

**ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL**

**DESIGNING EMOTION ANIMATIONS  
AS A STORYTELLING ELEMENT  
IN VIDEO GAMES**



**M.Sc. THESIS**

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**Department of Game and Interaction Technologies**

**Program of Game and Interaction Technologies**

**JULY 2021**



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**İSTANBUL TEKNİK ÜNİVERSİTESİ ★ LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ**

**VİDEO OYUNLARINDA  
HİKAYE ANLATIM ELEMANI OLARAK  
DUYGU ANİMASYONLARININ TASARLANMASI**

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**TEMMUZ 2021**



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**Date of Submission : 11 June 2021**  
**Date of Defense : 06 July 2021**





*To mom and dad,*



## **FOREWORD**

Video games became an important part of everyday entertainment with technological developments that put computers in our pockets however it is believed that entertainment is not their sole purpose. Nowadays, games are becoming more and more important as their potential to make people live through unique experiences getting recognized. The conversation about what can video games achieve while entertaining is getting popular, they are being seen as a new art form other than a pass time activity and even found a place for themselves on museum walls. This new art form is also appreciated as a new storytelling technique. Telling a story through video games opens a whole new ground to the player where they can experience, get involved, and live through all types of emotions.

In this study, we aimed to discover a new way to make people empathize with a video game character using animation. Two different studies with different, simple characters were prepared with the following survey to understand how the perception of an animated character can conduct the gaming experience for the player. The studies were implemented remotely since we have been living through a global pandemic.

My advisor Prof. Dr. Leman Figen Gül has been with me through all the stages of this study. Her support carried the project to where it is now, and I am forever grateful for it. My good friend Ece Naz Sefercioğlu worked hard with me to make my production stage work better than I could ever do, I am thankful to her for all the Unity lessons and support. Also, we have been lucky enough to gather participants who gave amazing insights and help to move the study forward, 130 for the first study and 44 for the second, I thank each one of them. Finally, I want to acknowledge the support of my family who always encouraged me to never give up, and my grandpa whom I lost recently, his support which he always gave generously ever since I can remember, still lives with me.

July 2021

Didem Kübra ATİLA  
Character Animator



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## **ABBREVIATIONS**

|             |  |
|-------------|--|
| <b>2D</b>   | : Two Dimensional                            |
| <b>3D</b>   | : Three Dimensional                          |
| <b>FPS</b>  | : Frames Per Second                          |
| <b>GEQ</b>  | : Game Experience Questionnaire              |
| <b>NPC</b>  | : Non Player Character                       |
| <b>PC</b>   | : Personal Computer                          |
| <b>PINE</b> | : Playable Interactive Narrative Experiences |





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## **DESIGNING EMOTION ANIMATIONS AS A STORYTELLING ELEMENT IN VIDEO GAMES**

### **SUMMARY**

Storytelling in video games is a young subject that turns video game designers into storytellers. The great power of stories, added with the interactive world of video games can turn a subject designed for entertainment into a new ground to communicate. The aim of this study is to explore animation design as an element to improve the storytelling in video games. While combining these two mediums to narrate emotional content, the main concern was communicating basic emotions through character animation and making people empathize with the emotions on-screen and raising the believability of the virtual characters.

Two different games were developed to help this purpose, the first game was aimed to shape the second one by giving an idea of the perception of basic emotions on a simple character design. The second game was closer to a standard gaming experience with a story based mostly on emotional animation design.

The first game was in a survey format, there were different animations implemented on a simple character which was a ball, and participants were asked to determine one emotion they see fit to each animation. The emotions that were taken as a base in the study were the basic emotions which are happy, sad, fear, disgust, angry, surprise, and neutral. The animations were produced using the keyframe animation method which requires an animator to draw – or in the case of 3D, pose – enough frames to convey the animation on the screen. In this study, 3D software, Autodesk Maya, is used to fill in-between keyframes that are determined by the animator. The character rig that was used in the study was Animation Mentor's Advanced Ball character which is consisted of a sphere shape with joints in it to give it the necessary flexibility that is required to implement the animation principles.

While designing the animations, the previously done research about perception of emotions and animation principles were taken into consideration. Some of the principles had a higher influence than others because of the simple shape of the character. There were six animations in total: two happy, one sad, one fearful, one surprise, and one angry. Disgust was not a part of the study since its conveyance is more complex and harder to represent on a simple ball.

There were 130 participants in the first study. It was presented as an online survey that people can interact through their phones, computers, or any other technological devices available to them that have an internet connection and a web browser in order to keep it simple and make it more accessible.

The results showed that some basic emotions were possible to convey even when the character used was extremely simple. While some emotions were perceived as intended by more than half of the participants, the others did not give clear results.

The feedback taken from the first game paved the way for the second game of the study. The second game aimed to convey a story that can interpret at least two of the

basic emotions in and freer interactive environment. For this task, the story and animations were designed together. In the design process, the results of the first game were kept in mind. The emotions that were understood clearly were used in the game while the animations that did not give clear results are left out.

The character used in the second game was a little bit more complicated than the ball. It was a sphere with two legs and had a belt in the middle of its head in order to make the animations read better by the players. The rig that was used in the study was the Ultimate Walker rig by Uğur Ulvi Yetişkin. The animations, again, were created in Autodesk Maya and the game was developed in the Unity game engine.

The story used embedded and emergent narratives together which gave the player two different options at the start, but the end of the options was predetermined. The aim was to give players enough freedom that would nudge them to exploration while having them experience both sad and happy endings. At the end, they were asked to fill the game experience questionnaire which is built to measure positive-negative experiences as well as immersion and social presence.

The game environment had a plain design to not to distract the player from the character animations. A two levelled closed area was designed, the upper level has consisted of a labyrinth that contains no danger. Random sculptures were placed inside the labyrinth in order to make people recognize the places they have been through. The lower level was full of traps that made the player character walk slower when they contact with them.

The player started the game in a room with two doors in front of them, the third-person camera is spaced to keep the character in focus to give the player a clearer view. The door to the left led to the labyrinth which takes the player to the starting point while the door on the right led to the part full of dangers. Two idle animations were designed and used in this part. First, neutral breathing animation that played at the start and if the player chooses the left door. Secondly, the shaky animation showed fear when the character comes close to the right door and kept playing if the player goes through this door. It was added to indicate that the character does not want to go to the right path because there are dangers on the way.

The only words that were used to help players get started in the game were the “Explore.” text on the left wall of the opening room and they were instructed to use either WAD or arrow keys on the keyboard in order to move.

If the player chose the left door first, they go into a labyrinth. Its complication was simplified by added shapes around the labyrinth and if they try to interact with the shapes arrows appear on the wall that puts them in the right path again. If they completed the labyrinth, they came out of the opposite side of the prime room and an animation that showed the character observing the room and getting sad is played upon entering the room.

Afterward, they did not have an option but to go to the right path. The obstacles on the path were designed to make the player feel helpless and establish empathy with the character that is in the same situation. The four obstacles were spikes coming out of the ceiling abruptly, followed by fast turning fans, moving walls, and shaky floors. There was not an option to start over if you die as most games have in order to keep the experience closer to reality, but the obstacles affected the character’s movement speed, caused it to decrease to indicate hurting. The fearful animation played through the path.

At the end of the final obstacle, there was a slope that rises above as a final difficulty. The end of the slope opened into a big room with a door on the other side and the character finds their child in the room causes a happy animation to play.

The testing was implemented remotely due to the global pandemic. Participants received two links with an explanation that tells them to play the game and take the survey right after. The game only required a computer and a working internet connection as well as the survey. The participants were not informed about the aim of the study or given any information about the game except for the “Explore” text and key commands. The test was shared on multiple social media platforms in order to reach a wider audience. The survey consisted of the pre-determined game experience questionnaire with a few custom questions added at the end that asks about the player’s age, gender, occupation, the path they took first, feelings while playing the game, and the most significant part of the game to them.

With the participation of 44 players, the results of the survey showed that both pre-determined and custom questions that follow the main purpose of the study were given positive answers. Character’s feelings affected what some players did as anticipated as well as made them feel what the character is feeling at the moment even though the experience was not very long. Most people were intrigued by the story and some even requested to play more if possible while some wished for a richer environment and were interested in the external elements more than the character.

This study shows that animations designed to demonstrate basic emotions could enrich a game experience and opens the ground for further testing in the area. A more complex character that contributes to an emotional story in an interactive setting is aimed to be the subject for further studies. The outcomes could be helpful with the animation design process on video games to give the players a wider link between them and characters, furthermore, it can open grounds for deeper storytelling opportunities in interactive settings.



## VİDEO OYUNLARINDA HİKAYE ANLATIM ELEMENTİ OLARAK DUYGU ANİMASYONLARININ TASARLANMASI

### ÖZET

Video oyunlarında hikaye anlatımı, video oyun tasarımcılarını hikaye anlatıcılarına dönüştürme potansiyeline sahip, gelişmekte olan bir alandır. Video oyunlarının etkileşimli dünyasıyla bir araya getirilen hikayelerin gücü, çoğunlukla eğlence için tasarlanmış bir araç olan oyunları, iletişim kurmak için yeni bir zemine dönüştürebilir. Bu çalışmanın amacı, video oyunlarında hikaye anlatımını geliştirmek için bir olarak animasyon tasarımının kullanımını keşfetmektir. Duygusal içeriği aktarmak için bu iki ortamı birleştirirken temel kaygı, karakter animasyonunu kullanarak temel duyguların iletilmesi, insanların ekranda tanıklık ettikleri duygularla empati kurabilmelerini sağlamak ve sanal karakterlerin inanılrlığını arttırmaktır.

İnsanların ekranda aktarılan duyguları nasıl algıladığını öğrenme amacı ile bu çalışmada iki farklı oyun geliştirilmiştir. İlk oyunda basit bir karakter tasarımı üzerinden duyguların algılanması ile ilgili fikir sahibi olunması sağlanmıştır. Bu fikir ikinci oyunu şekillendirmek amacıyla uygulanmıştır. İkinci oyun yoğun olarak duygu animasyonlarının tasarımına dayanan bir hikaye ile standart bir oyun deneyimine dayalı yakın bir test olarak tasarlanmıştır.

İlk oyun, bir top olan basit bir karakter üzerinde farklı animasyonlar uygulanmış ve katılımcılardan her bir animasyona uygun gördükleri bir duyguyu belirmeleri istenen bir anket formatında sunulmuştur. Araştırmada temel alınan duygular; temel duygular olarak tanımlanmış olan mutluluk, üzüntü, korku, tiksinti, öfke, şaşkınlık ve bunların yanında nötr ifadeleri olarak belirlenmiştir. Animasyonlar, bir animatörün hareketi ekrana iletmeye yetecek kadar arka arkaya çizmiş – ya da 3B için, doğru poza getirilmiş – olduğu karelerin arka arkaya oynatılmasıyla uygulanan keyframe animasyon tekniği kullanılarak üretilmiştir. Bu çalışmada animatör tarafından belirlenen anahtar karelerin arasındaki geçişi sağlamak için Autodesk Maya adlı 3B yazılım kullanılmıştır. Sahip olduğu iskeletle animasyon ilkelerinin doğru uygulanabilmesi için gerekli esnekliği elde eden ve şekil olarak bir küreden ibaret olan Animation Mentor kursunun Gelişmiş Top karakteri çalışmanın karakter modeli olarak kullanılmıştır.

Animasyonlar tasarlanırken, duyguların algılanması ve animasyon prensipleri ile ilgili araştırmalar dikkate alınmıştır. Animasyonlar uygulanırken temel animasyon prensipleri ve Richard Williams'ın Animator's Survival Kit isimli kitabındaki öğretileri göz önünde bulundurulmuş ve karakterin basit şekli nedeniyle temel ilkelerin bazıları diğerlerinden daha yüksek bir etkiye sahip olmuştur. İki adet mutluluk, bir üzüntü, bir korkulu, bir şaşkınlık ve bir öfke olmak üzere toplamda altı adet animasyon üretilmiştir. Tiksinti duygusu, aktarımı daha karmaşık bir duygu olduğu ve basit bir top üzerinde temsil edilmesi daha zorlayıcı olduğu için çalışmaya dahil edilmemiştir.

İlk oyunda araştırmanın çalışma grubunu 18-58 yaş aralığında 130 katılımcı oluşturmaktadır. Çalışma, erişilebilirliği arttırmak ve süreci daha basit tutmak için kişilerin telefonları, bilgisayarları veya internet bağlantısı ve web tarayıcısı bulunan diğer teknolojik cihazlarını kullanarak etkileşim sağlayabilecekleri çevrimiçi bir anket formatında sunulmuştur.

Araştırmanın bulgularında kullanılan karakter son derece basit olduğunda bile bazı temel duyguların iletilmesinin mümkün olduğu ortaya çıkmıştır. Araştırmaya dahil edilen beş duygudan mutluluk, üzüntü ve korku duyguları katılımcıların yarısından fazlası tarafından öngörüldüğü gibi algılanırken, öfke ve şaşkınlık öngörüldüğü gibi algılanmamıştır.

İlk oyundan alınan geri bildirim, çalışmanın ikinci aşaması için tasarıma öncü olmuştur. Daha özgür etkileşime izin veren bir ortamda temel duygulardan en az ikisini kullanarak oyunculara bir hikaye aktarmak ikinci oyunda temel amaç olmuştur. Bu amaç için, hikaye ve animasyonlar birbirleriyle ilişkili olarak tasarlanmıştır. Tasarım süreci, ilk oyunun sonuçları çerçevesinde şekillenmiştir. Oyunda, ilk çalışmada daha net sonuçlar veren animasyonlar temel alınırken, sonuçları belirsiz olan duygular dışarıda bırakılmıştır.

İkinci oyunda kullanılmak üzere, ilk oyunun karakteri olan topa göre daha karmaşık bir karakter seçilmiştir. Karakter, iki ayağı olan bir küre ve kürenin ortasında animasyonların oyuncular tarafından daha iyi anlaşılmasını sağlayan bir kemerden oluşmaktadır. Uğur Ulvi Yetişkin'e ait olan Ultimate Walker modeli çalışmada ana karakter olarak kullanılmıştır. Animasyonları oluşturmak için tekrar Autodesk Maya programı kullanılmış ve oyun Unity oyun motoru üzerinden geliştirilmiştir.

Hikaye, oyuncuya başlangıçta iki farklı seçenek veren, ancak seçeneklerin sonu önceden belirlenmiş olan gömülü ve ortaya çıkan anlatı biçimlerini birlikte kullanarak oluşturulmuştur. Hikayenin amacı insanlara hem üzücü hem mutlu sonları yaşatmak ve onları keşfetmeye itecek kadar etkileşim özgürlüğü sağlamaktır. Oyunun sonunda her oyuncudan olumlu-olumsuz deneyimler, oyuna kendilerini kaptırma seviyeleri ve sosyal mevcudiyetlerini ölçmek için tasarlanmış oyun deneyim anketini doldurmaları istenmiştir.

Oyunun ortamı, oyuncuyu karakter animasyonlarından uzaklaştırmayacak sade bir ortam olarak tasarlanmıştır. İki seviyeli, kapalı bir alandan oluşan ortamda üst seviye tehlike içermeyen, yalnızca oyuncuların geçtikleri yerlere aşinalık sağlaması amacı güden heykellerin rastgele yerleştirildiği koridorlardan oluşturulmuştur. Sonraki seviyede oyuncu, karakterin temas durumunda yürüme hızının yavaşlamasına sebep olan engellerle tasarlanmıştır.

Oyuncu, karşısında iki adet geçit bulunan bir odada oyuna başlatılmış, oyuncuya karakteri odak noktasında tutan net bir görüş alanı sağlamak için üçüncü şahıs kamera kullanılmıştır. Başlangıç odasında soldaki geçit oyuncuyu başlangıç noktasına geri getiren labirente, sağdaki geçit ise tehlikelerle bezeli olan yola çıkmak üzere tasarlanmıştır. Animasyon tasarımında ilk çalışmadaki prensipler göz önünde tutulmuştur. Bu bölüm için iki adet durma ve iki adet yürüme olmak üzere toplam dört adet animasyon tasarlanmıştır. İlk olarak başlangıçta ve oyuncunun soldaki yolu seçmesi durumunda oynayan, nötr nefes alıp verme ve nötr yürüme animasyonları yapılmıştır. İkinci olarak ise karakterin titremesiyle ifade edilen korku animasyonlarının durma ve yürüme halleri tasarlanmıştır. Bu animasyon, karakter sağdaki yola yaklaştığında korkuyu oyuncuya aktarmak için oynatılmış ve sağdaki yola girme durumunda son kısma kadar oynamaya devam etmiştir. Nötr ve korku

animasyonları, yoldaki tehlikeleri oyuncuya tahmin ettirmek ve merak uyandırmak amaçları için kullanılmıştır.

Oyuncuların oyuna başlamasına yardımcı olmak için oyun içinde kurulan tek yazılı iletişim başlangıç odasının sol duvarındaki “Keşfet” kelimesi olmuştur. Hareket etmek için klavyedeki W, A, D ya da ok tuşlarını kullanmalarını belirten gerekli talimatlara oyun penceresinin altında yer verilmiştir.

Beklenen seçim, oyuncuların önce soldaki yolu seçmesi ve labirente girmesi yönünde olsa da oyunun başlangıcında oyuncuları belirlenmiş geçide yönlendiren bir ifade kullanılmamıştır. Labirentin etrafına eklenen şekiller karmaşıklığını azaltmak ve oyuncuyu bir bağ kurmaya itmek amacını taşımakta olup, bu şekillerle etkileşime girmeye çalıştıklarında duvarda onları doğru yola yönlendirecek ok işaretleri eklenmiştir. Labirenti tamamladıklarında başlangıç odasının arka duvarında yeni açılan kapıdan geçtiklerinde karakterin odayı gözlemlediğini ve üzüldüğü gösteren bir animasyon oynatılmıştır.

Buradan sonra sağdaki yola girecekleri varsayılmıştır. Yoldaki engeller karakterin içinde bulunduğu stresli durumu oyuncuya hissettirmek ve karakterle empati kurmasını sağlamak için tasarlanmıştır. Oyunda; aniden tavandan çıkan dikenler, hızla dönen fanlar, hareketli duvarlar ve titreyen zeminler olmak üzere dört tip engel yer almıştır. Deneyimi gerçekliğe daha yakın tutmak için baştan başlamak yerine incindiğini göstermek için karakterin hareket hızının azalması sağlanmıştır.

En son engel aşıldıktan sonra dik bir rampa eklenmiştir. Rampanın sonu, karşı duvarında bir kapı bulunan ve içinde karakteri bekleyen çocuğunu bulduran bir odaya çıkartılmış ve birbirlerini görmeleri durumunda iki karakterde de mutluluk animasyonu oynatılmıştır.

Test aşaması, içinde bulunduğumuz küresel salgın dönemi nedeniyle uzaktan uygulanmıştır. Katılımcılara, oyunu oynamaları ve hemen ardından ankete katılmaları talimatlarını bildiren bir açıklamayla birlikte iki adet bağlantı iletilmiştir. Oyun ve anket çevrimiçi platformlar üzerinden uygulanmış ve katılımcılara gereksinimlerin sadece çalışan bir bilgisayar ve internet bağlantısının yeterli olduğu bilgisi verilmiştir. Bunun yanında, tuş komutları ve oyun içi metin haricinde çalışmanın amacı veya oyunun içeriği hakkında hiçbir ön bilgi verilmemiştir. Test, daha geniş bir kitleye ulaşmak için çeşitli sosyal medya platformlarında paylaşılmıştır. Sonrasında doldurulması gereken anket, önceden belirlenmiş oyun deneyim anketinin yanı sıra, oyuncunun yaşı, cinsiyeti, mesleği, ilk izledikleri yol, oyunu oynarken neler hissettikleri ve oyunun en önemli buldukları kısmı hakkında sorulardan oluşmaktadır. 19-35 yaş arası 22’si kadın 22’si erkek olmak üzere 44 adet katılımcı oyunu oynamış ve ankete katılmıştır.

