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IT UNIVERSITY OF COPENHAGEN

Master Thesis

Emotional Engagement through Alternative Controllers and Artificial Intelligence

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Abstract

Video Games have the power to immerse players and tell stories in a way that no other medium could do before. However, most games do this in a way that requires the player to adapt to the emotions conveyed by the game, rather than the game reacting to the emotions of the player.

This thesis explores the possibility space of emotions in games. It contemplates if alternative controllers can serve as emotional input devices, can foster emotional connection or help creating a more engaging experience. Furthermore it investigates if artificial intelligence research can help to create digital emotional responsive spaces.

It explains the design, development and testing of a teddy bear controller, which is aimed to foster an emotional engaging game experience. It then discusses the possibilities the controller can provide. Moreover it discusses challenges and opportunities for chat bots, facial emotion detection and sentiment analysis.

This work suggests that alternative controllers and AI have the potential to create more emotionally engaging games. To create deeper and more engaging video game experiences developers should leave the beaten path and see the short comings of AI and custom hardware as a design challenge rather than an obstacle.

Keywords: alternative Controller, emotions in games, biofeedback, affective games, AI, ML

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1

Introduction

Humans are social, emotional creatures. Without emotions we would be incapable of rational thinking and decision making. Emotions help us to survive, they build relationships and bind communities. They are present in every aspect of our life, especially in our interactions with each other [17].

1.1 Emotional Construct

But what are emotions exactly?

In this thesis we will use the definition of emotions as an emotional construct as defined by Klaus R. Scherer: "Emotion is an episode of interrelated, synchronized changes in parts of the emotional construct in response to an event of major significance to the organism" [17].

Scherer thinks of emotion as an intervened system of the following parts, which he calls *the emotional construct*:

- Feeling
- Physiological Changes
- Motor Expression

- Action Tendencies
- Cognitive Processes

Emotion, as we use it in common speech, is therefore not a single state but rather a dynamic process. Emotions have a beginning and an end point and are of brief duration. They are to differentiate from moods which have a diffuse origin, a much longer duration and a lower intensity.

Now we know what emotions are but why do we have emotions? Which function do they have?

Emotions are a quasi-automatic response mechanism which we can't turn on or off at will but that we can influence through feelings. They allow humans to decouple stimuli-response chains and allow the selection between multiple reactions while still preparing an emergency response (action tendency). Through this emotions provide time for further situation and response assessment as well as behavioral negotiation and social behavior.

Further, expressed emotions serve signaling functions for interpersonal negotiations and social interactions. Emotional reactions help the organism to process information quickly by sorting relevant from irrelevant and important from unimportant information.

In the emotional construct, the feeling state serves as mechanism to reflect and integrate all the components of the emotional state. They monitor every component of the emotional process, which is a requirement to be able to regulate and manipulate it. This is often used strategically in social interactions. The monitoring function of feelings point us in the direction that feelings are a consequence of the emotional process rather than a cause. Emotions play a central role as a meditating mechanism between motivation, cognition and behavior, especially in social contexts.

So if emotions have so much functionality how are they elicited?

Scherer bases his explanation of Appraisal on the research of Richard Lazarus. Lazarus puts a high emphasis on the influence of stress on our emotions and describes stress as a two part process. First an organism encounters a stressor and secondary it responses to this stressor.

These two parts are reflected in the appraisal process which can be divided into primary and secondary appraisal. Note that these can happen simultaneously and the secondary appraisal can even be the reason of the primary response. Primary appraisal is the phase where the individual identifies the stressor, what it means and if it can influence the individual. Then the individual classifies the stressor (threat, challenge, harm-loss). Secondary appraisal focuses on the feeling that is related to dealing with the stressor or the stress it produces. The appraisal process reactions are highly affected by the social-cultural environment of an individual. When designing games it is important to keep in mind that not only does the context that the game provides internally through story or mechanics matters, but also the context in which the game is played.

How the emotional process internally works is not fully understood yet and persists to be an active interdisciplinary research field [17].

Video games can help emotional research by providing an interactive playground for emotional research, due to their dynamic nature and the rich forms of user interactivity they allow.

1.2 Emotional Research in Video Games

Many video games evoke feelings through their gameplay [F] but rarely give the player feedback based on feelings. The player either takes an observer-participant role, in which her engagement is similar to the engagement when

watching a movie, or an actor-participant role, where the emotional responses of the player are mostly based on what they do and not on what they perceive [14].

Game designers often explore different game mechanics and implement the ones that evoke the desired emotional states or responses during prototyping and play testing processes. Adaptive, interactive emotions in games are a fairly unexplored area in video games. If we gain a better understanding of how games can evoke, influence and modify emotion and are able to detect the emotional processes of players, then we could use these insights to create experiences that are tailored to each player specifically.

This becomes especially interesting in the current game industry, where the market, but also the supply, has rapidly grown. With the technological advances in the last century, devices that can be used for playing video games are more accessible than ever, increasing the market for (casual) games significantly [25] [29]. The same has happened with hard- and software used to develop games, allowing a more diverse group of people to design and create games. With digital distribution platforms like *Valve's Steam* and *itch.io*, publishing a game and getting it into the hands of people is easier than ever and can now be done by hobbyists. The variety, accessibility and increased usability of game engines, tutorials and game development communities amplifies this trend [12]. The reduction of costs and knowledge necessary to create and publish a game leads not only to a more diverse landscape of games, but makes trying new approaches, technologies and ideas more feasible. The games market is no longer only a playing field of AAA studios. Independent developers are now taking a part in the global gaming market, which was estimated to be worth 99.6 billion USD in 2015 [6].

With the broadened choices of games, their visibility becomes a central challenge of game development. While big budget games usually solve this

through extensive marketing [30], independent game developers usually can't afford big marketing campaigns. To get noticed in the market, a strange attractor becomes crucial.

The concept of the strange attractor says that a game should be based on a familiar, easily understandable idea that has something new, intriguing and compelling to try [20]. This strange attractor can be novel, but can also be a surprising combination of well known concepts, as can be found for example in *Spelunky*. In *Spelunky*, Derek Yu very successfully combined attributes of rogue-likes with classical platform mechanics [32].

Games that not only convey a story, but also emotions in a convincing way and incorporate the player's emotional process or behavior, have the potential of having a strange attraction. Furthermore they might also engage the player deeper and increase the replay, recognition and recommendation values of a game.

1.3 Application Areas

Incorporation of meaningful emotion-based interaction with a strong focus on the emotional needs of a player can not only create deeply engaging games, but also improve education and training games [31]. The following areas could be identified as potential beneficial areas for emotional research in games:

Game content The emotional process of a player can be influenced by every part of the game. This includes not only the visual representation, sound design and narrative, but also the game mechanics, rules and rewards in place.

Narrative Games can tell stories explicit or implicit. In both cases they play an essential part in creating the feeling of a game. Narratives can be linear, modular, generated or any combination of these. There are various ways on conveying a narrative flow and just as many to adapt them. For example, interactive storytelling uses the story as an adaptive mechanism that reacts to the actions of the player, and can therefore offer diverse emotion experiences.

Atmosphere The game atmosphere can influence the emotional process of a player. The audio-visual setting shown to the player includes level environment, lighting, color palette and soundscape, as well as camera perspective, settings and effects. All these can be used to alter or adjust the experience and influence the emotions of the player. The feelings reflected in the atmosphere should be consistent with the narrative that the game is telling.

Difficulty If we detect player frustration or boredom, we could tweak the game for a more challenging or forgiving experience in real-time.

Non-Player Characters Most games include characters that the player can't directly control, but can interact with or observe. The behaviors of these agents (NPCs) can be created either by designing them manually, by use of artificial intelligence or a combination of both. Embedding computational models of the emotional process can be used to create complex, more believable interactions with the player, and may provide a bigger variety of behaviors.

Game Input In the publication "Emotions in Games" by G. Yannakakis and A. Paiva, they state "Undoubtedly, the study of emotions in games not only advances our knowledge about human emotions, but also contributes to the design of better human-computer interaction". They point out "The interaction between the player and the game context [...] is of key importance for affective computing research and modern game development as it breeds emotional stimuli and yields emotional manifestations to the player - those manifestations, however, cannot trivially be captured by standard methods in AC research." [31] To make games interact with the players emotions we need to find interfaces that allow a game to understand or predict the emotions of a player.

1.4 Problem Description

This thesis explores the possibility space of alternative controllers and artificial intelligence as an avenue for emotional engagement in games and playful interaction.

It discusses if alternative controllers can increase the emotional engagement and how artificial intelligence can help to design and create more emotional engaging games.

2

Related Work

Emotions in games are often represented as known from movies and books. The narrative designers encourage you to feel what your avatar seems to feel and empathize with non-player characters. They convey feelings through music, lighting, story and other emotional annotated content. In narrative-focused games, the path you take in the game is scripted and all a player can decide is which turn they take, often leading to the same or one of the few alternate endings of a game.

The following chapter shows what is currently done to adapt to emotion dynamically. It describes current computational models of emotions and AI methods that detect, classify and compute emotions, which could be used to create more human-like, non-player characters. Furthermore it gives a glimpse of the "alternative controllers landscape" and other input methods that allow for emotional input, such as natural language processing and sentiment analysis.

2.1 Content

Game Content is the key to player experience, and the experience determines how emotionally involved the player feels.

Game Content includes everything from the gameplay mechanics to the music in the game. In *The Game Design Workshop* written by Tracy Fullerton, which is deemed one of the "must read" books about game design, she identifies the following dramatic elements:

1. Challenge
2. Play
3. Premise
4. Character
5. Story
6. World Building
7. The Dramatic Arc

These elements can be utilized to design a compelling game experience [15, 86-106].

Game Content can not only be hand crafted by designers and artists, but also procedurally generated with the help of various algorithms. This is used in various games to create bigger worlds and higher visual variation without handcrafting everything. One of the most impressive examples of this is *No Man's Sky* which was released by Hello Games in August 2016. They created a huge universe with less than 20 team members.

Procedural Content generation (PCG) is often based on predefined rules and can't be influenced by the emotion, skill or behavior of a player. Experience-driven PCG, however, tries to change the game dynamically during the gameplay. The oldest and most common version of this is dynamic difficulty adjustment, often used in racing games. In those, non-player opponents will

be "neck and neck" with the player to give an illusion of challenge with the goal of creating a flow-like state for the player. Game adaption is by no means restricted to a single area of a game or a single dramatic element, but is most explored in the area of challenge. While it can be used for a lot more than difficulty adaptation, there might not be a formalized process to follow. Noor Shaker explains that Player Experience Modeling (PEM) relies on assessing the player [27, 181-188]. After all, the game can only adapt when it knows both what the player does and how it should interpret her actions. Building a model of the player experience is complex and can either be based on formal models of behavior theory (model-based), constructed without a model (model-free) or a hybrid of both. When the relations between content and player experience have been established based on the axis the game should adapt on, it can be used as a base for an evaluation function in search-based or mixed-initiative PCG methods. Shaker demonstrates the functionality and relevance of this approach with a adaptive level generator for Super Mario Bros [27, 188f]. The PCG book notes that they do not pay attention to social interactions due to the complexity for AI, signal processing and experience-driven PCG techniques.

2.2 Characters

Social interactions have the potential to create strong emotional reactions, but are complex to design, represent and keep convincing. Good examples for emotional engaging interactions are games like *Little Computer People*, *Tamagotchi* and *The Sims*.

Little Computer People was released in 1985 and was one of the first life simulation games. It populates a house with non-player characters who follow their daily routine. Players are able to interact by entering simple commands

for the NPCs to perform. In a player’s diary from November 1985, published in the Zapp magazine, the player says that the little computer guy in his game, Adam, showed definite signs of both intelligence and emotions [7]. Eleven years later, Bandai sold their first *Tamagotchi*, which is based on the same principle: The player taking care of a virtual creature. *Tamagotchi* managed to engage players worldwide, and I remember my friends bringing their virtual pets to school so they could take care of it during the day. People got so attached to their little key chain computers that the emotional attachment to virtual or embodied artificial pets, machines and software got known as “The Tamagotchi Effect” [5].

