a conversation about what they thought was still missing in the experience.

To give the players the option to talk with the agent in any way they intended we exported the game to Alexa mobile, however all the players who tried the prototype through this system, mentioned that it

was easy to get lost and thought it was more convenient to play on the personal computer. The only way a version using Alexa Mobile would work in a similar fashion to the developer console would be to use *Multimodal Responses*, which are an addition of other forms of communication, like adding visuals as a secondary aid, which in our case would be a transcript of the conversation so the player can read the answer given by the Agent, this would be interesting to add in the future as it would improve the user experience of the game.

Figure 5.2 shows the interface the players see while playing the prototype.

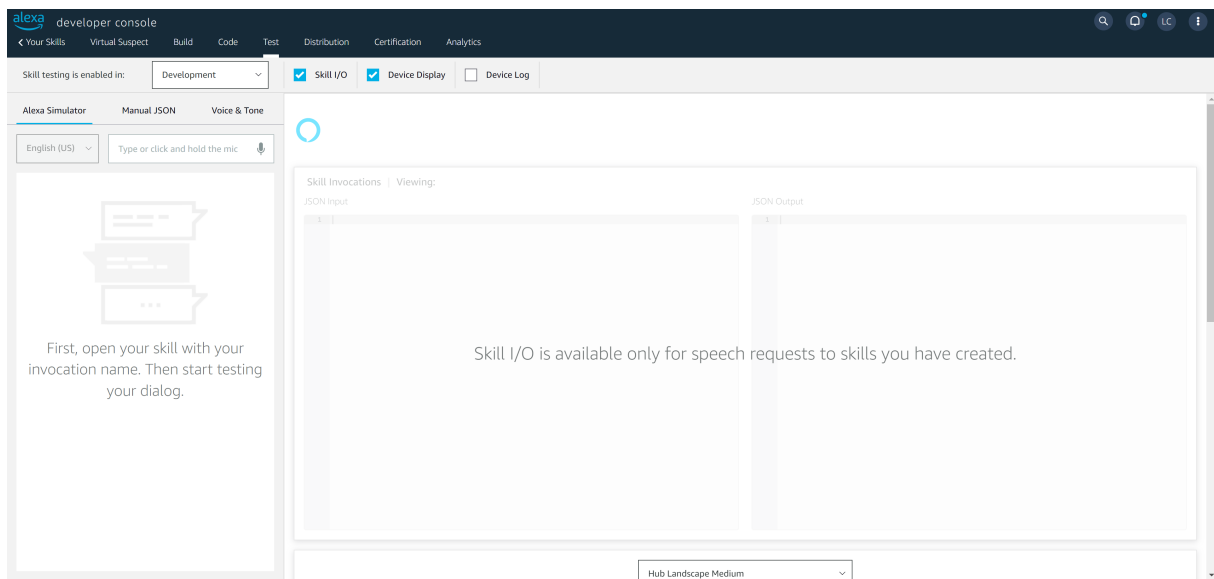


Figure 5.2: Alexa Developer Console

5.3.1 User Study

With all the changes fully implemented, it was time to conduct a User Study and verify if they improved the experience and delivered an interesting and concise mystery game. Even though the interaction could be improved even more, we think it is time to get feedback on our work and try to understand what can be done in the future to further improve the experience.

Our hypothesis was that these improvements to the story and overall adjustments would improve the experience and deliver a coherent game experience. Our procedure and findings can be found in chapter 6.

5.3.2 Last Adjustments

The last adjustments we made after the User Studies were:

- We fixed some bugs that were making the game crash. Most had to do with the Alexa side of things where some slot types were giving the system trouble. These issues were both because a minor difference in the entity text in the *XML* would automatically make that slot type to stop functioning and because of the order of the entities in the *XML* file being wrong;
- Created a lot of synonyms and paraphrases for all intents so the player can ask the questions in a more natural way. Great examples of this are "Christian Speedwagon" having the synonym "Chris", in the action slot types giving the events paraphrases to facilitate the questions, like the event "Go to a Doctor appointment" having the paraphrases "go to the doctor" and "go to an appointment", and the theme "Started living in Alex's Manor" has multiple paraphrases to facilitate the conversation, like "Started living together with Sarah and Alex", "Started living together with Alex and Sarah", "Started living together", and "You and Sarah start living with alex" which gives options to the player and avoids the agent not understanding minor differences in the dialogue;
- Fixed story inconsistencies that were found by the players. In the same vein adjusted some events incriminatory setting as the agent chose to respond inconsistent answers which confused the players;
- Fixed dialogue mistakes that went from spelling to missing exposition properties;
- Fixed the initial introduction to give players more information on what questions the system prefers so there is less probability of unsuccessful questions, adding "*who is ...; Where was ...; when was ..., what is your relationship with ...*" so the player has some idea of where to start questioning the agent.

These changes improved both the quality of the project and the game experience.

The complete project can be found at:

<https://github.com/lore473/VirtualSuspectJoannaInterrogation.git>

6

User Study

Contents

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Having concluded the development of this work, we carried a user study. The test was at the end of the development cycle, having the purpose of validating the improvements and design choices made for the game using the Virtual Suspect, whilst also having the purpose of identifying the shortcomings and areas of improvement for future work, for example having the lying component integrated it served to see how the testers reacted to the lies present.

6.1 Objectives

The main objective of this User Test was to validate and understand if the improvements and design choices came to fruition and had the impact desired. these choices are (as described in chapter 4):

- Giving the player complete freedom to explore the story at their own pace;
- Having the main character be an unreliable narrator, which the player is not told having to find out by themselves.

6.2 Scenario

The changes made to the story of the Virtual Suspect improved how the player receives knowledge and exposition, making it easier to flow through the story.