Çalışmanın bulgularına göre, çalışmanın temel amacını destekleyen hem önceden belirlenmiş hem de özel sorulara olumlu cevaplar verilmiştir. Karakterin duyguları bazı oyuncuların hareketlerini beklendiği gibi etkilemiş ve oyuncuların, deneyim çok uzun sürmese de karakterle empati kurabildikleri görülmüştür. Katılımcıların %46’sı bir miktar da olsa hikayenin ilgilerini çektiğini söylemiş ve cevaplama zorunlu olmayan oyunu oynarken oyuncuların ne hissettikleri sorusuna verilen yazılı cevapların 18’inde “ilginç” ve “merak uyandırıcı” benzeri ifadeler yer almıştır. Cevapların 11’i “amaçsız”, “sıkıcı” gibi ifadeler içermiş olup geri kalan 11 cevap oyunun oynanışı ve çevre tasarımıyla ilgili yorumlar içermektedir.

Bu çalışma, temel duyguları göstermek için tasarlanan animasyonların bir oyun deneyimini zenginleştirebileceğini ve bu alanda daha karmaşık testler için zemin açılabileceğini göstermiştir. Etkileşimli bir ortamda duygusal bir hikayeye katkıda bulunan daha karmaşık bir karakterin ilerleyen çalışmalara konu olması amaçlanmaktadır. Sonuçlar, oyunculara video oyunu karakterleriyle daha derin bir bağ kurmalarını sağlamak için video oyunlarındaki animasyon tasarım sürecine yardımcı olabilir ve etkileşimli ortamlarda daha verimli hikaye anlatım fırsatları için zemin hazırlayabilir.



## 1. INTRODUCTION

Video games are gaining important ground in everyday life not just as an entertainment instrument but as new art. They are appreciated for their capacity to engage and converse with people [1, 2]. Their nature that brings different types of communication and design techniques together and complements multiple human senses makes them accessible. Even though it is proven that the most important part of a video game is the interactivity element [3, 4], in most cases this interactivity needs the visual and audial assets that complement it to be more believable [5].

Video game design is a subject that gathers various art forms such as writing, painting, music, storytelling, cinematography, and so on [6]. The part that all of these art forms have to consider in a video game is the character. Character's believability whether it is the main character or a non-playable character (NPC), is the key to ensure immersion and flow [7-9]. Immersion is defined as being detached from surroundings and feeling the reality of the game as a new world. It is the desired state of mind for a player to be in [10]. Immersion is also described as an indicator for flow [11, 12]. Csikszentmihalyi (1989) named the flow theory and defined it as the holistic sensation when people feel total involvement [13].

In a story-driven game experience, an interesting character that balances believability with the interactive narrative is important to ensure engagement through immersion and flow [14]. Establishing a character through character design and movement is called characterization and it defines a character's core. Characterization includes concrete information about the character like; age, sex, education, occupation, clothing, traits, and habits that can be seen in a first look [9, 15].

The movement part of the characterization is created by animation in a virtual environment. Character animation is all about emotions; it is acting through a virtual character. Its quality is determined by how alive the character feels and how much care the audience gives them [16]. Character animation must address the emotions of the audience whether it is on a movie, game, or a different medium. It needs to read

well, it needs to be informed about its audience and it needs to be about the feeling [17].

One of the first computer-animated short films *Luxo Jr.* proved that character animation does not need conventional methods to connect with its audience. In *Luxo Jr.*, there are two lamps with personalities, and the only indication of their personalities is their body language. The audience connects with the younger, playful lamp simply because it's just like a kid who wants to play, jumps around, makes irrational decisions, gets over negative thoughts quickly while the bigger "parent" lamp is more complex, it's comfortable in its zone but when the ball gets away, he's not willing to go to get it or it doesn't want its child to go either, it gets away from the way of the big ball to not to get hurt at the end and it even reprehends its child for breaking a toy [18]. Animators are trying to discover ways of connecting to the audience with body language ever since the art has born [19].

## **1.1 Purpose of Thesis**

The main purpose of this thesis is to figure out how character animation shapes the player experience in story-driven video games. Helping to create a meaningful player experience by designing clear animations that shows emotional content and improving the storytelling within the interactive nature of games was the objective. To actualise this, perception of animation on non-human characters needed to be understood first in a player focused study. How character's movement effect player's choices while playing a game is tested in two stages. First stage consisted of a simple perception test while the latter stage includes a more elaborated gameplay test that uses basic emotions as a story element. Animation sequences for both stages were created in Maya. The first stage was staged as a survey on Google Survey and the production of the second stage was made with Unity game engine.

## **1.2 Research Questions**

What makes video games unique as a storytelling medium was the first question that was asked. The storytelling elements in an interactive environment were dismantled and the focus became the character animation as this thesis' subject. From that question, the animation as a medium was investigated and this investigation led to

the preliminary study that measures the perception of an animated character. With this knowledge the main study was designed to answer the following questions:

Research Question 1: Can simple animation design reflect emotions in an interactive environment?

Research Question 2: Do people show empathy towards a character that does not resemble them by only seeing its movement?

Research Question 3: Does the empathy they have for the character affect the player's choices in a game?

Research Question 4: Does video game storytelling get richer with emotional animation design for in-game movement?





## 2. LITERATURE REVIEW

### 2.1 History of Animation

Animation, by definition, is the technique that allows people to create a movement in a virtual environment. It is simply the art of making an object or a character move, whether it is created by a pen, computer program, sculptures or puppets does not matter. However, its potential to be much more than reflecting movement was recognized since the introduction of the technique [19].

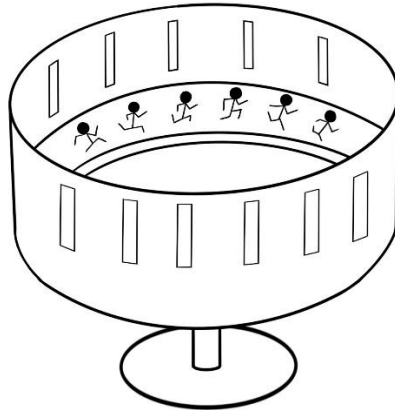
The word animate means bringing life and energy hence animation, in its history, never has been just an instrument to make virtual agents move, it is appreciated for its potential to tell a story, make a comment, teach a lesson, and create an illusion of life [20]. Nearly all the first animated works of the 20th century were trying to be impactful in different ways. One of the first animation directors, Winsor McCay, expressed how he worked relentlessly to make this new art form into something that can be effective and touching [17].

The history of animation goes beyond any of the currently known methods of animation. Humans were trying to reflect motion on cave walls by drawing multiple pairs of legs to imitate motion. Ancient Greeks decorated their pots with drawings of animals and humans in motion. Leonardo Da Vinci did some sketches that show different body parts in motion; the most famous example is his renowned drawing Vitruvian Man. 19th century witnessed to first machines which were invented solely for creating the illusion of motion [19].

**The Thaumatrope (1824):** It was a cardboard disc held between two strings with one drawing on each side. When you pull the strings the cardboard disc begins a fast movement, and the observer sees two drawings as one [19-21].

**The Phenakistoscope (1831):** A shaft with two discs mounted on each side. Both discs have slits around their edges and the rear disc has a drawing sequence between slits. When both discs are turned together it seems like drawings are moving through slits [19, 21-23].

**The Zoetrope (1834):** It consists of an empty cylinder on a shaft that has slits around and a drawing sequence inside it (Figure 2.1). Looking through the slits while it is spinning gives an illusion of movement. Despite mostly being used as a toy, zoetrope is believed to be one of the inspirations for cinema and was helpful for the improvement of Gestalt psychology [19, 20, 22-25].



**Figure 2.1 :** A zoetrope.

**The Flipbook (1868):** A book formed by a drawing sequence. When its pages flipped the drawings seem like they are moving [19, 20, 23].

**The Praxinoscope (1877):** A zoetrope with a set of mirrors as a second cylinder in between the first one to rotate the images. It is considered the first prototype of cartoons and laid the foundation for more complex projectors [19, 20, 23, 26].

In the early 20th century, animation was first used as special effects in live-action movies as seen in Georges Méliès' and J. Stuart Blackton's works, respectively [20]. Blackton is also credited for the first animated movie, *Humorous Phases of Funny Faces* in 1906. *Fantasmagorie* by Émile Cohl starred quite simple drawings of stick figures but got attention with its compelling story. In 1911, Winsor McCay was the first person who considered animation as an art form. His first movie, *Little Nemo*, was formed by 4000 drawings and it was a big hit when it was shown at the theatre. Afterwards, McCay created the first animated animal with a personality, *Gertie the Dinosaur* which demonstrated the first character animation, and used animation as a propaganda tool in the first animated documentary *The Sinking of Lusitania* which retells the catastrophic disaster [19, 20, 23].

In 1923, Disney made *Alice's Wonderland* which became impactful in the animation field. The Disney Studios continued their major contributions to progress animation

technologies. 1927 introduced sound to movies and animation was not late to follow this new development. The first animated movie that has synchronized sound effects has become Disney's *Steamboat Willie*. This led to a massively successful era for Disney Studios which produced the first full-colored animation, *Flowers and Trees* (1932), and then the first feature-length animated movie, *Snow White and the Seven Dwarfs* (1937) [17]. That gave the studio a commercial success and enough resources to design a systematic method, known as 12 principles of animation, to create compelling animations. Being able to do mass production by using these rules marked the starting of the animation industry as entertainment [17, 20]. While improving this new art form by their own rules, Disney animators did not forget to see animation as what it is, a powerful art form that can bring characters to life [17]. As Catmull (2014) described: "The definition of superb animation is that each character on screen makes you believe that it is a thinking being." (p. 8) [16].

With the development of computer technologies, the growth of animation became more visible. The creation of 3D animation software opened the door to a new type of animated movies [16] as well as a cinematic approach to video game animation [2]. Animation became more accessible with common animation software and the work of artists like Mark Leckey and Jordan Wolfson showed the potential of modern animation as an art form [27]. The use of digital animation allowed video games to be more realistic and narrative-focused, and with the interactive nature of video games, and enrich the already popular medium [28].

## **2.2 Video Game Animation**

Video games had a similar path to animation in their history; their progress followed available technologies from the first interactive video game released, *Spacewar* in 1962, to this day and animation was not a feature until the 1980s. *Pacman* (1980) was the first game to have cut scene animations to add a story element. However, it was mostly 2D and did not have much room for complexity until the 90s. Digital animation became popular upon the release of *Mortal Kombat* (1992). The same year, *Wolfstein 3D* created a big impact with a full 3D map and animations of non-playable characters. In 1997, *Final Fantasy VII* was praised for its animations and became a big hit [29].

In the 2000s, with better computer-generated animation, the development of technologies like motion capture, better home gaming systems that allow faster rendering rates, and the expanding definition of what makes a game; animation became more relevant for game design. Since video games' interactive nature requires instantaneous rendering, it brings different technical challenges to the table for animation design. Animation must be responsive enough to make the player experience more authentic and fun, but because the creation of animation is high costing, time-consuming, and has endless possibilities; the animation director for a game must prioritize animations from essential to less essential within the limits of production. This usually made animation a secondary element for game design [28] but video games are still a relatively young medium for entertainment and there is a lot of room for progress [30]. As it is seen in recent indie titles like *Inside* (2016), *Little Nightmares* (2017), *Gris* (2018). These games only use two elements to guide the audience: animation and environment design. Or there are games like *Dear Esther* and *Gone Home*, which are more like walking simulators that use voice design and environment to tell stories. Haggis described these games as Playable Interactive Narrative Experiences, PINE for short. He explains that a PINE has different goals than a traditional game; its highest priority is not being fun but giving the player a unique interactive experience, usually with emotional storytelling and rich character designs [31].

### **2.3 Storytelling in Animation**

Storytelling is one of the oldest communication phenomena of humankind, creating a platform to express emotions, inspire and entertain others and improve their understanding of the world [32]. The human brain creates stories even when it sees unconnected words, images, footage. Their understanding depends on the relationship between what is perceived with available senses and humans tend to build a story with perceived elements to make more effective connections, and learn [33, 34]. Storr (2019) writes, "When shown cartoons of simple moving shapes, viewers helplessly inferred animism and built cause and effect narratives about what's happening: this ball is bullying that one this triangle is attacking this line, and so on." (p. 34) [33]. Communicating stories, in other words, storytelling, is not an easy task given the unformulated aspects of stories. One can follow all the rules of

storytelling yet may not have an engaging story if it lacks the right energy. McKee (1997) explains creating that atmosphere requires a skilled imagination mashed with real-life experience. He says that people like to see stories on screen for the same reason, not to escape reality but to develop empathy, feel and learn [32, 35]. This type of visual storytelling should leave space for the viewer to anticipate, feel and make their own interpretations [33].

When it comes to stories and animation, the character must be mentioned. A story is as strong as its characters and people are more interested in characters than events. A compelling fictional character should make people feel positive and negative while observing [33]. Good stories are about the human condition; the character's reaction, and takeaway out of a scene are more important than anything else [32, 33]. The personality of the character could be shown with anything; thoughts, dialogue, social behaviors, memories, desires, and sadness.

Involving animation in this process creates character animation and it is all about emotions; it is basically acting through a virtual character. Its quality is determined by how alive the character feels, how believable their thought process is, and how much care the audience gives them. Character animation must address the emotions of the audience whether it is on a movie, game, or a different medium. It needs to read well, it needs to be informed about its audience, it needs to be about the feeling, and it should engage the audience or the player [17]. That requires a clear delivery for the character's thought process, hence acting. Acting is something people do unconsciously every day. Humans tend to act differently in different situations and around different people. There are different characters within everybody, an actor's job is figuring out why somebody does what they are doing [19, 36]. And acting requires great control over body language. The same consciousness helps an animator when it comes to acting. Williams (2009) wrote that art director Ken Anderson said: "Pantomime is the basic art of animation. Body language is the root and fortunately it is universal." (p. 324) [19].

## **2.4 Perception and Emotions**

In the early days of the 20th century, the German psychologist Mac Wertheimer suggested a perception idea after seeing a zoetrope. He started making his own zoetrope that did not have the following images that creates a sequence instead it

included unrelated shapes. From that, his apparent moment experiences were born which were aimed to investigate the perception of motion. Being worked with the philosopher who suggested people can recognize a melody even when it is played on different keys, Wertheimer made the connection and realized that movement is not perceived in pieces but as a whole that connects the dynamic relationship between individual ingredients. Wertheimer then published his findings on the perception of movement which became the foundation of gestalt psychology [24, 37, 38].

Gestalt psychology provides an explanation for human perception, using a scientific method. Gestaltists use human's tendency to see individuals as groups to explain that a unified structure that obeys certain rules is stronger than the separate parts. A classic example of this was movies, whether live-action or animation, which were created with individual frames, and every frame was designed with its composition. Although what makes them meaningful was projecting the frames together to form the movement and the story. Different design fields like cinema, graphic design, architecture, paintings, and so on use gestalt principles to communicate with people [39]. As Kepes suggested, organizing shapes, colors, even ideas are almost an instinctual process and human perception can not be taken into consideration with overlooking this instinct [39, 40].

Gestaltists preferred to get depictions of subjective experiences rather than observer's objective description while studying human perception. In their studies, the observers were not required to have any pre knowledge or training about the subject and they did not create highly controlled conditions to experiment within. It is believed that this would be helpful to understand natural human behavior [41, 42].

Perception of an emotion, an object, an art piece, a character, a play, of a human being is not an easy thing to generalize. Everybody has their own background of events and emotions that affects their way of seeing the world around them and their interactions [43, 44]. This behavior is also studied by Gestalt psychologists. Arnheim (1949) discussed that body language is also perceived and understood as an indicator for personality; however, it is not isolated from shapes and colors like the shapes of face and body or the clothes the person chooses. Arnheim wrote that expressions are invisible, and experience makes them meaningful [45].

On the contrary, some studies showed that human perception is simulated. The human brain observes the actions of others and tries to predict the outcome while trying to make sense of the intentions of other biological beings, even when they are infants [46]. Also, a person's first impression of another being is primarily focused on the emotional content [43]. Ekman (1982) claimed that human expression is universal and defined the basic emotions as easiest to identify on other humans, which are happiness, sadness, anger, fear, surprise, and disgust. In his studies about the perception of emotions, he showed that it is easier to distinguish emotions through facial expressions and recognition. But this does not decrease the meaning and importance of body language as an indicator of intentions [47].

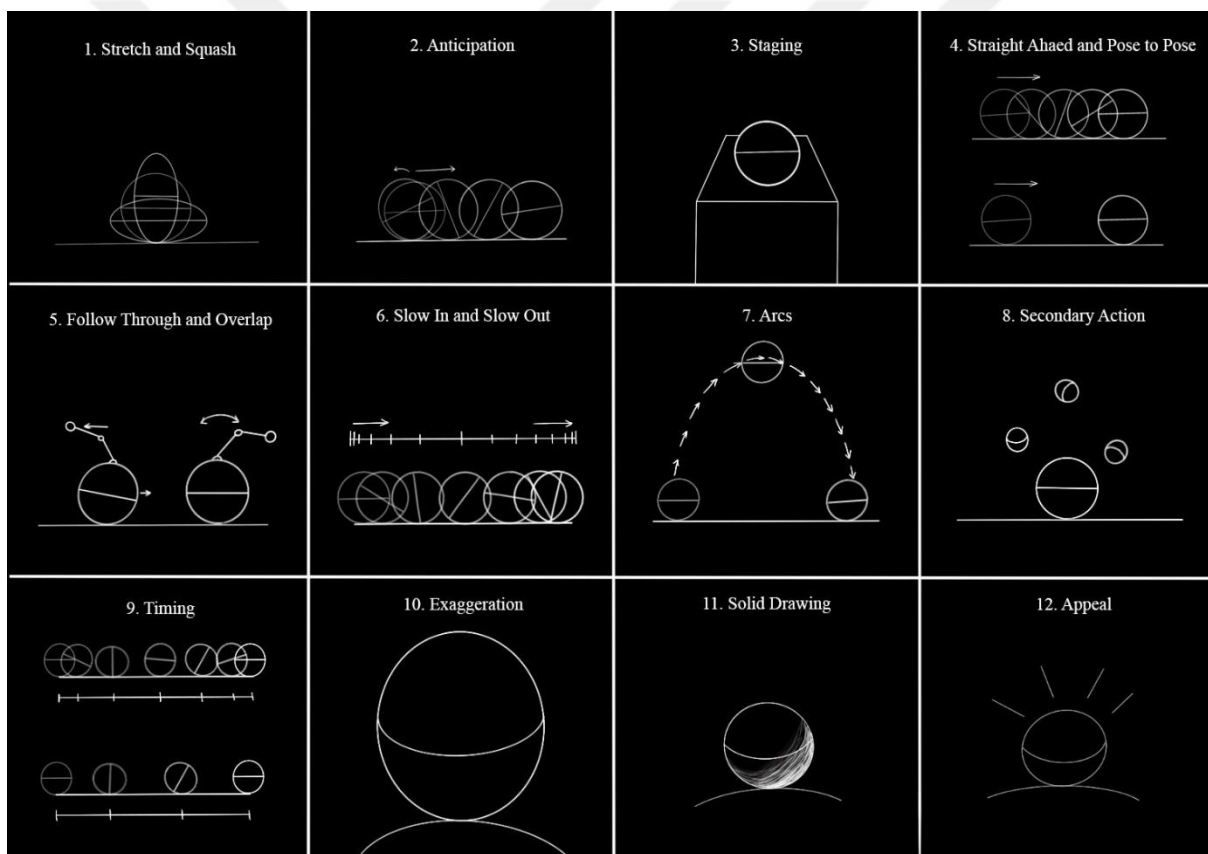
In a 2008 study, emotional recognition based on the perception of the body pose of single images which does not show the facial expression clearly proposed a system where the computer categorizes these images into seven (six basic emotion + neutral). This study proved that although human expression is extraordinarily complex, it can be recognized based on 2D images and proposed an improvement can be made with the addition of 3D images and movement [43].

## **2.5 Principles of Animation**

The twelve principles of animation, as visualized in the Figure 2.2, were found to create a ground for the different aspects of animation design. They are used to explain various facts about the animated object/character and their emotional state depending on the scene they are in. Whether the animation is for a short movie or a game, these principles are the core of the animation design. Here below, there are short explanations for these principles [17-20, 28].

**Squash and Stretch:** It is the movement of an object's shape caused by the energy flow. It is affected by the environment, the surface that the object contacts, the object's material, and the velocity of the object. For example, a plastic ball when it is bouncing; squashes on impact and stretches when it bounces back to the air. The more an object squashes and stretches, the more cartoony it looks. In games with a realistic style, crouching before a jump and extending limbs of a character during the take-off could be an example of squash and stretch.