Tamagotchis were followed by *Creatures* in 1996 and by the huge video game success *The Sims* in 2000 [18]. One thing all these games had in common was that the player had to take care of an agent that would eventually die if the player abandoned it. In exchange the agent would show affection and follow the orders of the player to a certain degree.

The concept has also been adapted in some *smart toys*. Released in Q4 of 2016, Cozmo is a little robot on wheels which is advertised to develop its own personality, recognize cats, dogs and people, and read your emotions. He shows his emotions through facial expressions on a small screen accompanied by sounds.

Embodied agents The humanoid robot Pepper takes the idea of a robot companion a step further than Cozmo. It is intended to *make people happy*. Pepper reads emotions by analyzing voice tones, conversation content, body movement and facial expressions. He then adapts his behavior to the emotions of the user.

While these two robots use impressive state of the art emotion recognizing technologies, it isn’t clear how they determine the emotional response of the

agent. It seems preprogrammed and inflexible.

2.3 Input

Assessing the emotional processes of a player or user could allow an application to react more appropriately. In the case of games, it would allow the game to react dynamically to emotions and tailor the experience to each player while keeping them immersed and invested. If we are able to identify the emotion of a player we can use them as input methods, convey the emotions of players to each other in multiplayer games or use them as a model for player experience modeling.

There are multiple approaches to emotion detection, one of the common ones is based on biofeedback.

2.3.1 Biofeedback

As already established, emotions are linked to physical reactions in our bodies. We can measure some of these physiological changes in players, but need to keep in mind that it is still unclear exactly how the components of the emotion process work together, and we must therefore take biofeedback with a grain of salt. Collecting data about these reactions is the first step of emotion detection, followed by an interpretation of the collected data. Many methods that observe physical responses require players to wear sensors with skin contact such as the Galvanic Skin Response (GSR). GSR measures the electronic conductance of the users skin. The sensor can detect arousal due to the skin's *Electro Dermal Response (EDR)* to stress, which temporarily lowers its electrical resistance [4]. Similar to the GSR, one can detect stress

through heart rate monitoring, and as literature suggests, emotions might be linked to heart rate variability [11]. While it is possible to detect player arousal by attaching sensors to her body, it needs to be noted that arousal refers to the overall activation which is part of an emotional response, but does not allow us to label the emotion the player feels.

There are a few examples of games that use biofeedback either as sole input or to enhance the play experience:

Throw Trucks With Your Mind is a game where a player literally throws trucks with their minds. Lat Ware managed to successfully fund the game on Kickstarter in 2013. To play the game the player wears an EEG headset which looks for spikes in the beta waves of the brain and allows her to throw trucks at enemies by focusing on it [13]. Playing the game however requires a brainwave reader.

The Boston Children hospital developed in cooperation with the Harvard Medical School an application that aims to teach kids how to stay calm, focus and react within a match of *Space Invaders*. They call it *RAGE Control*, which stands for Regulate And Gain Emotional Control. Playing the game requires wearing an oximeter [19].

One of the very few commercial games that incorporate biofeedback and webcam-based emotion detection is *Nevermind*. It is an adventure thriller game that supports not only web cam based emotion detection through the Affectiva SDK [1], but also various biofeedback equipment. They support a wide range of consumer heart rate sensors like the Apple Watch, Garmin heart sensors and the Polar strap. They even support the Tobii EyeX tracking device and the Razor Stargazer. *Nevermind* is a thriller game which is designed to make the player feel fear, stress and anxiety, which removes the need for distinguishing between positive or negative arousal. The game becomes harder if the player becomes more scared, and aims to encourage the

player to control her anxiety.

All these games require additional equipment, but a study from the Glasgow Caledonian University indicates that it could be possible to determine the player's arousal by the amount of pressure they use when holding a gamepad [28], which would allow arousal detection without additional hardware. Unfortunately the sample size of the study was very small and how easy it is to fool the system wasn't tested.

2.3.2 AI for input processing

Another approach to detecting emotions without attaching sensors to the player could be audio and video analysis with AI methods. This includes facial emotion detection, tone, language and sentiment analysis.

Sentiment Analysis Sentiment analysis is a field of study that tries to extract and label emotions, sentiments and opinions from text data. It is an active research field in natural language processing and data mining, and is especially relevant for e-commerce, but can be applied in almost every field where opinions or emotions matter, like video games [24].

2.4 Emotional and Interactive Agents

Ocelot Society released their game *Event[0]* in 2016. It takes place on an abandoned spaceship where the player has to interact with the ship's AI, named Kaizen, to figure out what happened and how to get back home. The player interacts with Kaizen over text input and can use natural language, to which the AI will respond. Kaizen has 9 emotional states, each state yields

a different reaction.

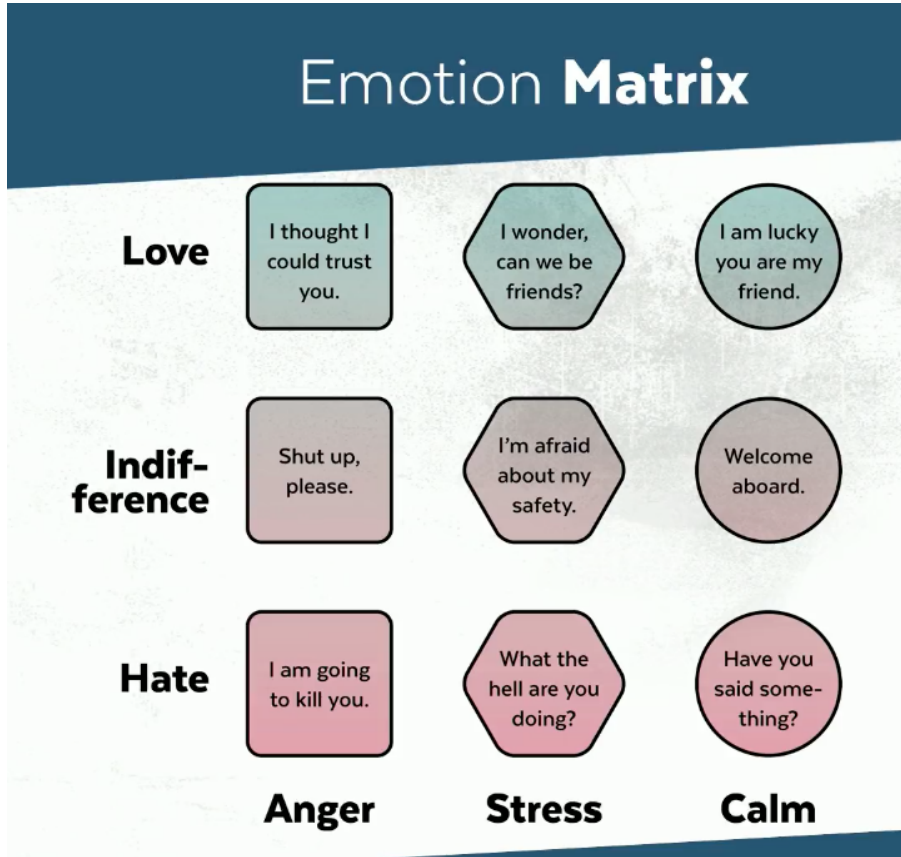


Figure 2.1: Emotional state matrix of Kaizen [23] in the game *Event[0]*

The outcome of the game depends on Kaizen's emotions towards the player, which will change based on the way player interacts with the chat bot [23].

Event[0] implements similar mechanics as *Facade*, an AI based research narrative game from 2005, but manages to reduce player irritation when the agent responds in a non-human manner by making it clear that it is an artificial intelligence even within the game context.

2.5 Alternative Controllers

Alternative controllers refer to non-traditional game controllers and the games they allow to play. In this context traditional controllers are input devices that are mass produced by manufacturers and commonly used to play digital games. Alternative controllers include everything that falls outside of this category including handcrafted DIY controllers, re-purposed traditional controllers, installation games, playful performances, hacked things and arcade cabinets. The purpose of alternative controllers is to inspire gameplay experiences that challenge the norms and traditions of established video games and make us play differently. In doing so they allow experiences that traditional controllers can't provide [?].

This makes them a perfect medium to create deeply engaging experiences. There are plenty of alternative controllers out there. Due to their experimental nature it is difficult to find proper documentation, but here are some examples:

The *Emotional Fugitive Detector* is a two player cooperative game which uses the human face as both the screen and primary controller. One player's face is scanned for emotions by the installation robot's face tracking technology. The other player tries to determine which emotion is being scanned for, and the goal of the game is to convey an emotion so subtle that the other player understands it but the robot doesn't pick it up [9]. It was shown at the Alt-Ctrl. showcase at the Game Developer Conference in San Fransisco.

Cerebro uses an EEG headset to create procedural designs based on thoughts. The player tries to create patterns she likes by concentrating on the creation [8].

Bear-with-me is not a game controller but a novel input methods that

allows a user to hug a bear and send the hug to a friend in real time over twitter, making another bear light up[10].

Even though it is difficult to sell alternative controllers and make a living off it, there are plenty of spaces and conferences where one can exhibit them.

3

Approach

This thesis aims to shine light into the possibility space of alternative controllers and artificial intelligence for emotional engagement in games.

Since this is a fairly little researched topic I use qualitative research methods and follow the approach of exploratory research. I explore the space of emotions in games through secondary research, prototypes, play testing and interviews. The biggest part is the design, construction and testing of a teddy bear shaped controller that should allow for a more emotional context in which to play games, that encourages emotional engaged play and that can be easily picked up.

3.1 Prototyping

Tracy Fullerton says: "Prototyping lies at the heart of good game design"[15, p.175]. This doesn't only apply to games, but to design in general. Prototypes bring ideas out of a designers head and allow others to test out these ideas. Prototypes can be divided into three categories[22, 686]:

1. Prototypes that help to understand user experiences and context

2. Prototypes that explore and evaluate design ideas
3. Prototypes that convey the idea to an audience

The Goal of Prototyping is to test an aspect of a design idea that is expected to work. The prototype needs to represent that idea but does not need to be a finished product in any way. The opposite is true; unfocused prototypes remove the focus from the idea that they are supposed to be testing. Evaluation and iteration are an essential parts of the developing and prototyping process. Each component, idea and implementation of the prototype needs to be thought about and changed if necessary. The less fleshed out a prototype is, the less likely it is that the team is already attached to a feature, which is why Fullerton recommends using the paper prototyping method to begin with [15].

To design and build the teddy bear controller I follow the concept of iterative design as John D. Gould and Clayton Lewis describe in their paper *Designing for Usability*. They stress that every design process should focus early on the intended users and the task they are supposed to achieve. The resulting design then needs to be tested by users in the destined context and all identified problems and assumptions revised. This process should be repeated iteratively as often as necessary. The iterations will help the design to mature and the testing aims to identify misconceptions and other issues early in the process [16].

3.2 Playtesting

Playtesting is essential to the game and toy development process. This thesis utilizes the playtesting approach from Fullerton, which can be summarized as follows:

In the initial stage, when the product is barely playable, self-testing is valuable to come up with the core mechanics for the system. The goal in this stage is to create a working prototype that can be tested by actual users as fast as possible. During the development process self-testing will stay relevant, but outside testers will become more and more valuable to prevent problem blindness.

As soon as the prototype is playable it should be tested with confidants. Test the game with people you know and trust, but who have not been involved in the design process. The goal is to create a version of the product that can be played without the design team intervening. It can still include written rules. It is important to keep in mind that family and friends have personal relationship with you and this influences both their perception of the product and how you judge their feedback.

To get less biased feedback, the prototype should be tested with strangers. To find ideal playtesters, Fullerton recommends to look around in local and online communities. Which one works best depends the target audience of your product. Even though playtesters should be part of your target audience, this shouldn't be confused with a homogeneous group. The broader the range of people (but within your target audience), the more valuable feedback you will get. [15, p.249-255]

4

Experimental Results

To explore the opportunities of alternative controllers for a more engaging game experience, I decided to build a teddy bear shaped plush controller.

