

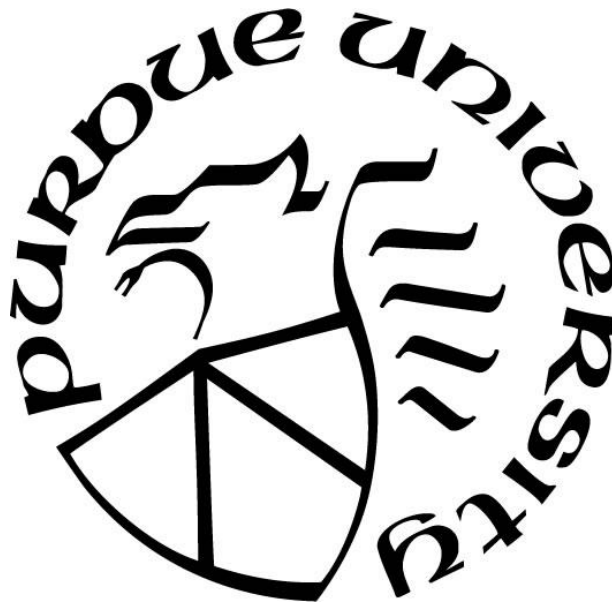
AUDIENCE PERCEPTION OF EXAGGERATED MOTION ON REALISTIC ANIMATED CREATURES

by
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To my parents, brother, sister, and fiancé. For their continuous love and support in my pursuit to study Animation, and for the patience they had to listen to the many ramblings of a passionate artist along the way.

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ABSTRACT

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The recent push for more detailed graphics and realistic visuals in animated productions has sparked much debate around the new films' photorealistic visual style. Some critics argue that the new "live-action" versions of movie classics such as the Lion King are not as visually stylish as the original ones, and the photorealistic characters are not as likeable, fun and intriguing as their stylized counterparts. This paper reports ongoing research whose goal is to examine whether it is possible to apply traditional animation principles to photorealistic animated animal characters in order to make them more expressive, convincing and ultimately entertaining. In particular, the study reported in the paper investigated the extent to which varying degrees of exaggeration affect the perceived believability and appeal of a photorealistic, anthropomorphic cat character performing a series of actions in a high detail environment. The study included 82 participants and compared three levels of exaggeration applied to the cat's motions, e.g. no exaggeration, low exaggeration and high exaggeration. Findings show that subjects found the no-exaggeration clip more appealing and believable than the exaggerated versions, although the difference in appeal was not statistically significant. When comparing the two exaggerated clips, participants rated the high exaggeration clip higher for believability and appeal than the low exaggeration one.

CHAPTER 1. INTRODUCTION

1.1 Statement of Purpose

If we examine recent movie productions featuring photorealistic talking animal characters we notice that the majority of the recent research efforts in computer animation have concentrated on developing new methods and tools for increasing photorealism and motion accuracy “Animating Quadrupeds: Methods and Applications,” (Skrba et al., 2008), with less focus on implementing unique, traditional animation techniques and principles, such as exaggeration. Some critics wonder whether the recent photorealistic approach robs animated films of character and argue that with real-looking animals there is less potential for strong visual characterization.

Disney animators Ollie Johnston and Frank Thomas published the “12 principles of animation” in 1981, codifying concepts of movement, pacing, and cartoon physics that had been used since Walt Disney’s early days (Johnston & Thomas, 1981). Most of these concepts were built around exaggeration, not realism. Ideas such as “squash and stretch” and “pose-to-pose movement” were both inherently unrealistic and incredibly effective. If we compare the shots in the 2018 Lion King to their 1994 counterparts, we cannot help but notice how the need to make the characters adhere to realistic physics makes the characters less convincing and less fun. It also decreases their ability to express feeling in their movements. For instance, A. Todd points out that “the way 1994 Rafiki thrusts baby Simba into the air would feel physically dangerous with realistic physics, so the remake tones the gesture down. A subtle difference in one shot, but spread across the whole movie, the original movie is much more powerful for that exaggeration,” (Todd, 2018).

In summary, failing to implement fundamental principles of animation, such as exaggeration when animating talking photorealistic animals might result in a significant decrease

in the characters' appeal and believability. Removing exaggeration gives a more realistic nature to the animal, however, this approach may reduce the audience connection with the character and the belief from the viewer that the character is both living and feeling.

The overall goal of this research is to investigate whether it is still possible to implement fundamental principles of traditional animation in new animated productions featuring photorealistic animal characters. More specifically, the objective of the study reported in the paper was to examine the extent to which different degrees of exaggeration in the motions of a photorealistic computer animated cat character affect perception of the character's believability and appeal. The paper is organized as follows. Chapter 2 presents a discussion of the 12 Principles of Animation and a review of relevant prior perceptual studies in character animation. Our experiment is described in Chapter 3 and the results are reported in Chapter 4. A discussion of findings and ideas for future work are included in Chapter 5.

1.2 Research Questions

This research examined the extent to which the degree of exaggerated motion affects audience perception of realistic, anthropomorphic animal characters placed in high-detail environments. More specifically, the work reported in this paper aimed to answer the following questions:

- How do different degrees of exaggerated motion affect audience perceived *believability* of the performances of realistic, anthropomorphic creatures placed in high detail environments?
- To what extent is exaggerated motion beneficial for making realistic, anthropomorphic creatures more appealing placed in high detail environments?

1.3 Hypotheses

The goal of the study was to examine the extent to which different levels of exaggeration affect (a) perception of believability of a realistic, anthropomorphic cat character performing a series of actions in a highly detailed environment and (b) perception of character's appeal. The study used a within-subjects design and collected both quantitative and qualitative data. The independent variable was the degree of exaggeration and 3 levels were considered, e.g. no exaggeration (control clip), low exaggeration (experimental clip 1) and high exaggeration (control clip 2). The dependent variables were 'perceived believability' and 'perceived appeal', which were measured by participants' ratings on a 7-point Likert scale. In addition, the study collected qualitative data in the form of open-ended comments expressing how the subjects felt about the animations. The design of the study was truly experimental by implementing a treatment to a random sample of participants through animated video clips.

The hypotheses of the study are listed below and were formulated based on best practices of animation, as well as prior research in character animation. Best practices and principles of animation show that exaggeration can improve the appeal of animated 3D characters (Williams, 2012). Recent perceptual studies in character animation suggest that a moderate level of exaggeration can improve the likeability of photorealistic characters, but too much exaggeration could detract from a realistic character's performance and believability.

H_{01} : There is no difference in perceived character believability between the control clip (no exaggeration) and experimental clip 1 (low exaggeration).

H_{a1} : There is a difference in perceived character believability between the control clip (no exaggeration) and experimental clip 1 (low exaggeration).

Perceived believability is higher for experimental clip 1 (low exaggeration).

H₀₂: There is no difference in perceived character appeal between the control clip (no exaggeration) and experimental clip 1 (low exaggeration).

H_{a2}: There is a difference in perceived character appeal between the control clip (no exaggeration) and experimental clip 1 (low exaggeration). Perceived appeal is higher for experimental clip 1 (low exaggeration).

H₀₃: There is no difference in perceived character believability between the control clip (no exaggeration) and experimental clip 2 (high exaggeration).

H_{a3}: There is a difference in perceived character believability between the control clip (no exaggeration) and experimental clip 2 (high exaggeration). Perceived believability is lower for experimental clip 2 (high exaggeration).

H₀₄: There is no difference in perceived character appeal between the control clip (no exaggeration) and experimental clip 2 (high exaggeration).

H_{a4}: There is a difference in perceived character appeal between the control clip (no exaggeration) and experimental clip 2 (high exaggeration). Perceived appeal is lower for experimental clip 2 (high exaggeration).

1.4 Significance of the Problem

As the film industry sees more successes in realistic animations such as *The Jungle Book*, *Life of Pi*, and the *King Kong* films, more projects are being put into production to challenge animators into creating more memorable and impressive performances with their characters. When creating animated realistic creatures, decisions must be made either to follow natural, instinctive body motion which may result in limited movements, or to aim for more entertaining, exaggerated gestures that alter realistic movement. Researching audience reactions to animated creature performances of varying levels of exaggerated movements will help guide animators to

know which areas are crucial for expressive animations and to what degree, if any, can the motion be exaggerated. By exploring these concepts and refining techniques, the character's animation will significantly increase in the ability to deliver a believable performance and build a successful connection with the audience.

1.5 Scope

The goal of this study was to explore beneficial techniques that can be applied to recent, successful projects in the animated film industry. Some reoccurring trends appearing in these recent films often include environments with intensive amounts of detail and realism, and highly realistic animated anthropomorphic animals. Therefore, this research utilized a character design and environment with high levels of detail to resemble these trending projects. The chosen character design was a realistic 3D rigged feline set in a realistic household environment. Assets for the rig and environment came from online animation resources while the animations were created by the researcher using keyframe animation techniques. In order to aid animators to make a character's performance more distinguishable and appealing in visually-loaded scenes, this study specifically targeted the character's motion. While there are the 12 Principles of Animation, this study primarily focused on the principles of exaggeration, squash & stretch, and appeal.

1.6 Assumptions

This research was performed with the following assumptions:

- The participants would have internet access when starting and while working through the survey and animated clips.
- All participants would reflect on their answers carefully and honestly when submitting their results for the survey.

- Since the animations contained spoken dialogue, it was assumed that the participants would play the clip with audio functionality and would be able to understand English. The participants would be informed before watching the videos that the survey would require audio.
- Participants would understand the content of the questions and be given enough time to view and rate the clips. Any lack of understanding by the participant would be explained in his or her commented feedback.
- Participant responses may be influenced by popular realistic animated films at the time of the study. Their opinions may be a reflection based on their favored or unfavored live-action animated films.
- There will not be issues with internet connection or other technical complications.

1.7 Limitations

The limitations for this study included:

- The animated clips accurately showed a realistic, anthropomorphic feline character in heavily detailed environments to represent current and upcoming trends in realistic animation.
- The survey explained complete anonymity to the participant to avoid dishonest or bias answers, along with the option to exit the study at any time.
- The participants should be able to recognize differences in the exaggerated motion between the clips of animation and answer with their preferences for animated performances. Some participants may not notice the exaggeration or may not have a preference for the motion of the character.

- The distribution of the survey relied on a random sample of participants using the online crowdsourcing sites Amazon Mechanical Turk and Qualtrics.

1.8 Delimitations

The delimitations for this study included:

- The study did not test participants under the age of 18.
- With limited time and labor resources for the production process, the animations did not include a variety of creatures from the animal kingdom. This study featured only one type of animal, e.g. a cat character; therefore, the results might be applicable to animations of feline characters only.
- Due to the limitations for production development, the animations were 18 seconds in length. The study included a series of short clips to quickly and accurately represent scenes from realistic animations.

1.9 Definitions

Anthropomorphic - described or thought of as having a human form or human attributes; ascribing human characteristics to nonhuman things. (Merriam-Webster, 2018)

Appeal - "...anything that a person likes to see, a quality of charm, pleasing design, simplicity, communication, and magnetism. Your eye is drawn to the figure that has appeal, and, once there, it is held while you appreciate what you are seeing." (Thomas & Johnston, 1995, p. 68).

Believability – "...good design coupled with a well-crafted performance...", "If the designer doesn't know and believe in the characters and the animator fails to emotionally engage with his subject, then an audience has no chance and the character will remain unconvincing" (Webster, 2005, p. 109).

Exaggeration - “This principle looks at magnifying or reducing a particular action or emotion to a certain extreme” (Wages, Gruenvogel, & Gruetzmacher, 2004).

Principles of Animation - “...acting principles into one animation workflow that helps novice animators to create believable characters” (Sultana, Lim Yan Peng, & Meissner, 2013).

Realism - “The notion of realism is used here to relate to a reference point; ... if we speak of realistic graphics the point of reference will be the sense-impressions we receive with our eyes from the real world and the graphics on the screen will be compared with those” (Wages, Gruenvogel, & Gruetzmacher, 2004).

Realistic - “Characters that closely mimic reality” (Maestri, 2006)

Stylized - A character design with some level of exaggeration, caricature, simplification, and/or unusual proportions. The design can range from icons and simple characters to just below photorealism (Bancroft, 2006).

Uncanny Valley - used to refer to the unpleasant feeling that some people have when they see robots, or pictures of a human being created by a computer, that appear very similar to a living human. (Cambridge, 2018).

1.10 Summary

This chapter covered the statement of purpose, research questions, significance, scope, assumptions, limitations, delimitations, definitions, and general information for this research. The following chapter will provide the literature review for topics relating to this research.

CHAPTER 2. REVIEW OF RELEVANT LITERATURE

Over the past century animation artists have pushed the boundaries for technology and expectations, starting with the silent hand-drawn shorts of the 20th century and growing into the stunning full-length feature films of today. As the time went by, animation techniques had to continuously evolve to meet critics' and audiences' increasing standards. By the end of the 20th century, the industry faced a shift toward computer-generated imagery (CGI). A new age of animation, at times referred to as the digital dawn (Cavalier, 2011) was born.

In recent years, the popular trend in animated film has been creating the most realistic imagery feasible with computer graphics, in terms of both detailed characters and extraordinary environments. Recent animated productions utilizing realistic graphics have been met with success. For instance, Walt Disney Co.'s live-action 2016 film *The Jungle Book*, earned \$103.6 million (Fritz, 2016) in the U.S. and Canada on opening weekend, and a cumulative \$966.6 world-wide ("The Jungle Book", 2016). Figures 2.1 and 2.2 illustrate the change in visual style between the film's 2D predecessor and its transformation into the trending realistic graphics. Success from this film has already led to announcements for future projects which will continue to combine both actors and animated characters, particularly realistic animals (Fritz, 2016).

Releasing the news for future productions of realistic style implies yet another shift for the animation industry. Along with the development of computer graphics, research has been applied to test the validity of different methods in the production process. To improve character performances, important areas to study are the character's design, visual style, personality, and motion. Understanding these areas and putting them into practice have not only shown to be beneficial for previous animated cartoons but can be applicable for future productions in the shift towards greater realism.



Figure 2.1 Comparison of realistic and stylized bear examples



Figure 2.2 Comparison of realistic and stylized tiger examples

Several studies whose goal was to examine how people perceive and interpret different aspects of animated characters can be found in the literature. In this section we present a partial review of relevant studies that focused on perception of animated characters' emotions and believability from body movements and facial articulations. We also report studies that examined whether there is a significant correlation between character visual design (stylized versus realistic) and perceptual effects.

2.1 Principles of Animation

The 12 principles of animation are a set of fundamental rules of the ‘language of movement’ that were taught at the Walt Disney Studios in the 1930s. They apply to all types of character animation and are crucial to the production of believable, life-like animated characters. They were first published by Thomas and Johnson in 1981 in the book “Disney Animation: The illusion of Life” (Johnston and Thomas, 1995) and include: stretch and squash, anticipation, arcs, overlapping action and follow through, secondary action, exaggeration, timing, appeal, pose to pose and straight ahead animation, staging, slow-in slow-out, and solid drawing. In this research, we are concerned primarily with the principles of exaggeration, appeal, and stretch and squash (resulting from exaggerated motions), the primary focus being on exaggeration.

The classical definition of exaggeration employed by Disney was ‘*to remain true to reality, but present it in a wilder, more extreme form*’ (Johnston and Thomas, 1995). Often, an exact recreation of real life can be static and dull, whereas adding exaggeration, e.g. for instance increasing the amplitude and speed of the movements, or the amount of character deformation, can make the performance more clear, convincing and interesting. According to Disney, every action, pose and expression can be taken to the next level to increase the amount of impact on the viewer, and adding exaggeration does not mean departing from realism. In other words, making a character’s performance more realistic does not mean making the character’s physics and proportions more consistent with reality, but rather making the idea or the essence of the actions more apparent and convincing by taking the movements and deformations to more extreme levels.

Two other important principles of animation relevant to the study are the principle of stretch and squash and the principle of appeal. Stretch and squash defines the rigidity and mass of an object/character by distorting its shape during an action, while maintaining a constant

volume (Lasseter, 1987). When the movements of a character are exaggerated the resulting stretch and squash is more pronounced. The principle of appeal refers to creating a design or an action that the audience enjoys watching. While an actor can have charisma, an animated character can have appeal. To the Disney animators, appeal meant “*anything that a person likes to see, a quality of charm, pleasing design, simplicity, communication, magnetism*” (Thomas and Johnston, 1995). Exaggerating the character’s movements and deformations can contribute to increasing the character’s appeal.

Another concept relevant to the study is ‘believability’. While believability is not included in the 12 Principles of Animation, it has been referenced over the years as another extremely important concept in character animation. An animated character is believable when it appears convincing to the audience, in other words, when it displays a clear emotional style and gives the illusion that is living and feeling. According to Webster (2006) believability is lost when “*...the animator fails to emotionally engage with his subject. Then an audience has no chance, and the character will remain unconvincing.*”

2.2 Prior Perception Studies in Character Animation

2.2.1 Realistic Character Designs

When diving into the subjects of modern realistic graphics, one well-known area of research and ongoing discussion is the uncanny valley. This concept, shown in Figure 2.3, began in 1970 with robotics professor Masahiro Mori (2012), and has been recently reestablished in his article “The Uncanny Valley” (Mori, Macdorman, & Kageki, 2012). According to Mori (2012), once a design reaches a high level of human likeness without genuinely appearing to have real life, the connection between the viewer and the design drops to a harsh, negative relationship. The viewer may often refer to the design as eerie, unsettling, or creepy.