**Anticipation:** Movement usually does not start right away. When something starts moving forward suddenly, it looks stiff and robotic. Anticipation is the technique that allows the animator to make the audience anticipate the movement before it happens by making the reverse movement just for a couple of frames, so they are prepared for what is coming. For example, a person does not punch something straight away. First, they pull their hand back and then move it forward for the punch. In cartoony animation, the amount of anticipation is usually determined by feeling. The anticipation gives the audience an expectation, so the amount of anticipation is in direct proportion to the movement that follows it. In games, anticipation gets trickier because it might delay the interaction and confuse the gamer. It is more exaggerated in NPC movements to make the player guess what is coming.



**Figure 2.2 :** Twelve principles of animation

**Staging:** Staging is important to show the idea of the scene clearly to the audience. It should not be too complicated, confusing, or crowded. If there is an essential action in the scene, it should be the only big movement. In games, staging is important because it usually guides the player. The difference in games, staging must be considered in level design and lighting as much as it is considered in animation.

**Straight Ahead Action and Pose to Pose:** These principles are more important for the production part because they are different approaches to produce animations. Straight ahead means, in a scene, the animator starts from the beginning and goes frame by frame to compose the movement. Pose to pose requires a more general approach, while doing the pose-to-pose animation, the animator first puts in the key poses also called storytelling poses. After showing what will happen in the scene they put in in-betweens until the scene is animated clearly. Even though straight ahead seems to suit 2D animation more, both of these techniques could be used in the same project, it depends on the scene and animator. But in games, the most used technique poses to pose because it gives faster results with rough animation and easier to revise.

**Follow Through and Overlapping Action:** The body, whether it is a human or an animal, never moves in blocks. It does not start moving or stop suddenly. There is always a looser part following behind like a ponytail, ears of a rabbit-like creature, or a clothing piece. This action is named follow through. Similar to that, overlapping is the continued action of those same limbs when the movement stops. It means a character could stop running suddenly but pieces of their clothing, their hair, even their head shoot forward and stops later than their feet. In games, uses of these principles are as a cooldown time before the player takes the control of the action again or in cloth simulations to improve animation quality.

**Slow In and Slow Out:** This phrase is used to indicate the acceleration and deceleration of movement. While trying to figure out what looks better to the audience, Disney animators analyzed real-life actions carefully to add the reality in their cartoons and improve the believability. This principle is important to show the weight of a moving object but also suffers from the same problem with anticipation. In-game animation the player has to get an immediate response to their actions, and this has to be kept in mind while making gameplay animation.

**Arcs:** Most actions follow a circular path in real life, except for some exceptions like a woodpecker or some insects. Therefore, animating movement in arcs makes it look more natural and realistic. But animating every single detail in clean arcs might give a floaty feeling to the animation. Especially in the realistic animation style of most 3D games, knowing when to break an arc is essential for an animator.

**Secondary Action:** The secondary action is a way to enrich a scene and show character traits without telling them. It should never shadow the primary action of the scene, should just be used to give small information to the audience. In games, secondary action could tell a lot about a character with little details and improve the animation quality drastically.

**Timing:** Both in games, feature films, or any media type that uses animation as a medium, the timing is essential to portray a character. It could show everything about the situation and the personality of the character. There are physical elements to timing like other principles. For example, the faster something moves, the less weight it has. But mainly, it is about the feeling and the pacing of the game.

**Exaggeration:** While developing these principles, Disney animators were going for realism to improve believability. Soon they realized realism is not always the most appealing option to show something on-screen and developed these principles to improve the realistic images in a caricatured way. Exaggeration is at the core of each of the other animation principles. It is necessary for every animated piece, but it also has a risk of breaking the consistency. Exaggeration level should determine the style of the project and stay consistent in every aspect of the animation and other visual design elements in a game.

**Solid Drawing:** Drawing is a skill a 2D animator must-have. Before 3D it was the first and most essential tool for an animator. In computer animation, drawing is not necessary, but an animator still must understand the human body – or the anatomy of the creature they are animating – to pose and animate it more believable.

**Appeal:** Appeal might not have one solid recipe, but Thomas and Johnston (1994) describe it as “...anything that a person likes to see, a quality of charm, pleasing design, simplicity, communication, and magnetism.” (p. 68). If something could keep a person’s eye on it, makes them wonder and want to discover more, it is appealing. The appeal is created by people from every step of the game design from character to lighting, working together.

The animation principles were taken into consideration while designing the animations for each part of the study. Due to the simple design of the characters squash and stretch, anticipation, slow in slow out, and timing were considered more than other principles.

## 2.6 Fundamentals of Game Animation

In his recent book *Game Anim*, Cooper explained the usage of twelve principles of animation in video game animation design and suggested the five fundamentals of game animation. These fundamental laws were based on Cooper's over 20 years of experience in the video game field as an animator and his knowledge about animation implementing basic animation principles in the interactive setting of video games. These five fundamentals are feel, fluidity, readability, context, and elegance [28].

**Feel:** With interactivity being one of the most important things in games, a game character needs to feel responsive to the player. Creating the feeling wanted from the character is about the timing between the player's physical action (pushing the right button) and the response they got. When it comes to technique the feel is mostly about the inertia and momentum. Even though there are different variables in the game development process that affects the animation design, creating the responsive feeling is animators' most important job.

**Fluidity:** Video games use real time rendering for animations because they are an interactive medium that should react to player's movement. This requires blending between animations. Video game animations are mostly consisted of cycles which are the animation type that plays on a loop without an apparent start and end frame. Blending is necessary to make the transition between cycles more fluid. When there is a transition between for example, a walking animation and a punching animation, developers cannot anticipate on which frame the first animation will stop. Making these transitions smooth makes the experience more fluid.

**Readability:** In non-interactive media, animation is almost always prepared for a set camera. Animators usually know where in the product their animation will be used and their biggest concern when it comes to appeal is how the animation is seen. Video games usually have a free camera, so animations need to be readable from every angle. The character's centre of mass is particularly important and not losing balance is essential to create believable animations. Keeping silhouettes and line action, which is an animation term that indicates the singular line a character's motion flows through in a single frame, in check on every frame is substantial.

**Context:** In video games, today's technology usually does not allow for every single character to have a different animation and movements. It is not a big concern with NPCs, in fact sometimes it is better to not have complex NPC animation because the main character should stand out and there should not be repetition in animations. To create the balance between characters, the animator needs to know the context which their animation will be used.

**Elegance:** Elegance requires appeal and like previously mentioned on the principle of appeal, it is extremely hard to calculate. However, there are some rules in video game animation design like any other design subject. For instance, an animator needs to know when to specialize a movement and when to go generic within the design language of the game. Determine what is more important in a scene and which part should stand out is essential while designing animations. Animators must know main mechanics and prioritize specific animations according to that. It is not realistic to assume they can animate every possible scenario by hand with current technologies.

Cooper's five fundamentals were also kept in mind while designing movement for the second part of the study. Even though all of the five fundamentals were needed to be considered in a game environment, in this study's case feel showed its effect the most.

## **2.7 Previous Studies**

Technology creates new stages for storytellers every day. In the past decade, games became another ground for stories. And the games have something different to offer for the audience, they must interact with the story [48]. This interaction factor changes the design, it is not simply storytelling, it includes designing a narrative that will give the audience an area to experience [49].

The story is proven to be an important asset to give players a connection and engage them in a game. Schoenau-Fog (2011) has described four different aspects that affect player engagement as objectives (extrinsic, intrinsic), accomplishment (completion, progression, achievement), activity (experiencing the story and characters, socializing, sensing, exploration, solving, experimentation, interfacing, destruction, creation), and affect (positive, absorption, negative). In his study with players, he investigates what makes them stay in the game and gives them the desire to return.

Although the overall results have shown that accomplishment is the most important thing for the players, experiencing the story was the lead between subcategories [50].

The question of how games can improve the storytelling to give the players unique experiences that another medium can never achieve because of the interactive nature of games is more popular than ever with the increasing interest in this type of game [30]. While there has been much research on how to improve storytelling in games, only a few researchers have taken animation into consideration.

In 2014, Bosse and Zwanenburg developed two game applications that involve a human player and a computer opponent; they addressed the game of “tic-tac-toe” and the dice game “2,500”. They build a facial model named Anne as the virtual opponent that shows emotions during the game, according to the state of the game. The computer’s aim was to win and the model, Anna, shows different reactions and sometimes comments on its human opponents’ movements. After the game, participants were asked to rate Anna’s believability, human-likeness, natural reactions, interest in the game, and whether she wanted to win. Also, they answered a questionnaire that determines if they liked to play the game with Anna. It is concluded that the emotional variants are considered a positive addition to the gameplay [51].

In a similar study, Kersjes and Spronck (2017) built a game in which a person plays as a detective and must interrogate three suspects to determine who is guilty. They choose facial expressions to describe emotions and put clear expressions for every emotion they want to show like anger, joy, distress, sadness, and admiration. There were three different personas: extraverted, neurotic, and neutral. There were 36 participants and results showed that they were able to tell which characteristics were dominant on which character just by looking at their facial expressions. Their aim was to understand how to make virtual characters more believable and diverse with emotions, personalities, and moods [52]. At the same time, Palmberg, Peter, and Quereshi (2017) detected that perception of emotions is mostly based on facial expressions even though the body motions occupy more space, with an experiment that gives the testers expressions on both body and face [53].

While body language has not been the focus of perception tests in an interactive environment, perception of body language is as important as other design elements in

media, especially in animation [19]. Besides, emotional storytelling in games is gaining more and more value each day. A new entertainment medium that is based on interaction but has different goals than a traditional game, its highest priority is not being fun but giving the player a unique experience, usually with an emotional story and rich characters are getting recognized [31].



### **3. METHODOLOGY**

For this thesis, an experiment with two stages was prepared. On the first stage the main objective was to understand how animation design perceived by people. In order to reach this aim, the other design elements were eliminated, and the only focus was the movement. This stage was also aimed to be guidance for the second stage. The second stage was designed to use the finding of the first stage in an interactive setting. It was planned to be character and story based and constructed to understand empathy and involvement of the players.

#### **3.1 Preliminary Study**

In order to understand how basic animations can convey human emotions, a simple video game scene was designed that uses basic emotions and animation principles as a guide. Body language for basic emotions was adapted to a simple computer-animated ball and participants are asked to determine “how the ball feels”. All the other aspects of the scene except for animation kept undistracting to give the participants space to decide. The part of the study was prepared as a multiple-choice survey in which participants can observe the animations one by one and choose one of the given answers as they see fit to each animation. There was no restriction about the answering system except that the participant had to observe and answer each animation individually. The multiple-choice options were six basic emotions which are happy, sad, fear, disgust, surprise, anger, and neutral.

##### **3.1.1 Assets and development**

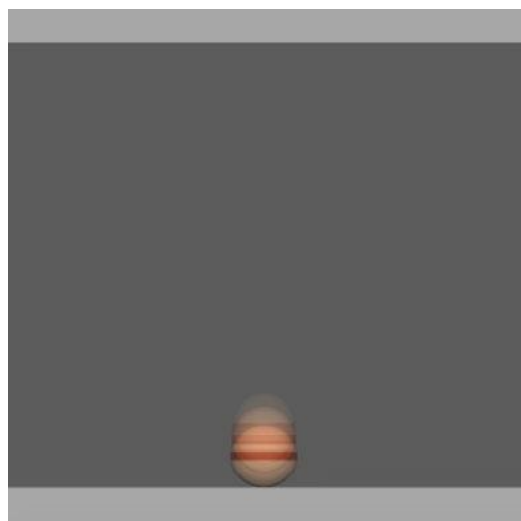
The production of 3D animation requires a rigged character in order to create movement in a virtual environment. A rigged character is a model which has an attached skeleton inside the skin. For this study, animations were created with the keyframe method which is made by moving the skeleton frame by frame and saving every frame on the timeline. This process could be made using various programs

however in this study's case they were prepared on Maya. The ball character that was used has belonged to Animation Mentor and necessary permissions have been obtained beforehand. The character was consisted of a sphere shape with a different colored line in the middle to make rotations clearer and a skeleton which gave the model the necessary flexibility to obtain the intended outcomes with the animations. The finished animations were rendered in gif format and the survey is prepared using Google Survey. The study was implemented online due to the current situation with the global pandemic, and it was sent to participants as a link.

### 3.1.2 Preparing emotion animations

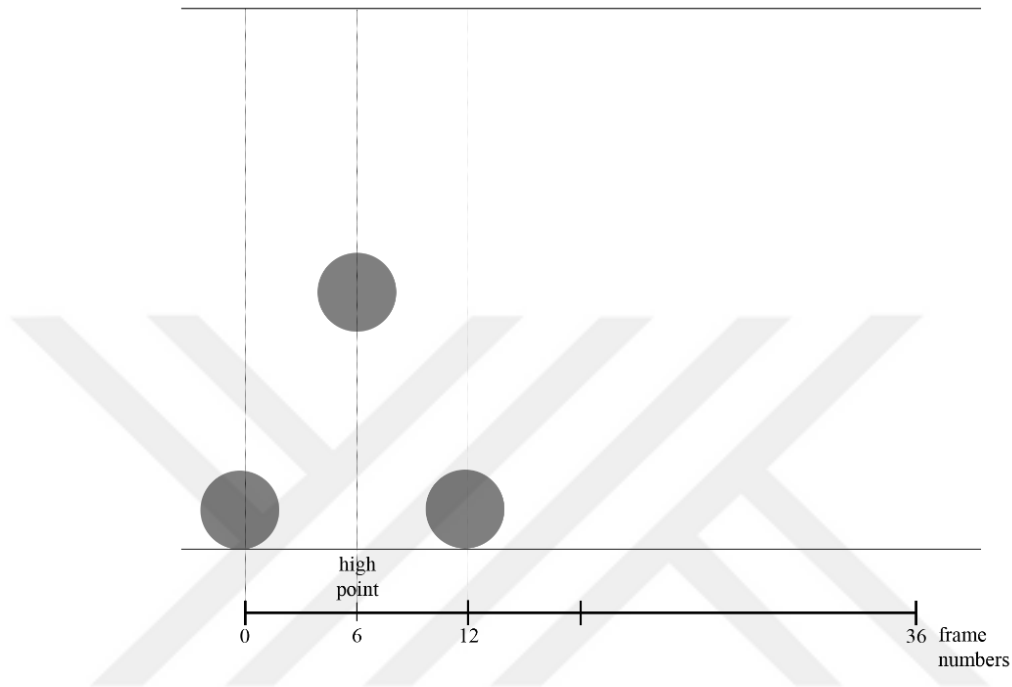
While interpreting basic emotions into action, some of the basic principles played a bigger role than others. The most significant changes between animations were timing, anticipation, squash and stretch levels, and height of the jump. The scene and the movement were kept simple, with only the character, ball, jumping up and down in front of a simple flat colored background (Figure 3.1). The animations were created at 24 frames per second and played as continuous cycles to remove the time constraint for the participants.

Time chart is the tool that is used to show timing, spacing, and key poses which are the main poses that make a movement meaningful, in animation design [19]. Each animation had its individual design to transfer the emotion better and this design approach is explained with the help of time charts.

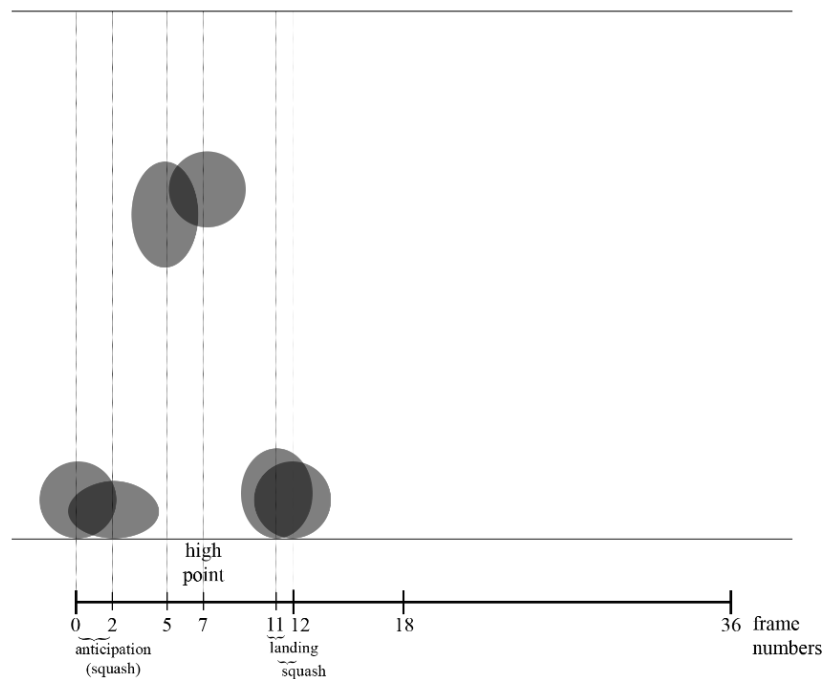


**Figure 3.1 :** Time lapse of one of the animations from the study.

Two animations that were designed as “happy” were only similar in timing. The time charts that show the key points of each action with frame numbers are given below (Figure 3.2, Figure 3.3). Figure 3.2 shows a simpler chart, there are no animation principles involved except for timing, the ball starts to move at frame 0, its highest point is frame 6, and lands at frame 12, making asymmetrical movement.



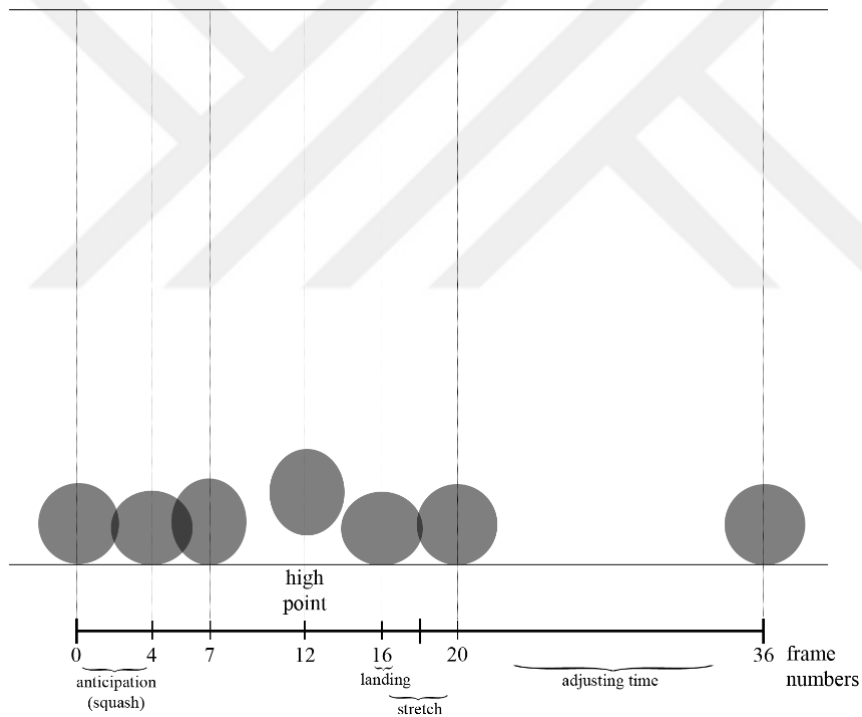
**Figure 3.2 :** Time chart for the first “happy” animation.



