Was This Motion Captured?

Observations made during the creation of animated performances through the combination of naturalistic movement, captured using motion capture, with stylised animated characters.

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Table of Contents

Attestation of Authorship

“I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.”

(RAFI SENGUPTA)

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Abstract

This research project has two main aims. The first is to investigate why digital cyber stars in recent live action movies have not always been widely accepted by audiences, despite being rendered to look photo-real and animated using motion capture. The second is to investigate possible pipeline integration issues as well as any creative concerns that arise when utilising motion captured data to generate movement for stylised characters. These observations are made through the creation of an animated short which integrates motion captured movement with non photo-real, caricatured digital actors. The short, titled *Perhaps, Perhaps, Perhaps*, features four characters and is created in the form of a music video.

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Introduction

Since the time the first illustrator flicked the pages of a series of line drawings in rapid succession to create the illusion of movement, animators all over the world have been trying to improve on techniques to do just that – give movement to inanimate objects, whether these are simple 2D drawings or more sophisticated 3D models. As Cantor and Valencia (2004) have said, “animation can be defined as the creation or manipulation of individual images or objects, such that when these images or manipulations are displayed in succession, the illusion of movement results” (Cantor & Valencia, 2004, p. 311). However, it is important to note that ultimately it is the illusion of movement that is the main aim of the animator, rather than the objects that s/he animates. As celebrated animator Norman McLaren has said, “animation is not ‘the art of drawings that move’, but rather ‘the art of movements that are drawn’” (as cited in Chow, 2009, p. 79). Different people have used different techniques to try and capture this movement, that elusive quality that transforms what might otherwise be a lifeless object and captures the heart of the viewer.

My research project explores some of these techniques through the creation of

an animated short film which uses a hybrid method - combining keyframe animation with animation derived through movement captured using motion capture techniques, to animate non photo-real, caricatured digital actors. The short will feature four characters, and will be created in the form of a music video, with a duration of 2.35 minutes, of which I will be submitting approximately two minutes. The title of the animated short is *Perhaps, Perhaps, Perhaps*. I will use the short to research the two different animation methods and the differences observed between characters animated purely 'by hand', where the animator is in complete control, and those animated through motion capture (mocap), where that control must be shared with the performer. My final goal is to use both methods for the animation of my short film, thereby demonstrating the amalgamation of both techniques. With this research project, I have focused solely on a few of the many sections in a production pipeline – working mainly as the animator and pipeline integrator, focusing on the story and character design rather than on the lighting, texturing and rendering aspects of the animation. As such, the final animated piece has been created using *playblasts* – video captures generally used to quickly test out animation, camera angles and general timing. It should also be noted that only the first two acts have been presented – as they contain a good mix of scenes involving not just all four characters, but also both animation techniques.

This research project will also investigate possible pipeline integration issues as well as any creative concerns that arise when utilising motion captured data to generate movement for stylised characters. Aspects such as advantages

presented and limitations to be considered as well as the aesthetic outcomes that result will be expanded on as well.

Narrative

Although not the primary focus of my research project, this next section will elaborate on the narrative of my short film. Many 3D short films are centred on simple, often happy sentiments and emotions, with clearly defined protagonists and antagonists and the expected triumph of good over evil in the end. Part of the practical component of my thesis is to create a short film (edited to the song, *Perhaps Perhaps Perhaps* by Doris Day) which explores darker human emotions and to use 3D as a medium to portray the psychological conflict within an individual. Although the story does have a resolution in the end, it is meant to generate questions as to whether that was the resolution expected and whether the victim was actually the villain all along.

The story centres on Adrian, an innocent and seemingly weak young man who works in a soulless job, desperately trying to get out. When he comes across an opportunity to transform his life through a change of jobs, he jumps at it, only to face rejection at the hands of three strong characters that are in positions of power over him. Taking matters quickly into his own hands, he decides to seduce them using what he perceives as chinks in their seemingly impenetrable armours – food in the case of the gluttonous Paula, the lure of tax evasion for high powered businesswoman Simone and the promise of sexual favours for the outwardly macho Ryan. When they reject him again, after having enjoyed the pleasures he had offered them, he decides to use the very same baits as

weapons to destroy them in one way or the other.

Animation Techniques

Although a lot of research and discussion has gone into the use of motion capture in animating photo-real synthespians (Aldred, 2006; Creed, 2002; Furniss, 2000; Lamarre, 2006; Sobchack, 2006; Zabiegly, 2007), there has been relatively little discussion about the use of motion capture to animate stylised or caricaturised characters, perhaps due to the limited number of films that actually do this.