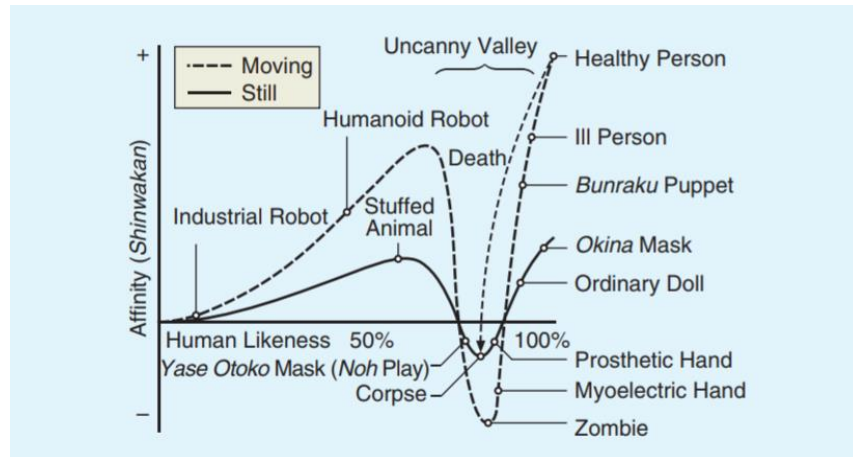


Figure 2.3 Mori's Theory of The Uncanny Valley

Mori goes on to explain in his research that once motion is applied to the product, the negative effects of the uncanny valley are significantly amplified. Products such as zombies and myoelectric hands, or moving prosthesis, were shown to drastically increase the negative relationship with viewers. The theory that applying motion to realistic characters will increase the unpleasant reactions from viewers is undoubtedly concerning for animators developing realistic characters. Therefore, understanding the concepts of the uncanny valley is applicable to this thesis work when examining opportunities for applying exaggerated motion to realistic characters.

While the research presented by Mori (2012) creates daunting concerns for animators working with realistic characters, there are exceptions and contradictions to the theory. In one study "Does the uncanny valley exist?" (Burleigh, Schoenherr, Lacroix, 2013), researchers tested the reactions from 162 participants viewing digital characters with varying facial proportions. In their conclusions, the researchers found a linear relationship between human accuracy and positive responses, therefore disproving Mori's theory for realistic characters. It should be noted that the portrait images were not animated, and the designs ranged similar in style for the

experiment. However, the results from this study may relieve some pressure off artists working to create realistically rendered characters.

In the case of another research article, “How Realistic Should Avatars Be?” (James et al., 2015), the researchers measured blood oxygen-level dependent (BOLD) activation in participant’s brains to better understand the perception of faces. Unlike the previously mentioned studies, this research included a focus on animal faces. Data was gathered from functional magnetic resonance imaging (fMRI) to analyze which areas of the brain show more activity when viewing images of real human faces, cartoon human faces, real animal faces, and cartoon animal faces. Their results concluded that real human faces elicit stronger reactions in the brain as opposed to animated human faces. Additionally, there did not appear to be a drastic difference when comparing real animal faces with animated animal faces.

These results, along with the aforementioned studies on realistic character design, show more leniency from viewers on animal characters. While there does not appear to be a strong negative or positive relationship among cartoon animals compared to realistically rendered animals, this thesis will take into consideration the effects of adding motion to realistic creatures. As claimed by Mori, the potential negative effects from the uncanny valley are heightened when animating a realistic character. In the data collection for this thesis, responses relating to eeriness, unpleasantness, etc., will be noted, particularly should such responses refer to the motion of the animal character. Nonetheless, the validity of this thesis will benefit from experimenting with animal characters as they appear to be exempt from potential effects of the uncanny valley when reviewing these research articles on realistic characters.

2.2.2 Character Personality

To enhance character motion for better performances, a study by Anasingaraju et al. (2019) examined the effects of different body channels (e.g. body motions, eye movements, facial articulations and lip synch) on audience perceived believability of an animated character's emotions. The study featured a stylized humanoid character displaying 5 different emotions, e.g. happiness, sadness, surprise, anger, and fear. Results of the study revealed that the body movements contribute the most to the perceived believability of the character's emotion across all 5 emotions, followed by facial articulations, eye movements and lip synch animation. Our experiment was also inspired by Anasingaraju's study which points to the superiority of body movements over lip synch and facial motions for the expression of character's believability. Our study in fact focused only on exaggerated body motions and did not consider facial articulations and lip synch.

Research on perception of a character's personality traits in animation was studied by Badathala et al. (2018) in the thesis, "Effect of Gait Parameters on the Perception of Personality." Badathala et al. (2018) investigated the effects of six different gait parameters e.g. stride length, walk speed, beltline tilt, upper body twist, forward/backward upper body lean, and foot inward/outward rotation on the perception of a humanoid stylized character's personality. Findings show that the gait of the character can inform the audience significantly about the character's personality and confirm the importance of body motions in perception of character's believability. Of the six parameters tested, it was observed that four have a particularly significant effect on the perception of the character's personality namely, stride length, speed, beltline tilt and upper body twist.

A study by Mc Donnell et al. (2008) examined perception of 6 basic emotions (sadness, happiness, surprise, fear, anger and disgust) from the movements of a real actor and from the same movements applied to 5 virtual characters (e.g. a low- and high-resolution virtual human resembling the actor, a cartoon-like character, a wooden mannequin, and a zombie-like character). Results of the experiment showed that subjects' perception of the emotions was for the most part independent of the character's body style. Several other studies have examined how virtual characters should be designed to be believable and elicit emotion from the viewer. A few experiments have shown that people feel empathetic towards the character if he/she is more similar in design and motions to a human being (Riek et al., 2009; Nass et al., 2000). Ruttkay et al. (2004) argue that people may view realistic characters as more intelligent but may view non-humanlike stylized characters as more appealing and entertaining. McCloud in his book "Understanding Comics" claims that iconic characters with exaggerated motions are more effective over realistic characters, as audience's involvement increases (McCloud, 1993). For that reason, iconic characters are often used commercially. People may prefer iconic agents because iconic agents are subject to fewer social norms (Woo, 2009). A study by Adamo-Villani et al. investigated whether the visual style of signing avatars (realistic vs. stylized) affect viewers' perception of the avatar's appeal (Adamo-Villani et al., 2015). Results showed that the stylized signing avatar was perceived as more appealing than the realistic one. The 'Uncanny Valley' hypothesis may explain why stylized characters with exaggerated movements and deformations could be more appealing and believable than realistic characters, as people feel eerie and unpleasant when a high degree of realism (but not complete realism) in a character is reached (Mori et al., 2012).

2.2.3 Character Motion

As mentioned before, a commonly noticed difference between classic cartoons and new, realistic graphics is the style of motion (realistic vs stylized) in the animation. Realistic characters are often consistent with real world physical limitations and therefore, often, their motions do not adhere to animation principles such as exaggeration and emphasized squash and stretch. This contradicts the animation research from the dissertation “Discerning Emotion Through Movement - A study of body language in portraying emotion in animation,” (Larsson, 2014). The research presented explains the importance of facial expression and tone of voice, and names body language the most important factor for a convincing performance. The author, Pernilla Larsson (2014), shares “...up to 93% of human communication is made up of body language” (p. 4), illustrating the importance of attention to detail when animating the bodies of characters.

Larsson (2014) went on to test human ability to identify emotion by having sixteen participants watch and rate a variety of animated clips each expressing a different emotion. Designs for the characters in the clips were kept very simple, lacking faces or any unique traits to avoid having other factors unintentionally affect viewer perceptions. The goal was to focus on body language communicating the emotional states: anger, sorrow, joy, and a neutral state. After results were gathered, the most successful emotion depicted was sorrow with all the participants correctly identifying it based on the performance. The least distinguished clip was anger, yet it still convinced a majority with twelve of the sixteen identifying the emotion. This research concluded that even when lacking other language cues such as speech and facial expressions, viewers can rely on body motion for understanding the character.

Pushing the concept of character motion further, a study by Hyde et al. (2013) investigated the effects of damped and exaggerated facial motion in realistic and cartoon animated characters. In particular, the researchers examined the impact of incrementally dampening or exaggerating the facial movements on perceptions of character likeability, intelligence, and extraversion. Participants liked the realistic characters more than the cartoon characters. Likeability ratings were higher when the realistic characters showed exaggerated movements and when the cartoon characters showed damped movements. The realistic characters with exaggerated motions were perceived as more intelligent, while the stylized characters appeared more intelligent when their motions were damped. Exaggerated motions improved perception of the characters as extraverted for both character styles. Our study was inspired in part by Hyde's study, which suggests that exaggeration can be applied to realistic humanoid character faces to improve their likeability. We extended their study by investigating the effects of exaggeration on the body movements of realistic animal characters.

2.3 Animating Realistic Animals

One might say it is ironic that modern computer graphics and research studies put realistic human characters in the spotlight, when the dawn of animation started its focus on animals. Whether they were presented accurately with natural instincts, or in an anthropomorphic style showing human-like traits, a unique animal creature was often used to star as the main character. In the article "Animating Quadrupeds: Methods and Applications," a team of researchers (Skrba et al., 2009) analyze the best methods for creature animation, while taking a particular close look at the achievements of *The Chronicles of Narnia*.

The authors weigh the pros and cons of popular techniques for developing animal animations, from ways to build the character to simulating accurate motion (Skrba et al., 2009).

Common methods involve working with the inner skeleton of the character for creating motion, or the counter method of working with the character's outer mesh for animation. Unfortunately, both methods have their limitations, especially in regard to mesh deformations and motion. These issues have led to hybrid methods or a shift toward physics-based modelling, where the development of the character relies on the correctly applied use of physics. Additionally, the researchers (Skrba et al., 2009) discuss the biomechanics of animal motion by describing the hypothesis of Froude number, where the motion of every quadruped (four-legged animal) has the constant quantity v^2/gh (where v is speed, h is hip height, and g is the gravitational acceleration). The researchers (Skrba et al., 2009) note that many animators, even today, still prefer to use hand-driven animation techniques in their software, along with video footage as a reference, to provide the utmost form of freedom in their work.

2.4 Conclusion

The collected research on character design and animation shows many theories and ideas for producing the most convincing performances. However, while the information gathered is highly useful for human animations, there appears to be a shortage of research studies performed on animal animations. The opportunity to study and question techniques for creature animation would be beneficial to studio projects concentrating on the growing trend towards realistic animal graphics. This would prove especially helpful for those projects involving talking, highly realistic anthropomorphic animals as the main characters. While implementing more exaggerated movements both in body and facial expression have proven successful for stylized characters, the effects of exaggeration in highly realistic animations are not clear yet. This research aims to fill this gap. The role of character development in terms of animal designs was explored in *Animation: The Mechanics of Motion*. The text explains, "...to make a really first-class cartoon

design of an animal, it is first necessary to have a clear understanding of that animal in real life, to know its proportions and its structure, and the way in which it moves,” (Webster, 2005, p. 143). After building up the accurate details of the animal, artists can refer to the classic 12 Principles of Animation when developing the performance. Despite these principles traditionally being used for 2D animation, there may be opportunities to implement these stylized techniques into realistic graphics, on the condition that certain animation rules, such as appeal, are kept in the process. There is an active relationship between creating realistic animal characters that can show anthropomorphic traits such as personality traits, speech, and human-like emotions. Developing the connection between realism and expressionism will play a critical role for creating convincing performances for this modern shift in the animation field.

CHAPTER 3. METHODOLOGY

The goal of this study was to examine the extent to which different levels of exaggeration (a) affect perception of believability of a realistic, anthropomorphic feline character in a highly detailed photorealistic environment and (b) affect audience appeal. To determine which aspects of motion are most beneficial to audience perception, this research compares viewer responses to animated performances given by a realistic feline character with varying degrees of exaggeration.

When animating a character that is designed to look real, the common approach is to have the character move naturally as they would in the real world with physical limitations. The tendency to make the character's motion adhere to the laws of physics might result in a performance being perceived as dull or lacking personality. Pushing the amount of exaggerated motion is an option that can liven the character, however, too much extra movement could result in an unsettling performance. Therefore, it is necessary to test the benefits and limitations of exaggerated motion for realistic animal characters compared to a control animation lacking the influence of exaggeration.

3.1 Study Design

In order to represent modern creature animation, this study used a realistically rendered feline character performing a line of dialogue and an action sequence (climbing, jumping, running, catching an object). The character was placed in a living room environment with high levels of detail applied in the background to provide plenty of visual stimuli surrounding the character. The created animations contained: one control clip with no exaggeration applied to the motions of the character, one replicated animation with a low level of exaggeration, and one

replicated animation with a high level of exaggeration. In terms of this study, increasing the amount of exaggeration referred to increasing the amplitude of the character's physical positions and applying squash & stretch techniques, which resulted in an apparent faster speed of motion. To achieve different exaggeration levels, a variety of controllers corresponding to the character's body were manipulated and given different values in order to move body parts higher/lower, stretch farther or squash closer together, etc. This produced animated clips with the positions of the character appearing more extreme and expressive to represent exaggeration in animation.

The experimental design draws from the study described in the aforementioned research, "Perceptual Effects of Damped and Exaggerated Facial Motion in Animated Characters" (Hyde et al., 2013). Participants for the experiment viewed three blocks of videos containing two stimuli at a time. Block 1 compared the Control and Low Exaggeration videos, Block 2 contained the Control and High Exaggeration, and Block 3 had the Low Exaggeration and High Exaggeration. The subjects participating in the study were unaware of whether the "top-most" or "bottom-most" video contained the control or exaggerated (experimental) version. The order of the blocks was randomized and once the participant viewed both animated clips, he or she was then asked to rate each clip for appeal and believability using a 7-point Linkert scale (1 = low believability/appeal' 7 = high believability/appeal). Once the participant viewed both clips of the same character with controlled and exaggerated motion, he or she was asked to choose their favored performance, along with any feedback or comments on the animations. After completing the section, the participant went on to view all variations of the controlled and exaggeration videos.

This research utilized both quantitative and qualitative results for analysis. The quantitative results were based on the participant's ratings, while the qualitative results included open-ended comments. The design for this research was truly experimental by implementing a treatment to a random sample of participants through animated video clips. Participants were recruited from Amazon Mechanical Turk where they were provided a link to an online Qualtrics survey and individually compensated \$0.50 for their time. The survey was set with a goal of 50 participants when posted on Amazon Mechanical Turk, although extra participants were recruited through the Qualtrics site and volunteered out of their own personal interest.

3.2 Variables

This study used a within-subject design. The independent variable (IV) was the degree of exaggeration and three levels were considered (no exaggeration, low exaggeration, and high exaggeration). The dependent variables (DV) were viewers' perceived believability of the performances and viewers' perceived appeal of the performance.

3.3 Population & Sampling

Any person over the age of 18 was in the targeted population for this study. The survey was distributed to volunteers on the online sites Amazon Mechanical Turk and Qualtrics. This research used simple random sampling by gathering results from the voluntary, online survey. A total of 201 responses were collected during the time the survey was open, however there were 119 non-respondents or incomplete surveys that were discarded before the final analysis. Therefore, a total of 82 responses were considered and used for the data analysis.

3.4 Data Collection & Analysis

Results from the experiment were recorded using Qualtrics. Any results that were shown to have non-respondents or incomplete answers throughout the survey were discarded from the data and noted in the final report. All participants were volunteer-based and given complete anonymity, along with the choice to exit the study at any time. Quantitative results were analyzed using One-Way and Two-Way ANOVA tests.

3.5 Evaluation Instrument

The evaluation instrument was an online survey developed in Qualtrics software. The survey contained three blocks of animated videos and a set of rating, multiple choice, and open-ended questions. Each block of videos included two animations and the order of presentation of the blocks was randomized. After watching each block of videos, the participants were asked to answer the following questions:

- I found the top/bottom character appealing – 7-point rating question; strongly agree=7; strongly disagree=1
- Please explain why you do or do not find the top/bottom character appealing – open ended question
- I found the top/bottom character believable – 7-point rating question; strongly agree=7; strongly disagree=1
- Please explain why you do or do not find the top/bottom character believable
- Do you prefer the video of the top or bottom character? – multiple choice question; 3 options: top video, bottom video, no preference
- Please explain your preference - open ended question

3.6 Stimuli Videos

The stimuli for the study included three animated videos of a photorealistic 3D cat character in a realistic living room environment performing a sequence of actions. Each video showed a different level of exaggeration of the cat movements. Implementing different levels of exaggeration referred to modifying the amplitude and speed of the cat character's motions. As the level of exaggeration increased, motion amplitude became larger and movements became quicker, and as a result of larger motions, the deformations of the cat (e.g. the stretch and squash) became more pronounced.