**Figure 3.3 :** Time chart for the second “happy” animation.

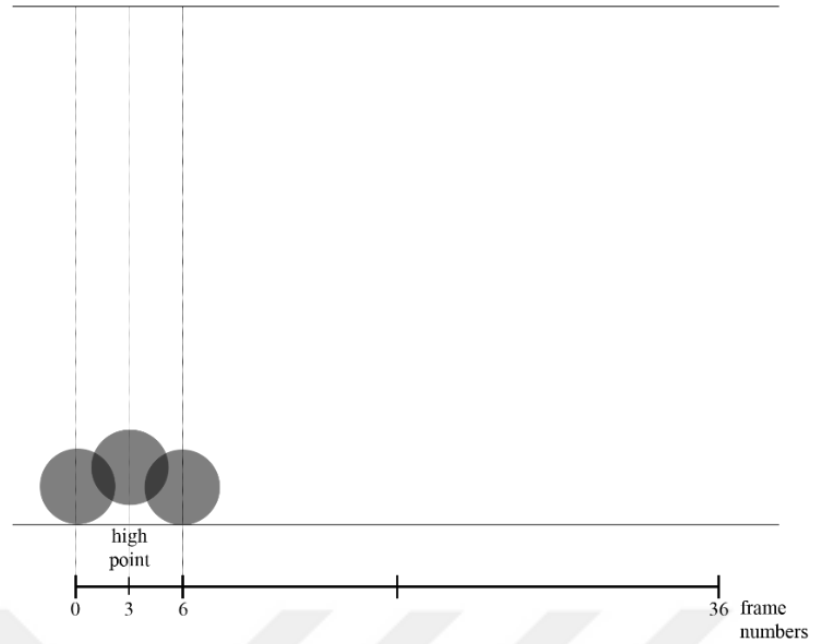
In the meantime, Figure 3.3 belongs to a more complex movement within the same timing. There is a two-frame window where the ball squashes and the jump can be anticipated, it goes to the highest point in frame 6 again but it stretches during the jump and floats in the air for one frame when it is on the top, afterward it lands on frame 11 and squashes for one frame, turning back to its original form.

The animation that represents “sad” has slower movements compared to others (Figure 3.4). It has a long anticipation time, small squash, does not jump as high as others, and has an adjusting time after landing before the movement begins again. Even though the frame rate for staying in the air is similar to the animations that were seen as “happy”, the lower jumping point moves slower than others. The timing, the long anticipation, long squash, and stretch levels are intended to give a heavier and tired feeling.



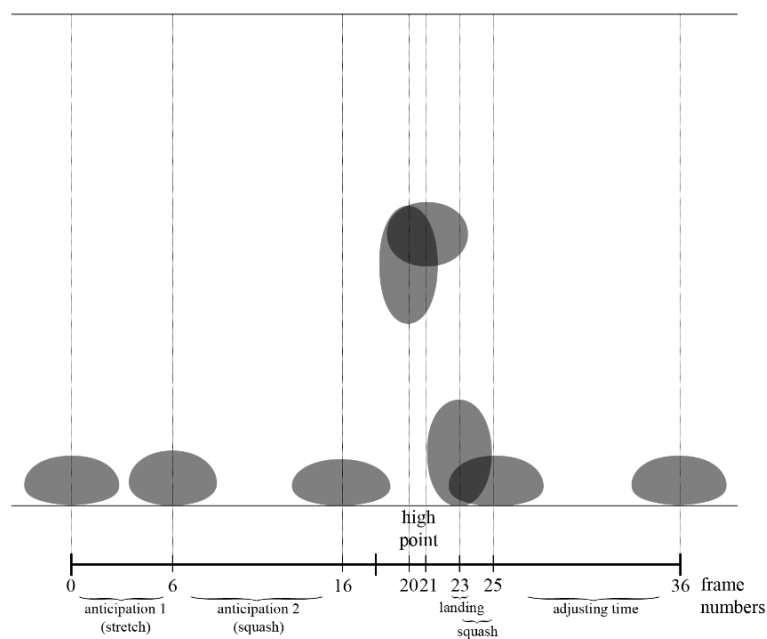
**Figure 3.4 :** Time chart for the “sad” animation.

The “fearful” animation does also have a quite simple movement. The timing is two times faster than “happy” animations, but it jumps lower like the case of “sad”, so it is not perceived as fast as it seems on the time chart (Figure 3.5). It was intended to give an impatient and fearful feeling with fast-paced and low, continuous jumps. To ensure that, no anticipation was added in the beginning or adjusting time after landing.



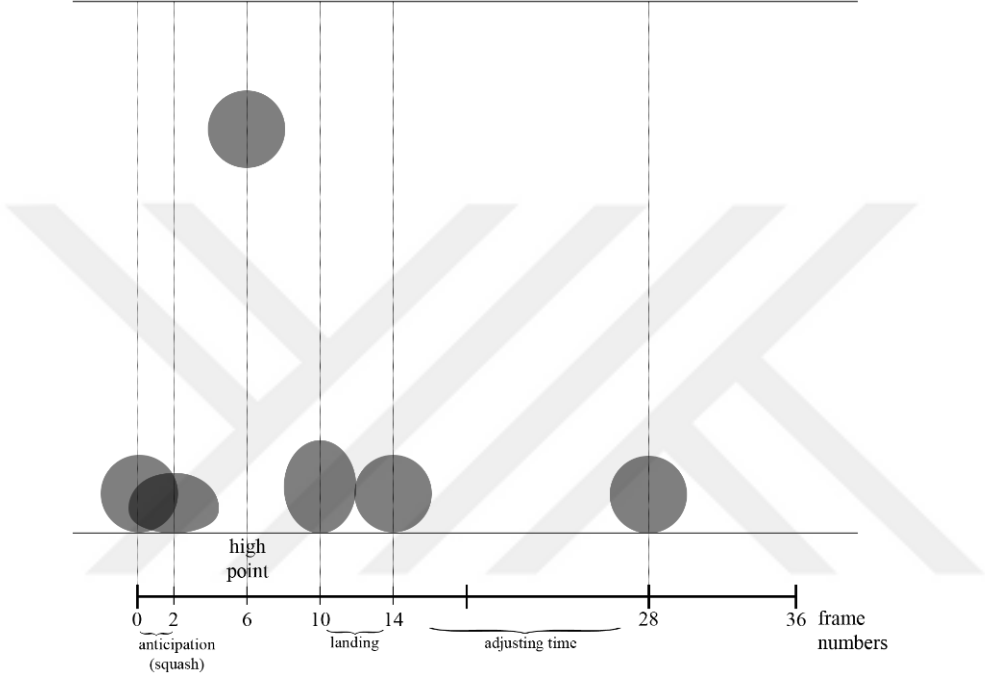
**Figure 3.5 :** Time chart for the “fear” animation.

The “angry” animation had the most complex movement among all animations in the study (Figure 3.6). Its anticipation happens in two stages, first stage is aimed to give the feeling that “it is observing something”, and the second stage is the actual anticipation for the jump. The fast and big jump is intended to be its angry reaction. There is also an adjusting time that is added to the observation time at the start when it is played as a continuous loop.



**Figure 3.6 :** Time chart for the “angry” animation.

Lastly, Figure 3.7 portrays the “surprise” animation with a fast jump and adjusting time afterward. It has big anticipation to indicate the high jumping point. The jump is almost identical to the second “happy” animation except for a little timing change, the higher jumping point, and added adjusting time. It needs to have an abruptness in it, so the adjusting time was added to give some time to breathe. That breaks the cycle causes it to have a sudden movement when it played in continuous loops and not perceived as a continuous jump.



**Figure 3.7 :** Time chart for the “surprise” animation.

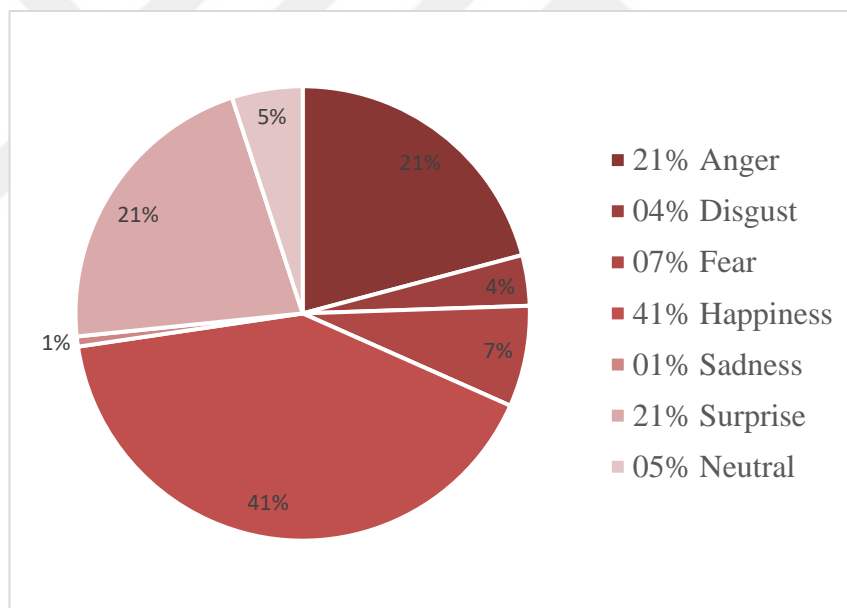
**3.1.3 Testing**

130 gamers, who are from the age of 18 to 56, were participated in the study. Animations were represented as an online survey that participants can interact through their phones or computers, and it was sent to them as a link using multiple platforms. They were asked to observe the ball animation in the scenes one by one and choose the emotion that represents the feeling most. The emotions were six basic ones, which are, happy, sad, fear, disgust, surprise, anger, and neutral. They were not given other explanation or required to have any pre-knowledge about the subject nor informed about the aim of the study, their only focus was animations in order to keep the results simple and as authentic as possible.

### 3.1.4 Results

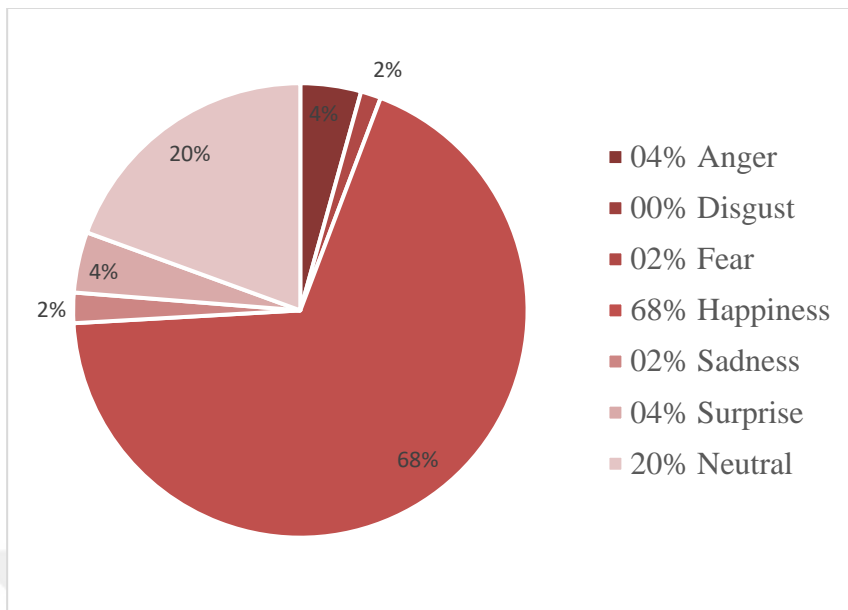
The study showed that not all basic emotions are easy to convey with motion on a simple character. While some emotion animations give promising results to move the study forward, others were not as clear as them. Both cases of happiness, sadness and fear animations had better results, but anger and surprise showed that they need more elaboration to be conveyed through a ball.

The animations that were intended to show happiness gave successful results. As Figure 3.8 and Figure 3.9 show, they both mainly perceived as happy however, the complexity was not meaningful for the observer in this case; even though the dominant answer is the same, 57 “happy” responds for the first animations and 95 for the second. The second animation which was the simple version was more clearly perceived as happy. The more complex happy animation was perceived as “angry” by 29 and as “surprised” by 30 participants the complexity shadowed the clarity.

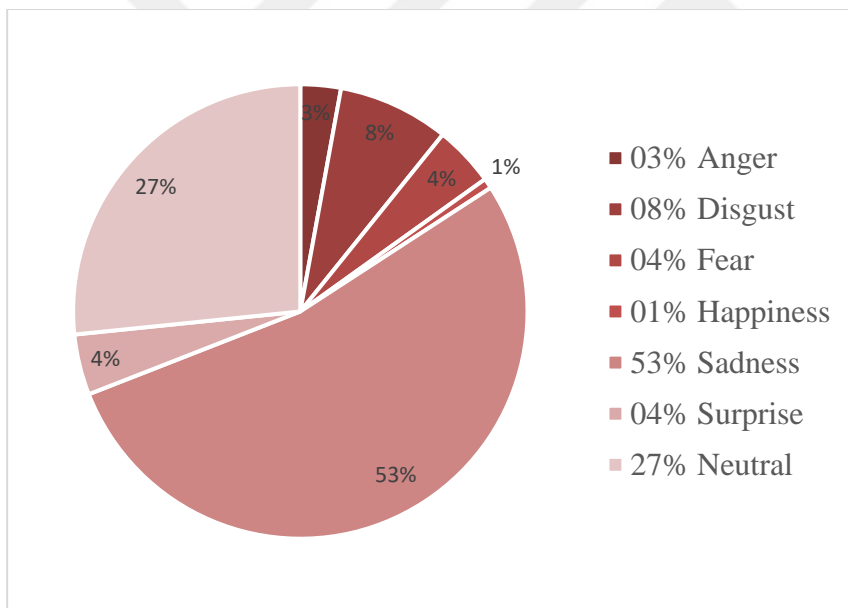


**Figure 3.8 :** Participants’ responses for the first “happy” animation.

“Sadness” was the second feeling that can be conveyed successfully. Results showed that 74 participants had caught the feeling of “sadness” from the jump (Figure 3.10). The “fear” animation also gave the expected result by having 62 participants, almost 44%, of the participants choosing the correct answer (Figure 3.11). Although “fear” had similarities with both “sad” and “happy” animations, it was able to transfer the intended emotion.

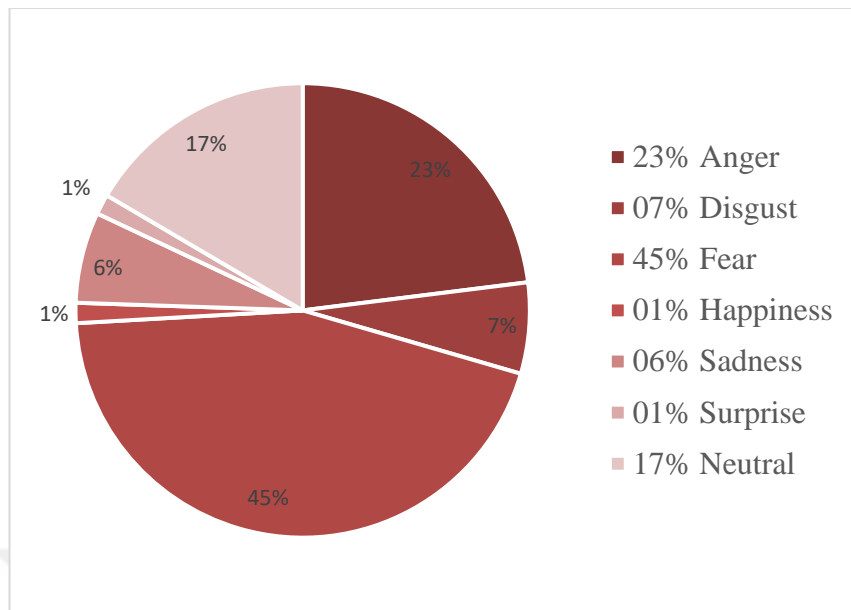


**Figure 3.9 :** Participants’ responses for the second “happy” animation.



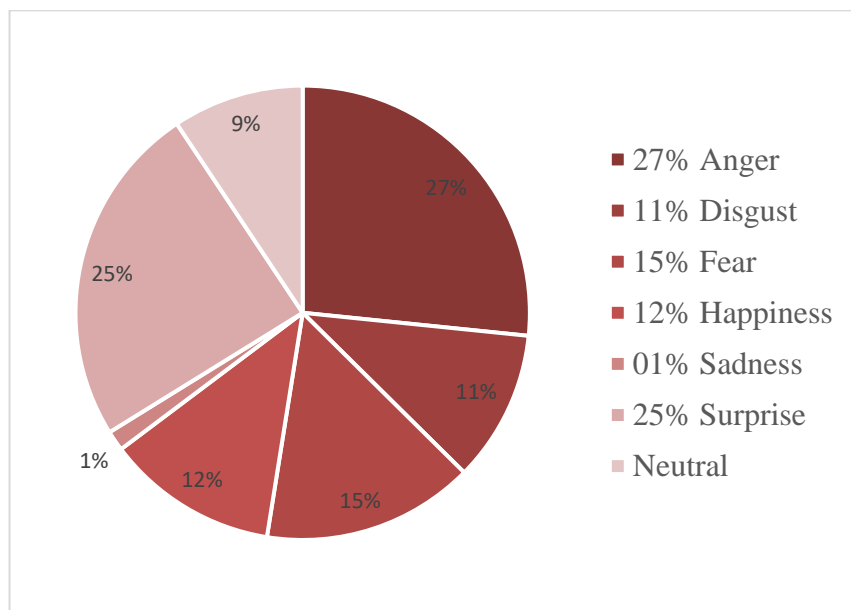
**Figure 3.10 :** Participants’ responses for the “sad” animation.

The last two animations, “angry” and “surprised” had the least clear results among all animations in the study. They both do not have one dominant answer, instead, they were perceived as either “surprised”, “angry” or “neutral”. The animation that was intended to be “angry” had 37 “angry” and 34 “surprised” responds (Figure 3.12) while the animation that was supposed to represent “surprise” was perceived as “angry” by 32 participants and as “neutral” by 32 participants. (Figure 3.13).

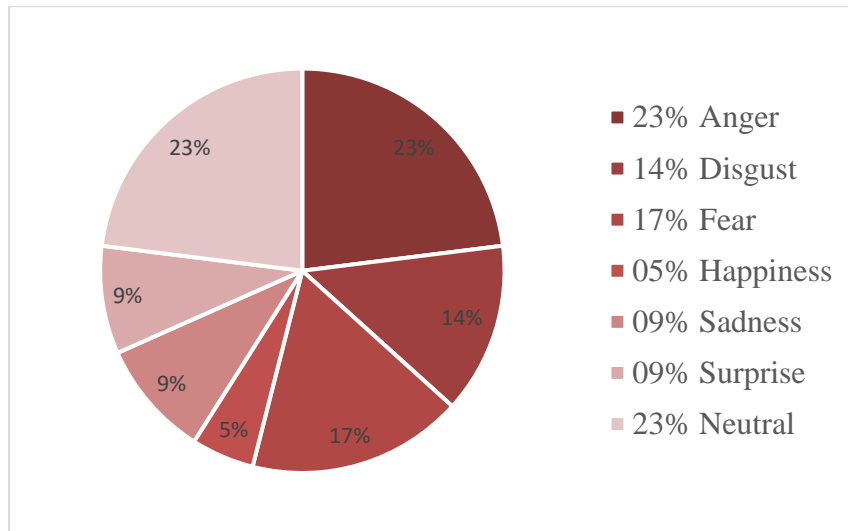


**Figure 3.11 :** Participants’ responses for the “fear” animation.

These results proved that happiness, fear, and surprise were clearer on the simple character that was used in the study. The overall results which were not dominant on “neutral” showed that humans tend to analyse emotional content even when the character does not represent a familiar anatomy. Based on these results the second part of the study, which was a game with an emotion-based story, was designed, developed, and tested.