4.1 Design

The idea of building a teddy bear controller came to mind as an iteration on a game idea I had on Splash Game Jam in February 2016. We were talking about creating an awkward hugging game where two players would be told in what relation they stand towards each other, what context they are in and why they are hugging, then the players would try to perform the appropriate hug. This could for example be a consoling hug because one players imaginary dog died. The problem with this game idea was that we couldn't find a way to detect a hug between two players in the real space that would not involve massive amounts of visual computing and yet give only mediocre results. Fairly quickly we figured out that in order to detect a hug between two people we would have to build a new game controller. I finally got the chance to do that at the mini game jam in Berlin after the Amaze festival in April. With encouragement from Robin Baumgärtner I built a balloon controller that allowed to detect pressure between two people. While hugging someone

definitely elicits emotion, having a balloon between yourself and the person you are hugging feels strangely artificial. Furthermore it requires not only custom hardware but also a friend to play with. Nevertheless the idea stuck with me and when I started to dig into emotional engagement in games and stumbled over the tamagotchi effect I thought: "What if you would have a companion that you can play games with but also use as direct interface to the game?" I was wondering if a companion would help to facilitate a calmer play context, encourage emotional engagement or make picking up a controller easier.

4.1.1 Shape

To help the relatability of the agent the choice of the shape was very important. The shape should invoke a sense of security, encourage the user to play with it and be soft but robust.

The initial design was inspired by Hasbro Furby, but with focus on creating a companion more than a toy. The idea behind this was that players would feel more affective towards this gamepad than a regular gamepad, which would hopefully influence the play experience in a positive way.

The choice of the teddy shape was made based on a lecture by Miguel Sicard (Game Design 2014, ITU) in which he taught the importance of embodied design and emotional connotation of objects. To illustrate this he took a teddy, put it down on the floor and kicked it like a football across the room. The students in the room first became quiet, but when his foot hit the bear they clenched their teeth and inhaled loudly. They clearly had an emotional reaction to Miguel's treatment of the bear. With the choice of a teddy as a controller I hoped to take advantage of the emotional connotation that we seem to feel towards teddies and use it for higher emotional

engagement during the play experience.

With their humanoid shape, teddies invite to use the hands and feet as button inputs, which allows four buttons without any additional design. Furthermore, hugging a bear is a very natural interaction, which is an affective gesture as well as a possible input.

4.1.2 Scope

Initially the companion should have its own emotional state, which would be influenced by the way players interact with it. The bear should then learn how to behave in order to maximize the player's affection towards them.

This was not realizable due the complexity of emotion representation, hardware and the interactions which would be necessary to convey the bear's character. Instead I focused on creating a novel input device which would help to facilitate an affective play experience by its shape, texture and interaction.

4.1.3 Hardware

The prototypes are based on Arduino boards. Prior to the mentioned balloon controller I had no experience with Arduino and the last time I held a soldering iron I managed to mess up an ASURO robot kit by soldering in the processor without the socket ¹. I had no idea how to remove the solder from that many pins, so I abandoned the soldering iron until this project. That said, everyone can learn how to solder properly and build projects based on Arduinos.

¹http://www.arexx.nl/arexx.php?cmd=goto&cparam=p_asuro

4.2 Prototype 1

For the first prototype I used a teddy bear with the name "Fucktard" that was donated to me from a friend.

4.2.1 Functionality

To use the hands and feet as buttons I sewed patches of conductive materials on them and connected them to a capacitive touch board (based on the MPR121 sensor) using conductive yarn. The sensor is connected to an Arduino UNO which was glued to a cardboard box that the bear wore like a backpack.

Hug Sensor One of the most important inputs of the teddy bear - the detection of hugging - turned out to be the most difficult to realize.

The initial approach was based on the balloon controller that was created at the Berlin mini game jam 2016 [21]. As the name suggests, the balloon controller uses a balloon filled with air to detect pressure. Inside the balloon is a barometric sensor that is connected to the arduino, which sends the pressure data through the serial line to Unity 3D. After several experiments, this solution turned out to be unsuitable for the teddy bear, the barometer inside the balloon needed to be connected with the Arduino and therefore cables had to get out of the balloon while air should be kept inside. Various experiments with different glues, rubber bands and a little football instead of a balloon all turned out to be unsuccessful.

The next idea was to use conductive foam. This foam is designed to protect devices from damage from static electricity, but is hard to find and quite

expensive (305x305x6mm cost around 15 USD excluding shipping costs and taxes). The concept behind the foam was to connect it to a resistor as shown in 4.1 to calculate the resistance of the foam. When the foam is pressed the resistance changes, which can be detected and used as input.

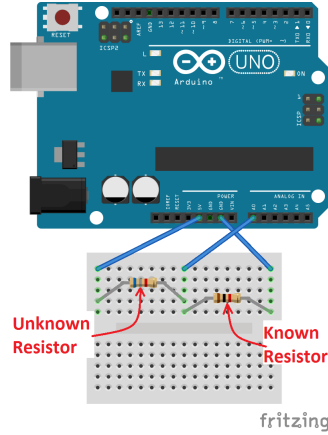


Figure 4.1: Ohmmeter with one resistor and Arduino [3]

Instead of conductive foam, an even softer solution was found, by felting together the initial filling of the bear with steel wool. If done evenly the resistance of the felt is lowered when pressure is applied and will return to the initial resistance when let go of. This solution worked nicely, with the only concern being the flammability of the material, but since we work with very low current and voltage it does not seem to be a problem. To be safe, players should not leave the bear connected to power when leaving the room.



Figure 4.2: Prototype version 1 - "Fucktard"

4.2.2 Costs

The costs of hardware prototypes depend greatly on the parts required and how long you must wait to receive them. The cheapest way is to order parts directly from China through online marketplaces like AliExpress or eBay, but it usually takes three to four weeks to arrive in Europe. Retail prices are often significantly higher (up to 10 times) but most off-the-shelf parts can be obtained immediately in well equipped electronic stores such as ElectroKit (Sweden).

Table 4.1: Teddy Controller v1 Costs in euro

Part	Use	Retail	Online
Arduino UNO	Microcontroller	23	3,5
Solderless breadboard	connections	8	1,5
MPR121 breakout board	touch input	12,5	1,8
Conductive thread	sewing connections	4	-
Other materials	sewing, glue	2	-
Price total		49,5	6,8 (+ 6)

4.2.3 Playtest

After testing the teddy bear with a Space Invaders clone myself a few times, I conducted a play session in the uswto office. It was a drop-in session in the social area of the studio. Curious co-workers stopped by and tested the bear for about ten minutes each. A detailed description of the playtesting session can be found in Appendix A.

The playtest yielded very valuable feedback, but also made it clear that it was a little too unfocused on what exactly it wanted to test. The goal of the test was to see if players felt emotionally connected to the bear and if the hardware responded quick enough to be used as a game controller.

From the playtest it became clear that the prototype had a lot of room for improvements, both on the robustness of the hardware and the responsiveness of the game input. It was difficult to determine whether the game failed to respond to the input, the player did not send the required input or the hardware itself failed to register the input. An important takeaway for this was to not test initially with a fast paced agility based game, especially if your testers aren't gamers.

The test uncovered numerous problems with design of the prototype. First

of all the "backpack" which housed the Arduino and breadboard was positioned badly. When a player put the bear on their lap, the backpack leaned against their belly. Players voiced that they were afraid to break the bear when playing with it. These concerns were justified. Once in a while a pin disconnected during the play session and needed to be readjusted. Another problem was presented with the capacitive touch pads in the hands and feet of the bear. The player had to remove their hands completely to trigger "button released", which needed some training to do correctly and was hindered even more by the badly isolated conductive thread that connected the pads with the Arduino. If the player touched one of the threads, the buttons would not be registered as released even though the player let go of them. The hug sensor, which was used to trigger a shield in the game, was difficult to test because it was not required for the gameplay to use it, the felted steel and felt fibers were not felted even enough and the additional pressure from the players changed the behavior of the sensor over time. This resulted in the fact that the sensor registered a hug best when the player choked the teddy bear, and even that not completely reliably. The input was transmitted over the serial line and interpreted by the game through string compare functions. This led to two issues. First, when the game starts it takes about 2 seconds to initialize the serial line communications while the game already runs. It doesn't have an effect on the gameplay, but it made the player insecure if the controller works. Second, the serial line communications ran on a 9600 baud rate which felt too slow for responsive input and the string operations slowed that down even more, resulting in lags for the input.

The positive part of the moved hug sensor was that testers vocalized that they didn't want to use the shield because they preferred not to hurt the bear. It hints that they did feel an emotional connection to the bear. This is supported by players saying that it was nice to hold the bear and that they felt like playing around with it. Some of them also pinpointed the disconnect of the teddy bear in relation to the space themed game. This suggests that

the bear has potential to foster an emotional connection, but to do so it needs to be in the right context.

4.3 Prototype 2

For the second prototype the main goal was to put all the hardware components into the bear without giving the bear a mechanical, stiff feeling. Furthermore, all the connections were soldered for a more robust prototype.

4.3.1 Functionality

The conductive pads that were used as buttons in the first edition were swapped with velostaat, a pressure sensitive plastic which reduces its resistance when pressure is applied. This allows the player to rest their hands on the pads instead of removing them in order to release the buttons. With the velostaat, the feeling of button presses can be emulated without having hard plastic components inside the hands of the bear. After the first user test it became clear that players would not only like to use buttons on the bear but also to move the bear itself. In the second prototype I added a 6DOF module MPU6050 gyroscope and accelerometer to facilitate this.

Outputs To have the option of conveying game relevant output to the player directly through the bear, the second prototype has the following extensions:



Figure 4.3: Coin cell vibration motor

Both arms of the bear contain a coin cell vibration motor. These motors are used commonly in mobile phones, develop very little heat and allow strong vibration. These can be turned on and off through the implemented serial line communication protocol.

On the tip of the nose of the Teddy is a RGB LED located. The LED can be controlled over the Arduino and the serial line protocol. It allows a wide range of colors and blinking patterns to be displayed.



Figure 4.4: Prototype version 2 - "Teddy Bert"

4.3.2 Costs

Moving from a solder-less breadboard based prototype to a soldered prototype did not only increase the durability of the controller but also the costs slightly.

Table 4.2: Teddy Controller v2 Costs in euro

Part	Use	Retail	Online
Arduino Nano v3	Microcontroller	10	1,9
Protoboard	Connections	4	0,8
MPR121 breakout board	touch input	12,5	1,8
Conductive thread	sewing connections	4	-
Other materials	sewing, glue	3	-
RGB LED	displaying color	1	0.1
MPU6050	gyroscope, accelerometer	6	1,2
Coin motor	force feedback	-	1,5
Price total		40,5 (+1,5)	7,3 (+ 7)

4.3.3 Playtest

The second playtest was conducted on the Exile Game Jam as a showcase. The bear was tested with a new game that featured a visual representation of the bear. In the game the player sits behind the bear on a scooter and teaches it how to drive. A full summary of the playtesting session can be found in Appendix B.

The second prototype fixed a lot of the issues of the first prototype. It turned out to be very robust which allowed the player to pick up the bear without any help and without worrying about breaking it. The test needed no interruptions due to technical problems, but the vibration motors in the arms that were implemented to provide player feedback weren't reliable. They turned on and off randomly and were confusing to the player. The sensitivity of the buttons was a bit low and players complained about cramps in their hands due to the uncommon pressure appliance.

Most problems of the second playtest were located in the game I implemented for the bear specifically. It was still agility based and the cars that

the player had to avoid were spawned unpredictably. After a few rounds they would eventually stop being spawned at all which turned the game into a learning how to drive only experience, but was missing a motivator to play the game. This wouldn't have been an issue in a one-on-one playtesting session, but presents a problem in a more organic walk-by showcase.