We decided to allow the player to freely explore all of the story, letting the player get lost and only answering questions that related to errors present in the game. This presented a challenge of what information to give the player. Without any initial information the player would have nowhere to start and no idea of how to interact with the agent. It is necessary to have in mind that the interaction was designed to enable the types of questions that the Virtual Suspect supports, and not to enable any kind of questions, which not being explained will confuse the players and make them think that the agent is not working.

With the objective of guiding the player on how to interact with the agent, we presented the players with just enough information as for them to be able to know what to ask from the get-go. That information contained the characters relevant to the story (Alex Larsson, Sarah Weisz, Christian Speedwagon and of course the name of the suspect Joanna Brando), the *where* and *when* the story happened (13th of November 1977 and the 15th of July 1978 in the fictional city Nomansland) and lastly the main theme of the story (Someone is trying to kill Joanna).

The method of interaction consisted on supervised User Testing, where the tester would play the game. Whilst being supervised by the researcher, the tester could ask questions regarding errors or anomalies but not about the story, preserving the freedom intended in the game.

6.3 Materials

The Materials for the study were as simple as possible, only requiring the researcher's personal computer or the user's personal computer if they had that preference, and a browser with a stable internet connection. The User interacted directly with the Virtual Suspect, hearing the suspect's voice and being able to either write their questions or speak them out loud using the voice option on the Alexa Developer Console. At the beginning of each individual study, the tester would start a Google Forms questionnaire that in the section, "Ready to play?" would ask the user to play the game. After the conversation the user would continue the questionnaire.

6.3.1 Instructions

The instructions for the player were simple *discover more about the story*. As said before we wanted to give the player as much freedom as possible, to let them explore as much as possible. It is also important to mention that, like said in the previous subsection, the player received some guidance to have enough context to start the conversation.

6.3.2 Questionnaire

With the intent of collecting data for the study, a questionnaire was constructed, comprised of four sections.

The first section was answered before playing the game and has the purpose of collecting general information about the player with the intent of characterizing the sample (gender, gaming frequency, if the player likes story-driven games and detective/investigation games and comfort with the English language). Questions related to the player's interest in the genres that the game consist in four options, *Don't like it at all*, *Indifferent*, *Like it a bit* and *Like it a lot*, whilst for comfort with the English language the player had to self evaluate themselves through a scale of 1 to 7, where 1 represented *Not comfortable at all* and 7 represented *Extremely comfortable*.

The second section and beyond were answered after playing the game and has the purpose of evaluating *The Game*. With this title, we mean the game as a whole. Here, the player responded to questions related both to gameplay and the feel of the game (*Did you feel like you had agency in the story?*, *Did you like the conversation with the agent?*, *Did you feel like a detective?* and *Did you feel the game had a quality interaction?*). All the questions mentioned were evaluated through a scale of 1 to 7, where 1 represented *Disagree Completely* and 7 represented *Strongly Agree*. The questions present in this section were adapted from *Playability as Extension of Quality in Use in Video Games* developed by Sánchez et al. [9], where Sánchez defined six facets of playability:

- **Intrinsic Playability:** Playability is inherent in the essence of the videogame itself and how the player is presented. This is closely linked to Game Core;
- **Mechanical Playability:** This is related to the quality of the videogame as a software system. Also related to the Game Engine;
- **Interactive Playability:** Is associated with player interaction and videogame user interface development. The Game Interface is closely related to it;
- **Artistic Playability:** Relates to the quality of the artistic and aesthetic rendering in the game elements (visual graphics, melodies, storyline and storytelling);
- **Intrapersonal Playability or Personal Playability:** Refers to the individual outlook, perceptions and feelings that the videogame produces in each part and as such has a high subjective value;
- **Interpersonal Playability or Social Playability:** Refers to the feelings and perceptions of users, and the group awareness that arise when a game is played with company, either competitive, cooperative or collaborative way.

One facet was discarded, *Interpersonal Playability*, as it refers to a multiplayer experience and taking into account that our game is a single-player experience it did not make sense to include. The rest were adapted to the questions shown before.

The third section has the purpose of evaluating **The Virtual Agent (Alexa Skill)** and measure the User Experience (UX). This evaluation was based on the *User Experience Questionnaire (UEQ)* by Schrepp et al. [10], which was also used by Baptista et al. [1] in his User Tests. The *UEQ* is a questionnaire designed to evaluate User Experience by presenting users with 26 items divided between 6 different scales - *Attractiveness, Efficiency, Perspicuity, Dependability, Stimulation, and Novelty*.

The players responded on a scale of 1 to 7, where, depending on the context, will mean they *Disagree Completely* if they choose 1 and *Strongly Agree* if they choose 7, this can mean that 7 could mean something negative, for example, *The Agent didn't understand what I asked* in this item a 7 means the player *Strongly Agrees* on something negative.

From the 26 items some were cut and the ones that remained were adapted to a series of statements written by us to better represent our game experience.

The last section has the purpose of evaluating the story. Using a open-answer format we could get more detailed answer to understand the player's opinions on each facet of the story. First we asked a general opinion on the story (*Did you enjoy the story? Why?*), and a *Virtual Suspect* and *Story* question (*Did Joanna lie? About what?*) in order to understand how the mechanic was interpreted by the player. After that we thought it was important to understand the player's opinion on the characters present in the plot (*Did you enjoy the characters?*), using a scale of 1 to 5, where 1 represented *Not at all* and

5 represented *I liked them a lot*. The last questions were related to the investigation, starting with a question about who the player suspected while playing the game (*Did you suspect any of them?*), giving the option of choosing between three answers for each character, *Never* meaning they never suspected this character, *Thought they were suspect* meaning they found the character suspicious at some point, and *I think they were the culprit* meaning they thought they were not only suspect but were fairly certain they were the culprit.