**Figure 3.12 :** Participants’ responses for the “angry” animation.



**Figure 3.13** : Participants' responses for the "surprise" animation.

### 3.2 The Main Study

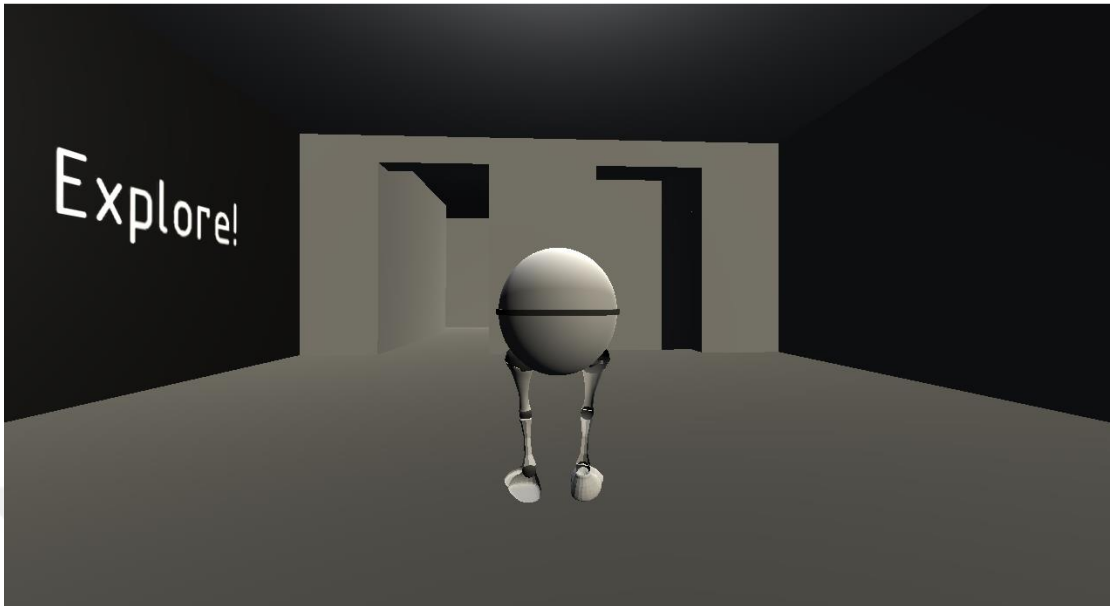
The main study is designed based on the knowledge that was acquired by the preliminary test as described above. At this stage, the aim was to create an interactive experience with emotion-based storytelling to measure empathy and understand if empathy can make the gaming experience more significant for the player. To achieve this, the environments and character design were kept simple to avoid distractions. Player's focus was kept on the character and the only variant for the character was its movement.

#### 3.2.1 The story design

A short, emotion-based story was designed for the study. The emotions that were better understood in the preliminary test were used in order to create a narrative. These emotions were happiness, sadness, and fear. The story followed a character going through emotional changes in reaction to the environment. It first started on neutral emotion with two choices presented to the player as two gates in front of the character as it stands in the prime room shown in Figure 3.14. The right side was the plain way, the character did not show any reaction to this, and the left side was the dangerous way which made the character show fear.

The right path was designed as a labyrinth which contains various objects in a museum format to awaken curiosity and having visual tokens to prevent player getting completely lost. These objects were placed in random. When getting out of the labyrinth, the player comes back to the prime room and sees the character show

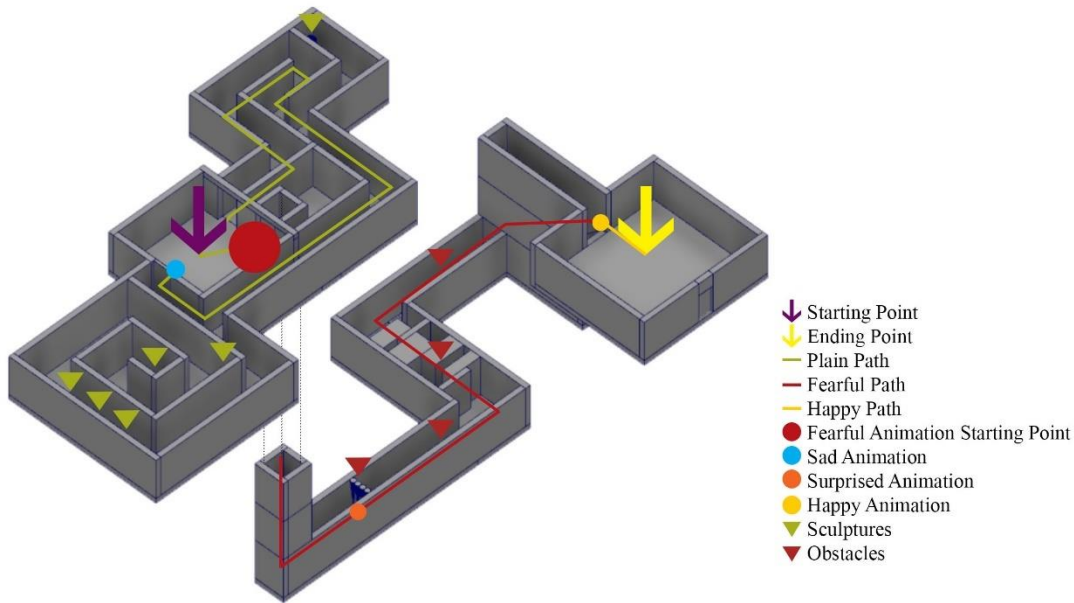
sadness to convey that this was not the expected outcome of the game and to encourage the player to take the second path.



**Figure 3.14 :** The opening scene of the game.

On the second path, there are dangers in the way and the character shows fear upon getting close to the path. Unlike the museum path which intended to keep people curious but on a neutral emotion, the right path contained multiple emotions. There is a big drop from the prime room when the player enters through the left path. After the drop, the player must get through some traps that make the character move slower in case of collision. If the character slows down too much, it becomes impossible to pass the traps. At the end of the dangerous way, there is another character, its child, waiting. When the two characters see each other, they both show happiness and the game ends. Figure 3.15 shows the narrative direction of the game.

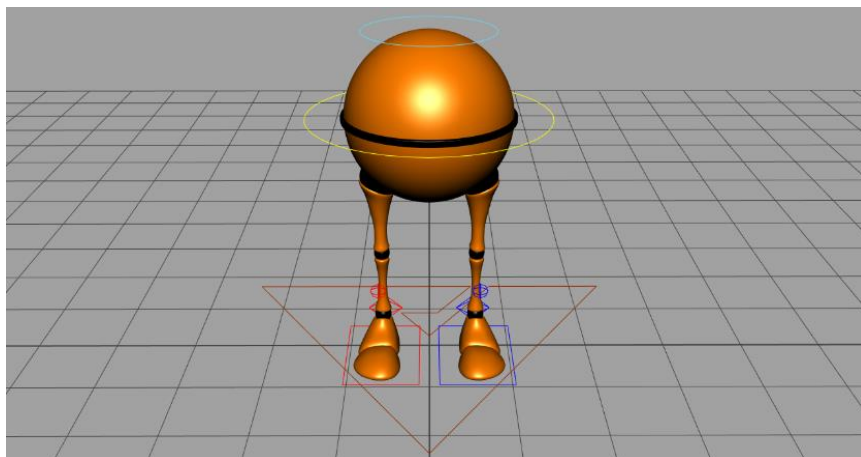
The base of the story was to give an experience that revokes basic emotions. If the player chooses the easy path (left path) at the start they lose time and does not get any reward but upon getting into the dangerous path the game offers an emotional ending with the reward. The main theme was “facing dangers leads to improvement”.



**Figure 3.15 :** The game map.

### 3.2.2 The character and animation design

The character in the main study was a little more complex than the preliminary study (Figure 3.16). It still is a ball, but it has legs to separate the necessary locomotion like walking from the emotion-based animations. The spheric part, again, has a differently colored belt in the middle to make the rotation visuals clear. The legs were simple three-part shapes, with two leg bones and a foot on each side.



**Figure 3.16 :** The character that was used in the main study.

The information gathered from the preliminary work was the guide for the animation design. Seven animations were designed: neutral idle (the animation that plays when the player is not interacting with the character), plain walk, fearful idle, fearful walk,

sadness, happiness, and surprise. These animations were placed separately in the story to prevent them to play on top of each other and confuse the player.

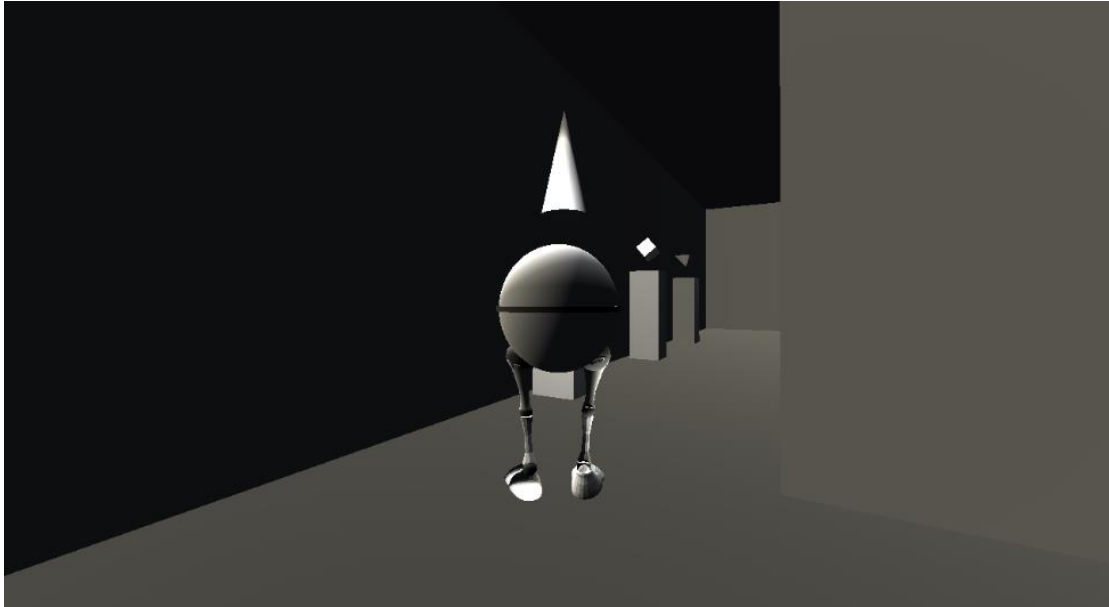
Plain idle and plain walk animations have consisted of basic breathing and walking animation cycles. For fearful idle and walk animations, a shaking movement was given that had the same timing as fear animation from the preliminary study. Neutral animations were placed at the start of the game and the labyrinth while fear animations played upon getting close to the left path and throughout this path. These four animations were the gameplay animations, walk animation was played on the player's command to move forward, and idle was played when the player stopped.

The other animations, which were sadness, happiness, and surprise, were based on the preliminary study and each of them were used only once in the game. Sadness had a more complex movement, but it had the slow-paced timing from the first animation but this time instead of jumping, the character first looked up and bowed its head slowly upon realizing it turned back to the start. It was placed after getting out of the labyrinth and coming back to the start. The surprise animation has consisted of a fast jump that was played upon seeing the first trap in the game. And finally, the happiness animation, which was a jump movement just like the happiness animations from the preliminary study with the same timing, was played when the character sees its child at the end.

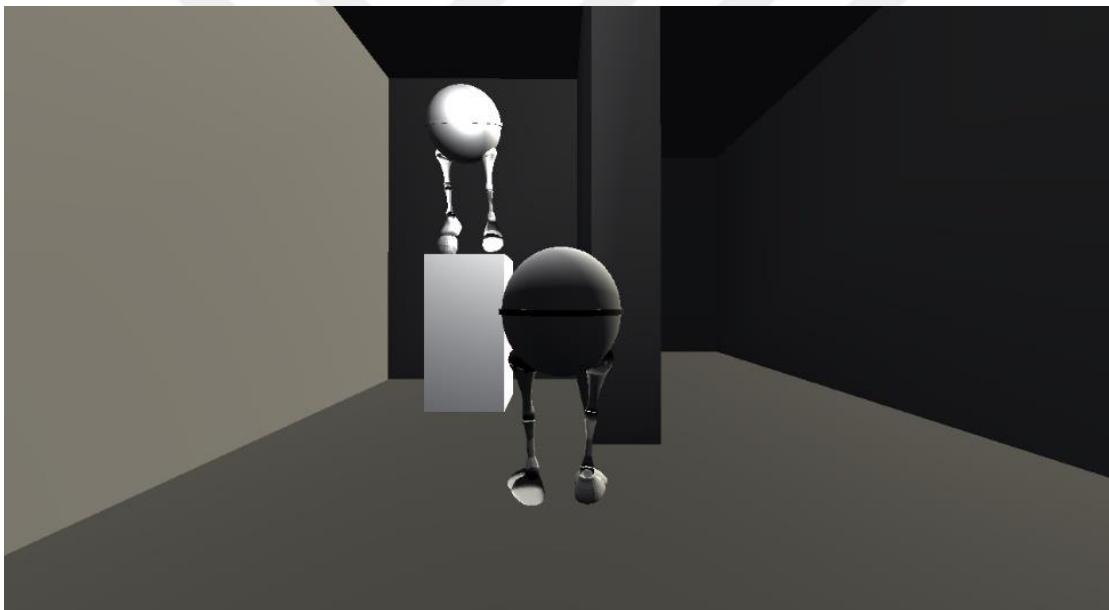
### **3.2.3 Environment design**

The environment of the game was minimalistic, with high flat walls and plain colors. The game starts in a room that had a square plan, with nothing but two gates in the front wall that leads to two paths. Only writing in the game was the "Explore" text that was placed on the right wall of the prime room to encourage the player to move.

The left path led to a labyrinth which furnished with nothing but random shapes. (Figure 3.17) These shapes have a simple movement that makes them look like they are floating in the air. Their main purpose was to prevent the player from getting completely lost. At the same time, they served the purpose of testing the gameplay Gestalt and people's tendency to make connections between unrelated elements. One of the dead ends of the labyrinth contained a sculpture of the character for the same reasons (Figure 3.18).



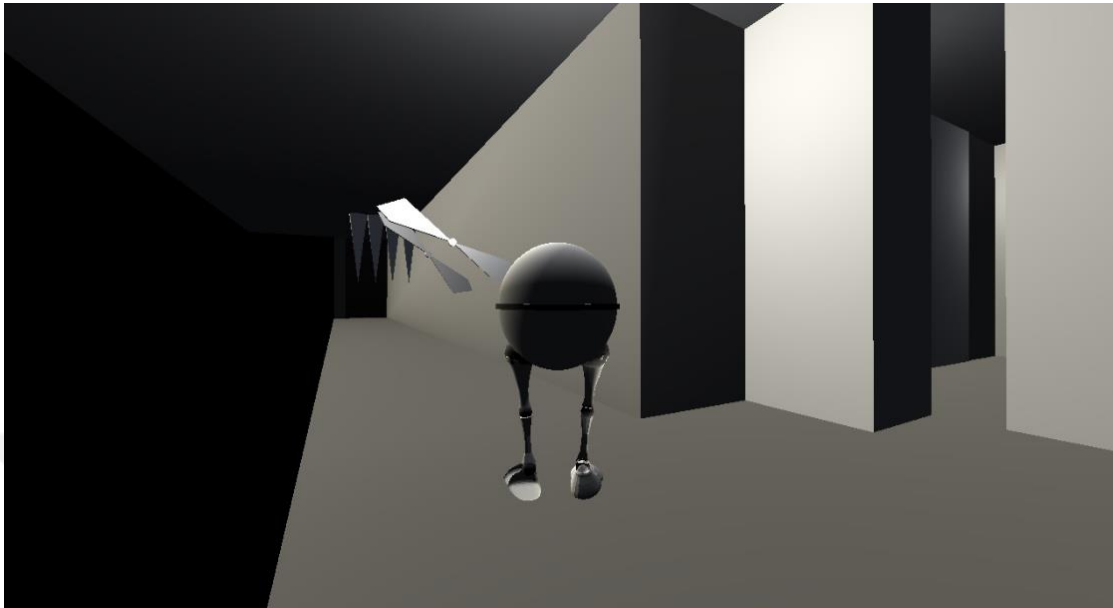
**Figure 3.17 :** Three shapes that was placed in the labyrinth.



**Figure 3.18 :** The sculpture of the character in a dead end.

For the right path, a hallway with multiple obstacles that cause the character to slow down on collision was designed. The first danger was spikes that come out of the ceiling suddenly when the player gets close to them. The surprised animation played at that point. When the player continues, they encounter two fast turning fans. After the fans, there is a corner (Figure 3.19) and on the next corridor, there are moving walls. Moving walls were massive and fast, with six segments that move and all of them move with different timing to be unpredictable. After the walls, there was another corner that leads to a shaky floor. It was placed to make the player nervous

with each step. Across the floor, there was the last obstacle which was a ramp. The ramp was more effective if the player's speed slowed down immensely. If not, they could just walk up and get to the ending. (Figure 3.15)



**Figure 3.19 :** The corner after the fans.

The final room after the ramp was similar to the prime room with a square plan and high ceiling. The only two differences were the glass door on the front wall which means escape for the character and the smaller version of the character, its child, waiting for it.

### **3.2.4 Game experience questionnaire**

Measuring game experience is a challenging task because the nature of the act of play is based on an unconscious process; it does not seem as successful when the user starts to evaluate it consciously while experiencing it for the first time but the importance of it cannot be denied for studies on video games. The Game Experience Questionnaire (GEQ) which is aimed to measure flow, immersion, and engagement is suggested by IJsselstein *et al.* (2013) [54] and used in various studies since [54, 55]. The aim of the questionnaire was to provide video game studies with a commonly agreed vocabulary, a measurement system for gaming experiences, a helpful guide for game designers who wants to create better user experiences and creating a new genre of experientially adaptive games [56]. Although it is suggested that it could be adapted for different genres especially for narrative-focused games it

is one of the most common measurement systems for evaluating the psychological aspect of game experiences [55] and was used in this study.

The questionnaire had different modules that are aimed to measure the experience after the game session which were shown in Figure A.1.1, Figure A.1.2, and Figure A.1.3. Each module has different components to evaluate different aspects of the game. The first module is focused on immersion, flow, competence, positive and negative effect, tension, and challenge, the second module is aimed at psychological and behavioral involvement, while the third module assesses the negative and positive feelings after the player stopped the game.

The GEQ also introduces scoring guidelines that categorized the questions into components for each module. The first module which was the core module had seven components such as competence, sensory and imaginative immersion, flow, tension/annoyance, challenge, negative effect, and positive effect. The second module, the social presence module, consisted of three components: psychological involvement – empathy, psychological involvement – negative feelings, and behavioral involvement. The post-game module which was the final module had four components: positive experience, negative experience, tiredness, and returning to reality.

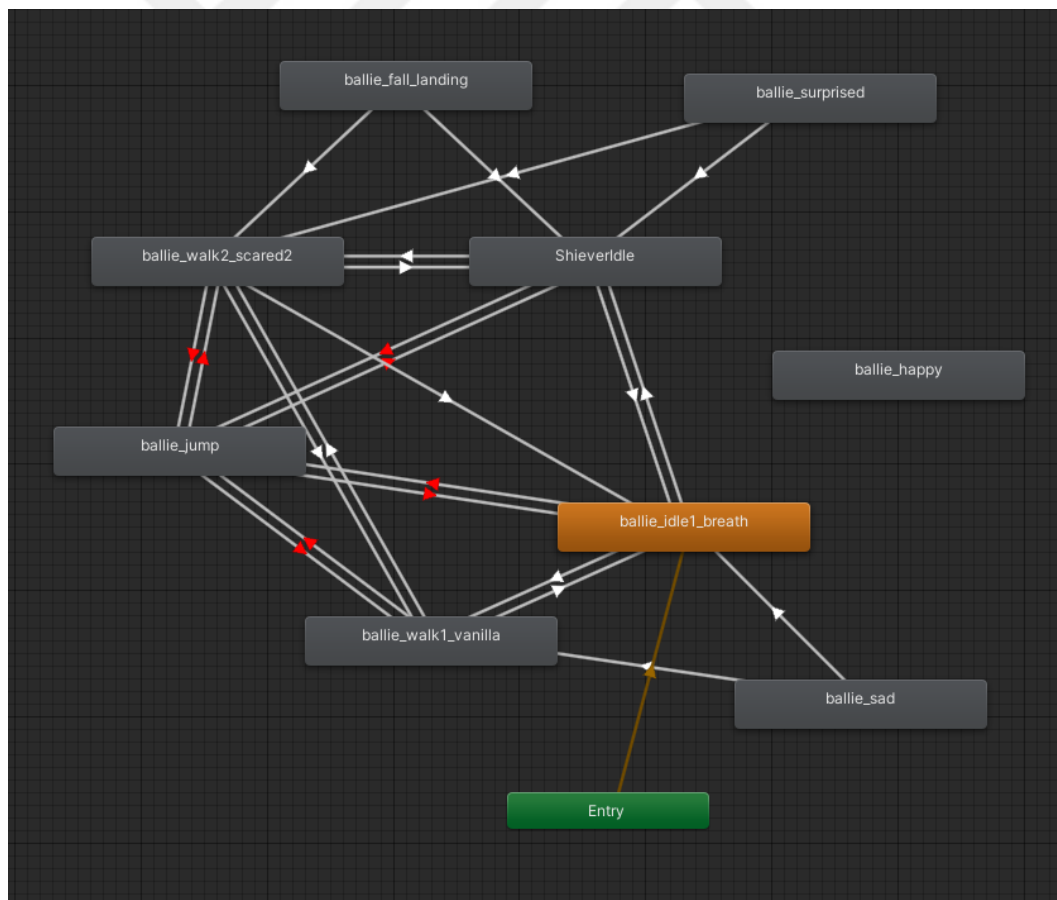
Due to the fact that the study has a very simple design, not all of the questions were relevant for the aim of the research, but the questionnaire was implemented as a whole. The questions that were more relevant to the research questions that were asked in this thesis were: “I was interested in the game’s story”, “I felt imaginative”, “It felt like a rich experience”, “I felt happy”, “I thought it was fun”, “I felt bored”, “I thought about other things”, “What the character did affected what I did”, “When the character was happy, I was happy” and “I was influenced by the character’s mood”. These questions were mostly parts of sensory and imaginative immersion, negative experience, positive experience, and psychological involvement components. The given answer choices for each question were listed as “0 – not at all”, “1 – slightly”, “2 – moderately”, “3 – fairly”, “4 – extremely”.