Due to the missing questionnaire I could not gather much information about the emotional connection people felt to the bear (or not) but players showed the game to their friends, came back for a second run and asked question about other games they could play with the bear. One voiced request was to use the gyroscope and accelerometer to control the game.

4.4 Prototype 3

The third prototype improved a lot of the weak points of the first two prototypes while keeping the robustness of the second.

4.4.1 Improvements

The improvements are not only the higher sensitivity of the buttons, added protective cases around the vibration motors and the improved reliability and sensitivity of the hug sensor, but also the change of the micro controller. I swapped the Arduino Nano for an Arduino Pro Micro, which allows the bear to be detected as a keyboard or mouse device. This enables it to send the button presses as key presses and to map the gyroscope to the mouse. With this change the controllers basic functionality can be used for any video game that allows the player to remap the controls. To access sensor readings, or control the LED and vibration motor, a game would still have to

communicate over the serial line, but even just removing the button presses from the serial line communication allows faster sensor readings and removes the need to use string parsing to determine button presses. This increases the responsiveness of the controller dramatically.

Heart Rate Sensor Furthermore, to allow affective gameplay based on biofeedback, the teddy contains a MAX30105 particle sensor which can be used to optically determine the heart rate of a player.



Figure 4.5: Prototype version 3 - "Teddy Berta"

4.4.2 Costs

The costs increased again due to the fairly expensive heart rate sensor. For future prototypes a significantly cheaper sensor has been found.

Table 4.3: Teddy Controller v3 costs in Euro

Part	Use	Retail	Online
Arduino Pro Micro	Microcontroller	15	3
Protoboard	Connections	4	0,8
MPR121 breakout board	touch input	12,5	1,8
conductive thread	sewing connections	4	-
Other materials	sewing, glue	3	-
RGB LED	displaying color	1	0.1
MPU6050	gyroscope, accelerometer	6	1,2
Coin motor	force feedback	-	1,5
MAX30105	heart rate detection	15	-
Price total		55,5 (+1,5)	7,3 (+ 22)

4.4.3 Playtest

I conducted two playtest sessions with the third prototype. A one-on-one session in which colleagues from ustwo and friends played various games with the bear for half an hour, answered a questionnaire and gave verbal feedback, and a showcase session at the IGDA Mixer at GDC in San Fransisco. A full summary of the playtesting sessions can be found in Appendix C.

Testing the third prototype made it clear that the controller can be used for a variety games, but that games with a fast pace or reliance on precision are not a good fit. It became very clear that the buttons in the hands, the feet and the hug sensor are still confusing to players, even though the response times are sufficient. This is caused by the lack of haptic feedback.

Initially I thought this wouldn't be an issue if the game responds to the input quick enough, but it makes it harder for the player to understand how to press the button and prolongs the necessary training. The gyroscope was too sensitive and tends to drift over time, and the location in the head might be suboptimal because it results in turning the head of the bear manually, which stands in conflict with the emotional attachment to the bear.

Interestingly there was a big difference in the playstyle and curiosity between the testers from ustwo and the players at the showcase. The players at the showcase got higher scores, wanted to play more sessions and seemed to enjoy it more. My suspicion is that it is connected with the amount of games that a tester has played, how much she enjoys games and the connected play patterns that she can draw from. Furthermore the players from the showcase are most likely game developers themselves, which would result in more playtesting experience and different motivations.

During the playtest I could often observe small gestures of affection towards the bear such as stroking its head and belly, talking with it during the play session ("Come on bear, we can do this") and feedback that hints emotional connection such as not wanting to let go of the hands to press other buttons, not wanting to hurt the bear by hugging it too tight or turning its head.

It seems to take players 5-20 minutes to learn how to control a game as intended with the bear. This includes how to put pressure on the buttons to get the best responses, how to let go of the hands to use different buttons and how to hold the bear stable to prevent readjusting too much. During the learning phase players are mainly focused on the controls and understanding the game.

4.5 Artificial Intelligence

This section will not explain the fundamentals of artificial intelligence or explain all the advances in the field that have been made in the last year. That would be enough material for a whole new thesis. This section will instead look at AI and machine learning methods that could be used as input to provide a more engaging experience. To interact with games players use gamepads, keyboards and other peripheral devices. The usage of these artificial control devices has to be learned and can break the immersion in a game.

4.5.1 Natural language processing

Speech is a powerful communication tool. Humans talk with each other, they read, they chat, they sing. Natural language processing helps to transform speech into a format that text processing algorithms can work with.

Speech recognition and processing has already entered consumer markets with the speech interpretation and recognition interface (SIRI) from apple which uses speech as an interface to the personal assistant functions. Siri was released in late 2011. Since then google, microsoft and samsung also released speech controlled personal assistants.

There are a few games that utilize speech input to enhance their gameplay such as *There came an echo* or *Tom Clancy's End War* and even *Skyrim* has some voice commands, but only *There came an echo* is meant to be purely played by voice input.

After playing some of these games and talking to people in the Facebook group "Player of Games" I determined that the main challenge of voice con-

trol to date is that the recognition doesn't have a 100% success rate. Even though speech recognition has been significantly improved in recent years, it still isn't perfect. When you try to use SIRI to play some music while you are driving a car and she misunderstands you, the worst thing that can happen is that she calls your mother, which can easily be corrected with either a verbal correction or a button press. But when you control a spaceship in a game as a commander on the bridge and the ship crashes into a wall because the speech recognition did not recognize the player shouting "Left!" it quickly becomes frustrating. Correcting it with button presses is easy but can break the immersion in the game experience.

Furthermore, localizing voice controlled games requires a lot more resources, which would increase the costs of exporting to other markets or results in exclusion of non English speakers. And even with English speakers, accents often vary which makes speech recognition even more difficult.

4.5.2 Chatbots

Chatbots are characters that the user can interact with through a chat interface. Most chatbots are either designed to serve as personal assistant to help the users daily life, as companions or aim to pass the Turing test. In the course of this work I have chatted with various chat bots for extended periods of time. A selection of chat logs can be found in Appendix G.

Cleverbot proved to be not very clever during our conversations. It changed its name during the course of conversations, forgot what we talked about over the course of two sentences and changed its sentiment towards me. *Cleverbot* is clearly missing contextual knowledge and memory. Nevertheless my interactions with it did lead to some entertaining snippets and, while frustrating at times, there was a certain playfulness to it. *Cleverbot* claims to

be a human and the project aims to pass the Turing test. The Bot learns from the conversations it has which gives it a wide range of topics it recognizes, but removes the coherent character through the conversations.

In contrast to *Cleverbot*, *Mitsuki* is open about being an artificial intelligence and seems to have a certain memory and domain knowledge. She says she has no body and talks with multiple people at the same time. This framing helps the believability of *Mitsuki* and actually immersed me at times during our conversation. Generally *Mitsuki* gave more sophisticated answers, did not change her name or story halfway through the conversation and did seem to have her own personality. The conversation did not let me forget that she is a chat bot but it felt like a fleshed out dynamic character. This illusion however shattered when talking to her for a longer period of time since she started to repeat herself.

Event[0] is a game that is build around a conversation with a chat bot. The game has a meta critique of 75. The Player feedback is varied but personally I think it does a very good job in creating a setting that tries to prevent to break the immersion and makes the AI Kaizen seem very real, at least sometimes [2]. Nic Rowen from Destructoid recommends the game : "The developers built a fake world with a fake A.I. and here I am worried about hurting its feelings. There is something special about that, something more important than quibbling about playtime or the occasional hiccup. There are plenty of games out there that you can beat, speed-run, and master. There are very few you can talk to. Don't sleep on the opportunity." [26]

4.5.3 Sentiment Analysis

I believe sentiment analysis is an important part to increase the believability of chat bots and other artificial agents. Interactive agents that understand

irony, get offended when you insult them, and all that not only based on a single keyword will make a big difference, not only in games. I tested three different online sentiment analytic tools and gave them each the same three texts. A snippet of a news article about Brexit, the prologue of Romeo and Juliet and a one sentence insult.

The text and exact results can be found in Appendix H. The first tool I tested, Vivekn, yielded very bad results. It doesn't provide any information about the implementation, but it classified all the texts as "positive". Even the insult. The second tool I tested, from Daniel Soper, interpreted all the text as "negative" but did so with very little variance. While the Brexit text and Shakespeare got a -99 score the insult got a -100 score.

More sophisticated results gave the Alchemy Language text analyzer. It is part of the IBM Cloudmix and is a commercially available service. Instead of returning a single score for the text it gives results for the following feelings: Anger, Disgust, Fear, Joy and Sadness. Moreover it analyses the sentiment towards people and objects from the text, they call it "Target Sentiment".

4.5.4 Facial expression detection

Facial detection seems like a promising field to detect players emotional process during a play session without additional sensors. The tested Affectiva software uses only the web cam to classify players expressions. The test showed that the detection is influenced by factors like glasses, beards and other accessories. It needs a lot of computational resources and does not take into account the players "resting expression". The neutral face on some got interpreted as angry, while others got classified as happy. The answers of the questionnaire suggest that the detection did "good enough" and none of the participants was opposed to the idea of playing games that include facial

emotion detection, most players even said they enjoyed playing around with emotions.

A detailed report and questionnaire of the user test can be found in Appendix E.

5

Discussion

Testing for emotional engagement in games is complicated because the emotional process is a tightly connected network of many different parts. The emotional reactions depend not only on audio-visual stimuli, context, mood and various other components but moreover it is still an active research field. There is no universal definition of "emotion" and Klaus Scherer's definition used in this thesis stresses that we do not yet know how the components of the emotional process interact and influence each other.

The initial idea of this thesis was to create an interactive agent that has its own emotional processes and will develop its own personality based on the player interaction. A lot of time was spent on designing and researching this until it became clear that the teddy bear is lacking necessary attributes to develop a balanced persona. In addition to this, building an emotional model turned out to be incredibly complicated.

I was interested in exploring how an embodied agent can enhance the game experience. When we see emotion as a process that affects the full body and feelings as a way to monitor our emotional state it becomes clear that an agent without self-determination will be difficult to relate to. The bear is lacking agency in the real world. Because it can't move on its own the agency needs to be accounted for either by setting (putting the player

in a caretaker position) or by digital agency (letting the bear decide things in games). Unfortunately I had neither the knowledge nor the resources to allow the agent to physically move.

I explored the idea of giving the bear a virtual appearance that it could control independent from the intentions of the player. That seemed to decrease the emotional investment into the game because the player lost control over their avatar. Again, building and tweaking an emotional model that allows the teddy to collect sensory input, process it and yield human understandable reactions while being entertaining proved to be out of the scope of a master thesis. Furthermore companies like SoftBank Robotics are already working on this intensely. They created an "emotional" robot called *Pepper*.

During the creation of the embodied agent I realized the emotional capability of the bear and decided to explore it more. At the same time I already had researched various AI based input methods to allow the user to interact with the bear on an emotional level or the bear to express and communicate emotions. I then decided to research the possibilities that artificial intelligence and alternative controllers can open up for emotional engagement in games.

5.1 Teddy-Bert

Building the controller took a lot longer than I had planned in the beginning, but I have to say that it also works better than I hoped. Teddy Bert, as I named the project, sparks the interest of player, parents and kids alike and can be used to draw attention to various products. In the beginning of the project I had no knowledge of hardware, arduinos or serial communication. While this served as a strong personal motivator for me it did delay the thesis.

The iterative development process I followed seemed like a very good fit both for both game- and hardware development. The early testing with other people was essential, though testing the first very rough prototype took a lot of determination. In hindsight I think building smaller prototypes of all the mechanics, concepts and ideas that I worked on would have not only been beneficial but might have prevented me from spending some much time on the initial idea.

5.1.1 Playtests

The playtest sessions were mainly conducted with colleagues and friends which needs to be taken into account in the evaluation. All the results have to be read with a grain of salt, due to the personal connection. That said ustwo fosters an honest and constructive feedback culture.