The control animation was created to match exactly a video of a real cat's movements. The motions of the 3D cat were keyframed by an experienced animator who used each frame of the live cat video as a reference, a technique very similar to rotoscoping. In the "low" degree of exaggeration clip the amplitude of the character's motion controllers was increased by 50%-200% compared to the control clip. In the "high" degree of exaggeration the amplitude of the same controllers was increased by 200%-400%. For example, if the cat's hips raised to a height of 10 units during a jump in the control animation, his hips were raised approximately to a height of 25 units in the Low Exaggerated animation, and a height of 40 units in the High Exaggerated condition. The percentages of increase in motion amplitude and speed used to achieve different levels of exaggeration were determined based on best practices in character animation and are grounded in animation theory and principles. In addition, four animation professionals provided feedback on the animated clips and their suggestions were used to iteratively refine the cat's movements in each clip. The only difference among the three animations was the degree of exaggeration of the cat motions and deformations. To eliminate potential confounding variables, camera framing, lighting scheme, background environment, color and textures were kept the

same across all three videos. Detailed images of the feline's character model and rig can be seen in Figures 3.1, 3.2, and 3.3.

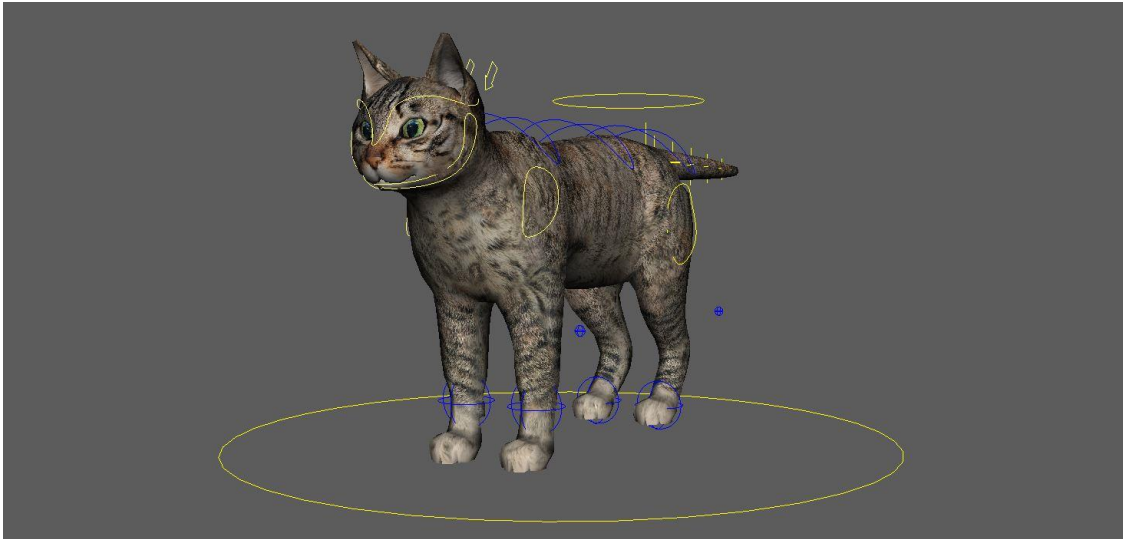


Figure 3.1 Perspective View of Feline Character Rig

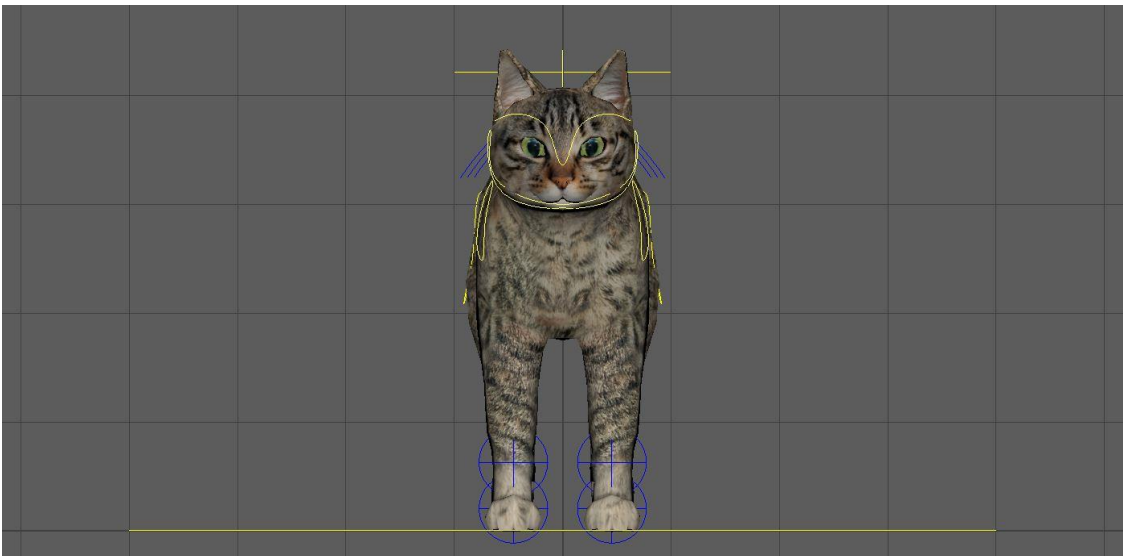


Figure 3.2 Front View of Feline Character Rig

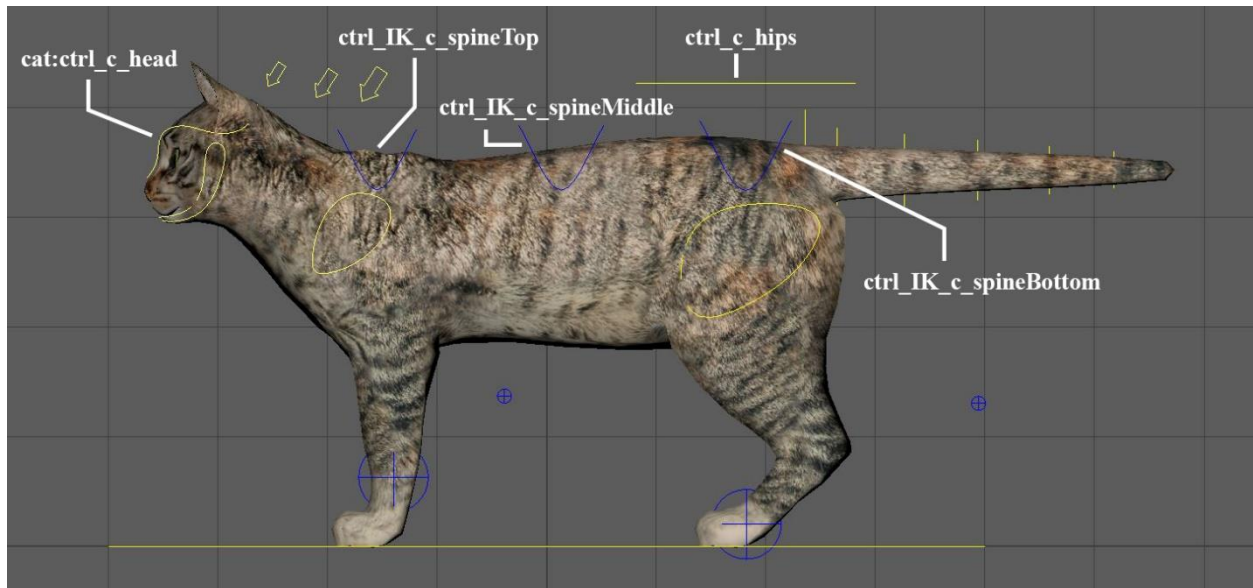


Figure 3.3 Side View of Feline Character Rig

In terms of this study, exaggeration was applied to the amplitude of the character's keyed poses. Controllers corresponding to the character's hips, shoulders, neck, etc., were raised higher, lower, rotated, squashed, or stretched to give the feline more dramatic movements throughout the scene (See Figure 3.3 for a diagram of the cat's rig with the essential controllers labeled). Specifically, the controllers *ctrl_IK_c_spineTop*, *ctrl_IK_c_spineMiddle*, *ctrl_IK_c_spineBottom*, and *ctrl_c_hips* were translated to create an exaggerated effect on the body which we referred to as "SquashStretchBody". Additionally, the controller *cat:ctrl_c_head* was translated to provide "SquashStretchNeck", *ctrl_IK_c_spineTop* was rotated for the exaggerated effect "Shoulder Rotation (Z)", and *ctrl_IK_c_spineBottom* was rotated to create an exaggerated effect on the hips referred to as "Hip Rotation (Z)". The following images (see Figures 3.4 through 3.13) are a reference to show how each of the described attributes appeared when individually affected by low and high levels of exaggeration; however, the final animations were made by keying a variety of controllers for each pose.

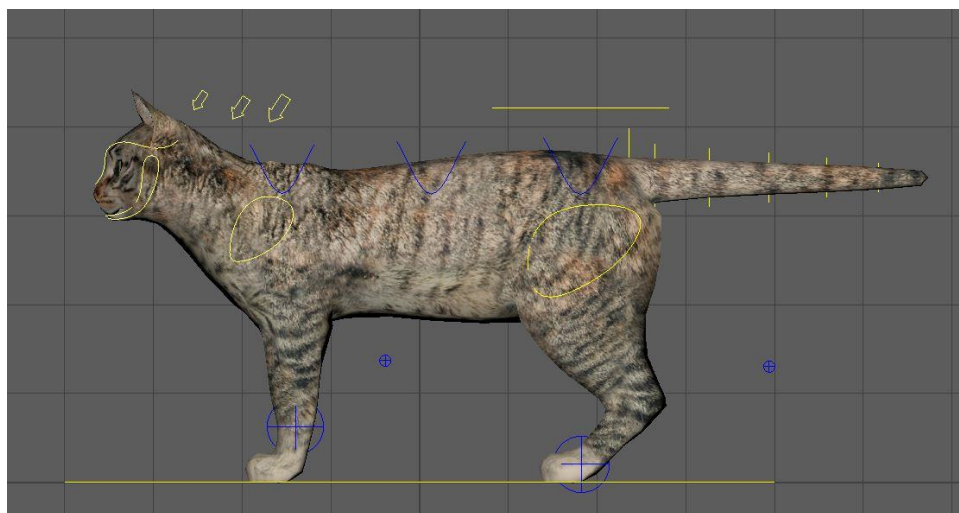


Figure 3.4 Control Side-View of Cat Rig (No Exaggeration)