### **3.2.5 Assets and development**

All the assets were created in Maya for this study except for the main character rig. The rig that was used in the study was the Ultimate Waller rig by Uğur Ulvi

Yetişkin, and the models were based on the walker models that trainee animators use to practice walk cycles. Necessary permits for the usage of the rig were obtained beforehand.

For the environment assets, Maya's low poly modeling tools were used. Models were finished in Maya and transferred into Unity for the development stage. The development stage had three main phases: character movement, animation triggers, and environment animations. All three processes were completed in Unity. Character movement animations were made in Maya on 30 FPS. Animations are arranged in Unity's animator component. (Figure 3.20) and animation triggers were added in Unity. A speed decrease mechanic was added, as a penalty, the character's speed gets 1/100 slower on every contact with the obstacles. The slowing ratio was not high because the moving obstacles were fast to intimidate the player and a higher ratio would have made the game impossible to finish. The environment animations were composed in Unity. The keyframe method is used in both animation types.



**Figure 3.20 :** Animator component of the main character.

The gameplay has consisted of three keys, one to move forward and the other two to turn to the right or left. Right and left turn keys did not turn the character instead turned the player camera around the character. The player camera was a third-person camera that puts the character in front of the screen to keep the player's focus on it. All interaction mechanics were coded with C# language on Unity game engine (Figure A.2.1 and Figure A.2.2).

The finished game was presented as an online game that can be played on any web browser, on PC. The questionnaire that should be filled after finishing the game prepared as a survey on Google Survey, and it consisted of two parts. In the first part, all three modules of the GEQ were included and each of the GEQ questions was obligatory to answer. In the second part, some custom demographic questions shown in Figure A.3.1 were added that asks the participant's age, gender, occupation, which path they choose first, how they felt while playing the game and which part of the game was the most significant part for them. The latter two questions were the only ones that required written answers and were not obligatory to answer.

### **3.2.6 Testing**

Testing was implemented online on this part as well due to the global pandemic. The volunteer participants received a text that explains they need to play the game first and fill out the survey later and they were not supposed to open the survey before completing the game. The key comments were written on the down left of the game window and participants were not given any other information about the game or the content of the game. The study was shared on multiple social media platforms as well as student groups to reach as much participants as possible.

44 participants took part in the study, 22 females and 22 males. The participants were from a wide range of professions and aged between 19 and 35. They were not required to have gaming experience or any pre-knowledge about the subject, only requirements were a PC that has an internet connection and a web browser.

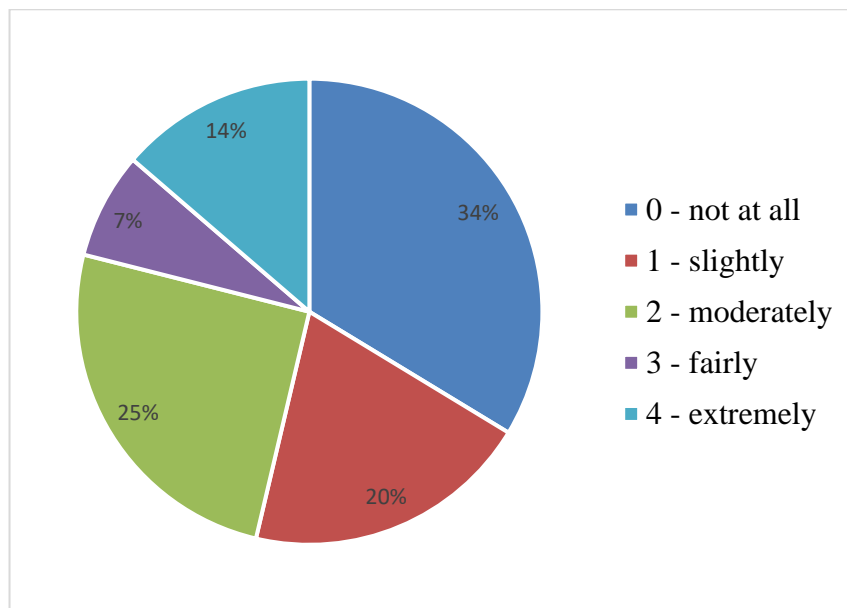
Two separate links that lead to the game and survey are sent. Participants were asked to play the game only once and fill the survey right after the game. GEQ part of the survey consisted of three stages of the GEQ, and it was filled by all 44 participants. The custom questions that were not obligatory were answered by 40 and 38 of the participants, respectively.

### 3.2.7 Results

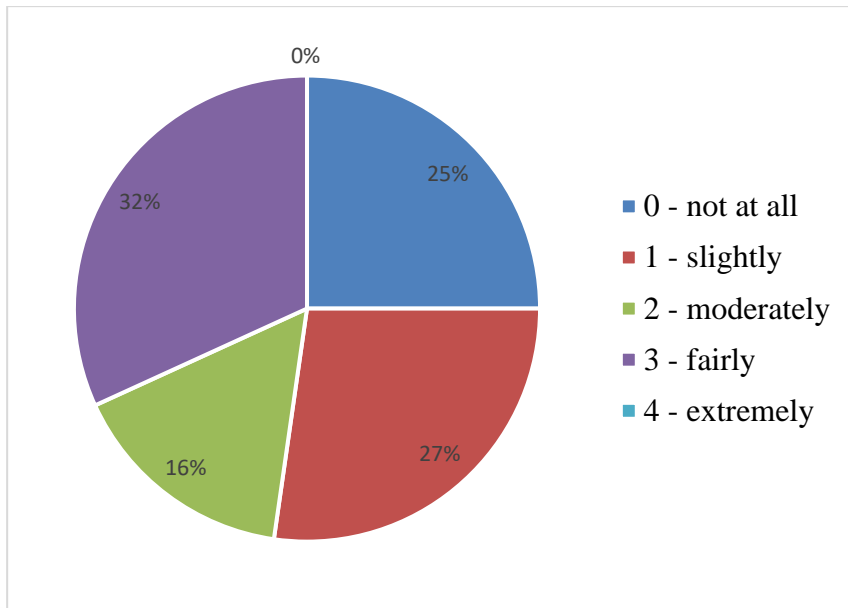
The results for the GEQ were mixed however the answers that were acquired by the custom questions were mostly positive. The questions that were listed as more relevant for the study mostly gave a positive or mixed answer.

Although 12 of the players went to the right path first and did not experience the left path, this did not cause a meaningful difference between their answers which shows that both sides were successful at awakening curiosity. Also, genders did not play a significant role in the answers that were given. However, it is seen that people between the ages of 30-35 responded more positively to the empathy and involvement-based questions.

If we look at the results with the listed scoring guidelines, almost half of the answers given for the questions listed under sensory and imaginative immersion component were between 2 and 4 (Figure 3.21, Figure 3.22) which showed that people respond to a story in an interactive environment even if it is told by unconventional methods. The written answers mostly supported this result. When asked what the most significant part of the game was, most players gave answers that indicate the sculptures in the labyrinth and the ending intrigued them the most. 11 out of 38 written answers specifically mentioned that ending was significant for them, and they were happy when the character was happy at the end.

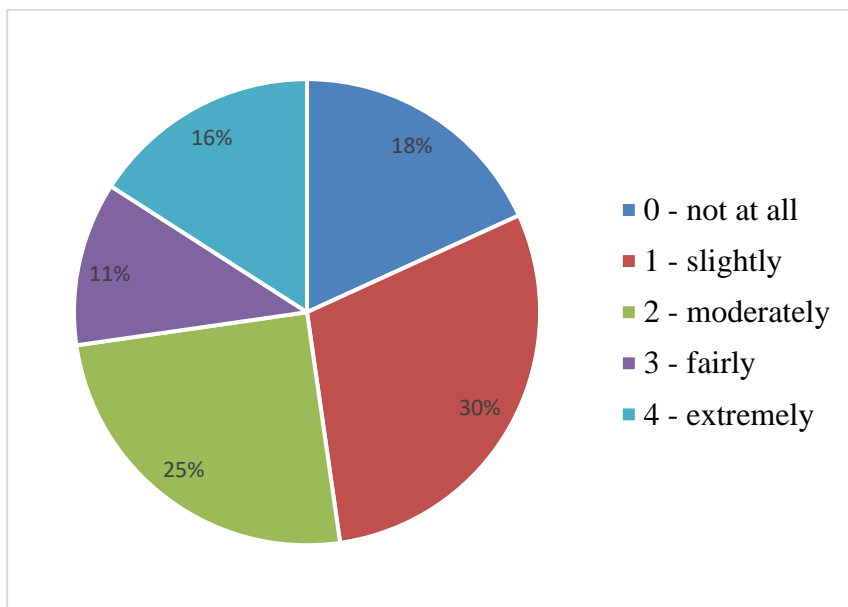


**Figure 3.21** : The participants' responses for "I was interested in the game's story".

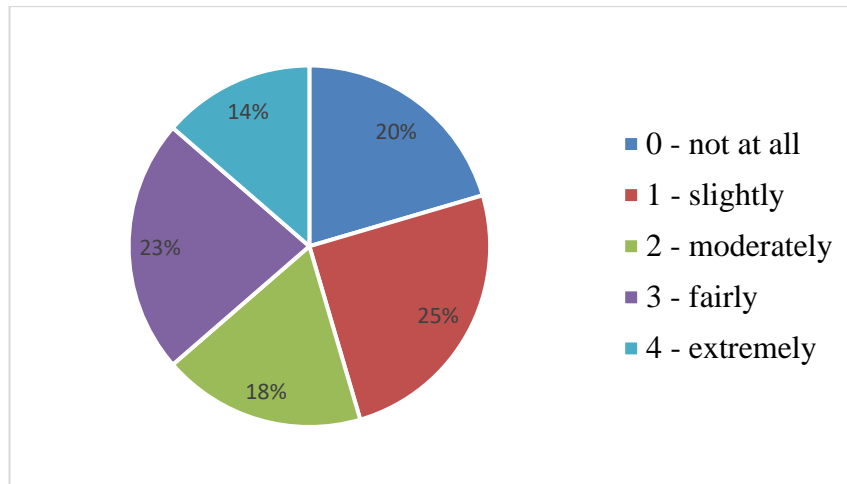


**Figure 3.22 :** The participants' responses for "I felt imaginative".

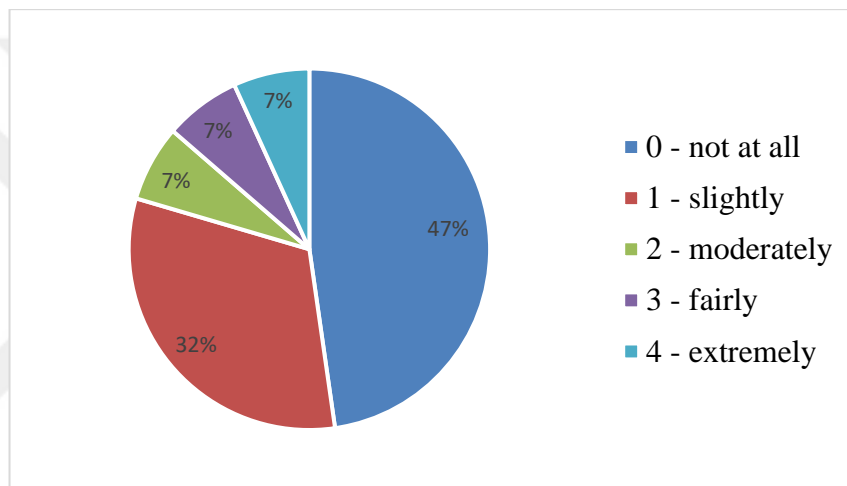
Questions under positive experience component like, "I felt content", "I felt happy", "I thought it was fun", and "It felt like a victory" also mostly given the answers between 2 and 4 (Figure 3.23, Figure 3.24). At the same time the negative experience component mostly had answers of 0 or 1 to the questions such as "I felt bored", "I thought about other things", "I felt bad", and "I found it a waste of time" (Figure 3.25, Figure 3.26). These results showed that players mostly had positive feelings during and after the experience.



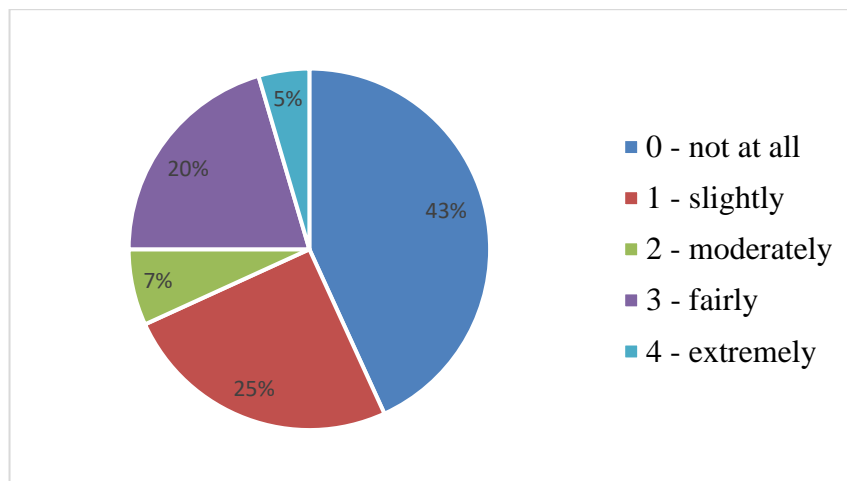
**Figure 3.23 :** The participants' responses for "I felt happy".



**Figure 3.24 :** The participants' responses for "It felt like a victory".



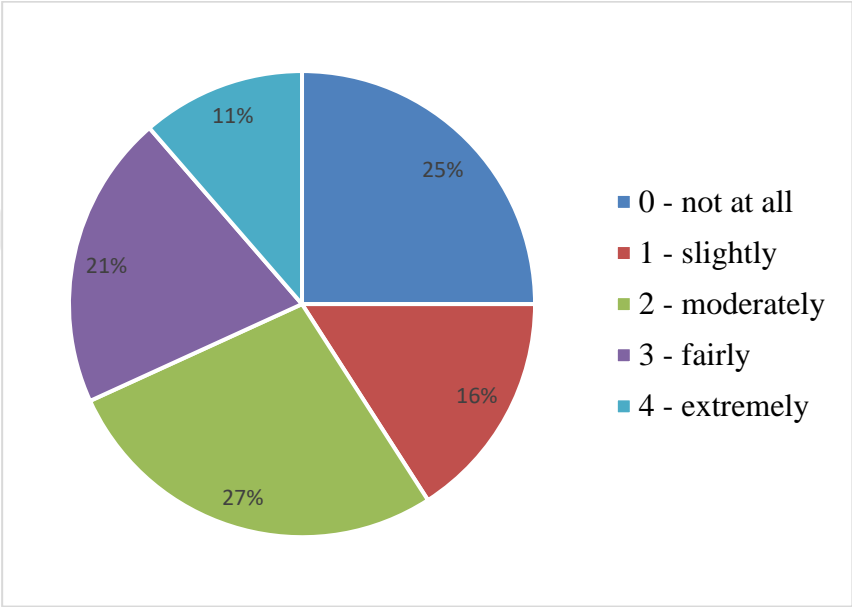
**Figure 3.25 :** The participants' responses for "I thought about other things".



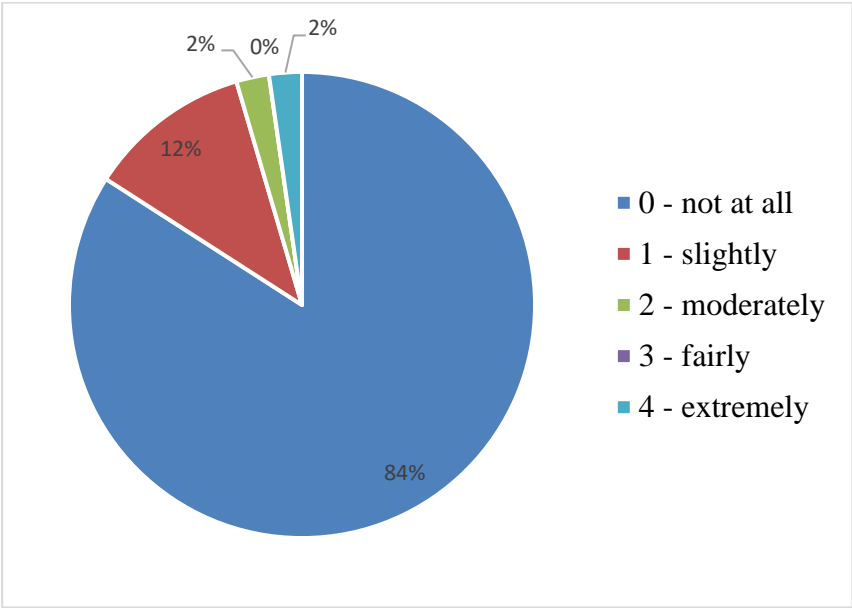
**Figure 3.26 :** The participants' responses for "I found it a waste of time".

The last components that were relevant for the study were psychological involvement components which were empathy and negative feelings. Empathy questions which

were “When the character was happy, I was happy”, “I felt connected to the character”, “I empathized with the character” had higher than 50% of 2-4 answers (Figure 3.27). Negative feeling questions like, “I felt jealous about the character”, “I felt revengeful”, and “I felt schadenfreude (malicious delight)” mostly gave results between 0 and 1 (Figure 3.28) These results proved that although players feel empathy toward the character and influenced by the feelings of the character, they do not have any positive or negative feelings for the character.



**Figure 3.27 :** The participants’ responses for “When the character was happy, I was happy”.



**Figure 3.28 :** The participants’ responses for “I felt revengeful”.

Participants' written answers for the custom question "What did you feel while playing? Could you describe with your own words?" in the end of the survey got very rich answers as shown in Figure A.4.1. While most players mentioned that "curiosity" was the dominant feeling on the left path, they experienced "happiness" and "excitement" in the end when they see the character get happy. 18 answers expressed interest or curiosity about the story and few even mentioned they were influenced by seeing the character's fear for the right path and that was why they went into the left path first and only choose the right path when they realize there was no other way. 7 participants mentioned the fact that the game gave them a choice in the beginning was meaningful and exploring was what made the experience remarkable for them.

11 people indicated negative feelings in this part. There were answers like "it was strange and scary", "I felt demoralized", "it made me stressful and nervous", "I felt very disoriented" which were not the intended emotions while designing the experience. Some of these answers mentioned the simple environment was the reason for their negative feelings and the lack of information made them "nervous". This showed that even with simple designs the effects of the environment can not be neglected while evaluating the emotional experience.

On the other hand, there were 11 answers that stated the experience felt empty or lacked something they can not name. Some of these answers suggested that the interaction should be improved, and interaction elements were not satisfying. These answers mostly came from the players who gave 0 or 1 point to the questions that show involvement and empathy.

When asked "What was the most significant part of the game for you?" (Figure A.4.2) 14 players mentioned happy ending. A few of them added that they felt happy upon seeing the character's happiness. 8 players mentioned they enjoyed discovering the sculptures around the labyrinth. Other answers varied with the choices like "having a choice at the start", "character becoming fearful", "beating the obstacles on the right path".