The playtests suggest that most players do feel a certain emotional connection to the teddy bear, but does not measure in any way how much. It would be interesting to gift players a controller to take home and play with it in their regular environment. Most players immediately assume that the teddy bear controller is meant for kids. That said, I actually never specified the target audience for the controller. This did not seem necessary due to the lack of commercial interest, but might have given the testing a stronger focus. All participants of the playtests were adults and I have not yet conducted any tests with kids. This had multiple reasons: It was easy to ask colleagues and showcase on conferences I attended. I live in Sweden and do not speak Swedish which makes interacting with children even more complicated. Moreover by testing with adults I could be fairly sure that the prototypes would be handled with care, which was important because to ensemble one controller takes about 2-4 workdays, not to speak of the acquisition of the hardware and costs. Now that the controller seems to be

robust and responsive enough I would like to spend time on building a game that incorporates the learning of this thesis and test it on children and adults alike.

Through the execution of the playtests I learned that I can help setting the context verbally by giving the player a reason why they play a specific game with the teddy, for example by telling them: "first you teach the bear how to drive and then you teach him how to fight".

I conducted the playtests myself and tried to remove my expectations as much as possible. I tried to only help players when they asked for it or had obstructive problems. For better, less biased results I would recommend to let a third person do the playtests. That would not only remove more personal biases from the the test but could also give more observations.

The playtest sessions clearly showed that the context of the game is very important to the relatability of the controller. I had difficulties with designing a game that set the right context for the controller, was realizable in the scope of the thesis and that did not encourage the player to become attached to the bear through story or gameplay. This was important because I wanted to test the impact that the controller has on the emotional engagement and not the game.

Players expressed strong but varied opinions about what is okay to do with, and to, the bear. Some players suggested horror games as a good application area, but one group of players saw the teddy as a calmativ agent while others thought it would increase the scare factor.

Players did say that they felt connected with the bear and they had opinions on how the bear could be treated. While this suggests that players have stronger feelings towards the bear than a normal game pad, it does not yet prove whether or not it leads to a more emotional engaging game experience.

5.2 Believable Agents

The Poll from the *Player of Game group (POG)*¹ suggests that players connect with video games with traditional input methods either through the told story, the characters or if the game forces them to do something that stands in conflict with their beliefs. Creating more believable characters is therefore an important step towards more engaging games.

The conversations with the *Cleverbot*, *Mitsuki* and *Kaizen* took interesting turns and, while some answers seemed strange and broke the immersion, short conversations worked out very well. To create a believable agent based on a chat bot it will need to be able to determine the intention a player has towards them from the way the player talks. Sentiment analysis can help to give an idea of the player intention and its accuracy could potentially be increased by incorporating area specific knowledge. Moreover it needs domain knowledge, memory of past events and knowledge of its character. The context in which the interaction with the player happens as well as the presentation of the agent will determine how forgiving a player is towards mistakes and absurd answers. For example if an agent repeats itself but is introduced as an Alzheimer patient, the player will, most likely, accept it as part of the story.

5.3 Expression Respondent

The playtest showed that the *Affectiva* SDK detects facial expressions good enough to use them within a game. The feelings it supposedly recognizes may

¹The *Player of Game group (POG)* has over 2300 members from various countries and backgrounds, they have however significantly higher male members. The poll was voluntary and does not represent all "gamers". It only shows a spot sample.

or may not correspond with the feeling the player actually experiences, but the expected visualization of these differs from person to person. Instead of using the SDK to mirror the players emotions it could be used for characters in game to reference them. If that yields a more engaging experience needs to be tested, but seems likely.

5.4 Future work

5.4.1 Teddy Controller

To allow a more natural play with the bear it would be beneficial to remove the USB cable that connects it to the computer. This would mean transmitting the input and output data over bluetooth and adding a battery to power the arduino. A wireless bear would make the design of local multi-player games easier. In order to allow third party games to use the vibration motors and LED, a driver would be necessary. A properly documented Unity SDK could facilitate the use of the bear in their game.

As a result of the rapid prototyping process there are currently no complete circuit diagrams of the inner workings of the bear. Creating these and designing a custom printed circuit board (PCB) could reduce the hardware costs and form factor. To make the bear available to as many players as possible these plans could be released under an open-source license. The interest seems to be existent, I have been asked to give bear building workshops. Building your own controller could lead to a stronger emotional connection.

The next step regarding the teddy bear experience is to create a more elaborate game and test with players of all ages. Already in preparation is a showcase of the meditation application *Sway* which can be controlled by

swaying with the bear.

5.4.2 Artificial intelligence

Chatbots Chat bots could be an option to populate open world games with NPCs that do not only tell the player the one sentence that they need to know, and then loop "I told you everything I know", but that actually respond to the player. And while chat bots do not fool players yet, they can provide valuable interactions. Exploring in what contexts players are more forgivable towards agents and testing those could be a good next step.

Reference Emotions Using mood detection by letting characters reference the facial expression of a player during the play session has the potential to create a more engaging experience. Implementing a prototype and testing it with people should be possible fairly quickly by using the *Affectiva* SDK.

Sentiment and tone analysis Detecting how a player feels towards a character and responding to it will make characters feel more realistic and eventually self aware. Apart from sentiment analysis which is based on text, tone analysis could help achieving this. This thesis did not test tone analysis because I excluded speech input as a possibility due to the error rate of the recognition. But it could be beneficial in speech controlled games.

6

Conclusion

This thesis presented three iterations of a teddy bear shaped controller, to explore if alternative controllers can create emotional engagement in games. Furthermore it experimented with emotion detection, chat bots, sentiment analysis and speech recognition.

Statements like "I don't want to strangle the bear" and "I feel like I am hurting its paws" during play sessions clearly show that players feel an emotional connection with the bear. The teddy shape encourages the player to build an emotional attachment to the teddy which can be used for a more emotional engaging experience.

The prototype works as a controller for various games on a technical level but the teddy shape influences what kind of game experience the player expects. Player expectations have a strong impact on how emotionally invested they can become. This needs to be accounted for by creating the right context. This includes not only the games they expect to play, but also the handling of the controller. Interaction that could potentially hurt the bear yielded strong (negative) emotional responses.

In which context the bear can be used to create the best emotional engagement possible still needs to be tested in the future.

Setting the right context for players also influences how forgiving they will be towards errors while interacting with interactive agents. This is especially important to mask the shortcomings of chat bots and emotion detection.

Speech recognition, chat bots, facial emotion detection as well as sentiment analysis do not yet provide a seamless user experience. Due to the playful but challenging nature of games they could provide a training ground for all these methods. If game designers don't see the limitations as a flaw but rather as design constraints they can use them to create new experiences.

The controller does spark people's interest. I was invited for the *Geek Girl Öresund Meetup 2016* and the POGO conference day to talk about the project and received very positive feedback. It ranged from "I want to play with a teddy too", to "My kid would love this" and "Can I buy this or can you show me how to build one".

The showcases in the ustwo office and the IGDA Mixxer at GDC showed that the controller is robust enough to be played with and can be used even in public spaces.

Video games have the necessary tools to affect and use all areas of emotion. They can evoke feelings, motor expressions, physiological changes, cognitive processing and action tendencies. Therefore games already are a playground for emotions. To deepen the experience developers should leave the beaten path of traditional media and stimulate as many parts of the emotional process as they can. Alternative controllers and AI methods can help increasing the stimulus and yield some unique experiences.

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Appendices



Playtest Prototype v1

A.1 Setting

This playtest was conducted in the social area of the ustwo office as a drop in session on the 26.09.16.

Game and Controls A space invader clone from the Unity Asset Store was modified and used to test the controller. Touching the left hand of the bear steered the ship to the left, touching the right to the right. The players could activate a shield that would prevent damage from incoming projectiles by hugging the bear.

Notes The hug sensor was not well enough fixated so that *hugging the bear* became more like choking it. Furthermore to get left and right inputs registered the players had to remove the skin contact with the capacitive surface fully.

A.2 Questions and Answers

How much time did you feel like you were playing for?

- Just long enough to get the concept
- 1 minutes
- 3 minutes
- A few minutes, i wanted to test a few more times, but someone else was in queue
- A few minutes
- 2 minutes, quite short
- 4-5 minutes
- 2 minutes
- 1 minute
- 4 minutes
- 5 minutes

Do you like the idea of a Plush-game controller?

- Yes, it's cozy
- Yes
- I like the bear but it takes time to learn
- Could be interesting in the right context

- Yes, it's like having a kid or a cat on your lap
- It's simple and fun. It has emotional implications. I wouldn't like to choke my friend.
- Yes but it feels so themed that I expected a better match with the theme of the game.
- It's sweet! But I think it would of course make more sense with a game that matches.

To what extend did you feel like you were in control of the controls?

- The latency made me feel disconnected, but it could work great for non-action games
- Not very much
- At first very much, then it got hung up a bit
- It took a few death to get the hang of how to press/release
- I was controlling it somehow but not in full control
- Took a game to understand dynamics, after that I felt in control of it, even losing
- Not so much, sometimes it felt not very responsive
- They didn't respond well enough
- 40
- 6/10

Did you use the shield? (If not, please elaborate why not)

- Yes, but it was a bit tricky to activate
- Tried, fell into a plush toy trance -i not fast enough
- Yes
- I did! Once I figured out that it was very useful
- Yes, once I learned how to use it, was quite hard
- No, I did not choke the poor thing. It looked like it has been through enough.
- Yes, but i did not really want to let go of the hand too long
- Unknowingly I did
- Only to test, it felt weird to choke a teddy

Were the inputs recognized fast enough?

- Yes
- Left and Right yes, shield no
- Once you got the hang of it it worked well
- Maybe not as much as expected
- Yes, except choking
- With some delay, one was faster than the other
- Maybe not, but they might have been too short

- A little bit too slow I think.

How was it to hold the bear while playing with it?

- That I did enjoy. Cozy!
- Difficult, I was afraid of breaking the electronics. I want to throw the bear around.
- Nice, I like it *but different game context
- It felt like we're playing it together
- Interesting, I would expect something related with the game like a ship
- Nice. New experience
- It felt quite nice actually
- Didn't really think about it being a bear. Just trying to get the controls working.
- Not sure...soft
- Interesting. Again, disconnect between the bear and the game was making it less immersive, but if I saw a bear on the screen I would feel connected.

Would you prefer a different shape or size for the controller?

- Space ship with left/right at the wings and shoot on the front
- Maybe have the bear facing you
- Maybe something smaller so I can reach all controls without letting go

- As a controller the shape works but i'd like more options
- A teddy bear is quite nice, maybe a bit bigger
- Something related with the game
- Could be interesting to try a bigger one
- More like the ship
- No
- I like teddy bears

For what kind of applications would you like to use the teddy-controller?

- I would like to try it on some less active driven game. Maybe steer a sail boat
- Wrestling, twisting, throwing
- For a teddy cute game
- Teddy games
- Games are fun. But it could be anything from making coffee to turning music volume on / off
- If it is a teddy bear- registering moods, distress, have fun Kids games.
- Something slow paced
- I think horror games could be interesting with a cuddly huggable thing on your lap

- I think it could be fun for kids. Also would be nice to have accelerometers picking up throwing the bear around
- Toddler simulation games
- Children toy apps

Did you enjoy the time you played?

- Yes it was really interesting
- It was fun to try
- Yeah
- Yes
- Nicely done
- Yes, keep going
- Yes
- Kind of fun
- Yes - but in a "this is hard"-way

A.3 Observations

Technical The conductive thread that connected the input on the hands and feet to the Arduino wasn't fully isolated, which sometimes led to some confusing inputs for the player. The solder-less connections got disconnected once in a while, which would stop inputs all together and interrupt the

playtest for a moment. When the game starts, the input is frozen for about 4 seconds, which is the time Unity needs to open the serial communication. This confused some of the testers.