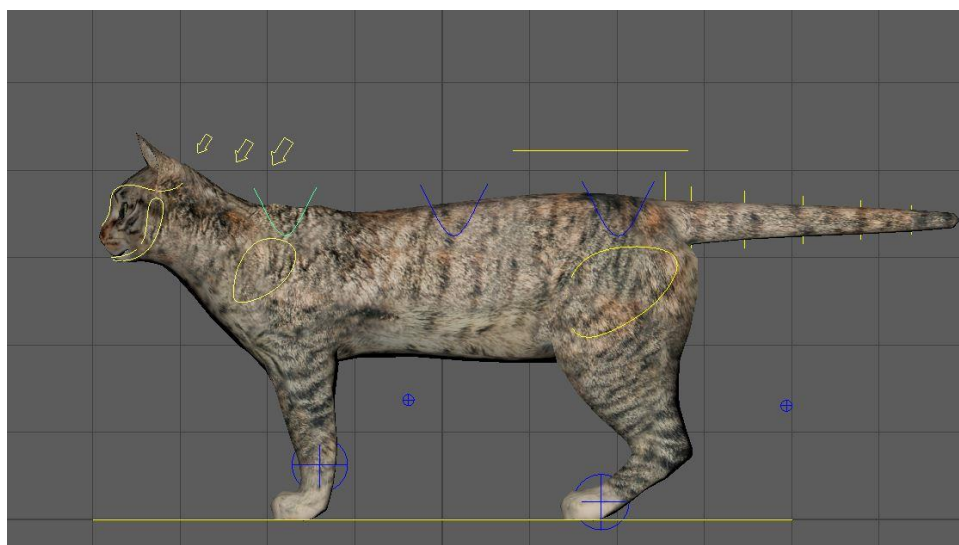


Figure 3.5 Low Exaggeration of SquashStretchBody Part 1

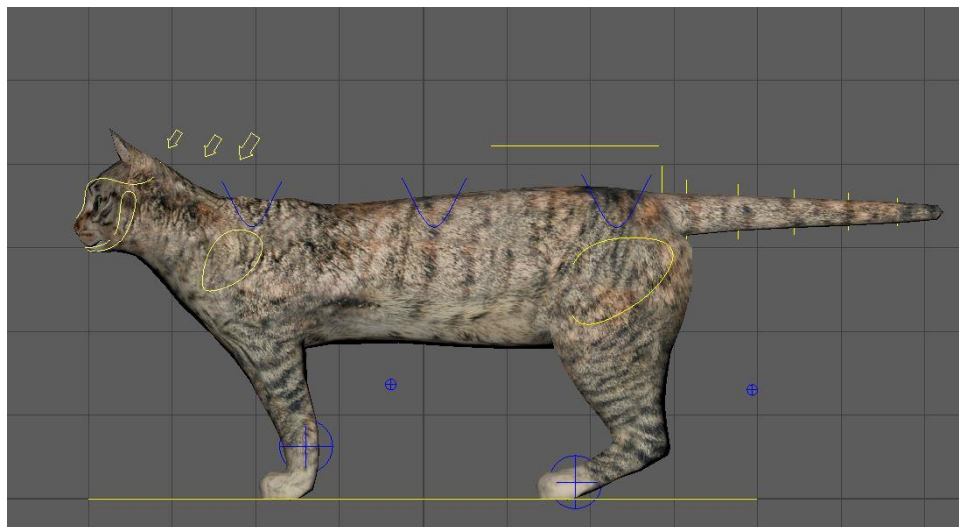


Figure 3.6 High Exaggeration of SquashStretchBody Part 1

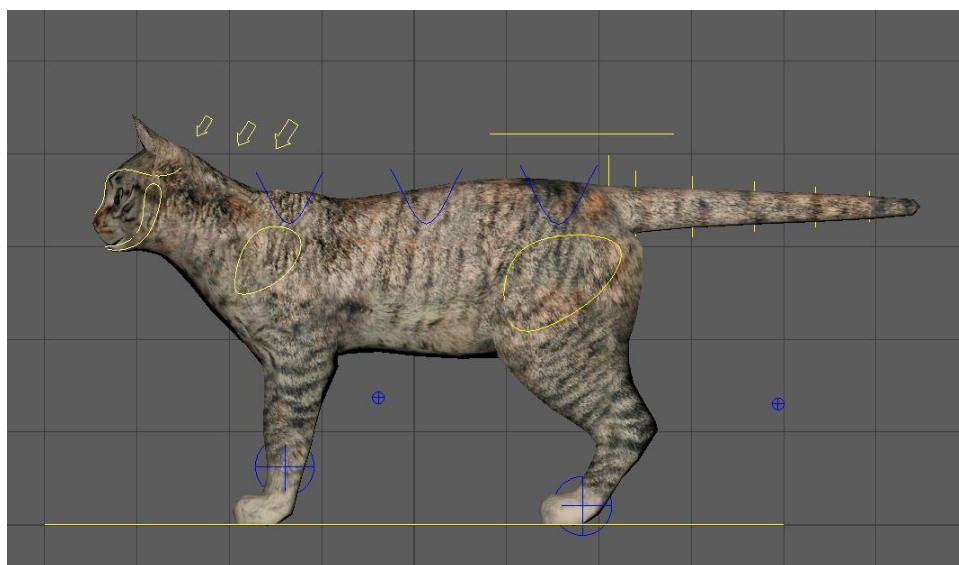


Figure 3.7 Low Exaggeration of SquashStretchBody Part 2

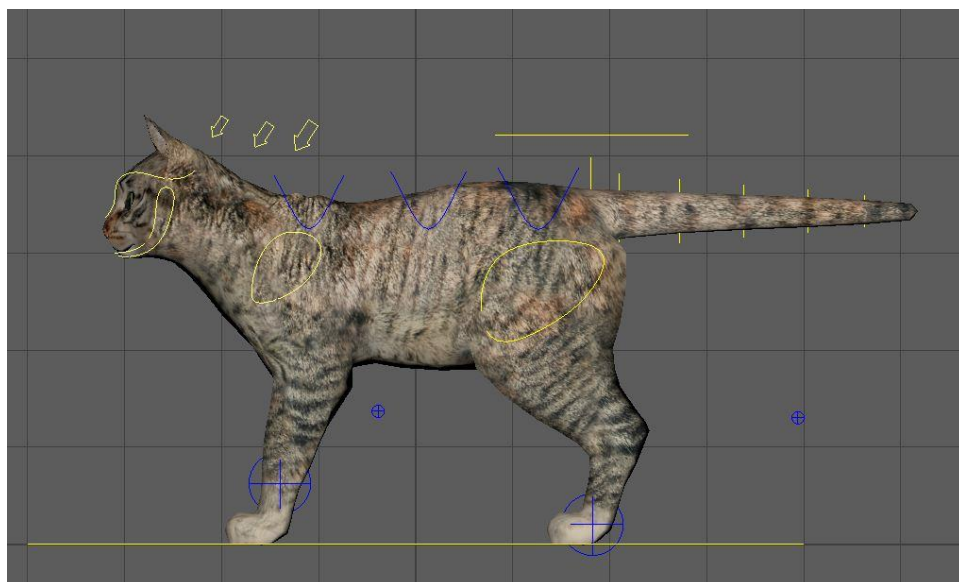


Figure 3.8 High Exaggeration of SquashStretchBody Part 2

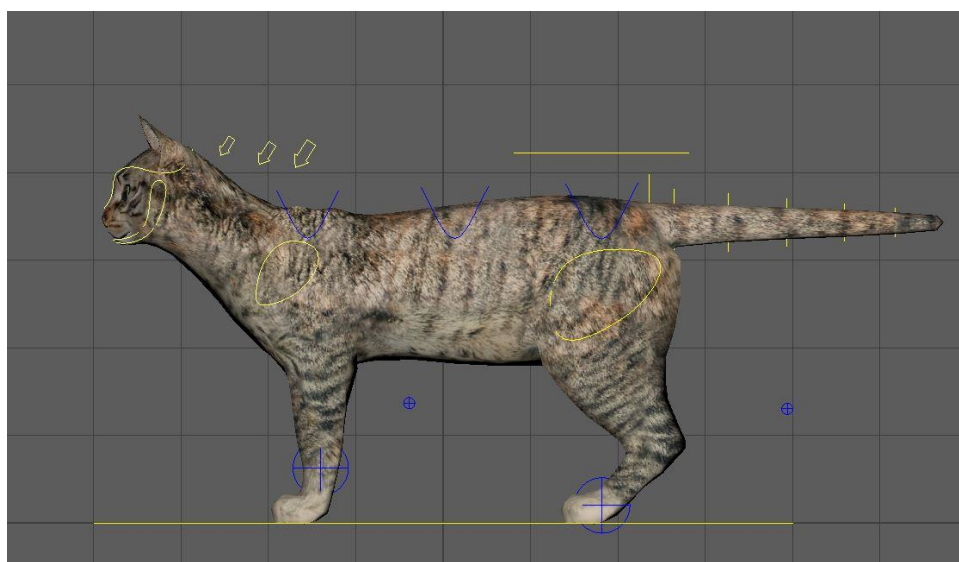


Figure 3.9 Low Exaggeration of SquashStretchNeck

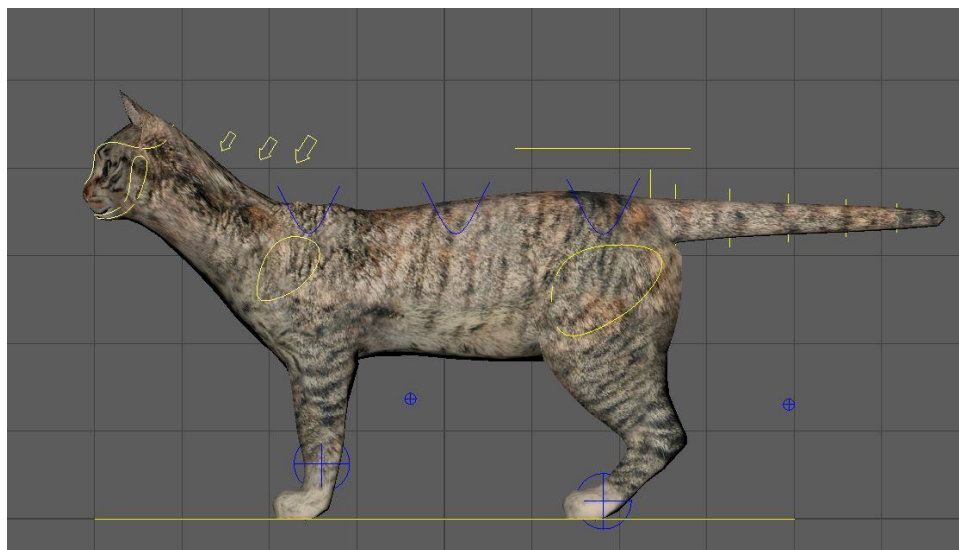


Figure 3.10 High Exaggeration of SquashStretchNeck

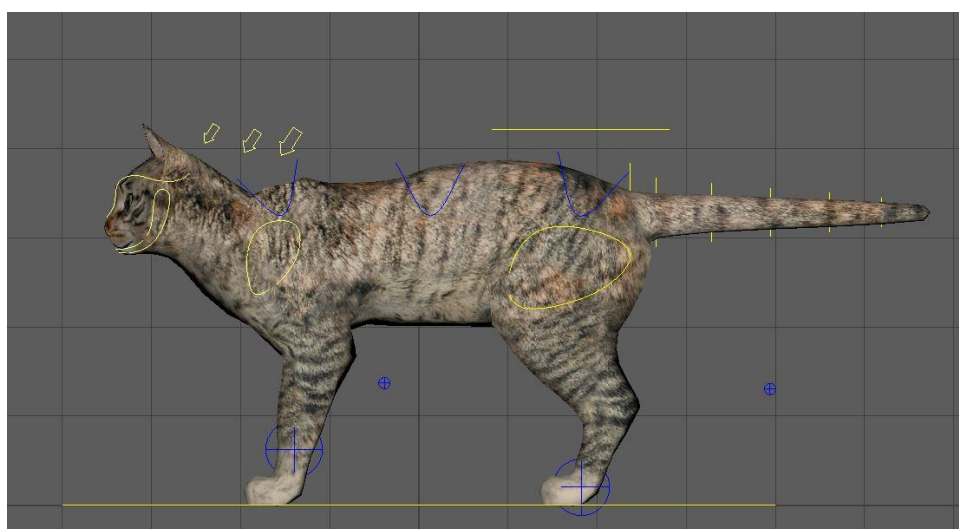


Figure 3.11 Low Exaggeration of Shoulder & Hip Rotation (Z) Part 1

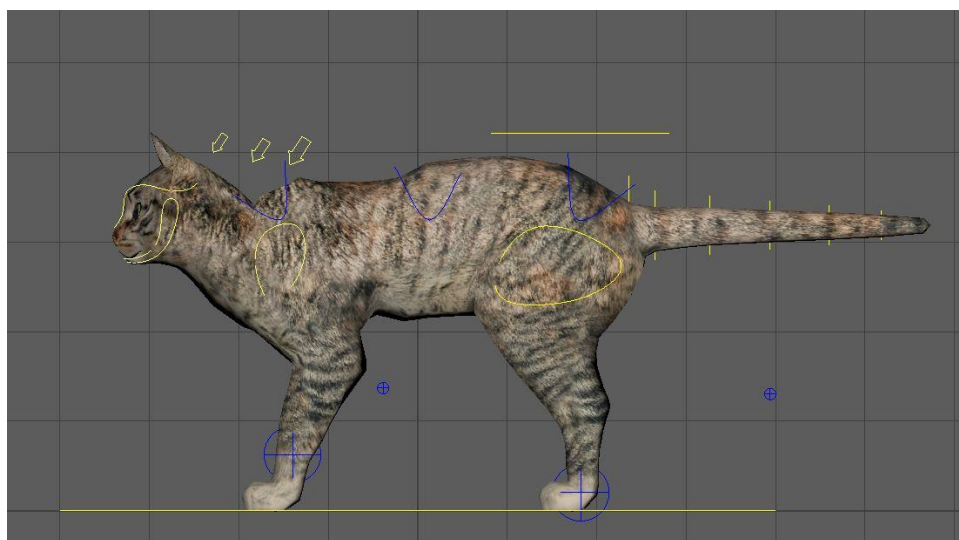


Figure 3.12 High Exaggeration of Shoulder & Hip Rotation (Z) Part 1

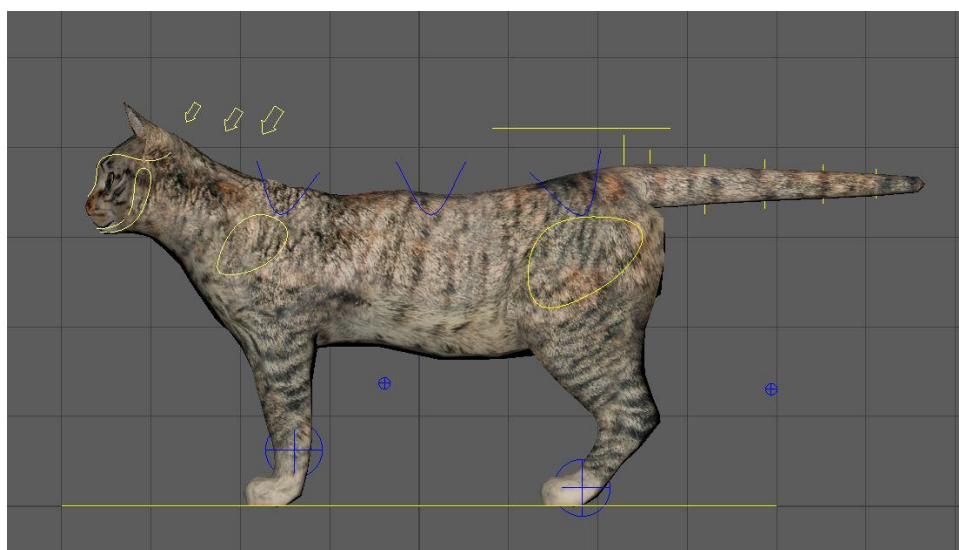


Figure 3.13 Low Exaggeration of Shoulder & Hip Rotation (Z) Part 2

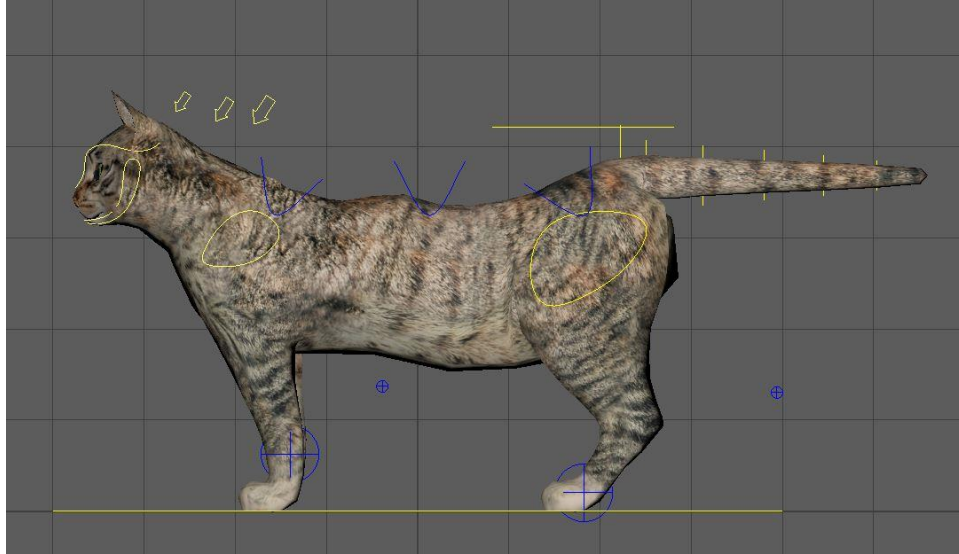


Figure 3.14 High Exaggeration of Shoulder & Hip Rotation (Z) Part 2

As an example of adjustments made to exaggerate the body of the feline in the final animations: during the first large jump from the couch to the cat's tower, the highest point of the spine bottom (*ctrl_IK_c_spineBottom* translated in the Y axis) on the controlled version is set to 1.0 centimeters (relative to the feline's hips). In the Low Exaggerated version, the height of the spine bottom has been pushed to 2.0 centimeters (100% increase), while in the High Exaggerated version the spine bottom has been pushed to 4.1 centimeters (310% increase) for the first jump. Spine middle (*ctrl_IK_c_spineMiddle*) and spine top (*ctrl_IK_c_spineTop*) received similar treatments to reinforce a stretched position for the feline character during the jump. Comparisons of these adjusted poses for the first jump can be seen in Figures 3.4, 3.5, and 3.6.



Figure 3.15 Control Version of Feline's First Jump



Figure 3.16 Low Exaggerated Version of Feline's First Jump



Figure 3.17 High Exaggerated Version of Feline's First Jump

Along with changes in the Y translation, the spine controllers received similar treatments in the Z translation. For instance, when the character is preparing for the second large jump from the tower to the couch, the feline tightens his body into a small, crouched stance before making the next long jump (see Figures 3.7, 3.8, & 3.9). In this moment, the spine bottom is set to 1.158 centimeters (Z translation) in the Control version, 2.5 centimeters in the Low Exaggeration (115.89% increase), and 4.933 centimeters in the High Exaggeration (323.1434% increase). Similarly, on his other end, spine top in the Control version is set to -1.316 centimeters, the Low Exaggeration is -2.5 centimeters (89.96% increase), and the High Exaggeration is -4.0 centimeters (203.95% increase).



Figure 3.18 Control Version of Feline's Crouch



Figure 3.19 Low Exaggerated Version of Feline's Crouch



Figure 3.20 High Exaggerated Version of Feline's Crouch

While the spine controllers received minimal alterations in X translation, the other notable changes were made in the Z rotation. These adjustments helped curve the character's body to appear more concave in a crouch or more convex when the body is stretched. When the feline prepares for the first jump while standing on the edge of the couch, his shoulders and back appear more hunched in the exaggerated versions (see Figures 3.7, 3.8, & 3.9). In particular, the spine top is rotated -14.967 degrees in the Z direction for the Control clip, whereas the controller is rotated -27.133 degrees in the Low Exaggeration (81.2855% increase), and -42.661 degrees in the High Exaggeration (185.0337% increase). An example of the spine bottom being rotated in a

stretched position is the final large jump the feline makes from the couch to the floor. In the final jump, the spine bottom is set to -19.0 degrees in the Control clip, -31.464 degrees in the Low Exaggerated version (65.6% increase), and -51.5 degrees in the High Exaggerated version (171.0526% increase).



Figure 3.21 Control Version of Feline's Upper Shoulder Rotation



Figure 3.22 Low Exaggerated Version of Feline's Upper Shoulder Rotation



Figure 3.23 High Exaggerated Version of Feline's Upper Shoulder Rotation

Adjustments such as the ones shown above are made throughout the animated clips for a variety of controllers to create a range of simple and extreme poses for the feline. A detailed list of the changes in range of motion with respect to their control values is included in Tables 3.1. In this table, the attribute SquashStretchBody refers to the changes made in the YZ axis along the feline's spine controllers to stretch and squash the character's overall body shape in the animation. Similarly, the attribute SquashStretchNeck shows when the character's neck was exaggerated in the YZ axis. Finally, the last attributes to receive significant changes were the upper shoulder area, i.e. Shoulder Rotation, and the lower hip area, i.e. Hip Rotation, on the feline which were rotated in the Z axis.

Table 3.1. Percentage of Increase in Values with Respect to the Control Values

Attribute	% Range of Motion (Low Exaggeration)	% Range of Motion (High Exaggeration)
SquashStretchBody (Controllers: <i>ctrl_IK_c_spineTop</i> , <i>ctrl_IK_c_spineMiddle</i> , <i>ctrl_IK_c_spineBottom</i> , and <i>ctrl_c_hips</i>)	50%-140%	175%-325%
SquashStretchNeck (Controllers: <i>cat:ctrl_c_head</i>)	125%-3,800%	235%-8,914%
Shoulder Rotation (Z) (Controllers: <i>ctrl_IK_c_spineTop</i>)	17%-183%	38%-347%
Hip Rotation (Z) (Controllers: <i>ctrl_IK_c_spineBottom</i>)	25%-70%	50%-150%

Note: SquashStretchNeck appeared to have higher ranges due to the keyframes starting at very low values in the control animation (Ex: an original value of 0.091 cm in the Z axis was changed to 2.423 cm in the high exaggerated clip, resulting in a 2,562.637% increase).

CHAPTER 4. RESULTS

A total of 201 responses were recorded for this survey; however, since only 82 responses were complete, 119 responses were discarded as incomplete or non-respondents. No personal demographic data were collected in the survey. The participants viewed three blocks of videos, each block containing two videos to watch of a realistic feline character, followed by a series of questions. Block 1 compared videos for the Control and Low Exaggeration, Block 2 contained the Control and High Exaggeration, and finally Block 3 had the Low Exaggeration and High Exaggeration. The order of blocks was randomized and evenly distributed to the participants.

Believability, appeal, and animation preference

Participants rated their responses to questions relating to appeal and believability on a Likert scale of 1 to 7 (1 = low appeal or low believability; 7 = high appeal or high believability). Generally, the Control video had higher mean scores in terms of perceived appeal and believability when compared to both the Low Exaggeration and High Exaggeration videos. Participants rated the High Exaggeration clip higher than the Low Exaggeration one for both appeal and believability. Means and standard deviations for each block of videos are reported in Tables 4.1, 4.2, & 4.3.