The findings of the study showed that even with limited design subjects it is possible to convey feelings to players in an interactive setting. While the most significant animations for the players were "fear" and "happy" animations, the game experience

mostly found intriguing, and few people wrote that they were interested in playing more or they want the know more about the story.



#### 4. DISCUSSION

This thesis was aimed to understand human perception in an interactive setting and propose new ways to enrich the video game experience for the player. A study with two phases designed and implemented for this purpose. The first phase was aimed to answer the questions about empathy and perception. It showed that half of the people empathize with a non-human character through movement. These results proved the suggestions made by Schindler et al. (2008) based on the perception of emotions. [43] They tested the recognition of six basic emotions which were happiness, sadness, fear, disgust, surprise, and angry based on single poses and suggested that movement could improve human perception. Although the simple designs that were used in the study were not as clear for everybody and some emotions, disgust, surprise, and anger, did not give the expected results, happiness, sadness, and fear showed promising results.

The second stage was based on these emotions, happiness, sadness, and fear. In this part of the study, interactivity played an important role. The players were allowed to interact with the character unlike in the preliminary study and the results were focused on seeing if the responses they got from the character can shape their experience. As Bosse and Zwanenburg (2014) tested in their study [51], the parts that character showed emotional reactions were significant for almost half of the players and 11 participants out of 44 mentioned that the character's emotions guided them in the game even when the character was not complex. This showed that it is possible to shape a player's choices with in-game movement and empathy is a significant part of the game experience.

This study also proved that the body language of the character could be helpful for players in a third-person game even though the facial expressions were proved to be more meaningful for the player in the previous studies [52, 53]. And it is possible to convey a basic story based on body cues. Although, the human's tendency to see the connection between individuals and create stories was also effective in the findings.

Some participants were more focused on environmental elements and tried to add additional meanings to these elements.

Even though the study showed some positive results about empathy, perception, and conveying stories through movement, whether these findings can improve a more complex video game experience was not clear. Environment stole the focus of players in some cases and distracted from the movement-based story.

Consequently, this study added body movement to previous perception studies on a non-human character and showed that body language is effective in an interactive environment as it can create empathy and shape a player's experience. The question of if these findings can enrich the video game storytelling when in-game movement design was designed to be responsive to the main character or NPCs emotions was not answered in the study and needs further testing.

## 5. CONCLUSION AND FURTHER STUDIES

The focus of this thesis was, understanding the perception of emotions through movement. The process for this aim consisted of design, development, and testing of a two-phased study; the first one was based on the research and the second one combined the results from the first phase with the research to answer some of the questions that were asked at the beginning. The preliminary study was a perception test for basic emotions on a simple character and had 130 participants who gave very insightful results to move the study forward. The results indicated that almost half of the participants were able to perceive happiness, sadness, and fear through movement-focused simple designs. On the other hand, surprise and anger got less than %25 correct responses and showed that these emotions are harder to convey. Disgust did not take part in the study for being more complex than other emotions and could not be conveyed on a character that had a basic sphere shape. This stage of the study was helpful for understanding human perception in a virtual environment, and the lack of neutral responses supported the idea that humans tend to characterize basic shapes with movement.

The findings of the preliminary study used as an inspiration for the next stage of the testing. It was the guide while designing the interactive story and character movement for the main test.

The second stage of the test was designed to give players an interactive setting and wake their interest in the narrative. This stage consisted of a game and survey to be answered upon finishing the game. The narrative design of the game was based on the feelings that got positive results in the preliminary test which were happiness, sadness, and fear. The beginning of the game gave two choices to the players in the form of two paths. Each path was based on a different emotion which was fear and neutral, combined with their endings which were based on happiness and sadness. The designs kept simple to highlight the movement and reduce the effects of other

factors on player perception and the character used while being more complex from a ball, did not have qualities that resemble a human.

44 people participated in this stage, and the responses were mixed. The survey had two parts which were a pre-determined questionnaire and the written part which contained custom questions. In the questionnaire, empathy and story-focused questions got about 50% positive answers. On the written responses, 29 of the participants described a meaningful experience when they were asked about what they felt while playing the game and 11 players showed indifference and described the experience as empty or boring. Out of 29, 18 of the response described positive feelings while the remaining 11 wrote that it was stressful or made them nervous. While the feelings were mostly perceived as intended, there was also some feedback about the characters and the environment's simple designs were not enough to create an engaging play experience.

Overall results about empathy and involvement with the story and character were significant. The test proved that emotions can be conveyed through movement, and these could make the player empathize with the character. It was seen that almost half of the players' choices were affected by the reactions of the main character. This indicates that better characterization in video game storytelling could support the narrative. These findings also support the idea that the human brain is interested in characters/people more than events [33].

This study also suggested that video game storytelling could be impacted by emotional animation design however, understanding how to achieve more meaningful improvement for in-game storytelling requires advanced testing.

For future studies, the emotions involved in the interactive process could be diversified by using more complex characters and movements. This could allow a richer narrative to be designed with a wider range of emotions. Furthermore, a comparison could be made by having participants play the same story through different characters with alternated movement designs. To figure out the character's real impact on the player, environmental aspects should be kept minimal. The results could inspire deeper storytelling in video games and richer character designs that could reach outside of the screen and come to life with the involvement of the player making the player a part of the character's life and vice versa. This possibility could

be significant to engineer a different entertaining experience also extends the usage of video games in the educational and psychological fields.

Interaction is what makes a video game unique and the mechanic that allows that interaction is seen as a most important part of a video game [3, 4]. Nonetheless, the gaming experience could become more impactful with the addition of emotional character design.





## REFERENCES

- [1] **Tavinor, G.** (2009). *The art of videogames*. Malden, MA: Wiley-Blackwell.
- [2] **Smuts, A.** (2005). Are Video Games Art?. *Contemporary Aesthetics*, 3 (6).
- [3] **Välisalo, T., and Ruotsalainen, M.** (2019). "I never gave up": engagement with playable characters and esports players of overwatch. *Proceedings of the 14th International Conference on the Foundations of Digital Games*, San Luis, CA, August 26-30.
- [4] **Fabricatore, C.** (2007) Gameplay and Game Mechanics: A Key to Quality in Videogames. In ENLACES (MINEDUC Chile) *OECD Expert Meeting on Videogames and Education*, Santiago de Chile, Chile, October 29-31.
- [5] **Tencé, F., Buche, C., Loor, P. D., and Marc, O.** (2010). The Challenge of Believability in Video Games: Definitions, Agents Models, and Imitation Learning. *Proceedings of 2nd Asian Conference on Simulation and AI in Computer Games (GAMEON-ASIA'10)*, Shanghai, China, March 1-3.
- [6] **Smithsonian American Art Museum.** (2012). The Art of Video Games. *American Art*. Retrieved from: <https://americanart.si.edu/exhibitions/games>.
- [7] **Warpefelt, H.** (2015). Cues and Insinuations: Indicating affordances of non-player character using visual indicators. *Proceedings of the 2015 DiGRA International Conference: Diversity of Play*. Lüneburg, Germany, May 14-17.
- [8] **Lankoski, P. and Björk S.** (2007) Gameplay design patterns for believable non-player characters. in *Situated Play Proceedings of the 2007 DiGRA International Conference*, Tokyo, Japan, September 24-28.
- [9] **Lankoski, P., Heliö, S., and Ekman, I.** (2003). Characters in Computer Games: Toward Understanding Interpretation and Design. In M. Copier & J. Raessens (eds.). *Proceedings of the 2003 DiGRA International Conference: Level Up*, University of Utrecht, Utrecht, November 4-6 (CD-ROM).
- [10] **Murray, J. H.** (1997). *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*. New York: The Free Press.
- [11] **Jennett, C., Cox, A.L., Cairns, P., Dhoparee, S., Epps, A., Tijds, T., Walton, A.** (2008). Measuring and defining the experience of immersion in games. *International Journal of Human-computer Studies*, 66 (9), 641-661.

- [12] **Brown, E.** and Cairns, P. (2004). A grounded investigation of immersion in games. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, Vienna, Austria, April 24-29.
- [13] **Csikszentmihalyi, M. and LeFevre, J.** (1989) Optimal experience in work and leisure. *Journal of Personality and Social Psychology*, 56 (5), 815-822.
- [14] **Bevacqua, E., Richard, R., and De Loor P.** (2017). Believability and Co-presence in Human-Virtual Character Interaction. *IEEE Computer Graphics and Applications*, 37 (4), 17–29.
- [15] **Margolin, U.** (1986). The Doer and the Deed: Action as a Basis for Characterization in Narrative. *Poetics Today*, 7 (2), 205-225
- [16] **Catmull, E., and Wallace, A.** (2014). *Creativity Inc. Overcoming the Unseen Forces That Stand in the Way of True Inspiration*. New York: Random House.
- [17] **Johnston, O., and Thomas, F.** (1994). *The Illusion of Life: Disney Animation*. Disney Editions; Illustrated edition.
- [18] **Lesseter, J., and Rafael, S.** (1987). Principles of Traditional Animation Applied to 3D Computer Animation. *Computer Graphics*, 21 (4), 35-44.
- [19] **Williams, R.** (2009). *Animator's Survival Kit. Extended Edition*. New York: Farrar, Straus, and Giroux.
- [20] **Wells, P.** (2013). *Understanding Animation*. London: Routledge.
- [21] **Azema, M., and F. Rivere.** (2012). Animation in Palaeolithic art: A pre-echo of cinema. *Antiquity*, 86, 316–324.
- [22] **Leskosky, R. J.** (1993). Phenaskiscope: 19<sup>th</sup> century science turned into animation. *Film History*, 5 (2), 176-189.
- [23] **Michelsen, E. R.** (2009). Animated cartoons, from the old to the new: evolution for the past 100 years. *Malaysian Journal of Media Studies*, 3 (1), 94-101.
- [24] **Behrens, R. R.** (1998). Art, Design and Gestalt Theory. *Leonardo*, 31 (4), 299-303.
- [25] **Smoot, L., Bassett, K., Hart, S. J., Burman, D., and Romrell, A.** (2010). An interactive zoetrope for the animation of solid figurines and holographic projections. *Proceedings of International Conference on Computer Graphics and Interactive Techniques*. Los Angeles, CA, July 26-30.
- [26] **Warnecke, E.** (2016). Animation: A True Art. *ESSAI*, 14 (39).
- [27] **Leslie, E., and McKim, J.** (2017). Life Remade: Critical Animation in the Digital Age. *Animation: An Interdisciplinary Journal*, 12 (3), 207-213.
- [28] **Cooper, J.** (2019). *Game Anim: Video Game Animation Explained*. Boca Rotan, FL: CRC Press.

- [29] **Kent, S. L.** (2001). *The Ultimate History of Video Games: From Pong to Pokemon – The Story Behind the Craze That Touched Our Lives and Changed the World*. Roseville, CA: Prima.
- [30] **Haggis, M.** (2016a). *Video Games and the Value of Entertainment*. Breda: NHTV Breda University of Applied Sciences, 2016.
- [31] **Haggis, M.** (2016b). Creator’s Discussion of the Growing Focus on, and Potential of, Storytelling in Video Game Design. *Persona Studies*, 2 (1), 20-26
- [32] **McKee, R.** (1997). *Story: Substance, Structure, Style, and the Principles of Screenwriting*. It Books.
- [33] **Storr, W.** (2019). *The Science of Storytelling*. London: William Collins.
- [34] **Gottschall, J.** (2012) *The Storytelling animal: How Stories Make us Human*. Boston, MA: Houghton Mifflin Harcourt
- [35] **Manney, P. J.** (2008). Empathy in the Time of Technology: How Storytelling is the Key to Empathy. *Journal of Evolution & Technology*, 19 (1), 51-61.
- [36] **Hooks, E.** (2017). *Acting for Animators: 4<sup>th</sup> Edition*. Routledge. ISBN: 978-1138669123
- [37] **Hunt, M.** (1993). *The Story of Psychology*. New York: Doubleday Dell Publishing Group.
- [38] **Smith, B.** (1988). Gestalt theory: An essay in philosophy. Idem (Ed.), *Foundations of Gestalt Theory*, 11–81. Munich/Vienna: Philosophia
- [39] **Graham, L.** (2008). Gestalt Theory in Interactive Media Design. *Journal of Humanities & Social Sciences*, 2 (1).
- [40] **Kepes, G.** (1944). *Language of Vision*. Chicago, IL: P. Theobald.
- [41] **Kohler, W.** (1959). Gestalt Psychology Today. *American Psychologist*, 14, 727-734.
- [42] **Freidenberg, J., and Silverman, G.** (2012). *Cognitive Science: An Introduction to the Study of Mind*. Thousand Oaks, CA: Sage.
- [43] **Schindler, K., Van Gool, L., and de Gelder, B.** (2008). Recognizing emotions expressed by body pose: A biologically inspired neural model. *Neural Networks*, 21 (9), 1238–1246.
- [44] **Figuirodo, C.** (2015). Narrative and Visual Cinematic Strategies in Communication Design. *Procedia Manufacturing*, 3, 4358-4361.
- [45] **Henle, M.** (1961). *Documents of Gestalt Psychology*. Berkeley and Los Angeles: University of California Press
- [46] **Blakemore, S. J., and Decety, J.** (2001). From the perception of action to the understanding of intention. *Nature Reviews Neuroscience*, 2 (8), 561–567.
- [47] **Ekman, P., and Friesen, W. V.** (1982). Felt, false, and miserable smiles. *Journal of Nonverbal Behavior* 6 (4) 238–252.

- [48] **Carlquist, J.** (2002). Playing the story: Computer games as a narrative genre. *Human IT*, 6 (3), 7–53.
- [49] **Jenkins, H.** (2004). Game Design as Narrative Architecture. *First Person*, 44 (53), 118-130.
- [50] **Schoenau-Fog, H.** (2011). The Player Engagement Process – An Exploration of Continuation Desire in Digital Games. *Proceedings of DIGRA International Conference: Think Design Play*. Hilversum, Netherlands, September 14-17.
- [51] **Bosse, T., and Zwanenburg, E.** (2014). Do Prospect-Based Emotions Enhance Believability of Game Characters? A Case Study in the Context of a Dice Game. *IEEE Transactions on Affective Computing*, 5 (1). 17-31.
- [52] **Kersjes, H., and Spronck, P.** (2017). Modeling Believable Game Character. *IEEE Conference on Computational Intelligence and Games*. Santorini, Greece, September 20-23.
- [53] **Palmberg, R., Peters, C., and Qureshi, A.** (2017). When Facial Expressions Dominate Emotion Perception in Groups of Virtual Characters. *Proceedings of International Conference on Virtual Worlds and Games for Serious Applications, VS-Games*. Athens, Greece, September 6-8.
- [54] **IJsselsteijn, W. A., de Kort, Y. A. W., and Poels, K.** (2013). The Game Experience Questionnaire. Eindhoven: Technische Universiteit Eindhoven.
- [55] **Norman, K. L.** (2013) GEQ (Game Engagement/Experience Questionnaire): A Review of Two Papers. *Interacting with Computers*, 25 (4), 278-283.
- [56] **IJsselsteijn, W., de Kort, Y., Poels, K., Jurgelionis, A., and Bellotti, F.** (2007). Proceedings of International Conference on Advances in Computer Entertainment Technology. Salzburg, Austria, June 13-15

## **APPENDICES**

**APPENDIX A.1:** The game experience questionnaire.

**APPENDIX A.2:** The scripts that was used in the study.

**APPENDIX A.3:** The custom questions.

**APPENDIX A.4:** The participants' responds to the custom questions.





## APPENDIX A.1

The first section of the survey was GEQ. First part of GEQ, the core module, is shown in Figure A.1.1

### The Game Experience Questionnaire

Please read every line carefully and choose the option that is most suited to your experience.

\* Gerekli

#### The Game Experience Questionnaire - Core Module \*

Please indicate how you felt while playing the game for each of the items.

|                                      | 0 - not at all        | 1 - slightly          | 2 - moderately        | 3 - fairly            | 4 - extremely         |
|--------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| I felt content                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt skilful                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I was interested in the game's story | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I thought it was fun                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I was fully occupied with the game   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt happy                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| It gave me a bad mood                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I thought about other things         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I found it tiresome                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt competent                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I thought it was hard                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| It was aesthetically pleasing        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I forgot everything around me        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt good                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I was good at it                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt bored                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt successful                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

**Figure A.1.1:** The Game Experience Questionnaire – Core Module.

|   |                       |                       |                       |                       |                       |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| I felt imaginative                        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt that I could explore things        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I enjoyed it                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I was fast at reaching the game's targets | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt annoyed                            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt pressured                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt irritable                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I lost track of time                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt challenged                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I found it impressive                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I was deeply concentrated in the game     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt frustrated                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| It felt like a rich experience            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I lost connection with the outside world  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt time pressure                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I had to put a lot of effort into it      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

**Figure A.1.1 (continued):** The Game Experience Questionnaire – Core Module.

The second section of GEQ, social presence module, is shown in Figure A.2.2.

The Game Experience Questionnaire - Social Presence Module \*

Please indicate how you felt while playing the game for each of the items.

0 - not at all    1 - slightly    2 - moderately    3 - fairly    4 - extremely

|  |                       |                       |                       |                       |                       |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| I empathized with the character                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| My actions depended on the character's actions       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The character's actions were dependent on my actions | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt connected to the character                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The character paid close attention to me             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I paid close attention to the character              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt jealous about the character                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I found it enjoyable to be with the character        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| When I was happy, the character was happy            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| When the character was happy, I was happy            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I influenced the mood of the character               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I was influenced by the character's moods            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I admired the character                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| What the character did affected what I did           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| What I did affected what the character did           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt revengeful                                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt schadenfreude (malicious delight)             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

**Figure A.1.2:** The Game Experience Questionnaire – Social Presence Module.

The third and final section of GEQ, post-game module, is shown in Figure A.2.3.

The Game Experience Questionnaire - Post-Game Module \*

Please indicate how you felt after you finished playing the game for each of the items.

|  | 0 - not at all        | 1 - slightly          | 2 - moderately        | 3 - fairly            | 4 - extremely         |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| I felt revived                                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt bad                                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I found it hard to get back to reality           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt guilty                                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| It felt like a victory                           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I found it a waste of time                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt energised                                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt satisfied                                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt disoriented                               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt exhausted                                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt that I could have done more useful things | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt powerful                                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt weary                                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt regret                                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt ashamed                                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I felt proud                                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I had a sense that I had returned from a journey | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Figure A.1.3: The Game Experience Questionnaire – Post-Game Module.