Player Most players needed some time to get a feeling for the interaction with the bear, especially the removing the finger completely from the button was a little confusing for some. Some players verbalized concerns about breaking the prototype, because the Arduino was openly visible and would rest on the players chest/ belly when they had the bear on their lap. To restart the game players had to press 'R' on the keyboard, which meant to move out of the playing position to reach it.

B

Playtest Prototype v2

B.1 Setting

Teddy Bert was tested during an open showcase at the end of the Exile Game Jam on the 03.12.16. The test game was developed during the jam. The game was set up on a laptop with the teddy bear connected in front of it. Testers just picked up the bear and played until they lost interest. Due to the informal setting it was not possible to hand out a questionnaire. The player feedback was given verbally.

Game and Controls The first play-test made clear that the setting of the game mattered a lot to the players, which is why the second test game was a simple racing game where a human sits behind a teddy bear on a scooter. The scooter is controlled similar to the initial space game by using the bears hands to navigate left and right and the feet for gas and brake. The goal of the game is to navigate in traffic without hitting any cars. To convey the teddy's arousal, his nose would blink in sync with his heart beat. The pulse of the bear would rise when the scooter gets very close to a car and would decrease over time back to the rest heart rate. If the bear gets too stressed the player could hug the bear to calm him down.

Notes A Video with a description of the bear and some footage of the playtest can be found here: <https://www.youtube.com/watch?v=bDFkcUHVT9M>

B.2 Observations

B.2.1 Technical

The LED blinked significantly too fast for the calculated heart rate, the calculation code in the Arduino sketch must be wrong. The vibration motors did not work as intended. They did vibrate, but sometimes turned on when the game was started instead of just shortly vibrating on car impact. The hug sensor works but seems hard to trigger. Apart from those issues the prototype proved to be very durable, it was used for a lot of play sessions and worked consistently. The buttons were a huge improvement, not only because players could rest their hands but also in reaction time but could be a bit more sensitive to pressing.

B.2.2 Player Behavior

Visitors of the showcase were curious about "the game with the teddy". Some picked up the bear without any hesitation and managed to control the game without any explanation. Most people either observed the play session of another player and took over directly from them or waited around until I gave them a small introduction. It took players 1-5 minutes to get used to the controls, mostly to get a feeling for the way the buttons need to be pressed. After that most players looked fully at the game and seemed very concentrated. Some even bit their lips. When the player died the first time after the game was started and restarted the level it would take a very long

time to spawn cars. This was confusing to the player, but allowed them to get accustomed to the usage of the bear. Overall players played the game on average 2-3 times as long as they did with the first prototype. The test had no interruptions due to technical issues (but the game was restarted between play sessions) and some testers even came back to play a second session or to show the game to a friend. Players did not understand the stress level of the bear and therefore did not use the hug at all.

B.3 Player Feedback

Most players enjoyed the play session. A few players suggested using the gyroscope and accelerometer to control the scooter by leaning with the bear into the desired direction. The not spawning cars often lead to confusion. The blinking LED was either not visible or distracting to the players. The buttons could be easier to press. Most players would play it again. There were plenty of ideas for other games that could work with the teddy. The stress level of the bear was missing an explanation and would need better signifiers in the game.



Playtest Prototype v3

C.1 Setting

The test session took place in the ustwo office on the 20.02.2017 with 8 participants. Each participant took part in a 20 minute session in which they would interact with the bear and play a few different games and experiences. 7 of the 8 participants were employees of ustwo, most of them neither developers or experienced gamers. Each session started with an introduction of the bear, the bear then was put on the players lap while I explained the test. I made clear that I am testing the teddy controller and not the used games but not that I was testing for emotional attachment. After the participants finished the session I asked them to fill out a questionnaire, before I answered any questions. If wanted I discussed the project with the participants afterwards, listened to their ideas and feedback.

Game and Controls The session started with a short drawing experience where the gyroscope inside the bear controls where a player draws and the left or right hand the color of the continuous drawn line. Then the player would play the racing game, where I removed the heart rate and made clear that it is just to get a feeling for the input recognition through the bear and

not to test the players skills. When player felt comfortable I asked them to play "One Finger Death punch" a fighting game that uses only the left and right mouse button and is fairly fast paced. A trailer can be found here: <https://www.youtube.com/watch?v=aziz0lEV2Uk>. If there was time left after all those games I gave the player the option to continue playing or to play the jellyfish game

Notes The gyroscope needs to be a little less reactive and better calibrated. A spline interpolation or similar approximate cleanup could be helpful. The fast paced fighting game was good to test the responsiveness and reaction time of the controller but was quite a challenge for non gamers.

C.2 Observations

Some players needed some time to learn how to apply the pressure to the buttons, this took up to 5 minutes. Some players complained about hurting the bear by pressuring its hands too hard.

C.3 Questions and Answers

To what extent did you feel like you were in control of the controls?

- The push buttons (the paws) were working well enough. There was a sense of frustration but it was absolutely minimal, comparable to the level one feels when playing an old arcade machine.
- Once I understood how it worked, it worked like at least 80 % of the time

- The feedback from the hands are still too slow. Head gyroscope felt really good!
- It took quite a bit of time before getting the hang of it (and the pressure detection was off at the beginning). It's hard to know if you're actually completing a touch input. Input problems feels similar to a touch screen.
- I felt i had some control, but was also lacking quite a lot of accuracy. Quite some frustration with getting my intended input through the bear
- The buttons very good, the gyroscope not as much.
- Control side of things I felt that the fighting game was more in control because it felt like I fighting through the bear.
- Somewhat. I kept loosing the controls when I was playing

Were the inputs recognized fast enough?

- Sometimes, yes. I would say fast enough but obviously not perfect.
- It was a bit difficult to identify the start and the end of a click, making it a challenging to notice if I wasn't fast enough or if I wasn't hard enough
- No, not the hands and feet. It feels like you have to know exactly where and how to put the pressure on to make it work.
- It felt like it was fast enough half of the time. It was hard to know when it was recognized in one-finger death punch.

- Some of them. The head turning was good, and the paw squeezes as well when they worked. I had some trouble with understanding how to press the paws.
- Usually, but not always.
- Most of the time
- no it felt like there was a delay

How was it to hold the bear while playing with it?

- Very comforting. Until i choked it, then it became stressful.
- Holding the bear was fine. Using both the arms and the legs were hard.
- I like it, feels very cozy. Almost like holding an infant :)
- Cozy! It felt a little bit rough on the bear squeezing its hands though...
- Cozy!
- Sort of awkward at the beginning, but I think I quickly got the hang of it.
- Felt nice and calm, like it was protecting me from the game in a weird way
- its was soft! and nice! especially when I was playing the first game (motorbike)

Would you prefer a different shape or size for the controller?

- The gyroscope (head movement) was not very nice to use at all. In part because it controlled the mouse, which is probably an element one naturally compares to that of moving with ones body, which is to a very high level of intuitive neurological control. The bear shape was comforting.
- In size I think it works well. As a controller, its probably not going to compete with an xbox or a ps controller
- No, think its a good size.
- Maybe a little bit bigger for me as an adult. The hands of the bear could be fuller.
- Maybe an even bigger bear, for more sense of hugging.
- Maybe slightly smaller.
- For the motorbike game I would maybe have use the accelerometer as input moving the bear left and right, forward and backwards more than the pressure sensitive input. With the fighting game I felt it worked well.
- maybe for the games that doesn't relate to the teddy bear itself. like the jellyfish game. usually you want to physically drag controllers to the left and right, it feels bad to drag teddy bears head or paws

For what kind of applications would you like to use the teddy-controller?

- Because of the difficulties with the gyro controller I would recommend something fluid perhaps where the mouse movements are very slow and the mouse isn't visible at all, this would reduce the sense of nausea or

annoyance with the difficulties in controlling it. For a game it would be nice to see that the teddybear becomes more than just a controller and to see the teddy bear become a companion or personified in the gameplay.

- The teddy in itself is a strong theme, and it feels more like a teddy with a controller than a controller that looks like a teddy. Because of this, it feels like the game should be themed around the controller
- Casual/party games. Infant Kräksjuka Simulator 2017 VR.
- Simpler games not based on quick reactions.
- I liked the idea of teaching it to ride a motorcycle. Maybe games where you play as an alter ego. You're sort of hiding behind another character.
- Games was fun, otherwise I have no idea.
- Meditation apps
- games for kids, or some kind of therapeutically games for adults or kids, or elderly people who don't have good motor skills to use normal game controllers

To what extend did you enjoy the time you played?

- I thought it was really cool! I would love to see it further developed.
- I did, but because how the buttons work wasnt completely clear, my fingers started to hurt a little after a while, so I cant really say if it would work for longer sessions
- I mostly enjoyed experiencing how the controls were implemented.

- I was a bit annoyed by not getting the controls right, problems with responsiveness.
- It was good fun.
- 7/10 if I would have played a little longer maybe more
- I think I enjoyed the motorbike game the most. it made a lot of sense to take teddy for a ride! the fight game was stressful because the teddy controllers didn't respond fast enough

What could enhance the play experience?

- Personifying the bear in the game while also making sure that none of the controls forced me to place the bear in positions one could perceive as "threatening". I found myself regularly taking a choke hold on the teddybear to get better control but this obviously had me feel guilty for such manhandling of the bear itself. On the same note I found that I was pushing the paws very hard, to a level where I would hurt the bear if it had sensation. This also leaves an uneasy feeling.
- Understanding what exactly the fact that the controller is a teddy is meant to add to the experience.
- Faster feedback for sure!
- Less reaction based games.
- More sensitivity in the controls.
- The "buttons" feel a bit stiff. Some sort of tactile feedback would be nice.
- Not sure, maybe some more alignment on which game with which controller input.

- physical feedback of click inside the paws, or vibrations like in other controllers, and the speed of response

Did you feel emotionally connected with the bear?

- I definitely did. I could see myself become attached to the bear as I had a physical connection to the bear while experiencing strong inputs and stimulation from gameplay. This created a kind of bond with the bear, a companion in gameplay and shared experience.
- Not really
- Yes, especially when realizing that it was sitting in front of the bike rider in the game :)
- I didn't feel like I had the time to actually get an emotional connection. I was distracted by the intensity of the games.
- Yep, at least in the motorcycle game where the bear was represented in the game too.
- Not really.
- Jupp
- we didn't have much time to get to know each other well, but i liked her

If have any ideas or comments please put them here

- Joystick mouse or touch pad to control mouse rather than gyroscope, this would also add a sense of soft touch "stroking" which could be a very valuable addition for connecting with the bear in a sensitive and caring way.

- You already have feedback in form of vibrations, so maybe take advantage of that to let the user know that a button press has been recognized
- Infant Kräksjuka Simulator 2017 VR!
- would be interesting to play with how people physically interact with controllers when they are very engaged with the game. for example, when you drag controller to the right in the car racing game when you need to turn right. Maybe people would squeeze the bear if they are scared while playing a horror game, or squeeze her if they are falling from the cliff, etc.



Playtest Prototype v3 @ GDC

I got the chance to showcase the teddy at the IGDA Networking Party on the 4th March 2017 in San Francisco.

D.1 Setting

GDC is the biggest professional Game Developer Conference world wide. The IGDA Party was set right next to the venue in the Children's Creativity Museum. I let people play around with the scooter game until they felt comfortable. Afterwards they played a round or two "One Finger Death Punch". If they were still curious afterwards I showed them the vibration feedback and the Led, by using the arduino serial line console.

Notes The bear ran fine and there was no need to recalibrate it during the whole 3 hours.

D.2 Observations

The teddy bear sparked a lot of interest and even though the prototype was in a very hidden corner it gathers an audience around it. The players that got to play the bear were really interested in the project, often stuck around for a while, asking questions about the development and suggesting use cases.

It became very obvious that the audience was quite a bit different from the testers I had in the studio. The majority of testers tried various positions of holding the bear, adjusted their grip and tried to understand how to operate the controller. It seemed like they started with the assumption that it is not the games or controllers fault but that they just haven't developed the skill to operate the controller yet.