After finishing the questionnaire the player would engage in a open conversation being able to make questions about the *Story*, the *virtual suspect* and anything else they wanted to ask.

6.4 Procedure

The study counted with the participation of **fourteen** people. All of the participants had never interacted with the project.

The procedure was consistent with all the testers, the tester and the researcher would be present in the same room with a personal computer connected to the internet. The participants started the questionnaire, where they read the terms of the study, where the participant understood that **everything was anonymous**, having the **option to quit at any point** of the study, and that **no personal information would be collected**. After reading these terms all users agreed to participate.

After agreeing to participate, the participants were presented with the next section of the questionnaire that gives the player instructions to play the game. After understanding these instructions the player started playing the game, where the player could ask whatever they wanted for as long as they wanted, being instructed that when satisfied the player could stop and continue the questionnaire. When the player expressed that they were finished with the game, they would promptly continue the questionnaire, where they would answer the rest of the questions until the end of the questionnaire.

After finishing the questionnaire, the participants would engage in a small conversation where they could ask anything related to the study (questions about the game, the virtual suspect or the study), after finishing this conversation, the participants were thanked for their participation.

The length of each session depended on the participant and could take anywhere between 1 hour to 1 hour and 40 minutes..

6.5 Results

Our study sample comprised of **14** participants. Of these 14, **11** participants identified as **male** (78.6%) and **3** participants identified as **female** (21.4%). Although the **14** participants were non-native English speakers, the levels of *comfort with the English language* were high, with **8** participants (57.1%) respond-

ing 7, the highest value, and 5 participants (35.7%) responding 6 the second highest value, leaving 1 participant that responded 5, which is still a relatively high value. We can conclude that our sample was comfortable with the English language, 92.8% responding **6 or higher**.

From the 14 participants there were a great variety of *weekly gaming habits*, with the most common being **everyday** with 5 participants (35.7%), coming second was *three to four* with 4 (28.6%), *five or six* and *once or twice* were tied with 2 participants each (14.3% each), finally only 1 participant responded *never* (7.1%), we can conclude that the majority of the participants play games often, with **78.6%** responding **three or more times a week**.

Moving to the genre questions, we see that, from the 14 participants, 10 responded *like it a lot* as their opinion on Story-driven games (71.4%), with the rest of the participants responding either *indifferent* or *like it a bit* with 2 each (14.3% each). The results relating to the opinion on *investigation/detective games* had, as expected because of the smaller popularity for investigation/detective games, 7 respond *like it a bit* (50%), and 3 responding *like it a lot* (21.4%), with the remaining 4 responding *indifferent* (28.6%). We can conclude that we have a sample of mostly regular *gamers* that enjoy *story-driven* games and, either, tolerate or enjoy the *investigation/detective* genre.

After answering this section, the player, like mentioned before, played the game, moving now to sections related to **the Game**, **the Virtual Suspect**, and finally **The Story**.

6.5.1 The Game

The next section was related to **The Game**, having questions adapted from the six facets of playability developed by Sánchez et al. [9]. The first question asked the player if they felt like they had *Agency* (explained to the players that did not understand the question as *action or intervention producing a particular effect*) in the story, to which the players were mostly positive, in Figure 6.1, we show the responses to the question. We can see that the most common answer was 6, with an average of 5.54, and a standard deviation of 0.938, which can be interpreted as a success.

The next question regarded *how much the user liked the conversation with the agent*, and, as shown in Figure 6.2, had mixed feelings, with players going as far as responding lower than 4, with an average of 4.15, and a standard deviation of 1.31, that shows that the players had problems with the conversation, in the next section we asked, in an *open-form* question *what limitations the player found in the conversation*, which we will delve into later.

The next question related to if the player *felt like a detective*, in figure 6.3 we can see the responses were mostly extremely positive with the most common answer being 7 with an average of 6.23, and a standard deviation of 1.14, which shows that the game succeeded in one of its biggest objectives, *making the player feel like a detective*.

The last question of **The Game** section asked the player to evaluate the *quality of the interaction*, to

Did you feel like you had agency in the story?

14 responses

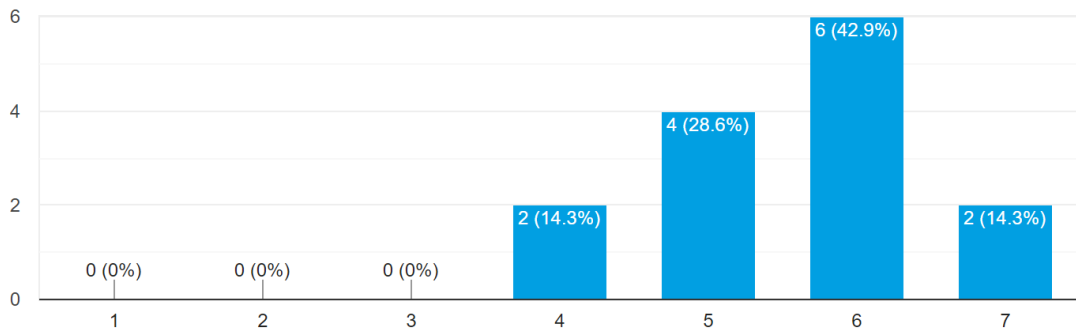


Figure 6.1: User Study responses to question: "Did you feel like you had agency in the story?"

which the responses were below average, as we can see in figure 6.4, with an average of 3.77, and a standard deviation of 0.91, showing that it will be worthwhile to further improve the talking mechanic.