## APPENDIX A.2

The movement and animation scripts that was used in the study shown in Figure A.2.1 and Figure A.2.2.

```
Movement Animation Controller (Mono Script)
#
Assembly Information
Filename Assembly-CSharp.dll

using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class MovementAnimationController : MonoBehaviour
{
    private string moveTag = "IsWalking";
    private string jumpTag = "IsJumping";
    private string shieverTag = "IsShiever";
    private string animTag = "ShieverIdle";

    private Animator chracterAnimator;
    // Start is called before the first frame update
    void Start()
    {
        chracterAnimator = GetComponent<Animator>();
    }

    // Update is called once per frame
    void Update()
    {
        //sonra sil
        if (Input.GetKeyDown(KeyCode.O))
        {
            ChangeShiverState(true);
        }
    }

    public void Move( bool StartMoving)
    {
        chracterAnimator.SetBool(moveTag,StartMoving);
    }

    public void Jump(bool StartJump)
    {
        chracterAnimator.SetBool(jumpTag,StartJump);
    }

    public void ChangeShiverState(bool IsShiver)
    {
        chracterAnimator.SetBool(shieverTag,IsShiver);
    }
}
```

**Figure A.2.1:** Animation controller script.

```
private string animTagHappy = "ballie_happy";
private string animTagSad = "ballie_sad";
private string animTagSuprised = "ballie_surprised";
private string animTagFall = "ballie_fall_landing";

public void PlayFallAnim()
{
    chracterAnimator.Play(animTagFall);
}

public void PlayHappyAnim()
{
    chracterAnimator.Play(animTagHappy);
}

public void PlaySadAnim()
{
    chracterAnimator.Play(animTagSad);
}

public void PlaySuprisedAnim()
{
    chracterAnimator.Play(animTagSuprised);
}

}
```

**Figure A.2.1 (contunied):** Animation controller script.

```

# Movement Controller (Mono Script)
Assembly Information
Filename Assembly-CSharp.dll

using System;
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class MovementController : MonoBehaviour
{
    public float speed;

    public GameObject CanvasReference;

    private CharacterController cc;

    private MovementAnimationController mac;

    // Start is called before the first frame update
    void Start()
    {
        mac = GetComponent<MovementAnimationController>();
        cc = GetComponent<CharacterController>();
    }

    private bool HasJumped;

    private Vector3 MoveVector;

    private bool WasMoving;
    // Update is called once per frame
    void Update()
    {

        CheckMove();
        cc.Move(Time.deltaTime*MoveVector);

        transform.Rotate(RotateWithASDQWE());

    }

    void CheckMove()
    {
        MoveVector = MoveWithArrows();
        if (MoveVector.magnitude > 0)
        {
            if (!WasMoving)
            {

```

**Figure A.2.2:** Movement control script.

```

        WasMoving = true;
        mac.Move(WasMoving);
        HasJumped = false;
        mac.Jump(HasJumped);
    }
}
else
{
    if (WasMoving)
    {
        WasMoving = false;
        mac.Move(WasMoving);
    }
}
}

void CheckJump()
{
    if (Input.GetKeyDown(KeyCode.Space))
    {
        HasJumped = true;

        mac.Jump(HasJumped);
        Invoke("StopJump",0.2f);
    }
}

void StopJump()
{
    HasJumped = false;

    mac.Jump(HasJumped);
}

public float increment = 44;

Vector3 RotateWithASDQWE() //Unity built in rotations
{
    if (Input.GetKey(KeyCode.LeftArrow) || Input.GetKey(KeyCode.A))
    {
        return new Vector3(0, -increment * Time.deltaTime, 0);
    }

    if (Input.GetKey(KeyCode.RightArrow) || Input.GetKey(KeyCode.D))
    {
        return new Vector3(0, increment * Time.deltaTime, 0);
    }

    return Vector3.zero;
}

private Vector3 MoveWithArrows() //point transformation
{
    if (Input.GetKey(KeyCode.UpArrow) || Input.GetKey(KeyCode.W))
    {
        return - transform.forward.normalized * increment * Time.deltaTime;
    }

    return Vector3.zero;
}

```

**Figure A.2.2 (contunied):** Movement control script.

```

}

private const string triggerTagHappy = "HappyTrigger";
private const string triggerTagSad = "SadTrigger";
private const string triggerTagSuprised = "SupriseTrigger";
private const string triggerTagShiver = "ShiverTrigger";
private const string triggerTagAntiShiver = "AntiShiverTrigger";
private const string doorTagShiver = "DoorTrigger";
private const string triggerTagFall = "FallTrigger";
private const string triggerTagCanvas = "CanvasTrigger";

public GameObject arrow1;
public GameObject arrow2;
public GameObject arrow3;
public GameObject arrow4;

void OnControllerColliderHit(ControllerColliderHit hit)
{
    if (hit.gameObject.CompareTag("Obstacle"))
    {
        increment = (increment - (0.001f * increment));
    }

    if (hit.gameObject.CompareTag("arrow1Trigger"))
    {
        arrow1.SetActive(true);
    }

    if (hit.gameObject.CompareTag("arrow2Trigger"))
    {
        arrow2.SetActive(true);
    }

    if (hit.gameObject.CompareTag("arrow3Trigger"))
    {
        arrow3.SetActive(true);
    }

    if (hit.gameObject.CompareTag("arrow4Trigger"))
    {
        arrow4.SetActive(true);
    }

    switch (hit.gameObject.tag)
    {
        case triggerTagHappy:
            if (!hasHappyPlayed)
            {
                GameObject.FindWithTag("littleBallie").GetComponent<Animator>().Play("ballie_happy");
                mac.PlayHappyAnim();
                hasHappyPlayed = true;
            }

            break;
        case triggerTagSad:
            if (!hasSadPlayed)
            {
                mac.PlaySadAnim();
                hasSadPlayed = true;
            }
    }
}

```

**Figure A.2.2 (contunied):** Movement control script.

```

        break;
    case triggerTagSad:
        if (!hasSadPlayed)
        {
            mac.PlaySadAnim();
            hasSadPlayed = true;
        }

        break;
    case triggerTagSuprised:

        if (!hasSurprisedPlayed)
        {
            GameObject.FindWithTag("Spikes").GetComponent<Animator>().Play("spikes");
            mac.PlaySuprisedAnim();
            hasSurprisedPlayed = true;
        }

        break;
    case triggerTagShiver:
        mac.ChangeShiverState(true);

        break;
    case triggerTagAntiShiver:
        mac.ChangeShiverState(false);

        break;
    case doorTagShiver:

        if (!hasDoorAnimPlayed)
        {
            GameObject.FindWithTag("Door").GetComponent<Animator>().Play("DoorAnim");
            hasDoorAnimPlayed = true;
        }
        break;
    case triggerTagFall:
        if (!hasFallPlayed)
        {
            mac.PlayFallAnim();
            hasFallPlayed = true;
        }

        break;
    case triggerTagCanvas:
        CanvasReference.SetActive(true);

        break;
    }
}

bool hasSadPlayed;

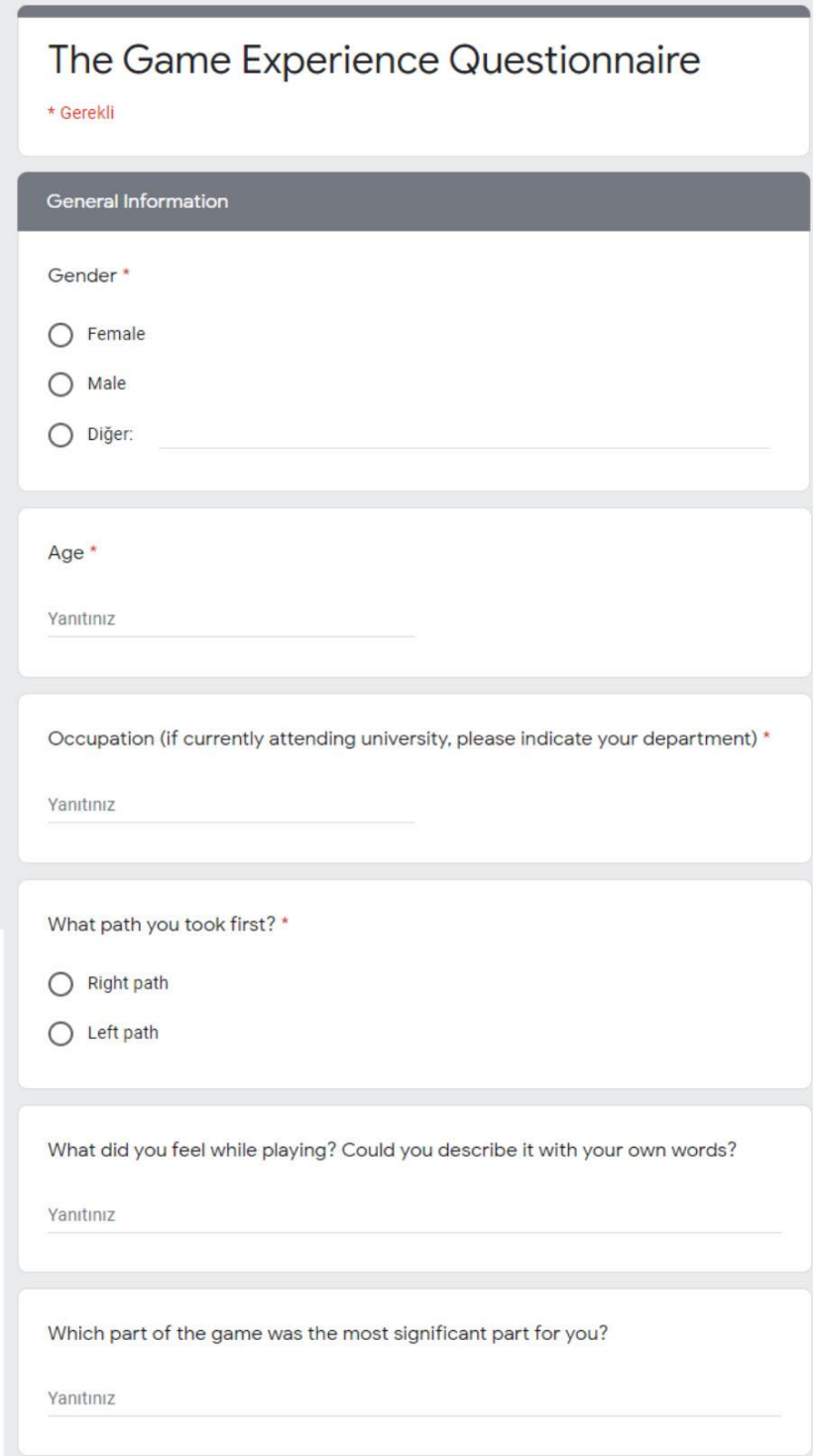
private bool hasDoorAnimPlayed;
private bool hasFallPlayed;
private bool hasSurprisedPlayed;
private bool hasHappyPlayed = false;
private bool hasSadPayed = false;
private bool hasShieverTriggered = false;
}

```

**Figure A.2.2 (contunied):** Movement control script.

## APPENDIX A.3

The custom demographic questions that took part in the second section of the survey are shown in Figure A.3.1.



The Game Experience Questionnaire

\* Gerekli

General Information

Gender \*

Female

Male

Diğer: \_\_\_\_\_

Age \*

Yanıtınız \_\_\_\_\_

Occupation (if currently attending university, please indicate your department) \*

Yanıtınız \_\_\_\_\_

What path you took first? \*

Right path

Left path

What did you feel while playing? Could you describe it with your own words?

Yanıtınız \_\_\_\_\_

Which part of the game was the most significant part for you?

Yanıtınız \_\_\_\_\_

**Figure A.3.1:** The second section of the survey.

## APPENDIX A.4

The answers to the last two questions on the second part of the survey were written answers. These questions were not obligatory, all the given answers to these two questions are given in Figure A.4.1 and Figure A.4.2.

|  |
|--|
| It was interesting.  |
| I was excited because I was very curious about the end of the game and it was a new experience for me.   |
| oyunun beni aldatmaya çalıştığını  |
| sol döngüyü tamamlayıp aynı yere geldiğimde aldatılmış hissettim, oyunda kaybetme duygusunu hiç hissedemedim   |
| I feel aimless. because i dont know where and why i am going.  |
| At first I thought I was in a maze and the only purpose was finding the end so I was bored at first but when I started to see different objects, surfaces and structures and when character started to bounce I was more curious about the game and I get excited.   |
| When I took the left path, I did not understand what I was doing. But then I took the right path, the character started jumping and it was funny.  |
| I was curious first. But, graphics, lights and lack of interaction downed my mode and expectation from the game. After one min, I just played to see the ending without paying too much attention to the game that much, since I thought, it is just a simple walk and discover game. So, I was feeling curious, while playing the game. But there was no other feelings   |
| first confused then proud  |
| I was fully focused on game mechanics and tried to find all the bugs I could.  |
| First, i thought it was just a walking simulator and then the right path came... Those spinning thingies were really challenging but i made it.  |
| eksik  |
| numb   |
| önce bir keşif oyunu olduğunu düşündüm, düz gittim ve labirente gittim ilk sapakta yolun sola kıvrıldığını düşünerek çıkmaz yola çıkacağını düşündüm ve yolu takip etmeye çalıştım. yoldaki objeler ile etkileşime geçmeye çalıştım ama süsten ibaret olduğunu anladım yolun sonuna ulaştığımda ok işareti beni duvara yönlendirince duvardan geçebileceğimi düşündüm ama geri gitmem gerektiğini biraz geç anlattı. geri döndüğümde başta tercih etmediğim yol sapağına gittim çünkü tam geri dönersem ve doğru yol burasıysa geri dönmekten kurtulurum diye düşündüm. o yolun sonunda da benzer yere ulaşın en başa dönme kararı verdim. sağdan gittiğimde ise olay bir parkura dönüştü ilk kafama inen dikenleri fark etme imkanım olmadı ve can kavramı olmadığını fark edince bodoslama parkuru geçmeye çalıştım. pervanelerde pek bir şey hissetmedim ama açılır kapanır duvarlarda yer yer ezileceğimi hissettim. sallanan yerlerde diğer oyunlardan alışık olduğumuz beklersen zemin düşecek hissi oluştu bu yüzden arkama bakmadan koştum. yolun sonunca bizim robotun eşini bulmasındaki mutlulukları bana da yansıdı. Fakat o kadar labirentten sonra iki yolda aynı yere çıkmıyormuş keşke bunu seçseydim pişmanlığı oluşturdu. insan kendini kötü hissediyor bu noktada oyunda geri gitme ihtiyacında S tuşuna elin gitmesi bir boşluk yaratıyor ama nedense çabuk adapte olunuyor. ortam ile ışıklar zaman zaman şaşırtıcı olabiliyor ama bunu bir mücadele etkeni olarak hissettim. hissettiğim eksiklerden birisi ise ortamdaki dokulardı. bu yüzden kendimi oyunun içerisinde hissedemedim sunu bir ortam olarak geldi. |

**Figure A.4.1:** Participant responds to “What did you feel while playing?”

Kaybolduğumu ve bir labirenti çözmem gerektiğini düşündüm, yolda karşılaştığım işaretleri takip ederek yönümü buldum. Çeşitli objelerle karşılaşmamın bir amacı olduğunu ve duvarların arkasının görülmesinin bilerek yapıldığını düşündüm. Oyun içerisindeki mekanikleri yetersiz buldum. Ama oyunun içerisinde bir mesaj gizliydi ve ben bu yolculuk sonunda kendimi huzurlu hissettim.

A little bit lost

I liked the interesting objects hidden around the maze, I wanted to find them all! The last hall I chose was the one that made me fall. I'm not certain whether it opened after I found the objects in the maze, but it surprised me and was really fun! I like the way the character responded to the objects hitting it and the way it jumped for joy at the end. A fun experience!

I felt myself in a tough situation. Couldn't figure out exactly what to do.

I felt a bit stressed. My character dropped down a hole that they could only move forward from (no way to return up or explore backwards), and then they had to get past moving walls, tilting floorboards, and swirling fans, all of which could have caused damage to my character. Also, my character kept bouncing energetically, but I wasn't able to understand why, so that made me nervous that I was missing something that was important to maintaining my character's health.

I felt very disoriented and wasn't sure where I was going and the controls were hard to maneuver

I felt the unknown

at the beginning it was okay but then it became stressful for me and made me nervous

I felt like I was in a labyrinth and something was about to leap out and attack me. Overall it was exciting.

At first I couldn't understand what the game was. I just started to move forward with the "explore" text. I also don't know how I can get the objects I come across or whether I should get them. That's why I was a little surprised. I don't know what to feel. The uncertainty was too much.

I felt bored. The gray images and the difficult movement of the character made me nervous.

The character was too slow which bored me. I started with left part and thought that I was in the maze and I also tried to jump to the statues for no reason :D . I also couldn't understand the logic in the game exactly. So I am a little bit annoyed.

I was boring because character movement was too slow.

ilk başta labirentten dolayı gergin hissettim fakat bir çıkış yolu bulunca gerçekten sevindim. tabii ki geliştirilecek bir oyun olduğu için bazı eksiklikleri var fakat bu haliyle de eğlenceli.

First of all, I tried to understand what should I do in the game. Then, I found some geometrical objects and thought that I could collect them. However, there was no indication that I had succeeded or lost; this situation made it difficult for me to understand the game. Moreover, I did not even understand what the game was going to do in the end. Also, looking from under the character and the high walls made me feel like I was lost.

I couldn't finish it and the character was so slow. The environment wasn't attractive. I felt bored but I continued because I wanted to understand the story.

I felt empty.

It was a curious journey, my interest increased as the game continued.

Kendimi bir labirentin içinde gibi hissettim. ve oradan en çabuk şekilde kurtulmak istedim. Bu da tüm odalara bakıp en çabuk şekilde çıkışa ulaştım. Bu şekilde benim keşfetme duygumu ortaya çıkardı. Eğlenceli bir oyundu. Teşekkür ederim.

**Figure A.4.1 (continued):** Participant responds to “What did you feel while playing?”

I was curious to find out what came next and tried to pay attention to details. I also liked how happy ballie was when they found their child / friend.

I felt aimless and didn't know what to do. The signs and explanatory sentences were insufficient so I felt lost. I didn't realize the game was over.

Slow and without a sense of navigation.

Firstly, I've looked for the capable of character. I've learned my capabilities by pressing all the keys on the keyboard. Then I looked behind of me before i went straight. I was cautious because i didn't know what the result of the two ways would be. Since the road on the right was down and i couldn't go up, i choosed left one. I always continued from the left because i felt myself in labyrinth. I would like to take the objects that i came across, but the direction signs on the wall became my reference. It was a different experience.

It was strange and scary but it is an interesting idea that game design changes when you look at the objects.

I felt demoralized and i felt like i was at a dead end.

It was an interesting experience. At first, I tried to go the right path but the character started to shaking and I felt like I don't wanna go that way. So, I chose the left path. That said to me something that I can't describe about the concept of the safe zone. I felt some anger when all I have to do choose the right path.

**Figure A.4.1 (continued):** Participant responds to “What did you feel while playing?”

When I chose to jump after exiting everything else.

The moment I realized that there was a second way, my interest in the game grew even more.

sol taraftan gittiğimde karşıma çıkan top kısmı

sol kapıdan geçip aynı odaya geri döndüğümü gördüğüm an

End of the game. When our character met yellow one, im happy

when the character bounce and when I started to see trap-like structures.

When I saw the statue of character on the left path.

Statues and level ending. I have wondered what those statues mean. I also felt happy when two robots meet up happily.

ending

I felt bad when labyrinth went to nowhere at all.

SPINNING THINGIES

none

aynı görünmesine rağmen giriş kapılarının farklı yere çıktığı an

Son kısımdaki kavuşma anı benim için en önemliydi.

**Figure A.4.2:** Participant responds to “What part of the game was the most significant part for you?”

|   |
|---|
| Jumping. It was fun   |
| The falling into the scary part of the maze was fun!  |
| I still am curious about why i couldnt interact with that flying whitw ball   |
| Getting through/past the obstacles is generally the most memorable part of the game for me - I often find myself stressing over that part.  |
| when I saw little yellow Ballie soo cute  |
| at the beginning of the game  |
| I'm extremely curious as to what those hovering 3D objects over those pedestals were.   |
| I think him/her joy when he/she met the yellow character was beautiful.   |
| seeing yellow character   |
| Reaching the end. Finding my partner was significant because in the left part I thought that there is no aim in the game.   |
| Shape Discover Phase  |
| Pervanelerin olduđu bölüm, beklenmeyen bir şekilde aşağıya düştüğümüz bölüm ve oyunda labirent olduğunu anladığım an çok önemliydi. o yuvarlak heykeli gördüm ama ne olduğunu şahsen ben pek anlayamadım. bir ödül sistemi getirilebilir. |
| Finding the objects   |
| at the end of the left path I found myself but I couldn't unite.  |
| The beginning.  |
| I think that the right path is more intriguing than the left path, especially when the character met its friend. The traps got me more interested to the game.  |
| Benim için önemli olan keşfetme duygusuydu.   |
| The right path and ending for sure.   |
| When I come across objects while I'm wandering  |
| Where I got stuck between the propellers.   |
| First scene that i have to choose left or right ways.   |
| Exploring   |
| The second part, for sure. Because I found my friend, the chaos ended.  |
| The first part is the most significant part.  |

**Figure A.4.2(continued):** Participant responds to “What part of the game was the most significant part for you?”



## CURRICULUM VITAE

**Name Surname** : Didem Kübra Atila



### **EDUCATION** :

- **B.Sc.** : 2017, Istanbul Technical University, Faculty of Architecture, Department of Architecture.

### **PROFESSIONAL EXPERIENCE AND REWARDS:**

- 2019 Mavi Baykuş Animation
- 2021 – Nyctophile Studios

### **PUBLICATIONS, PRESENTATIONS AND PATENTS ON THE THESIS:**

- **Atila, D. K., and Gül, L. F.** 2021: Designing Emotion Animations as a Storytelling Element in Video Games. Mimarlıkta Sayısal Tasarım XV. Ulusal Sempozyumu. June 28-29, 2021. Istanbul, Turkey.