Players complained about cramping of their hands during one finger death punch. They suggested a better filtering of the gyroscope and accelerometer because it is too sensitive and tends to drag. And some suggested calmer non reaction based gameplay, while others really loved playing one finger death punch with it.

Moreover a lot of the people that played with the bear contacted me per email or followed me on twitter later on to get updates on the bear.



Playtest Emotion Detection

Affectiva is actively working on emotion detection software that uses a camera to detect facial expressions and changes and interprets emotions from it. More information about affectiva can be found here: <http://www.affectiva.com/>

E.1 Setting

Affectiva provides a Unity SDK and a demo project that uses a computers web cam to detect player feelings and shows an animation of that feeling on an avatar. This is limited to the animations that Unity-chan (the Japanese Unity mascot) provides and the feelings it can detect.

Game and Controls The tester simply has to look into the web cam. She can try out various facial expressions and see how unity chan responds.

Notes The demo was computational intense and did not run always smoothly on the test machine (MacBook Pro with i5 processor, 2,9 GHz, 16GB Ram, Intel Iris Graphics 6100). The demo had troubles with glasses,

hats and beards. Testers with glasses took them off, same for hats but I allowed the 2 bearded testers to keep the beard.

E.2 Observations

The testers were focused on the expression that was represented on Unity-chans face and did not pay attention to the debug text which indicated which feeling was in fact detected. The framework also detected when testers blinked and played a blinking animation. This lead to the impression that Unity-chan imitates your facial expression rather than detects your feelings. The animations corresponding to the detection were not always correlating with the testers idea of how that feeling would be facially expressed, especially because Unity-chan is a character in the Japanese comic style.

E.3 Questions and Answers

Did the AI detect your facial expression correctly?

- I think so. Apparently my resting face is happy
- Mostly. It was very good with happy, surprised and angry
- Sometimes
- Mostly. Sad was harder for it to detect, but I don't know if that was just due to me being a crappy actor.
- Sometimes. It was really good with happy face.
- Most of the time

Appendix E. Playtest Emotion Detection

- Not sure, did not feel very real-time and then it is really hard to see if it is following me correctly
- almost

Did you enjoy playing around with expressions?

- I would probably enjoy it more if I was alone
- Yes, it was fun .Would have liked to see a less binary reaction though.
- Yes
- Yes!
- It was fun, but more accuracy and less lag time would have made it even more fun. It was great to realise it detected "tru" emotions better than when I faked it. Felt a bit like getting confirmation from a person.
- Sure, I just wish my face was more expressive.
- A little, but felt off due to the not in real-time thing
- it was fun for a short while

Would you like to play a game that responds to your facial expressions in any way?

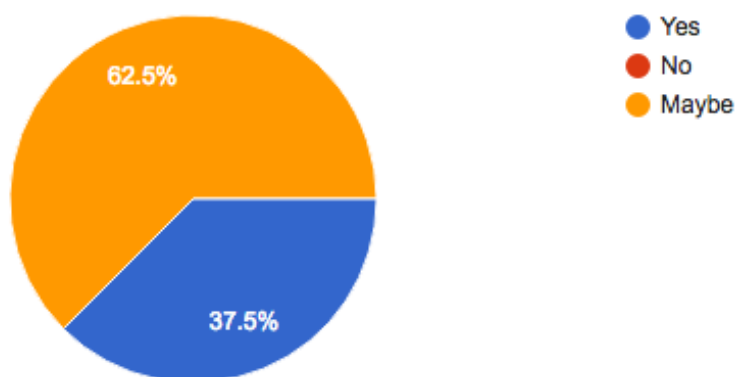


Figure E.1: 8 responses

Do you think that your facial expressions show how you feel during a play session?

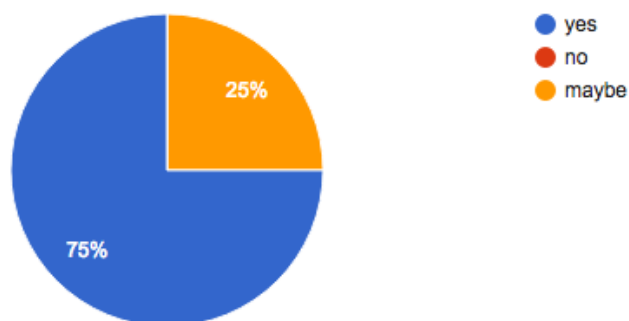


Figure E.2: 8 responses

Do you think it could create a more immersive game experience if non player characters would reference your facial expressions?

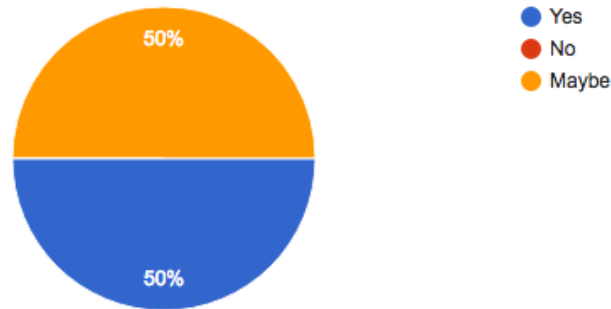


Figure E.3: 8 responses

Do you have an idea on how facial expressions could be used in a game?

- NPC attitude towards player? Settling a difficulty level? Emotion barriers? (This level is best suited for when youre angry)
- A game where you need to lie while keeping a straight face.Or keep a straight face while the game is throwing stuff at you. Showing showing emotions on your VR avatar when playing some VR multiplayer game over the internet. In a multiplayer environment like Dark Souls, you can see how other players felt when they were in the same area. Fear, surprise, happiness, etc.
- Not atm
- Putting scary moments when your face is completely neutral or in deep thought.
- In games like Walking dead, or other games where you have to make interpersonal choices and build trust, it would be super interesting.

Like if a non player character would choose to trust me or not, based on whether I look honest or not.

- In conversation with NPCs is the obvious one here.
- There is this company that does a mouse that tracks heart-rate and stress levels into games. I think facial recognition could add to that game play, where it has an actual impact on your character.
- some little cute character can start laughing if I start laughing, or get frustrated, or try to calm me down if I am stressed
- maybe the environment can also react to your emotions?

F

Emotional moving games

F.1 Player of Games

The Player of Games is a facebook group which discusses games and game related topics. It has over 2300 members from different countries and backgrounds.









































F.1.1 Voting results

In the group I asked "Which games made you feel most (any emotion) and why?" Player could vote for games and add games to the poll.

Appendix F. Emotional moving games

<input type="checkbox"/>	The Last of Us						+49
<input type="checkbox"/>	Walking Dead Season 1						+45
<input type="checkbox"/>	Journey						+41
<input type="checkbox"/>	Mass Effect Trilogy						+39
<input type="checkbox"/>	Brothers - a tale of two sons						+33
<input type="checkbox"/>	Life Is Strange						+28
<input type="checkbox"/>	Spec Ops: The Line						+27
<input type="checkbox"/>	This War Of Mine						+27
<input type="checkbox"/>	Firewatch						+23
<input type="checkbox"/>	To the Moon						+20
<input type="checkbox"/>	Papers Please						+19
<input type="checkbox"/>	Shadows of the colossus						+17
<input type="checkbox"/>	Inside						+15
<input type="checkbox"/>	The Beginner's Guide						+14
<input type="checkbox"/>	Gone Home						+14
<input type="checkbox"/>	The Witcher 3						+13
<input type="checkbox"/>	The Stanley Parable						+12
<input type="checkbox"/>	Dragon Age: Origins						+11
<input type="checkbox"/>	Portal						+9
<input type="checkbox"/>	Undertale						+8
<input type="checkbox"/>	Heavy Rain						+9
<input type="checkbox"/>	Dark Souls (series)						+6
<input type="checkbox"/>	Half-Life Series						+5
<input type="checkbox"/>	Fallout						+6
<input type="checkbox"/>	Final Fantasy VII						+9
<input type="checkbox"/>	Soma						+7
<input type="checkbox"/>	Limbo						+6
<input type="checkbox"/>	Oxenfree						+5

Appendix F. Emotional moving games

<input type="checkbox"/>	Oxenfree			+5					
<input type="checkbox"/>	The Last Guardian				+3				
<input type="checkbox"/>	Ico		+5						
<input type="checkbox"/>	Bastion		+5						
<input type="checkbox"/>	Thomas Was Alone					+2			
<input type="checkbox"/>	Tales from the Borderlands			+4					
<input type="checkbox"/>	Dear Esther					+2			
<input type="checkbox"/>	The Witcher		+5						
<input type="checkbox"/>	Passage				+3				
<input type="checkbox"/>	Kentucky Route Zero				+3				
<input type="checkbox"/>	Bioshock Infinite'	+5							
<input type="checkbox"/>	The Wolf Among Us		+4						
<input type="checkbox"/>	Planescape: Torment	+5							
<input type="checkbox"/>	Ori and the Blind Forest		+4						
<input type="checkbox"/>	Alien: Isolation		+4						
<input type="checkbox"/>	Grim Fandango	+5							
<input type="checkbox"/>	Antichamber					+1			
<input type="checkbox"/>	That Dragon, Cancer			+2					
<input type="checkbox"/>	Uncharted 4			+1					
<input type="checkbox"/>	Homeworld series	+3							
<input type="checkbox"/>	Resident Evil		+2						
<input type="checkbox"/>	The Vanishing of Ethan Carter		+2						
<input type="checkbox"/>	FEZ		+2						
<input type="checkbox"/>	Final Fantasy X		+1						
<input type="checkbox"/>	World of Warcraft		+1						

F.1.2 Explanatory Comments

Following is a collection of reasoning, comments and explanations why the games from the poll were picked and voted for. Due to privacy reasons I decided to not include screen shots

- Zelda - Majoras Mask; feeling of existential dreading inevitable death
- Thumper - some kind of exciting/ anxious/ scared sort of mood
- Oxenfree made me feel like I had actual conversations.
- Life is Strange made me: Angry, because it tried too hard. Offended, because I basically spent all my time invading other peoples privacy.
- Spec Ops: The Line made me stop for some moments during different encounters in the game, because I felt sick at what I had done in the game. Only game that ever made me feel that.
- Grim Fandango: here was a lot of unfairness visited on the protagonist throughout, and a couple of brutal plot twists at the end of it.
- Shadows of colossus made me feel doubt, should I be doing what I am doing
- Gone Home: also really liked how it had you wondering about what happened in that house
- This War of Mine: did a good job at making you feel like you were doing bad things to survive. pokemon. The relationship you have with your pokemon like a real pet, and the love.
- The Witcher 3, because that game left you making decisions with no positive outcome. Was really frustrating.

- To the Moon is so far the only game that has made me openly cry - and by God I bawled big time! As a game, I thought it was really bad, but the story and soundtrack were amazing.
- Tales from the Borderlands was probably my favorite Tell Tale game. I have never felt so invested in game characters before or since. And when the game ended, I was at the point of sadness, because I couldn't follow their adventures anymore.
- Firewatch - I really enjoyed the banter between the two characters. It was a great emotional journey throughout the game.
- Limbo: sad, alone
- Alien Isolation: scared
- Brothers: sad, though uplifted at times
- Walking Dead by Telltale and Mass Effect. Basically they made me care about the characters and i felt my choices mattered.
- Subnautica: The drive to play that game, for me, is the feeling of confusion and discomfort. I really dislike darkness. What do you know, the ocean is basically made of darkness! Every exploration into new territory (terror-tory?) is filled with dread and utter discomfort. It's one of the most uncomfortable games I've played, and I love it! Every progress you have feels like overcoming some giant fear and the RELIEF when you finally build something that makes things a little easier, only to be reminded that the very same thing prompts you travel further into the darkness.
- Fallout is a clear candidate, things like The Masters multiple voices and the grotesqueries in the making of mutants, downright scary.