6.5.2 The Virtual Suspect

The section that followed related to **The Virtual Suspect**, the *Tool* used to create the game. In Table 6.1 we see three columns, one shows the *Items* that the player evaluated from 1 to 7; Then *Valence* which shows if the item represent a positive idea or a negative idea or, in some cases, neutral; Lastly we have the **Average** which shows the *average* answer for each item.

Analyzing the table we can see what the players thought about the *Agent*, its strengths and weaknesses.

Regarding the **Positive** items, we can consider any result under 3.5 as negative, 3.5 to 4.5 as average and over 4.5 as positive, taking this into account, we can see that the most noticeable negative value is the item *I had a fluid conversation with the Agent* with an average of 3, and a standard deviation of 0.92, which shows that the conversation was far from fluid, which is something to take notice and try to improve in the **future work**. The most positive items, were *"I was able to uncover more information than I had initially"* with an average of 6.62, and a standard deviation of 0.84, and *"I felt I was interrogating a suspect"* with an average of 5.85, and a standard deviation of 0.53, both showing that the *Virtual Suspect* helped having a successful *story-driven* game, being capable of delivering information needed for the story and accomplishing giving the *experience of interrogating a suspect*.

Concerning the **Negative** items, we can consider any result under 3.5 as positive, 3.5 to 4.5 as average and over 4.5 as negative, bearing this in mind, we can notice that the most concerning aspect is the agent's lack of understanding for the user's questions, with questions like *"I had to change my*

Did you like the conversation with the agent?

14 responses

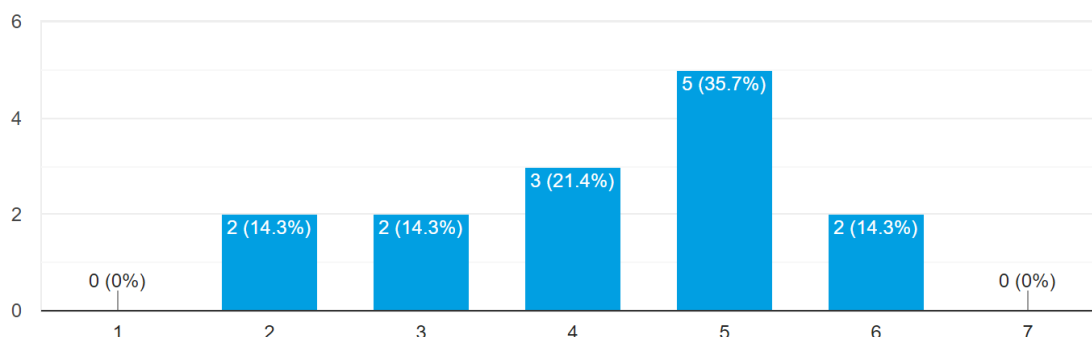


Figure 6.2: User Study responses to question: "Did you like the conversation with the agent?"

manner of speaking in order to be understood", and *"I was not able to properly ask the questions I wanted because of the Agent's limitations"* having extremely negative results (6.38 and 5.54, with a standard deviation of 0.76 and 0.74 respectively), it is safe to say that improving the interaction with Agent will greatly improve the experience.

Lastly there were two **neutral** questions, which had to do with lying mechanic present in the Virtual Suspect. The item *"The Agent was always truthful"* had an average of 3.08, and a standard deviation of 1.64, showing that most players understood that the agent could be lying, and, the item *"It was easy to understand when the agent was lying"* has an average of 2.38, and a standard deviation of 0.76, shows that, even though the players could understand that the agent could lie, they still had difficulty understanding when the agent lied.

The last question of this section was *"What limitations did you encounter in your conversation with Joanna?"*, which was an *open-form question*, giving the player freedom to express the limitations that they noticed, from the answers gathered, the most common limitation mentioned was "Joanna's" understanding of their questions, forcing players to reform their answers so the agent understood them, here are some of the answers:

- "The agent had trouble understanding some question which disrupted the flow of the conversation";
- "Most of the time she wouldn't understand what I was trying to ask her, so I would have to rearrange my question in a way she would understand and reply";
- "It is hard to change the question so she understands what I want";

Did you feel like a detective?

14 responses

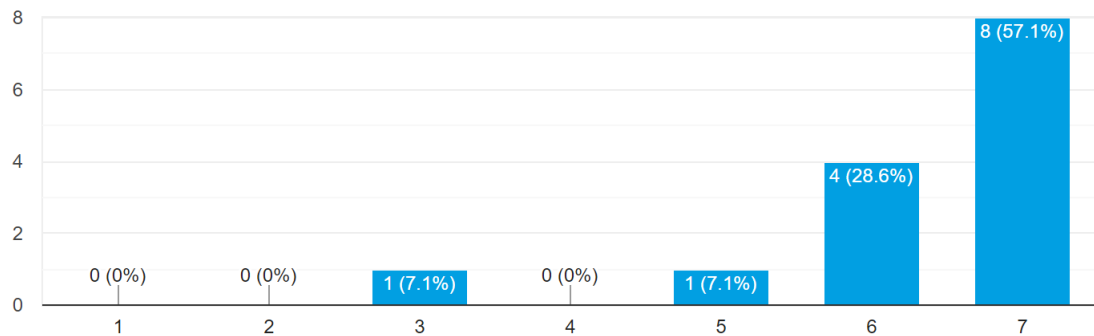


Figure 6.3: User Study responses to question: "Did you feel like a detective?"

Did you feel the game had a quality interaction?