Table 4.1. Results for Block 1: Control Video Compared to the Low Exaggeration

Animation Responses	Mean	Standard Dev.
Appeal for Control	5.07	1.35
Appeal for Low Exaggeration	4.87	1.48
Believability for Control	5.04	1.48
Believability for Low Exaggeration	4.60	1.60

Table 4.2. Results for Block 2: Control Video Compared to the High Exaggeration

Animation Responses	Mean	Standard Dev.
Appeal for Control	5.04	1.49
Appeal for High Exaggeration	4.72	1.57
Believability for Control	5.10	1.41
Believability for High Exaggeration	4.68	1.59

Table 4.3. Results for Block 3: Low Exaggeration Compared to the High Exaggeration

Animation Responses	Mean	Standard Dev.
Appeal for High Exaggeration	5.11	1.41
Appeal for Low Exaggeration	4.74	1.66
Believability for High Exaggeration	4.99	1.56
Believability for Low Exaggeration	4.80	1.66

The mean scores were consistent with the participants' responses to choosing their preference between two videos in a single block. When asked "Do you prefer the video of the top-most or bottom-most character?" there were more votes of preference collected for the Control video compared to the exaggerated versions. However, the High Exaggeration video had more votes of preference compared to the Low Exaggeration. A list of the participants' votes for their favored animation can be found in Table 4.4.

Table 4.4. Results from Participants Voting for Their Favorite Animated Clip per Block

No. Votes for Favorite Video in Block 1	
Control	32
Neither/No Preference	30
Low Exaggeration	20
No. Votes for Favorite Video in Block 2	
Control	35
Neither/No Preference	26
High Exaggeration	21
No. Votes for Favorite Video in Block 3	
High Exaggeration	36
Neither/No Preference	29
Low Exaggeration	17

One-Way ANOVA hypothesis tests were conducted to determine if the levels of exaggeration had a significant effect on participants' perceived appeal and believability. Results from the One-Way ANOVA tests for appeal and believability are included in Table 4.5. With a chosen significance level of 0.05, it was found there were no significant differences in appeal ($p = 0.319$) between the animations. Similarly, the data showed no significant differences between the animations for believability, although, the p-value was closer to being considered statistically significant ($p = 0.098$). The null hypotheses H_{01} , H_{02} , H_{03} , H_{04} could not be rejected.

Table 4.5. ANOVA Results: Appeal and Believability

		Sum of Squares	df	Mean Squares	F	Sig.
Appeal	Between Groups	5.150	2	2.575	1.144	.319
	Within Groups	1101.067	489	2.252		
	Total	1106.217	491			
Believability	Between Groups	11.236	2	5.618	2.334	.098
	Within Groups	1177.177	489	2.407		
	Total	1188.413	491			

Two-Way ANOVA tests were also carried out to determine if the order of viewing the animation blocks in addition to the varying levels of exaggeration had a significant effect on participant perceived appeal and believability. Results from the Two-Way ANOVA tests for appeal and believability are included in Tables 4.6 and 4.7. With a chosen significance level of 0.05, it was found that the difference in perceived appeal between the animations was not statistically significant ($p = 0.375$). However, the data results did show statistical significance ($p = 0.037$) for believability, indicating that the perceived believability of the Control animation was significantly higher than the believability of the high and low exaggerated versions.

Table 4.6. Test of Between-Subjects Effects for Appeal
Test of Between-Subjects Effects

Dependent Variable: Appeal

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	12.059 ^a	5	2.412	1.071	.375
Intercept	11932.783	1	11932.783	5300.267	.000
Block	3.817	2	1.909	.848	.429
Exaggeration	8.280	2	4.140	1.839	.160
Block*Exaggeration	3.091	1	3.091	1.373	.242
Error	1094.159	486	2.251		
Total	13039.000	492			
Corrected Total	1106.217	491			

a. R Squared = .011 (Adjusted R Squared = .001)

Table 4.7. Test of Between-Subjects Effects for Believability
Test Between Subjects Effects

Dependent Variable: Believability

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	16.961 ^a	5	3.392	1.407	.220
Intercept	11658.587	1	11658.587	4836.798	.000
Block	5.382	2	2.691	1.116	.328
Exaggeration	15.980	2	7.990	3.315	.037
Block*Exaggeration	.343	1	.343	.143	.706
Error	1171.451	486	2.410		
Total	12847.000	492			
Corrected Total	1188.413	491			

a. R Squared = 0.14 (Adjusted R Squared = 0.004)

Qualitative Results

After rating each block of animated videos in terms of appeal and believability, participants were asked to provide written feedback on each animation. A list of short answers was recorded in response to the prompt “Please explain why you do or do not find the [top-most/bottom-most] character [appealing/believable]”. One theme that appeared consistent throughout the blocks of videos was the participants commenting that all animated videos appeared to be very similar, almost the same. Other comments showed distaste towards the character model and textures, and the voice-over audio for the cat. These responses suggest that changes made to the motion of the character might have not been easily noticed by viewers, as participants might have been distracted by other factors such as audio and visual design.

Those participants that did comment on differences among the videos claimed that the Control video appeared more “realistic”, with examples of comments including “*This cat seemed to move more realistically; its body looked more natural and didn't warp when it jumped*” and “*It's believable because it moved like a cat and looked like a cat and behaved like a cat, despite the human speech*”. These comments are consistent with the Control video receiving higher ratings for appeal and believability.

As for the low and high exaggeration videos, some reoccurring comments stated that the animation appeared “*more fluid*” and “*faster*”. These comments make sense considering that in the exaggerated videos the character’s movements had larger amplitudes, hence the character appeared faster, as the body covered a wider range of motion in the same amount of time. The High exaggeration Clip received conflicting responses on whether the animation appeared “*smoother*” or “*rough*”. One participant commented that the character had “*stretchy movement*”, another commented that the cat appeared “*disfigured when walking*”. Interestingly, one

participant specifically noted “*the back end of the cat was too close to the ground while jumping,*” which makes sense given the greater amplitude of the highly exaggerated animation.

Several participants commented that the cat did not appear to be “believable” in any of the clips, whereas some participants included descriptions of the character as being “*cute*”, “*curious*”, “*endearing*”, “*intelligent*”, and “*funny*” in all animations, thus showing a connection between them and the character. The comment that was repeated most often was that the cat is not believable because real cats do not speak in human voices.

CHAPTER 5. CONCLUSION

5.1 Appeal

Findings from the study show that participants on average rated the control animation more appealing than the low exaggeration and high exaggeration ones, although the difference in ratings was not statistically significant. In addition, there were more votes of preference collected for the control video compared to the exaggerated versions. When comparing the two levels of exaggeration directly, participants on average rated the high exaggeration clip to be more appealing than the low exaggeration one. When analyzing both the One-Way and Two-Way ANOVA tests, the results revealed the level of exaggeration does not have a significant effect on audience perceived appeal of the realistic feline character.

5.2 Believability

The study yielded similar findings in regard to character's perceived believability. The control clip received higher believability ratings compared to the exaggerated versions, with the difference in perceived believability being more significant than the difference in perceived appeal. The One-Way ANOVA hypothesis test yielded a p-value for believability that was close to statically significant ($p = 0.98$), and the Two-Way ANOVA test yielded a p-value ($p = 0.37$) below our alpha, showing statistical significance. When comparing the exaggerated clips, participants rated the high exaggeration clip higher for believability than the low exaggeration clip.

5.3 Discussion

The results from the study are interesting in many ways. First, they suggest that while the principle of exaggeration can be used to improve the likeability and performance of stylized characters, it might not produce the same positive effect when the character design is highly realistic. This finding seems to contradict a common belief in animation that there should be some type of exaggeration in any shot, even if the shot is realistic.

Contrary to previous research findings that suggested that realistic characters with exaggerated facial motions are more likeable than realistic characters without exaggeration, results of this study show that exaggeration makes the character less appealing and convincing. These apparently contradicting results could be due to the differences between our study and previous experiments. Prior studies focused on exaggeration of facial articulations while we considered the exaggeration of body movements. It is possible that there is a difference in perception of exaggerated facial deformations versus perception of exaggerated body motions/deformations, future studies could be conducted to investigate these perceptual differences.

One particularly interesting finding from our study is that the high exaggeration clip received higher ratings of believability, appeal and overall preference than the low exaggeration clip. This finding seems to contradict the animation concept that if the shot is more on the realistic side the exaggeration level should be moderate (Pluralsight, 2019). We believe that the low exaggeration clip received the lowest ratings for believability and appeal due to the uncanny valley effect (Mori et al., 2012). The cat in the low exaggeration clip is realistic but something in his motions appears slightly off due to the moderate level of exaggeration. Although the character looks like a real cat, his motions imperfectly resemble those of a real cat making him fall in the uncanny valley. In contrast, the highly exaggerated cat departs from reality in a more evident way

because of the more extreme movements/deformations that make him look less realistic and more caricatured, despite the realistic design. In Figure 3 we visualize the position of our realistic cat in the 3 animated clips and in the live action video in relation to the uncanny valley.

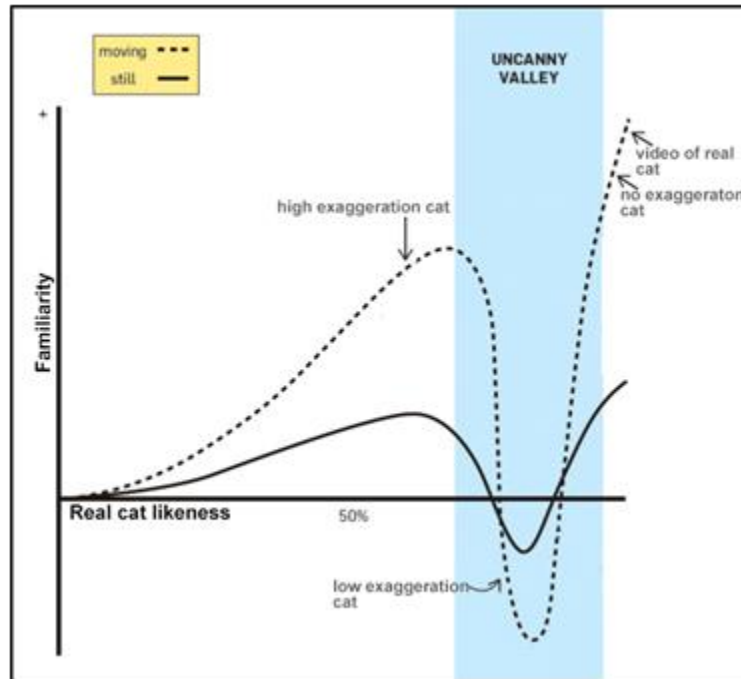


Figure 5.1 Graph Visualizing the Position of the 3 Animated Clips and the Live Action Video in Relation to the Uncanny Valley

The study had several limitations that prevent us from stating with confidence that the findings will hold true for other realistic anthropomorphic animal characters. First, the study included only one character (the cat) hence the results might be due in part to the intrinsic characteristic of that particular character design and 3D model and that specific set of motions. In future studies we will examine a variety of anthropomorphic animal characters performing different actions in different settings.

Second, as mentioned in the qualitative results section, it is possible that there was some misunderstanding among the participants in regard to the meaning of the word ‘believability’. In

future studies, a clearer definition of all the terminology used in the experiment would be beneficial to maintain consistency among the context of the prompts and the responses.

Third, the study included a relatively small sample size with all subjects above the age of 18. In the future it would be interesting to conduct additional experiments with larger pools of subjects and with younger participants to investigate how the exaggeration effects are moderated by subjects' age.

Despite its limitations, the findings from the study could have practical implications for character animators, as they could help them make more informed motion design decisions. The lesson learned from this experiment is that when working with anthropomorphic realistic animal characters, the animator should key the characters realistically in order to achieve a higher level of perceived believability and appeal from the audience. If the decision is made to add exaggeration to the characters based on script needs, the findings from this experiment suggest utilizing higher levels of exaggerated motion.

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APPENDIX A. ABSTRACT

The recent push for more detailed graphics and realistic visuals in animated productions has sparked much debate around the new films' photorealistic visual style. Some critics argue that the new "live-action" versions of movie classics such as the Lion King are not as visually stylish as the original ones, and the photorealistic characters are not as likeable, fun and intriguing as their stylized counterparts. This paper reports ongoing research whose goal is to examine whether it is possible to apply traditional animation principles to photorealistic animated animal characters in order to make them more expressive, convincing and ultimately entertaining. In particular, the study reported in the paper investigated the extent to which varying degrees of exaggeration affect the perceived believability and appeal of a photorealistic, anthropomorphic cat character performing a series of actions in a high detail environment. The study included 82 participants and compared three levels of exaggeration applied to the cat's motions, e.g. no exaggeration, low exaggeration and high exaggeration. Findings show that subjects found the no-exaggeration clip more appealing and believable than the exaggerated versions, although the difference in appeal was not statistically significant. When comparing the two exaggerated clips, participants rated the high exaggeration clip higher for believability and appeal than the low exaggeration one.

APPENDIX B. SURVEY QUESTIONS

Please watch both videos with the sound on and answer the following questions. The first video will be referred to as the "top-most video", the second video will be referred to as the "bottom-most" video.

I found the top-most character to be appealing.

Strongly Agree / Agree / Somewhat Agree / Neither Agree nor Disagree / Somewhat Disagree / Disagree / Strongly Disagree

Please explain why you do or do not find the top-most character appealing.

I found the bottom-most character to be appealing.

Strongly Agree / Agree / Somewhat Agree / Neither Agree nor Disagree / Somewhat Disagree / Disagree / Strongly Disagree

Please explain why you do or do not find the bottom-most character appealing.

I found the top-most character to be believable.

Strongly Agree / Agree / Somewhat Agree / Neither Agree nor Disagree / Somewhat Disagree / Disagree / Strongly Disagree

Please explain why you do or do not find the top-most character believable.

I found the bottom-most character to be believable.

Strongly Agree / Agree / Somewhat Agree / Neither Agree nor Disagree / Somewhat Disagree / Disagree / Strongly Disagree

Please explain why you do or do not find the bottom-most character believable.

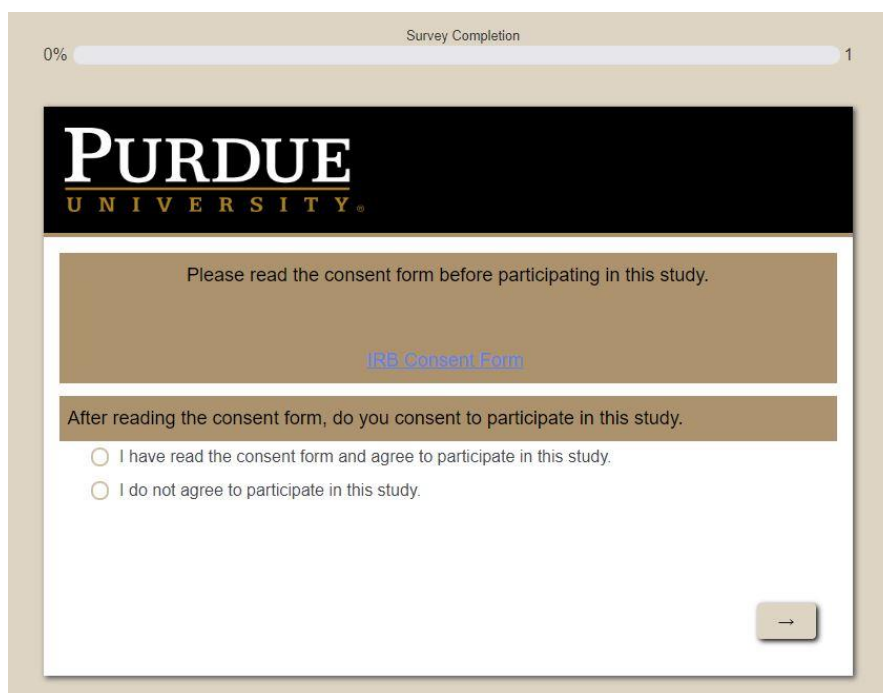
Do you prefer the video of the top-most or bottom-most character?

Please explain your answer to the previous question.

(Asked for Block 1 Control vs. Low Exaggeration, Block 2 Control vs. High Exaggeration, and Block 3 Low Exaggeration vs. High Exaggeration)

Do you have any final comments or feedback for this study? (Optional)

APPENDIX C. QUALTRICS



0% Survey Completion 1

PURDUE
UNIVERSITY.

Please read the consent form before participating in this study.

[IRB Consent Form](#)

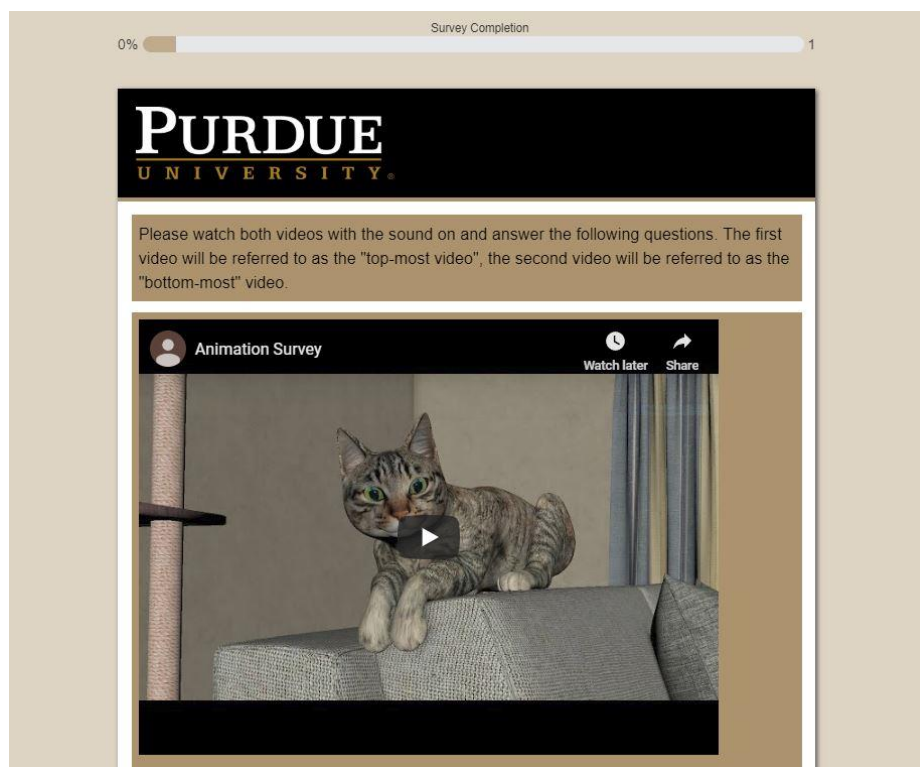
After reading the consent form, do you consent to participate in this study.