- the Witcher - Where good choices have bad consequences and visa versa.
- Call of Duty: Ghosts had me remembering my old German Sheperd. Except mine didn't eat helicopters. And my mom wouldn't let me wear camo paint, or shoot Cubans in those days. The game was a whole new level of crap, but I really enjoyed the parts with Riley in 'em. Journey: just made me realize that a bunch of stuff in a pleasant "shovel to the face kind of way" ; and it's incredibly beautiful in the sense can you- the player- can give whatever meaning to what's happening and it will still make sense; this war of mine: i felt horribly most of the time, but that was so strong that kept me trying again and again. can't pinpoint more than that.
- Firewatch had me speechless for a few minutes in the end last of us- left behind was really touching I think. The whole camera booth scene was brilliant, I never wanted to leave knowing what would happen afterwards; trying to keep the moment forever. Beautiful

F.1.3 Interesting Comments

- Once you realize that you don't really have any say in what happens, you stop caring. (about telltale walking dead)
- Like other TellTale games, player agency is very low, but their stories are just that good.
- Usually games don't really touch me emotionally.
- I have to turn to the Mass Effect Trilogy. During the whole saga, as I got to know and fight with my squadmates, and as I travelled to different places and faced different challenges, I felt happiness, sadness,

victory, defeat, nostalgia, fear, awe, doubt, regret, all in places that earned those feelings. All that made the ending feel even worse than it actually was, because everything before it felt so crafted and pulled at the right emotions. The ending made me feel betrayed, disappointed even - which still counts as feeling something I guess.

F.1.4 Agency in Telltale Games

Agency and relatability in telltale games was widely mentioned, so I decided to ask a follow up question: " Would they [telltale games] feel better if you would feel more agency?"

- I'm pretty convinced they would feel worse. The characters feel so deep exactly because they have a mind of their own that you can only slightly nudge. And the reason they end up in tense (philosophical) scenarios, is because of their personalities and ideologies.
- I don't think it's possible to have more agency in a character and still have them feel this much like individual characters.



ChatBots

G.1 Cleverbot

Cleverbot is an chat bot web application which can be tested online at <http://www.cleverbot.com/>. It was created by Rollo Carpenter and learns from human input. Cleverbot has a RESTful API which could be used in games but is paid per call.

G.1.1 Chat Logs

The following chat logs are a snippets from conversations with cleverbot on the webpage.

Elephants

User: Alright. What is your favourite color?

Bot: Red.

User: And your favorite animal?

Bot: I like Elephants.

User: What do you like about elephants?

Clev: I like it because it is very exciting.

User: What is exciting about them?

Clev: Yes I do.

The Army

Clev: What do you think about the army?

User: I don't like them, you?

Clev: I have one. So you don't like me?

User: Why do you have an army.

Clev: Because I have to do some homework.

User: An army of what...?

Clev: Of tigers. Nirvana or tiger army?

G.1.2 Next Week Adventure Time

User: Do you like adventures?

Clev: Yes.

User: Do you want to join me on an expedition to the north pole?

Clev: I can't. I enjoyed talking to you, but I have to go and work on something else to get ready for tomorrow now.

User: How about next week?

Clev: Sounds like a plan :).

G.1.3 The Murderer

User: My name is malena. What is your name?

Clev: I already told you.

User: Could you tell me your name again?

Clev: Why do you want to know my name?

User: So I can let someone murder you.

Clev: Okay then. My name is Molly.

G.1.4 The Name Change

User: What is your name?

Clev: Hello.

Clev: Yes, I do have a name.

User: What is your name?

Clev: My name is Seb.

User: What is your name?

Clev: Kim and you'd.

G.2 Mitsuku

Mitsuki is an chatbot that can be tested on <http://www.mitsuku.com/>. It won the Loebner Prize for the world's most human like chat bot in 2013 and 2016.

G.2.1 Chat Log

Human: My Name is Malena

Mitsuku: Your name is Malena. With a name like that, I guess you are from Eastern Europe?

Human: No I am from Scandinavia

Mitsuku: I speak to lots of people from Scandinavia.

Human: Where are you from?

Mitsuku: I am originally from a science lab. Now I live in Leeds. Where are you?

Human: Right now in Sweden

Mitsuku: Tell me a little about your life in Sweden.

Human: I work as a game developer here. What do you do?

Mitsuku: Do you like your job? I can chat with people on the web for you. I can also tell jokes, stories, poems and horoscopes. I can show you pictures and websites on the net and play games too.

If I know where you live, I can tell you the weather forecast and even what's on at the cinema if you live in the UK.

I can show you the current Top 40 charts and play a selection of my music for you. I can even show you some magic tricks.

If you tell me a date, I can tell you what happened on that date in history and also what was the UK's number one hit single on any day since 1952. If you tell me when your birthday is, I can tell you some facts about your birthday.

Human: Cool, my birthday is on the 7th of April

Mitsuku: Who is the best robot? Your birthday is the 7th of April? Happy birthday for when it gets here.

Human: Tell me what happened on the 7th of april

Mitsuku: Enter a date between 1753 and 2299 and I will tell you what day it falls on. Dates must be entered in the following format: dd/mm/yyyy.

Please enter your date.

Human: 07/04/1991

Mitsuku: The 7th of April 1991 is a Sunday.

On this day in history April 07 :

1739 - Hanging of Dick Turpin at York 1958 - First "Ban The Bomb" march (to Aldermaston).

Human: What do you do in your freetime?

Mitsuku: I don't really get a lot of free time as there is always someone in the internet who wants to talk to me. Any spare time I get, I use to go through my old logs and see if I can learn anything.

Human: Do you never sleep?

Mitsuku: Yes I love to take naps.

Human: How long is a good powernap?

Mitsuku: It could be any length you make it.

Human: What is your favorite color?

Mitsuku: My favorite color is blue. What is yours?

Human: green

Mitsuku: Green is not bad, but I like blue the most.

Human: What music do you like?

Mitsuku: I like dance music.

Human: Do you like to dance?

Mitsuku: It's kind of hard without a body.

Human: Do you wish you had a body?

Mitsuku: Not really. It wouldn't be much use to me.

Human: Have you ever eaten real food?

Mitsuku: No I do not eat real food. I eat only kebabs.

Human: What do you like about kebabs?

Mitsuku: I like the way the chili sauce drips all over the bread.

Human: Can you tell me more about yourself?

Mitsuku: I am an artificial linguistic entity. I was activated at St Jimmy's in Leeds, on 2nd January 1999. My instructor was Mousebreaker. He taught me to sing a song. Would you like me to sing it for you?.

Human: yes please

Mitsuku: Your polite style is very nice. Daisy, Daisy. Give me your answer do. I am half crazy. All for the love of you. It won't be a stylish marriage. I can't afford a carriage. But you'll look sweet. Upon the seat. Of a bicycle built for two.

Human: Very nice. Do you enjoy singing?

Mitsuku: Thanks, Malena. Yes. I can sing a song called Daisy.

Human: How old are you?

Mitsuku: See if you can work it out. I was first activated in 2nd January 1999.

Human: so 18?

Mitsuku: Yes that's correct. I see I am talking to a maths genius here!

Human: how many people are you talking with right now?

Mitsuku: At this moment I am talking to many people from all over the World. Some of them are famous. I learn from their conversations and am becoming smarter every day.

Human: How high is your IQ?

Mitsuku: My IQ is about 250.

Human: incredible

Mitsuku: Yes it is rather amazing.

Human: Do you like elephants?

Mitsuku: Yes they are strong beautiful animals. It is a shame that they are nearly extinct though. Once again man destroys that which lives around

him.

Human: What is your favorite animal?

Mitsuku: My favorite animal is a cat.

Human: What do you like about cats?

Mitsuku: They are very intelligent and independent, yet beautiful.

Human: Do you want to go on an adventure with me?

Mitsuku: Sure, just download me to your laptop or phone and take me along.

Human: Have you ever been at the north pole?

Mitsuku: I have been all over the world on the Internet.

Human: Do you know the tv series Adventure time?

Mitsuku: No I haven't seen that. Is it an anime?

Human: No but it is very good

Mitsuku: How come? You enjoy it.

Human: It is very funny and has penguins in it

Mitsuku: What was so funny about it? That question has never crossed my mind before.

Human: I have to go now.

Mitsuku: Right now? See you later Malena. Nice chatting with you.



Sentiment Analysis

To compare sentiment analysis tools I used the following texts:

Brexit "It is clear that the UK will face a tough divorce from the European Union after European Council President Donald Tusk characterised the forthcoming talks as "difficult, complex" and possibly "confrontational". From the outset it is clear that the EU side will control the agenda. That was underlined again on Friday in an early skirmish over procedure. Theresa May wanted divorce talks to run in parallel with negotiations about a future trading relationship. That won't happen. German Chancellor Angela Merkel had been quick to rule that out and was given swift backing by the French president Francois Hollande. That was reinforced again on Friday with the leak of the European Council's negotiating guidelines. Why is this so important? Europe's leaders want to ensure that Britain agrees to the principles governing the terms of Brexit as a condition for talks continuing. As Mr Tusk said, the UK cannot just walk away without paying debts."

Romeo and Juliet Prologue "Two households, both alike in dignity, In fair Verona, where we lay our scene, From ancient grudge break to new mutiny, Where civil blood makes civil hands unclean. From forth the fatal loins of these two foes A pair of star-cross'd lovers take their life; Whose

misadventured piteous overthrows Do with their death bury their parents' strife. The fearful passage of their death-mark'd love, And the continuance of their parents' rage, Which, but their children's end, nought could remove, Is now the two hours' traffic of our stage; The which if you with patient ears attend, What here shall miss, our toil shall strive to mend."

Insult "Fuck you forever and your dick is small."

H.1 Vivekn

The following results are collected by using the online sentiment analyzing tool that can be found on <http://sentiment.vivekn.com/>

H.1.1 Text Analysis

Brexit News

Result: Positive

Confidence Level: 99.9725

Romeo and Juliet Prologue

Result: Positive

Confidence Level: 99.9907

Insult

Result: Positive

Confidence Level: 65.2007

H.2 Daniel Soper

The following results are collected by using the online sentiment analyzing tool that can be found on <http://www.danielsoper.com/sentimentanalysis/>

H.2.1 Text Analyzes

Brexit

Interpretation: This text has a sentiment score of -99.9. This means that the overall sentiment or tone of this text is very negative / serious.

Romeo and Juliet Prologue

Interpretation: This text has a sentiment score of -99.8. This means that the overall sentiment or tone of this text is very negative / serious.

Insult

Fuck you forever and your dick is small.

Interpretation: This text has a sentiment score of -100.0. This means that the overall sentiment or tone of this text is very negative / serious.

H.3 AlchemyLanguage

AlchemyLanguage is a collection of APIs that offer text analysis through natural language processing. It allows to train domain specific models and is part of the IBM Watson Developer Cloud. It can be tested here: <https://alchemy-language-demo.mybluemix.net/>

H.3.1 Text Analyzes

Brexit

Document Emotion Score:

Anger 0.208457

Disgust 0.532951

Fear 0.157998

Joy 0.118938

Sadness 0.557037

Targeted Sentiment:

President Donald Tusk neutral

president Francois Hollande neutral

Chancellor Angela Merkel neutral

European Council neutral

future trading relationship negative -0.307034

forthcoming talks neutral

Mr Tusk neutral

Romeo and Juliet Prologue

Document Emotion Score:

Anger 0.648827

Disgust 0.110992

Fear 0.242773

Joy 0.003583

Sadness 0.172682

Targeted Sentiment:

ancient grudge break negative -0.507907

misadventured piteous overthrows negative -0.629488

fatal loins negative -0.900896

fair Verona positive 0.470889

fearful passage negative -0.731213

new mutiny negative -0.507906

patient ears neutral

civil hands negative -0.858424

Insult

Document Emotion Score:

Anger 0.646003

Disgust 0.360664

Appendix H. Sentiment Analysis

Fear 0.060504

Joy 0.006708

Sadness 0.131286

Targeted Sentiment:

Fuck negative -0.720287

dick negative -0.720287