14 responses

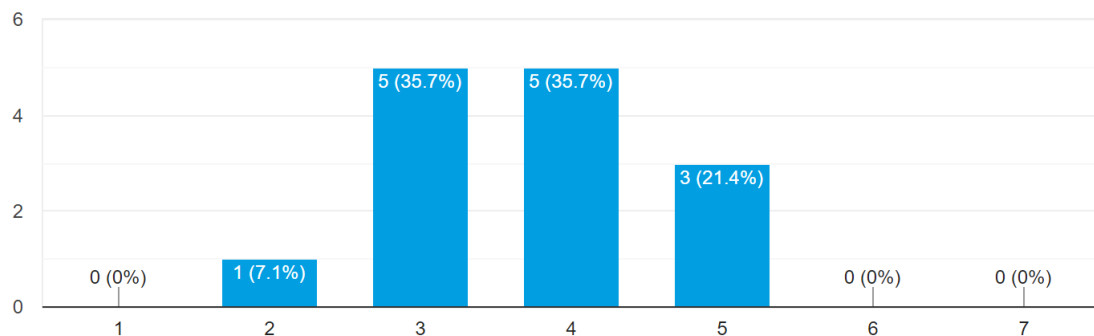


Figure 6.4: User Study responses to question: "Did you feel the game had a quality interaction?"

6.5.3 The Story

The final section concerned **the Story**. Here we can finally understand if our design choices come to the result we expected.

The first question was simple and direct, *"Did you enjoy the story? Why?"*, most players enjoyed their experience with the story, commending the game for creating a good story, here are some of the answers:

- "Yes, I thought the mystery was intriguing, which made me want to unravel who the culprit was.;"
- "I did enjoy the little story that I was able to get from the experience, it was intriguing and I wanted

Virtual Suspect (Alexa) Section			
Items	Valence	Average	Standard Deviation
The Agent has intelligence	Positive	5	0.92
The Agent Understands Natural Language	Positive	5	1.36
The answers corresponded with my questions	Positive	4.31	0.84
The Agent answered the questions I asked	Positive	4.15	1.17
I had a fluid conversation with the Agent	Positive	3	0.92
The limitations of the Agent didn't keep me from interacting as I wanted	Positive	3.46	1.34
I was able to uncover more information than I had initially	Positive	6.62	0.84
I felt I was interrogating a suspect	Positive	5.85	0.53
The Agent didn't understand what I asked	Negative	4.92	1.04
I was often not sure what to ask next	Negative	5.08	0.77
I felt I wasn't having a normal conversation with the Agent	Negative	4.69	1.08
I often felt I didn't have enough information to ask the next question	Negative	3.15	1.35
There were multiple errors in the conversation with the agent	Negative	4.85	1.29
I was not able to properly ask the questions I wanted because of the Agent's limitations	Negative	5.54	0.74
I had to change my manner of speaking in order to be understood	Negative	6.38	0.76
The Agent contradicted itself	Negative	2.38	1.45
The Agent was always truthful	Neutral	3.08	1.64
It was easy to understand when the agent was lying	Neutral	2.38	0.76

Table 6.1: Virtual Suspect (Alexa) Section's items and answers

to know more about what had happened with the characters.”;

- "I enjoyed the story, I liked the freedom me as a player was given to do whatever I wanted.”;

These answers show that the story was solid enough to intrigue the players as to make them want to unravel each of their storyline.

The next question was specific for the lying mechanic, *"Did Joanna lie? About what?"*, to which the players had difficulty in answering, having multiple players mentioning that they thought Joanna was lying about Sarah's death, which was in fact a *incriminatory* event. The conclusion that we can take from the answers is that having a lie easy to notice would help the player understand the mechanic from the get-go.

The following item asked the player to evaluate how much they enjoyed the characters from 1 to 5, with 1 representing *Not at all* and 5 representing *I liked them a lot*, to which the players were mostly positive, with *Joanna* and *Christian* having a higher average rating (4.31 and 4.31, and a standard deviation of 0.63 and 0.73 respectively) which was expected as they were the characters with more

Did you enjoy the characters? (1 - Not at all; 5 - I liked them a lot)

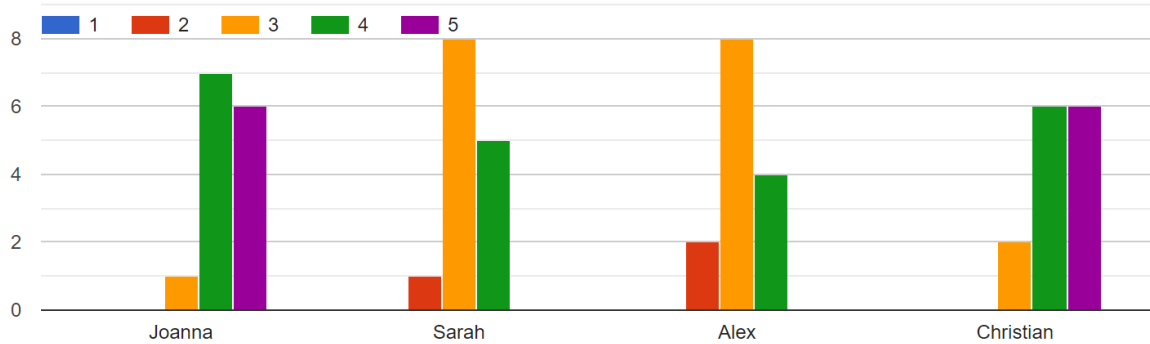


Figure 6.5: User Study responses to question: "Did you enjoy the characters? (1 - Not at all; 5 - I liked them a lot)"

mystery and more involved in the story, *Sarah* and *Alex* although having a more average result, still had a positive result (3.23 and 3.15, and a standard deviation of 0.61 and 0.66 respectively) which was also expected as these characters were less present in the mystery. In Figure 6.5 we can see the full results.

Did you suspect any of them?