☐ I have read the consent form and agree to participate in this study.

☐ I do not agree to participate in this study.

→

Figure C.1. Qualtrics Survey



0% Survey Completion 1

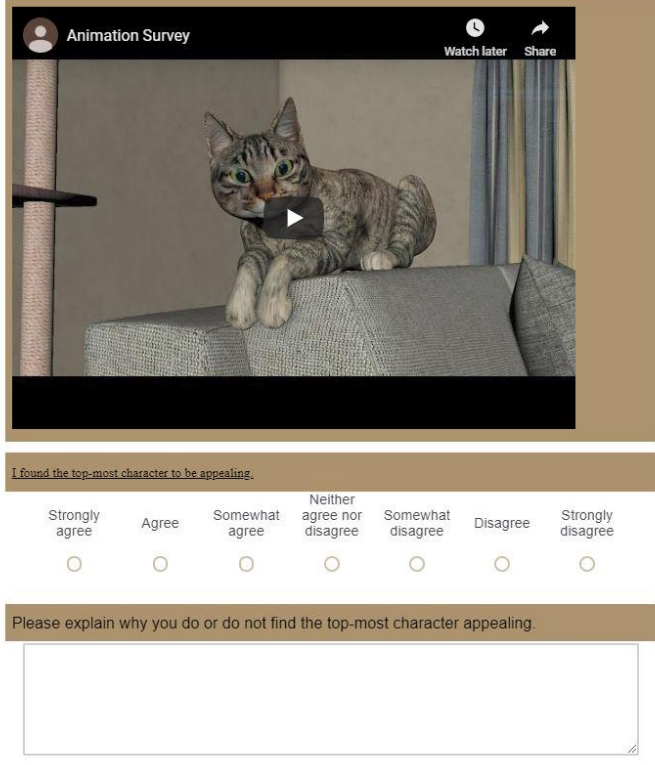
PURDUE
UNIVERSITY.

Please watch both videos with the sound on and answer the following questions. The first video will be referred to as the "top-most video", the second video will be referred to as the "bottom-most" video.


Animation Survey Watch later Share

Video player showing a cat sitting on a couch.

Figure C.2. Qualtrics Survey



Animation Survey Watch later Share

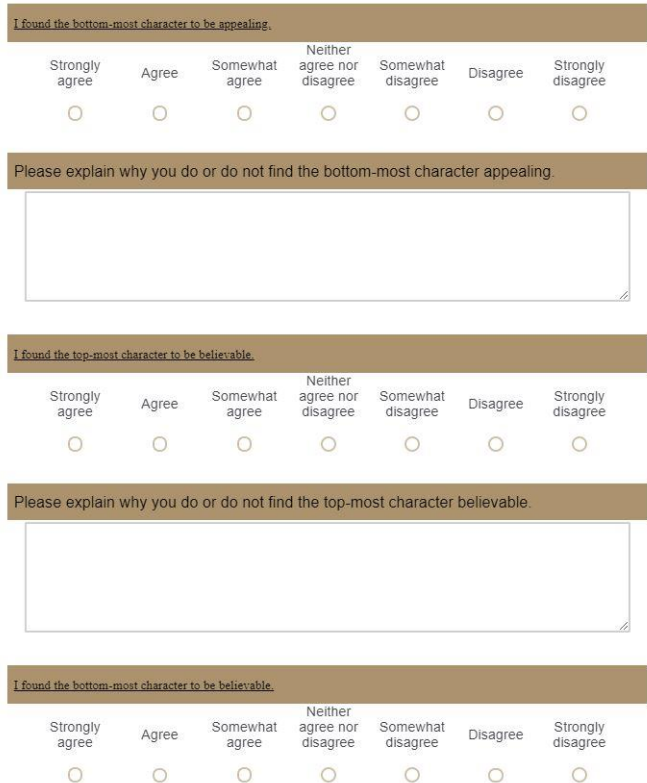


I found the top-most character to be appealing.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please explain why you do or do not find the top-most character appealing.

Figure C.3. Qualtrics Survey



I found the bottom-most character to be appealing.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please explain why you do or do not find the bottom-most character appealing.

I found the top-most character to be believable.

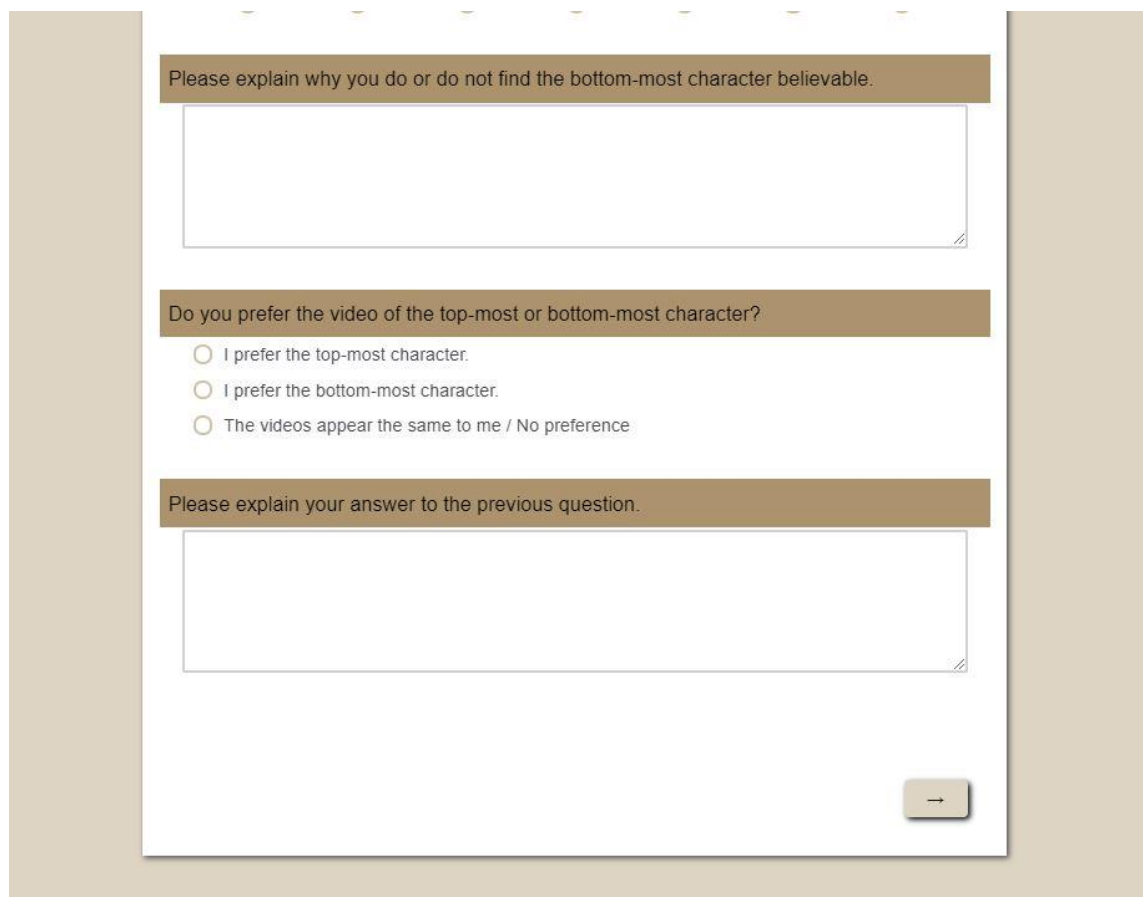
Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please explain why you do or do not find the top-most character believable.

I found the bottom-most character to be believable.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure C.4. Qualtrics Survey



Please explain why you do or do not find the bottom-most character believable.

Do you prefer the video of the top-most or bottom-most character?

☐ I prefer the top-most character.

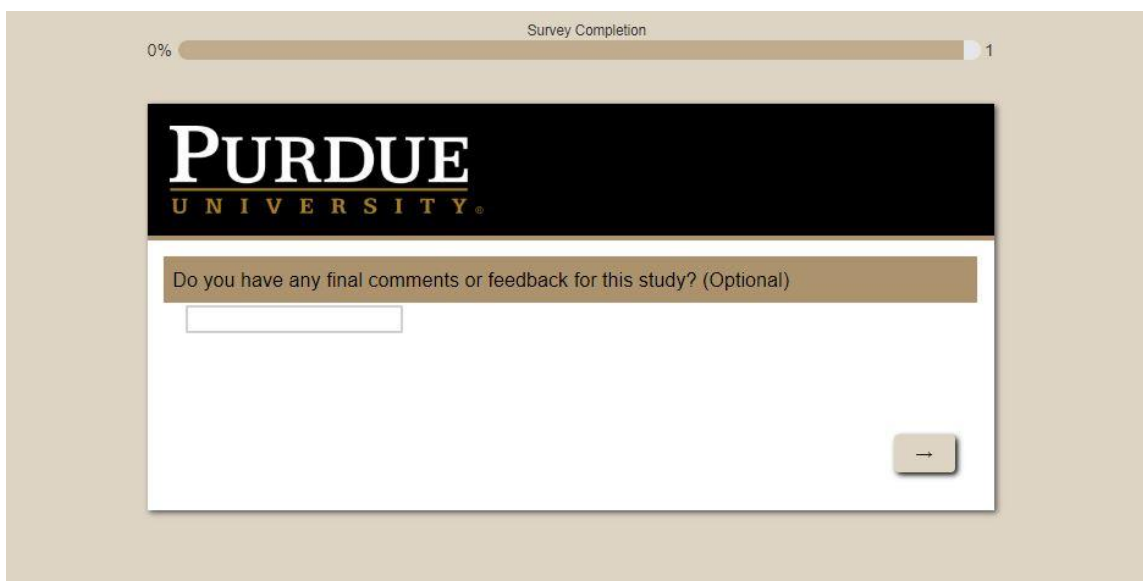
☐ I prefer the bottom-most character.

☐ The videos appear the same to me / No preference

Please explain your answer to the previous question.

→

Figure C.5. Qualtrics Survey



0% Survey Completion 1

PURDUE
UNIVERSITY.

Do you have any final comments or feedback for this study? (Optional)

→

Figure C.6. Qualtrics Survey

APPENDIX D. QUANTITATIVE DATA

The following tables show the data collected for each block of videos throughout the survey study. Participants rated their scores on a Linkert scale where 1 corresponds to “Strongly Disagree” and 7 corresponds to “Strongly Agree”.

Block 1: Appeal Scores for Control Video

7	4	6	5	5	4	6
6	7	7	6	6	3	3
6	4	5	6	6	7	6
4	7	7	6	6	3	5
6	5	7	6	4	6	4
7	6	6	6	2	6	6
6	4	3	6	3	4	5
5	6	4	6	4	4	6
4	6	5	6	2	2	6
4	3	4	6	6	2	4
4	6	6	6	4	6	
4	6	4	6	5	3	

Block 1: Appeal Scores for Low Exaggerated Video

7	4	5	4	6	4	2
6	1	7	5	6	3	3
5	4	6	5	6	6	6
4	5	7	3	6	5	5
2	5	6	6	4	7	5
4	5	6	5	6	5	6
5	4	3	6	5	4	3
6	6	4	6	4	5	7
4	5	2	6	7	2	6

3	4	4	6	6	2	5
4	7	6	7	5	6	
1	6	4	6	6	3	

Block 1: Believability Scores for Control Video

6	4	7	4	5	4	6
6	4	7	6	6	3	2
7	4	6	6	6	7	6
5	7	7	6	5	3	5
6	5	7	4	4	6	4
7	6	6	6	5	6	6
6	4	3	6	4	4	4
6	5	4	6	6	5	6
3	3	4	6	2	2	2
6	6	6	7	6	2	5
4	6	6	6	5	6	
1	6	4	6	4	2	

Block 1: Believability Scores for Low Exaggerated Video

5	4	6	4	5	4	2
2	5	7	5	6	2	6
6	4	5	5	6	7	6
3	7	7	3	6	4	5
2	5	6	4	4	6	3
4	5	6	7	3	5	6
2	4	3	5	4	4	2
7	5	4	6	6	5	7
5	3	4	6	6	2	2
2	5	2	6	5	2	6
4	6	6	7	4	3	
1	6	4	6	5	2	

Block 1: Votes for Favored Performance (1 = Control, 2 = Low, 3 = Neither)

2	3	2	1	2	3	1
1	3	1	1	1	2	2
1	3	1	1	1	3	3
3	3	2	1	3	3	2
1	1	1	3	3	1	2
1	1	3	2	2	1	3
3	3	3	1	3	1	2
1	2	3	2	3	1	1
2	3	1	3	2	3	3
3	2	1	2	1	3	1
3	1	2	1	2	1	
3	1	3	1	2	3	

Block 2: Appeal Scores for Control Video

6	4	6	4	3	5	6
6	1	7	5	6	3	6
5	4	6	6	5	7	6
3	1	7	6	6	6	4
6	6	7	5	4	7	3
7	5	6	6	2	6	7
5	4	3	5	2	4	4
6	6	4	6	4	5	6
6	5	5	6	6	5	6
4	6	4	7	6	2	6
4	6	6	7	4	6	
4	6	2	5	6	2	

Block 2: Appeal Scores for High Exaggerated Video

3	4	5	4	6	4	2
2	2	7	6	6	4	2
5	4	5	5	6	7	6
6	7	7	3	6	5	3
2	6	6	5	4	6	4
2	6	6	6	5	6	3
5	4	3	6	3	4	4
6	5	4	6	4	4	7
2	6	2	5	5	2	6
2	5	4	7	6	2	6
4	6	6	6	4	5	
4	7	7	6	6	2	

Block 2: Believability Scores for Control Video

6	4	6	4	5	6	6
6	1	7	5	6	3	5
6	4	7	6	6	7	6
3	7	7	6	6	4	5
6	5	7	4	4	7	5
2	6	6	6	5	5	6
6	4	3	6	5	4	6
6	5	4	6	6	4	6
4	3	4	6	6	5	2
4	6	4	7	6	2	5
4	6	6	7	5	6	
4	6	2	6	5	2	

Block 2: Believability Scores for High Exaggerated Video

5	4	6	4	4	4	2
2	1	7	6	6	4	2
6	4	7	5	6	6	6
6	7	7	3	6	3	4
2	6	6	4	4	6	5
2	5	6	7	4	5	4
2	4	2	6	5	4	4
5	5	4	6	6	5	7
5	3	4	6	5	2	2
2	6	4	6	6	2	4
4	6	6	6	6	4	
4	7	7	6	5	2	

Block 2: Votes for Favored Performance (1 = Control, 2 = High, 3 = Neither)

2	3	2	3	1	1	1
1	3	1	2	1	2	1
3	3	1	2	1	1	3
2	2	2	1	3	3	1
1	1	2	3	3	1	2
1	1	3	1	2	1	1
3	3	3	2	3	1	2
1	2	3	1	3	2	1
2	3	1	1	1	1	3
3	2	3	2	1	3	2
3	1	2	1	1	1	
3	1	2	1	3	3	

Block 3: Appeal Scores for High Exaggerated Video

7	4	6	4	5	6	6
6	7	7	6	6	3	5
5	4	6	6	5	6	6
2	7	7	6	6	3	5
6	5	6	7	5	6	5
6	5	6	6	5	6	3
5	4	3	6	2	4	5
6	6	4	6	4	5	7
4	6	5	6	6	2	6
4	5	4	6	6	2	6
4	6	6	6	4	6	
1	6	2	6	6	2	

Block 3: Appeal Scores for Low Exaggerated Video

7	4	5	4	6	6	2
3	1	7	6	6	4	2
5	4	5	5	6	6	6
6	7	7	3	6	6	5
2	5	7	7	5	7	3
4	6	6	6	2	6	6
6	4	3	5	3	4	3
6	5	4	6	4	4	6
4	5	2	6	2	2	6
3	6	4	6	6	2	5
4	7	6	6	3	2	
1	6	6	6	6	2	

Block 3: Believability Scores for High Exaggerated Video

7	4	6	4	5	5	6
6	4	7	5	6	3	6
6	4	2	6	6	7	5
2	7	7	6	6	7	5
6	5	6	7	3	6	4
7	5	6	6	2	5	4
6	4	3	6	5	4	5
5	5	4	6	6	4	7
4	3	4	6	6	3	2
6	3	4	7	6	2	6
4	7	6	7	3	6	
1	6	2	6	5	2	

Block 3: Believability Scores for Low Exaggerated Video

7	4	5	4	5	5	2
2	1	7	4	6	2	2
6	4	6	6	6	7	6
6	7	7	3	6	6	5
2	5	7	7	3	7	5
4	6	6	7	5	5	6
5	4	3	6	5	4	4
4	5	4	6	6	4	6
4	3	4	6	2	3	2
2	6	4	6	6	2	6
4	7	6	6	4	6	
1	6	6	6	6	2	

Block 3: Votes for Favored Performance (1 = High, 2 = Low, 3 = Neither)

1	3	2	3	1	3	1
1	3	1	2	1	2	1
3	3	1	1	1	3	3
2	3	2	1	3	2	2
1	1	1	1	3	1	1
1	1	3	1	1	1	2
3	3	3	2	3	1	1
1	2	3	2	3	3	1
2	3	1	3	1	3	3
3	1	3	1	1	3	1
3	2	1	1	2	1	
3	1	2	2	2	3	

APPENDIX E. QUALITATIVE DATA

The following tables show the qualitative data collected for each block of videos through commented feedback.