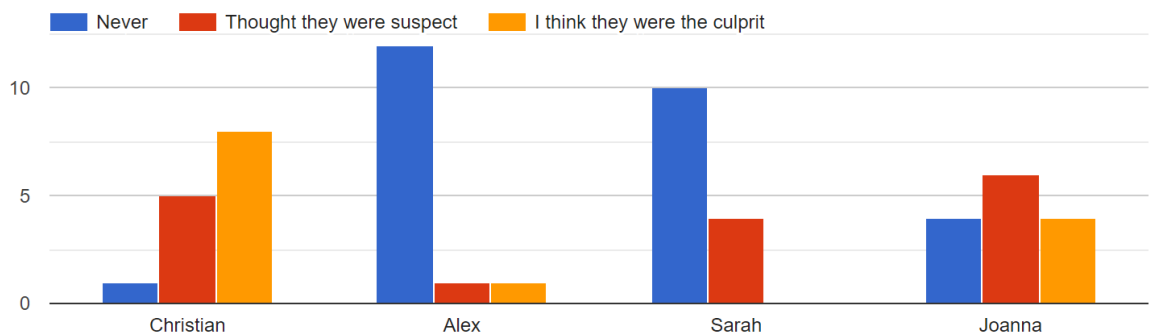


Figure 6.6: User Study responses to question: "Did you suspect any of them?"

The next questions asked the player about the mystery and had the objective of understanding how the players interpreted the story. Starting with "Did you suspect any of them?", the results, shown in Figure 6.6, were as expected with our design idea, leaning the players to suspect *Christian* taking the attention away from *Joanna*, awarding players whom try to think outside the box with the real story, whilst giving a coherent story for those who let *Joanna* trick them. To summarize the results, *Christian* was considered the likeliest to be the culprit, with *Joanna* coming second by a far margin, then *Alex* and *Sarah* were mostly never considered as a likely culprit.

The following item asked the players to explain the *order of events* that occurred previous to the interrogation. The results for this item were quite interesting as many players filled the missing parts of the story with their own interpretation, which is an important part of this style of games, here are some of the answers:

- "Sarah Joanna and Alex lived together, then on the 12th of June between 11am and 12 am there is a series of events leading to Sarah's death. Sarah and Joanna ride in a car to the hospital where Sarah drops off Joanna and continues on the vehicle where she is killed, also at the same time Joanna and Alex get married in secret. After this on the 22nd of June Alex dies in the war. Also there is little information about a 4th character named Chris who seems to be involved.";
- "After Joanna, Sarah and Alex started living together, strange things started to happen, first Joanna was poisoned, right after that Sarah was killed, a few days later Alex died in Ireland and mysteriously Christian disappeared.";
- "I think Chris killed Sarah after poisoning Joanna, after that Alex died.";

The last two items asked the players their opinion on "*What do you think really happened?*" and "*Who do you think was the culprit?*", to which there were multiple interesting answers. Starting with the first question, here are some of the answers:

- "I think Sarah's death was not an accident and Joanna is somehow involved. Also i think Chris is somehow involved but i don't really know how. Probably Alex and Sarah had some kind of love affair that triggered a rampage of Joanna to kill her and get married with Alex.";
- "Christian had an affair with Joanna so he killed everyone she loved so she could be only with him.";
- "Chris planned and killed everyone (other than Joanna), although I'm not sure how he killed Alex in Ireland.";

We can see that there is a tendency of accusing *Christian*, with some players noticing that *Joanna* might be involved.

The last question was fairly straightforward, asking the players to, in other words, accuse someone. In figure 6.7 you can see the whole results. Of the 14 participants, 8 accused *Christian*, 3 accused *Joanna*, 1 accused *Chris and Joanna*, 1 accused *Alex* and the remaining answer was *No one*. As previously mentioned these results were to be expected and can be considered positive.

6.6 Analysis

In this section we will analyse what we learned from the results of the study.

Who do you think was the culprit?

14 responses

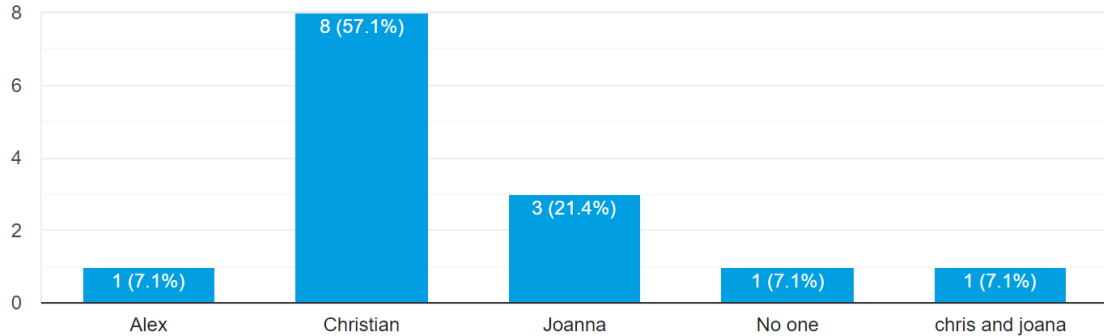


Figure 6.7: User Study responses to question: "Who do you think was the culprit?"

6.6.1 The Game

From this section of the questionnaire we learned that the game succeeded in many aspects, in particular it made the players *feel like a detective* and gave them a sense of *agency* and impact on the plot.

The downside of giving total freedom to the player is having to cover almost every single way the player might interact with the agent. After analysing the results, we can see that it is extremely important to improve the interaction in order to improve the user experience and immersion.

6.6.2 The Virtual Suspect

Continuing the thought of the need to improve the interaction, we saw in more detail what the agent still lacks in **The Virtual Suspect** section.

The biggest problem with the agent at this moment is the small sample of questions it understands, creating a challenge for the players to interact with it how they really want.