Block 1: Please explain why you do or do not find the top-most (Control) video appealing.

none
it looks good satisfies me
This cat seemed to look more realistic when it moved. It didn't warp when it leaped from the climbing toy.
They appear to be the same video
look good
It looks beautiful
cat is the top most character.
appealing is living thing
They're both the same video for me.
IT was not appealing cats can not talk
they were the same
I think the helicopter is not very attractive the sound of the annoying wings
Same characters and same movements
i find it appealing because of it's quality
NONE
NONE
I thought they were the same.
The way it expresses its attitude. It is interesting and funny.
Don't know
THIS CHARACTER SO FAST
BELIEVABLE
none
normal
nice
nice
first one is top most character
The cat has a scary voice and is scary looking.
This is the same video, I have no change in my opinion.
It's a cute cat and has decent animation
I think they were equally appealing.
They both seemed the same to me.
I somewhat agree with the top-most character being more appealing because he seems like he has lighter fur.

likely
good
I think the top-most-character is more appealing than the second because of more visually appealing graphics and clarity.
ACCORDING TO MY OPINION CAT IS THE TOP MOST CHARACTER IN THESE VIDEO SO I FOUND IT TO BE APPEALED IN VIDEO AND FOR THAT I CHOOSE TO BE AGREE
good
top most helicopter playing to top most the cat jumping to no catching
Both videos had the same character and was appealing
YES
YES
the cat is the top-most character
Yes
I liked the movements of the character; they seemed very cat like.
same video
this is good
helicopter is top character
The video was exactly the same as far as I could tell.
The voiceover was a bit off and the cat just seemed grumpy
cat playing
There is something lacking in the animation. It is not smooth.
SAME AS LAST ONE? THIS TIME I DIDN'T SEE THE CAT'S PAW REACH FOR THE HELI IN THE CAT TREE.
good
The top character had a grisly, serious voice.
ITS CORRECT
good
The cat body is too long, his skin is ugly and the meow sounds too fake
it's creepy and unnatural
good to see
I found it scary. The animal was scary to me and the sound was so frightening.
look great
The top-most character is not much appealing as it is not doing as like cat.
it is appealing because it is funny and curious
BECAUSE THE CAT IS BEATIFUL
seemed to have good movement and only a little choppy
BECAUSE THE CAT IS VERY ACTIVE
YES
I find curious cats to be appealing.
Maybe ok

Block 1: Please explain why you do or do not find the bottom-most (Low Exaggerated) video appealing.

none
look good
I liked this cat but it looked less realistic than the other, and therefore less appealing.
They appear to be the same video. No noticeable differences in appearance or quality
not
N/A
helicopter s the bottom most character .
YES
They're both the same video for me.
It was appealing at all
they were the same
the cat is attractive because he is curious and wants to take the plane
Same characters and same movements
I find it appealing because of it's quality
NONE
NONE
I thought they were the same.
The character's attitude is nice to watch.
slightly good
THIS CAT SLIGHTLY SLOW
UNBELIEVABLE
none
nothing
none
nice
nice
second one is bottom most
The cat has a scary voice and is scary looking.
This is the same video, I have no change in my opinion.
Has janky animation, needs a lot of polish
I don't see a different in appeal.
They both seemed identical.
I don't see all that much difference in the top and bottom but if I had to be swayed one way or the other, I'd pick the first one.
likely
good
Because it doesn't have good quality and sharp graphics.

ACCORDING TO MY OPINION CAT IS THE TOP MOST CHARACTER IN THESE VIDEO SO I FOUND IT TO BE APPEALED IN VIDEO AND FOR THAT I CHOOSE TO BE AGREE
good
explain to the character appealing catch to cat
cat
Both videos had the same character and was appealing
YES
HAPPY
the helicopter is the bottom-most character
Yes
I thought the last movement of the character was realistic; when he came up on the helicopter it was like he was surprised he was there already.
same video
find most impotent
cat is bottom character
The video was exactly the same as far as I could tell.
He seemed more friendly somehow and more catlike
cat playing
The animation is good.
THIS SEEMED TO BE THE SAME VIDEO. AGAIN, CAT DIDN'T REACH FOR THE HELI. BUT IN BOTH VIDEOS, THE MOVEMENT WAS SMOOTH.
sweet
While similar to the top character, the bottom character seemed more rushed and fast talking.
SAME
good
The cat body is too long, his skin is ugly and the meow sounds too fake
the same, it's creepy and unnatural, and the video seems the same, I didn't find any difference
look slightly bad
I found it scary. The animal was scary to me and the sound was so frightening.
bad forming
The bottom-most character is appealing as like cat.
it is appealing because it is curious and funny
AIRPLANE IS FAST
seemed to also have good movement they were same.
BECAUSE THE AIRPALNE IS VERY FAST
YES
I find curious cats to be appealing.
good

Block 1: Please explain why you do or do not find the top-most (Control) video believable.

first stage has good
This cat seemed to move more realistically--it's body looked more natural and didn't warp when it jumped.
The top video seems slightly more smooth and the cat moves easier.
likable
It looks so pretty and real
because its mammal animal so its believable
NO
its living things
its a mammal
Again, they're both the same video.
It was not believable cats cannot talk
they were the same
is a little believable, at first glance it is seen that the cat does not act anything natural
Same characters and same movements
i find it believable because of the sound
NONE
NONE
I thought they were the same.
The aggressive behavior of the character.
good
MOST BELIEVABLE
GOOD
nice
understand animal method
nice
nice
the airplane is top most character
Cats don't speak.
This is the same video, I have no change in my opinion.
Moves like a cat but also talks
The cat's actions were as quick as most cats.
They both seemed identical
There was not enough occurring in the video to make assumptions about the believability of the character.
likely
good
Top-most character have good sound, graphics and quality. So, that's why it's believable.
IN MY POINT OF VIEW I SAW A CAT MOVING AROUND HERE AND THERE AND I COULDN'T FIND A POINT TO BELIEVE IT OR NOT AND SO THAT MY OPTION IS NEITHER

good
bottom explain to catch the cat find the most of the believable
good
Both characters were believable as they talked
YES
VERY GOOD
yes
Yes
The movements were very believable; the character moves like a cat does.
same video
fine
believable is a cat
Other than the cat talking, it portrays cat behavior.
The voice didn't match the movements as well
cat playing
The character is almost believable.
i FEEL THEY WERE THE SAME VIDEO. MOVEMENT WAS SMOOTH, BUT FELINE AGGRESSION AND CURIOSITY WEREN'T THERE.
best
I find them serious enough to be believable and didn't notice anything to the contrary.
IT BELIEVABLE
cat
yes, it is good.
The cat body is too long, his skin is ugly and the meow sounds too fake
the voice is terrible, the character is blatantly false
look believable
No, it does not seem believable since animals cannot talk.
more believable
The top-most character is not believable as it is not promising.
It is believable in the sense that a cat is curious and would surely follow a quad copter.
CAT
Cat had good movement and was not too choppy.
YES
YES
Because cats do not speak in English.
good

Block 1: Please explain why you do or do not find the bottom-most (Low Exaggerated) video believable.

none
not
The animation was a little less realistic for this one, but still had a lot of cat-like motion in it.
The slight movement of the cat.
not
N/A
its the robotic element helicopter
its operating object
its robotic
Again, they're both the same video.
If the cat was real it would have destroyed the airplane
they were the same
the truth is that the videos are identical
Same characters and same movements
I find it believable because of the sound
NONE
NONE
I thought they were the same.
Because the character crash the plane.
nice
SLIGHTLY BELIEVE
NOT ENOUGH
none
nothing
nothing
nice
nice
the cat is the bottom most character
Cats don't speak.
This is the same video, I have no change in my opinion.
Moves like a cat but also talks
It was a little faster than most real life cats.
good
The bottom-most character is less visually appealing that top-most character and it's also doesn't seems believable.
IN MY POINT OF VIEW I SAW A CAT MOVING AROUND HERE AND THERE AND I COULDN'T FIND A POINT TO BELIEVE IT OR NOT AND SO THAT MY OPTION IS NEITHER
good

down the catch the cat top most find the catch believable
good
Both characters were believable as they talked
YES
GOOD
yes
Yes
The movements were very believable; the character moves like a cat does, especially at the end.
same video,
good thing
toy helicopter is a believable
Other than the cat talking, it portrays cat behavior.
The actual movements of the body seemed a bit slower but the voiceover was better.
cat playing
Full disclosure: Historically, I have been both a cat and dog person, but now cats are more my style.
The animation is good and this is the way a cat behaves.
SAME VIDEO? MOVEMENTS SMOOTH, BUT FELINE BEHAVIOR WASN'T REALISTIC.
good
As explained above, the voice seemed genuine and normal to me.
SAME
it is believable.
The cat body is too long, his skin is ugly and the meow sounds too fake
as the other, they are practically the same
looks not believable
No, it does not seem believable since animals cannot talk.
bad believable
The top-most character is not believable as its action as like cat.
It is believable in the sense that a cat is curious and would surely follow a quad copter.
Again the cat had the same movement and seemed like the first video.
NO
YES
Because cats do not speak in English.
nice

Block 1: Please explain why you voted for your preferred video.

none
because I like it
The top-most character moved more realistically and its body didn't elongate and warp when it leaped off the climbing toy to the sofa edge. That made the video seem more realistic and preferable.
They seem to be the same videos but the 2nd one seems to have slightly poorer quality.
good
I like its moves and actions
I'm not eligible for the kind of work.
YEAH
its game tocat just for entertainment
I do know
Again, they're both the same video. There's no noticeable difference between the two.
there were the same
they were the same
as you can clearly see the video is the same as the other, same cat and miso helicopter doing the same in both videos
These videos are exactly the same. Nothing changed between the videos
the videos are the same since their is no changes in their quality
They look absolutely the same to me.
Both the videos have same action which is performed by the character in the video(cat)
BEST
THIS CAT RUN FAST
GOOD
this is a bottom most character
the animal method
nice
nice
both are the same video
Both videos look exactly the same.
This is the same video, I have no change in my opinion.
Has slightly better animation, that is the only difference I observed
The top-most one seemed more realistic. The bottom character seemed like it was too sped up.
I was not able to tell a difference between the two videos. They both appeared identical.
The video seems lighter and superior quality.
good
top-most-character have great visuals, sound and graphics and it's also better than bottom-most character.

BOTH THE CHARACTERS AND VIDEOS ARE APPEAL TO BE THE SAME SO I PREFER THE 3RD OPTION
good
nice the catching cat good
good
Both characters were the same and were doing the same thing
YES
HAPPY
both of them are trying to irritate the each other
Yes
The videos were very similar to me.
same thing to me.
good things to do
two videos like same
There did not appear to be anything different. I replayed them both several times.
Somehow he is more catlike and friendlier
cat playing
The animation in bottom most character is better than top most character.
THEY SEEMED TO BE THE SAME VIDEO
I can't spot too many differences between the two videos to make a judgment. I need more information.
BOTH ARE SAME PERFORMENCE
cat
it is good.
I couldn't see any difference between the two cats
just played and watched, that's it, they don't seems to be different at all.
good
All the two videos were just the same to me. I did not see any difference.
good
I prefer the bottom most character as it likes cat action.
both seem to be same
VERY NICE
NOTHING
I think they are so close that there is no real difference.
NO
YES
Both videos appeared to be exactly the same.
very good

Block 2: Please explain why you do or do not find the top-most (Control) video appealing.

None
good
I thought it was interesting because it moved a lot like a real cat but its talking allowed me to better connect with it and identify with it.
The cat seems to speak less clear in first video.
cat is the top most character.
GREAT
top most character is cat
Again, they're both the same video.
The cat did not look real
they were the same
I do not find it attractive since it is a cat speaking with a human voice
They both appealed to me a lot
because it's quality is low
NONE
NONE
The characters are the same
The vivacity of the character.
It is so clear.
CAT GOING TO CATCH AIRPLANE
GOOD
none
nice
none
nice
nice
airplane is top most character
The cat's voice was a bit scary.
I thought that the video was unremarkable. There was not anything that stood out to me.
It's a cute cat and has decent animation
I don't prefer either one.
The movements of the cat didn't seem very catlike. Especially when it pounced on the helicopter at the end.
I do not see a difference in the two characters.
likely
good
It seems real and visually appealing. It's also better than bottom-most character.
I FOUND THE TOPMOST CHARACTER IS CAT SO GUESS CAT MUST BE THE TOP MOST CHARACTER AND I FOUND IT TO BE APPEALED

video 1
cat is jumping helicopter catch
good
Made precise and fast movements
YES
GOOD
the cat is very interest
I found the top most character that is the cat
The movements were very believable; the character moves like a cat does.
its just there
good is batter
cat is a top most character
Both are the same
Movements were most catlike.
cat playing
The cat looks good.
THIS TIME I DID THINK THE CAT REACHED FOR THE HELI IN THE TREE. MOVEMENT WAS SMOOTH
good
A curious cat with a calculating mind.
CAT IS CATCH THE DIA PRODUCT
The character is good.
He has better fur color
the same
look real
None of them was appealing to me. They all seemed scary and frightening.
its look like the more earnest
The top-most character appealing because of its animated character.
it seems curious and comic
NOTHING
more natural like movement
YES
YES
I find curious cats to be appealing.
Nice

Block 2: Please explain why you do or do not find the bottom-most (High Exaggerated) video appealing.

none
not
I liked the mixture of both human and cat sounds, just like with the other cat, as well as the movement. It seemed like a real cat, just one that could talk and was therefore more relatable.
The cat audio is better in 2nd video.
not
N/A
helicopter is the bottom most character.
YES
bottom most character is no
helicopter
Again, they're both the same video.
Again the cat did not look real
they were the same
the truth is not since both videos are identical
Both got me very engaged
because it's quality is high
CAT
NONE
The characters are the same
Rapid action to catch the plane.
It is nice but not focus in the good clearness.
CAT GOING TO CATCH AIRPLANE
GOOD
none
nice
nothing
nice
nice
the cat is the bottom most character
The cat's voice was a bit scary.
It was the same exact video clip, so my answer is the same.
It has janky animation that needs polishing
They're both appealing.
The cat seemed more kitten like in it's movements. Especially at the end.
I do not see a difference in the two characters.
likely
good

The quality is not good and It's also not visually appealing.
I FOUND THE TOPMOST CHARACTER IS CAT SO GUESS CAT MUST BE THE TOP MOST CHARACTER AND I FOUND IT TO BE APPEALED
cat is top most bottom character do or find the cat catch the helicopter
good
Made a little bit slow but precise movements
YES
YES
the helicopter is a thing
The movements were very believable; the character moves like a cat does.
its just there
this is good for you
helicopter is a character
Both are the same
Voiceover matching was better.
cat playing
The cat looks realistic.
I STILL DON'T THINK THE CAT WENT FOR THE HELI IN THE TREE. MOVEMENT WAS SMOOTH, THOUGH
good
Cool, genuine and funny.
CAT IS SOME SPEAK TO CATCH THE DIA PRODUCT
helicopter
on seeing the video character may be good.
The fur is ugly
the same
look slight low
None of them was appealing to me. They all seemed scary and frightening.
slightly not good
The bottom-most character is not much appealing because its too dull character.
it is comic and funny
NOTHING
the movement seemed unnatural - a bit choppy
NO
YES
I find curious cats to be appealing.
good

Block 2: Please explain why you do or do not find the top-most (Control) video believable.