The positives to take are the novelty and immersion the agent creates. If the interaction can be improved this positives will become even more noticeable.

6.6.3 The Story

The last section had the most information on account of the prevalence of *open-form* questions.

The results showed the story was a success, being able to *intrigue* and guiding the players through the *story beats*, whilst giving them the freedom to explore at their own pace. One down side we found by analysing the results was that because of the agent's weaknesses and the complexity of the story, players could often get lost, which will happen less if the interaction is improved.

7

Discussion

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In this chapter, we will discuss the limitation we faced while trying to make a game with the Virtual Suspect and analyse the results of our studies.

7.1 Limitations

During the development of our work, although we managed to achieve many improvements in order to make a game using the Virtual Suspect, there were certain constraints that limited our ability to improve the experience and interaction.

These constraints related with the Story Creation process using the Virtual Suspect, the Alexa Skills Kit (ASK), and improving the interaction.

7.1.1 Story Creation

The Virtual Suspect Story Creation is done in an *XML* file where the developer has to deconstruct its story into entities and events, this process is obtuse and exhausting.

In order for the system to accept each entity, it has to have a *number Id* which has to follow an exact order, from 0 to any given number and will stop functioning if any number is missing. Each entity has a type where each functions in different ways and have to be extremely well planned in order for the system to work properly, which creates an excruciating process of planning each event to the tiniest detail while having to be extremely careful not to break something along the way.

After finishing the *XML* file the story creation is only half way, having now to update each entity in the *Alexa Developer Console* in its correct slot type, being careful to give the exact name existing in the *XML* file. After finishing this process, each entity can have synonyms that improve the interaction massively, allowing the players to interact in many different ways.

7.1.2 Alexa Skills Kit

The Alexa Skills Kit, although being innovative and quite advanced, has a limited amount of feedback given to the developer when the skill has a problem, making debugging a process much harder than it needs to be.

Another problem present in ASK is how complicated it is to make changes to the project. Like mentioned before there is an extra step after when creating the story, where the developer has to update everything they changed with scrutiny as to not break the skill.

7.2 Results

We can analyse the results of our User Studies in two sections, *the Game* and the *Agent's Performance*, which we measured separately in the User Study.

When we look at *the Game* results (the experience, design goals and immersion) we can see that we were successful in creating an engaging game where the players felt freedom and were immersed in the story. Where the game could be improved would be in its interaction, which relates with the Agent's performance.

Looking at the *Agent's performance*, we can see that a lot of improvements can still be made to its interaction, even though the players felt something great can come out of the experience, the agent still has trouble understanding them and necessitates multiple changes to their answers in order to respond.

On a whole the development can be seen as success continuing the efforts of the **Virtual Suspect**, but a lot of work can still be achieved by improving the interaction further.

8

Conclusion

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The Virtual Suspect has enormous potential to become something great in both the voice games sphere and as a Interactive Agent, with each iteration we unravel more and more of its potential.

In conclusion, this was a interesting new route for the continuous development of the Virtual Suspect, creating a game with the aforementioned agent. If the objective was successful depends on the following:

- We were able to create a story that could be adapted to the Virtual Suspect, whilst using its strengths to create a unique experience;
- We were able to improve the way the agent interacts with the players;
- We were able to use the unique lying mechanic in an engaging way.

Looking at our results, we can consider the project a considerable success, whilst being attentive that the agent's interaction can be further improved. We were able to create an engaging story that could be adapted to the agent, whilst using the lying mechanic in an interesting way and improving the agent's interaction.

8.1 Future Work

In order to improve the Virtual Suspect as a tool to be used in a game, there are a variety of things that we consider highly important:

- An important improvement that would not only improve the development of other stories and would as well make the Virtual Suspect an exciting tool to work with, is to improve the **Story Creation** process, making it easier to adapt stories for the system. Right now adapting a story to the system is extremely complicated and its extraordinarily difficult to learn how to use the system, if this process was improved the Virtual Suspect could become a serious tool to create an interactable agent with unique properties.
- Even though Baptista et al. [1] work improved the **interaction**, there is still a lot of possible improvements. We would recommend to improve the relationship between events and the entities it comprises, this would make both the interaction improve as well as make the story more coherent and consistent.
- To give a more game-like feeling to the system it would be interesting to both explore the *multimodal responses* alexa provides, as it offers a variety of audio responses, like *polly voices*, *sound effects* and *music*, and it also offers visual responses, like *graphics*, *images*, and *video*, which could improve the game **immersion** massively.

- The **lying mechanic** can be massively improved. the agent comes up with lies automatically depending on multiple properties given to the system in the story creation, if this method could be more controlled it would give extra control over the interaction.
- It would be interesting to be able to interact with **multiple characters** in the same conversation, giving the lying mechanic more purpose, whilst being able to give multiple perspectives on the story the player is enquiring about.

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User Study

Virtual Suspect User Test

Hi there! My name is Lourenço Cortesão and I am currently a student in need of your help! This study is for the purpose of my thesis to finish my Master's degree in Information Systems and Computer Engineering at Instituto Superior Técnico, my supervisor is Rui Prada. The purpose of this questionnaire is to evaluate the performance of the Virtual Suspect. If you accept to participate, you won't be evaluated for your performance, the purpose of this questionnaire is to evaluate the Agents ability. Participation in this study is anonymous and voluntary, none of the information collected will be used to identify you. The study will take approximately 1 hour. In the end we will ask you to fill a questionnaire to report your experience.

***Required**

1. Do you agree to participate in this study? (If you agree to participate you can quit at any time) *

Mark only one oval.

- Yes
- No *Skip to section 7 (The End)*

Skip to question 2

We want to know a bit more about you before you play the game

Before you play the game we want to know a bit more about your gaming habits and your characteristics, as said before this study is anonymous and voluntary.

2. What is your gender? *

Mark only one oval.

- Male
- Female
- Prefer not to say
- Other: _____

Figure A.1: Questionnaire Page 1

3. How many times a week do you play video games? *

Mark only one oval.

- Never
- Once or twice
- Three or four
- Five or six
- Everyday

4. Do you like storydriven games? *

Mark only one oval.

- Don't like it at all
- Indifferent
- Like it a bit
- Like it a lot

5. Do you like investigation/detective games? *

Mark only one oval.

- Don't like it at all
- Indifferent
- Like it a bit
- Like it a lot

Figure A.2: Questionnaire Page 2

6. How comfortable are you with the English Language? *

Mark only one oval.

1 2 3 4 5 6 7

Not comfortable at all Extremely comfortable

Skip to question 7

Ready to play!

Greetings Detective!

In this test, you will interact with Joanna, an autonomous conversational agent, in a police interrogation, imagine yourself as a detective. Joanna is, as she will surely tell you, a victim, she thinks someone is trying to kill her, it's your job to to interrogate her to know more about what happened. Beware as Joana might not be reliable, she is "human" after all.

The story takes place in the fictional town Nomansland between the 13th of November 1977 and the 15th of July 1978, all you know is that Joanna thinks someone is trying to kill her and there are four people involved in the story, Joanna Brando, Alex Larsson, Sarah Weisz and Christian Speedwagon, your goal is to understand if someone is actually trying to kill her, and if that someone exists, who are they.

Joanna is a direct participant in the story, so you should ask everything directly to her and about her (for example: At what time was... ? Where were you... ?) and not (for example: Tell me about... ? Do you have an opinion on... ?).

Joanna, even though she is rather intelligent, she still has some flaws, she is very capable at responding to some questions, whilst being very incapable to answer others. Try to be patient, rephrase your question or change the topic.

You are finally ready to talk with Joanna, grab your detective gear and a notebook if you so desire. Don't forget, your goal is to understand as much as you can about the story!

Try saying hello, it's always a great start to a conversation.

Good Luck!

7. Have you finished playing the game?

Mark only one oval.

Yes

I've changed my mind I don't want to participate *Skip to section 7 (The End)*

The Game

Here you will answer a few questions about the game experience.

Figure A.3: Questionnaire Page 3

8. Did you feel like you had agency in the story? *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

9. Did you like the conversation with the agent? *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

10. Did you feel like a detective? *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

11. Did you feel the game had a quality interaction? *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

Figure A.4: Questionnaire Page 4

The Virtual
Suspect
(Alexa)

Here you will evaluate some statements about the conversation you had with the agent (Joanna). Where, 1 - I disagree completely; 7 - I agree completely



12. The Agent has intelligence *

Mark only one oval.

	1	2	3	4	5	6	7	
Disagree Completely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

13. The Agent didn't understand what I asked *

Mark only one oval.

	1	2	3	4	5	6	7	
Disagree Completely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

14. The Agent Understands Natural Language *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

15. The answers corresponded with my questions *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

16. The Agent answered the questions I asked *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

17. I had a fluid conversation with the Agent *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

Figure A.6: Questionnaire Page 6

18. I was often not sure what to ask next *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

19. I felt I wasn't having a normal conversation with the Agent *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

20. I often felt I didn't have enough information to ask the next question *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

21. I was able to uncover more information than I had initially *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

Figure A.7: Questionnaire Page 7

22. I felt I was interrogating a suspect *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

23. There were multiple errors in the conversation with the agent *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

24. I wasn't able to properly ask the questions I wanted because of the Agent's limitations *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

25. I had to change my manner of speaking in order to be understood *

Mark only one oval.

1 2 3 4 5 6 7

Disagree Completely Strongly Agree

Figure A.8: Questionnaire Page 8

26. The limitations of the Agent didn't keep me from interacting as I wanted *

Mark only one oval.

	1	2	3	4	5	6	7	
Disagree Completely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

27. The Agent was always truthful *

Mark only one oval.

	1	2	3	4	5	6	7	
Disagree Completely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

28. The Agent contradicted itself *

Mark only one oval.

	1	2	3	4	5	6	7	
Disagree Completely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

29. It was easy to understand when the agent was lying *

Mark only one oval.

	1	2	3	4	5	6	7	
Disagree Completely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Figure A.9: Questionnaire Page 9

30. What limitations did you encounter in your conversation with Joanna? *

The Story

In this section you will answer questions about the story you experienced.

31. Did you enjoy the story? Why? *

32. Did Joanna lie? About what? *

Figure A.10: Questionnaire Page 10

33. Did you enjoy the characters? (1 - Not at all; 5 - I liked them a lot) *

Mark only one oval per row.

	1	2	3	4	5
Joanna	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sarah	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alex	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Christian	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

34. If you didn't like one or multiple characters, could you briefly explain why? (If you didn't dislike any just answer "not applicable" or "N/A") *

35. Did you suspect any of them? *

Mark only one oval per row.

	Never	Thought they were suspect	I think they were the culprit
Christian	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alex	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sarah	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Joanna	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure A.11: Questionnaire Page 11

36. Explain the order of events that happened before the interrogation *

37. Did you get lost at any point? *

38. What do you think really hapenned

39. Who do you think was the culprit? *

Skip to section 8 (The End Thank You!)

The End

Thank you for your time.

Figure A.12: Questionnaire Page 12

10/29/21, 6:21 PM

Virtual Suspect User Test

The End Thank
You!

Thank you for participating in our study! With your help we hope to improve our project!

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Figure A.13: Questionnaire Page 13