none
good
It's believable because it moved like a cat and looked like a cat and behaved like a cat, despite the human speech.
The cats voice doesn't seem as harsh in the 2nd video.
yes
It likes like real one
its a mammal
NO
its very special things god gift
its a mammal
Again, they're both the same video.
It did not seem believable because cats can not talk
they were the same
It was not believable, a cat talking like a human? That's not credible
Both characters did the same exact thing
because of the sound
CAT
NONE
The characters are the same
top-most character believable.
The aggressive behavior.
Yes, It is believe.
YES THAT CHARACTER BELIEVABLE
GOOD
cat
nice
agree
nice
nice
yes i found the top most. the cat catch the airplane
Cats don't speak English.
I don't find it believable because the cat is talking.
It moves like a cat but also talks
They were both pretty realistic.
The movement of the joints didn't seem as fluid and jerky as a cat's can be.
I do not see a difference in the two characters and I don't think the video was long enough to make an assumption about believability.
likely

good
The quality of overall video is visually appealing and believable specially the character.
ITS A CHARACTER JUST MOVING HERE AND THERE SO I PREFER TO BE NEITHER AGREE OR DISAGREE
good
explain the cat is top most character believable the cat
good
He talked
YES
YES
yes
Yes
Other than the voice, I found the character to be believable.
same thing
fine
catch the helicopter
Other than the cat talking, it portrays cat behavior.
Movements were good.
cat playing
It is how a cat behaves.
SEEMED MORE REALISTIC
best
There is nothing to indicate they aren't believable.
I FIELD THAT BELIEVABLE
cat
Yes, it is believable.
He has better fur color
the same
earning
Animals do not speak so the video is so unbelievable to me.
its real and believable
Its believable because its doing as like as the cat do.
NOTHING
cute cat with more fluid movement
YES
YES
Cats do not speak in English.
nice cat

Block 2: Please explain why you do or do not find the bottom-most (High Exaggerated) video believable.

none
not like it
Again, it looked like a real cat to me, other than the human speech.
Better quality audio.
not
N/A
its a object or robotic element
NO
no its object
its robotic
Again, they're both the same video.
N/A
they were the same
both videos are identical so I did not find it credible
They were both the same
because of the sound
NONE
The characters are the same
The plane was crashed by the cat.
It is slightly believe
BOTTOM VIDEO ALSO MOST BELIEVABLE.
GOOD
none
nice
no
nice
nice
the cat is bottom most character
Cats don't speak English.
Again, since it is the same video, I have the same opinion as the former statement.
It moves like a cat but also talks
I don't see any differences in realism.
The joint movements were more realistic and behavior seemed more catlike.
I do not see a difference in the two characters and I don't think the video was long enough to make an assumption about believability.
likely
good
The quality of graphics is not good and the character seems dull.
SAME VIDEO DISPLAYED SO I PREFER TO CHOOSE NEITHER OPTION

good
it was the explain the cat down the cat to catch
yes
He talked
YES
HAPPY
yes
Yes
Other than the voice, I found the character to be believable.
same thing
good thing
moving of cat
Other than the cat talking, it portrays cat behavior.
Voice matched the visual better.
cat playing
It correctly depicts the behavior of a cat.
STILL MOVED SMOOTH, LIKE THE TOP, BUT I THINK THE TOP CAT'S ACTIONS WERE SMOOTHER AND MORE BELIEVABLE
better
It seems to be reasonably believable.
I FIELD THAT UN BELIEVABLE
helicopter
I think the character is believable.
The fur is ugly
the same
feel good
Animals do not speak so the video is so unbelievable to me.
not looks good
Its not believable because its action prevails it.
NOTHING
choppy movement when jumping on to cat tree
NO
YES
Cats do not speak in English.
ok

Block 2: Please explain why you voted for your preferred video.

none
real and earnest
I honestly can't tell a difference between the two videos. They seem like exactly the same cat to me, doing and saying and meowing the exact same things.
The audio was slightly better.
good to see
It looks pretty and real
no know how to make this
NO
bottom most character used to all objects
I'm not interest
Again, they're both the same video.
They were the same
they were the same
The truth is that both videos are the same and I have no preference.
They are the same video.
because of it's quality
CAT IS MOST CHARACTER
I played the videos at the same time and they were the same.
Both the videos have same actions of the cat. There is no difference
Good
YES IT LOOKING TO MOST BELIEVABLE
GOOD
this video is bottom most character
nice
the top most character
nice
nice
the cat and airplane is top and bottom most character
Both videos appear to be exactly the same.
The videos were exactly the same. I observed no differences.
It has slightly better animation
They both seemed pretty realistic to me.
I preferred the bottom. The top video was fine but the bottom video seemed to capture more of the essence of a cat and it's behaviors.
I do not see a difference in the two characters.
likely
good
I think top-most character is visually appealing, graphic quality is good than bottom-most character. So, that's why I consider the top-most character is best.

BOTH VIDEOS APPEAR AS SAME FOR ME SO I PREFER TO CHOOSE THE THIRD OPTION
good
explain to the cat do and the nice animation video trail
good
the video was fast and had clarity
YES
GOOD
it is very interesting
Yes
I am not seeing much of a difference in the videos.
same quality
nothing
two videos are same
No difference
The movements were more fluid and catlike.
cat playing
Both looks the same.
SAME AS ABOVE...THE CAT SEEMED TO GO FOR THE HELI IN THE CAT TREE WITH ITS PAW...MORE BELIEVABLE MOVEMENT
no
I find the top character more endearing and curious.
IT IS SAME TO PREFER TO THIS VIDEOS
cat
I like that video
The top-most has a better fur color
the same
good
Both videos appeared same to me. There was no difference.
look good
I prefer to the top most character as compared to bottom most character.
both are the same
VERY GOOD
NOTHING
The top most character seemed to have smoother movement to me. I think it looked more realistic.
YES
YES
Both videos appeared to be exactly the same.
super

Block 3: Please explain why you do or do not find the top-most (High Exaggerated) video appealing.

none
good to see
These characters look identical to before. I like the mix of talking and cat stuff.
The cats body movements seem more rough.
great to see
helicopter looks real
cat is top most character
YES
it is a animal
cat this top most character
Again, they're both the same video.
IT WAS bad
they were the same . A talking kitty lol , I love animals , we have 6 total . We have 3 kitty stands so I could relate
the most striking is the talking cat
Both are the same characters
i find the top-most character appealing because of it's quality
NONE
NONE
The characters in both the videos are the same
yes
The rapid action of the cat when a object comes.
I see a cat in the video and it catch the remote control airplane and finally it got that.
THIS VIDEO IS GOOD
GOOD
none
nice
none
nice
nice
the first one is the top most character
The cat is not pretty and its voice is scary.
This is the same video, I have no change in my opinion.
It's a cute cat and has decent animation
They're both equally appealing.
The cat seemed almost too stiff like.
I do not see a difference in the two characters.

likely
Top-most character have great graphics and visually appealing. So, I think it's better than the other one.
ACCORDING TO MY OPINION CAT IS THE TOP MOST CHARACTER IN THESE VIDEO SO I FOUND IT TO BE APPEALED IN VIDEO AND FOR THAT I CHOOSE TO BE AGREE
target achive
I find him appealing as he communicates
YES
HAPPY
the cat is very interesting to catch helicopter
Yes
The character moves realistically.
its smooth to watch
this is good for you many year
the cat is a top character
It is the same as the bottom
He was more catlike.
cat playing
none
Looks good.
MOVEMENT WAS SMOOTH, SEEMED REALISTIC
good
The voice is serious and dark.
IS GOOD
cat catch the helicopter
cat is trying to catch the toy.
Sorry, but he's ugly. The cat doesn't even have fur, and his body is too long.
answers as before, they don't seems to be different at all
feels good
None of them was appealing to me. They all seemed scary and frightening.
look good
The top-most character is appealing as it looks like cat action.
I like it because it seems curious and somewhat comic.
BECAUSE THE CAT IS VERY ACTIVE
movement seemed not as fluid
YES
YES
Because it is a curious cat and I find curious cats appealing.

Block 3: Please explain why you do or do not find the bottom-most (Low Exaggerated) video appealing.

none
not satisfied
Once again I like the anthropomorphizing of the cat. It makes it more appealing and relatable than just a normal cat.
The cat seems more fluid.
none
N/A
helicopter is the bottom most
YES
its toy
helicopter is the bottom
Again, they're both the same video.
It was bad
They both looked the same to me
both cats are the same and say the same
Both videos are exactly the same
I find the bottom-most character appealing because of it's quality
NONE
NONE
The characters in both the videos are the same
The vivacity of the cat.
I don't know. sorry
THIS VIDEO VERY QUALITY.
GOOD
none
nice
nothing
nice
nice
the second video is a bottom most character
The cat is not pretty and its voice is scary.
This is the same video, I have no change in my opinion.
It has janky animation that needs more polish
I don't find either more appealing.
The back end of the cat seemed to move more appropriately for a cat on the hunt.
I do not see a difference in the two characters.
likely
It doesn't appealing because of the dull graphics.

ACCORDING TO MY OPINION CAT IS THE TOP MOST CHARACTER IN THESE VIDEO SO I FOUND IT TO BE APPEALED IN VIDEO AND FOR THAT I CHOOSE TO BE AGREE
good
airplane
I find him appealing as he talks
YES
GOOD
the helicopter is trying to irritate the cat
Yes
The character moves realistically.
its same thing
this is the best graphics
the helicopter is a bottom character
It is the same as the top.
He was more choppy in his movements and voiceover
cat playing
nothing
The animation is good.
SAME REASON...SMOOTH MOVEMENT, GOOD ANIMATION
good
Very similar to the top character, I like the voice.
ITS ALWAYS GOOD
good.
Sorry, but he's ugly. The cat doesn't even have fur, and his body is too long.
answers as before, they don't seems to be different at all
not earnable
None of them was appealing to me. They all seemed scary and frightening.
bad
The bottom most character is not as much appealing as it is not realistic animated.
I like it because it seems curious and somewhat comic.
BECAUSE THE AIRPLANE IS TO SMALL
movement was more natural and more fluid
NO
YES
Because it is a curious cat and I find curious cats to be appealing.
funny games

Block 3: Please explain why you do or do not find the top-most (High Exaggerated) video believable.

none
watched and believed
It moves, sounds, and acts like a cat, other than the human speech, so I find it believable.
The cat seemed to be more computerized.
its good
cat looks pretty, real and believable
its a mammal animal
NO
animal
cat is the mammal type animal
Again, they're both the same video.
It was bad
they were the same
I do not see it believable since it is a cat that speaks, that is out of the ordinary, that is weird and apart the cat is disfigured when it is walking
Both of them do the same moves in the same manner
I find the top-most character believable because of it's quality
NONE
The characters in both the videos are the same
no
The character's aggressive behavior.
Nothing
THIS VIDEO UNBELIEVABLE.
GOOD
cat
nice
understand animal method
nice
nice
the airplane is a top most character
Cats don't speak.
This is the same video, I have no change in my opinion.
It moves like a cat but also talks
I didn't really see any differences.
The back end of the cat was too close to the ground while jumping.
I do not see a difference in the two characters and I don't think the video was long enough to make an assumption about believability.
likely

good
The moving of the character (Cat) seems realistic and graphics is great and believable.
IN MY POINT OF VIEW I SAW A CAT MOVING AROUND HERE AND THERE AND I COULDN'T FIND A POINT TO BELIEVE IT OR NOT AND SO THAT MY OPTION IS NEITHER
good
good
Both characters are believable as they talk
YES
YES
yes
Yes
Other than the voice, I found the character to be believable.
does not seem so
cat is good quality
cat is a believable
Other than the cat talking, it portrays cat behavior.
He was most catlike
good
Neat animation.
REAL CAT WOULD HAVE BEEN FASTER, AND WOULD HAVE TROUNCED THE HELICOPTER, NOT JUST CRADLED IT.
good
I see no reason to not believe them.
ITS BELIEVABLE
nice
yes, believable.
The cat body is too long, and his skin is ugly
answers as before, they don't seems to be different at all
good
Animals do not speak so the video is so unbelievable to me.
good
The top-most character is believable as it seems the actions of cat.
It is believable in the sense that a cat is curious and would surely follow a quad copter.
YES
stretchy movement / choppy did not move as well as other cat video
YES
YES
Because cats do not speak.
intelligent cat

Block 3: Please explain why you do or do not find the bottom-most (Low Exaggerated) video believable.

none
not
It moves, sounds, and acts like a cat, other than the human speech, so I find it believable.
The cats movements were better.
not
N/A
its just a object
MM
operating mechanic system
helicopter
Again, they're both the same video.
It was bad
they were the same
both videos are the same so no, they do not look like igaules
B did the same thing as A
I find the bottom-most character believable because of it's quality
NONE
NONE
The characters in both the video are the same
The plane was caught by the cat. It leads to danger.
Airplane.
THIS VIDEO BELIEVABLE.
GOOD
none
nice
none
nice
nice
the cat is the bottom most character
Cats don't speak.
This is the same video, I have no change in my opinion.
It moves like a cat but also talks
They both seemed realistic to me.
It's movements and actions seemed more realistic.
I do not see a difference in the two characters and I don't think the video was long enough to make an assumption about believability.
likely
good

Character and overall graphics is not good and the character (cat) moving is also not so realistic and believable.
IN MY POINT OF VIEW I SAW A CAT MOVING AROUND HERE AND THERE AND I COULDN'T FIND A POINT TO BELIEVE IT OR NOT AND SO THAT MY OPTION IS NEITHER
good
target
Both characters are believable as they talk
YES
YES
yes
Yes
Other than the voice, I found the character to be believable.
its same thing
this is fine
helicopter is a believable
Other than the cat talking, it portrays cat behavior.
Movements were choppy and less feline.
cat playing
good
Smooth animation.
SAME REASON. CAT SHOULD HAVE MOVED FASTER, EVEN IN STEALTH. WHEN IT SAW THE HELI STOPPED ON THE CAT TREE, IT DIDN'T TRY TO GRAB OR TOUCH IT.
good
Same as above--I see no reason to not believe them.
SAME GOOD
good
The cat body is too long, and his skin is ugly
answers as before, they don't seem to be different at all
good believable
Animals do not speak so the video is so unbelievable to me.
bad
The bottom-most character is believable as it is not realistic animated
It is believable in the sense that a cat is curious and would surely follow a quad copter.
NO
this cat's movement seemed more natural and less choppy.
NO
YES
Because cats do not speak.
super

Block 3: Please explain why you voted for your preferred video.

none
good
I can see no difference between the two videos. They appear identical to me.
The cat seemed more cat-like in the 2nd video.
look good
I like the way of action
I not eligible this making video.
NO
entertainment for cats
this kind of video I would not make
Again, they're both the same video.
it was bad
they were the same
both videos are the same, same voices same movement and same cat
Same thing as last time where the character does the same thing
there is no different in both characters
CAT IS THE TOP MOST CHARACTER IN THIS VIDEO
I played these videos at the same time as well and they are the same videos as before
Both the videos have same kind of actions and motions of the animated character
This video contain top and bottom most character, that is cat and airplane.
THIS IS SO GOOD
GOOD
bottom most character
nice
animal method
nice
it 's nice
two video is same
Both videos appear to be exactly the same.
This is the same video, I have no change in my opinion.
It has slightly better animation, that's the only difference I observed
They were both equally realistic.
The positions of the cat seemed more authentic. I found it to be more believable than the top.
I do not see a difference in the two characters.
likely
it is good

The top-most character is visually appealing and have great quality graphics. The moving of character is also better than the bottom-most character. So, top-most character is much better than the bottom-most character.
BOTH THE CHARACTERS AND VIDEOS ARE APPEAL TO BE THE SAME SO I PREFER THE 3RD OPTION
good
good
both videos were the same
YES
GOOD
the cat and the helicopter are very interesting
Yes
Videos seem the same to me.
they have same quality
good graphics
the two videos are same
Could not find any differences
The top one was more catlike.
cat playing
none
The animation is smoother than top.
BOTH CATS MOVED THE SAME, BUT DID NOT REACT IN A REALISTIC WAY. NEITHER CAT SHOWED REAL FASCINATION, DIDN'T TRY TO TOUCH THE HELI ON THE TREE.
no
I can't make my mind up, they are too similar.
NICE AND BOTH ARE SAME
super
I like that video.
I watched the two videos and the cats look the same for me
answers as before, they don't seems to be different at all
i like it
Both videos appeared same to me. There was no difference.
good
The video of the top-most or bottom-most character is very much promising as compared to bottom.
both are the same videos
VERY NICE
CAT IS TO STRONG
This time the bottom most character had the more fluid of movement. Looked more natural.
YES

YES
Both videos appear to be exactly the same.
Ok

Do you have any final comments or feedback for this study? (Optional)

No
N/A
its good
GOOD
entertainment
good
All 6 videos were the same video with the same audio of the same cat doing the same actions. Playing them exactly at the same time showed no difference between them.
no
GOOD SURVEY
NO COMMENTS
Use different videos
happy
It is nice experience. The animated character is nice. Thank you.
GOOD
GOOD
good
nice
the goal of the survey is to understand animation method realist to make an animal appear believable
nice
nice
nice
I'm fairly sure all the videos were exactly the same.
Why!? That was torture, ugh!
I answered the same in all three pages because I didn't see any difference between them
happy
None
good
Thanks.
good
good
NO COMMENTS
GOOD

YES
good
nice
no
Thanks
very nice survey
nice
nothing
WERE THEY THE SAME VIDEO?
This was fun, but I couldn't spot too many differences between the animations.
NO
I LIKE THIS SURVEY
NICE
no
please explain what was the difference, so we can pay attention. But I think they are all identical
good
good luck
GOOD
GOOD
GOOD
GOOD
Thank you for the opportunity to participate in this study.
very easy