Animation is often done not only for its aesthetic appeal but also to sell something – it is after all used primarily in the film, advertising and gaming industry, all commercial enterprises - so the question of which technique is the most cost-effective – i.e. is able to produce the desired results with the most efficient use of time and energy – also becomes of paramount importance. Apart from keyframe animation, which has been used for decades, motion capture has recently gained increasing popularity (Furniss, 2000).

In spite of its increasing popularity however, the term itself has typically had a "negative connotation" (Furniss, 2000, p. 2). I would also like to explore the various current uses of motion capture in recent blockbuster movies (both live action and animation) and where it seems to work better – when used with photo-real or hyper-real cyberstars, as seen in *Final Fantasy: The Spirits Within* (2001, Square Co.), *The Polar Express* (2004, Castle Rock Entertainment) or *Beowulf* (2007, ImageMovers) or with stylised CG characters, as seen in movies like *Monster House* (2006, Columbia Pictures) and series like *Jane and the Dragon*

(2005, Weta Workshop). Why is it that the photo-real cyber-stars of the first three have not been well received when compared to their more stylised counterparts in the latter two, in spite of the fact that motion capture was used as the primary method of animation in all of them? I'm interested in exploring which method achieves more believability, and why.

I believe this research project is important because of the commercial aspect of animation that was mentioned earlier – i.e. the cost effectiveness of the different animation techniques. "Throughout the history of animation, producers have sought ways of reducing the time and money needed to create animated images", and although extensively debated, motion capture is often advertised as being both time and money saving (Furniss, 2000, p. 2). Similarly, the main 'disadvantage' of key-frame animation, in either medium, is that it is a lot more time consuming and labour intensive and can drive up production costs astronomically (Furniss, 2000).

However, before going any further, it is necessary to differentiate between the two techniques under consideration, i.e. keyframe animation and animate derived through motion capture techniques.

Keyframe Animation

Developed out of the "master / apprentice hierarchies" seen in many animation studios, keyframe animation involves the head animator drawing out only a few keyframes, with the gaps being filled in by junior animators or in-betweeners, thereby fleshing out the animation (Watkins, 2001, p. 306). Keyframes can therefore be defined as the "frames within a sequence of motion that are most

important in defining the moment or motion sequence" (Watkins, 2001, p. 306). This means that the master animator will still dictate the timing, movement, pose and overall feel of the animation.

When applied to computer animation, the software user basically becomes the master animator, defining the keyframes, with the computer acting as the in-betweener, interpolating the information between the keyframes and thereby filling in the frames of the animation (Watkins, 2001). It should be pointed out that this is not as easy as it sounds. For computer generated animation to not look too stiff or watery, the master animators have to create "a sufficient number of intermediate keyframes" and shape the function curves appropriately so they don't look like they have been mathematically calculated (Cantor & Valencia, 2004, p. 312).

Also worth noting is that "the basic elements of existing 2D animation, such as timing, anticipation, follow-through and weight" should still hold true in 3D animated films, although the performance garnered often produces a more stylised, non-naturalistic performance (Butler & Joschko, 2007, p. 55).

Motion Capture

Motion capture is the process of recording the movement and then using that recorded data to study motion (Kitagawa & Windsor, 2008). Commonly used to aid the animation of computer generated characters, data can be sourced from humans, animals, inanimate objects, facial expressions, cameras and even light positions. In other words, an object's position and orientation are measured in physical space, before that information is recorded in a computer usable form

(Dyer, Martin & Zulauf's, 1995 as cited in Furniss, 2000).

Due to its usefulness, especially in the medical sciences, armed forces and to create computer generated imagery, the technology has recently seen a lot of development (Kitagawa & Windsor, 2008). The technology itself however is not new, dating back to the 19th century when landscape photographer Eadweard Muybridge invented the zoopraxiscope, considered to be one of the earliest motion picture devices (Kitagawa & Windsor, 2008).

Having perfected the technology for taking sequential photographs of humans and animals in motion, Muybridge is arguably considered to be "a pioneer of mocap and motion pictures" (Kitagawa & Windsor, 2008, p. 2). Other early pioneers include French physiologist Etienne-Jules Marey, who invented a portable sphygmograph, whose modified versions are still used to graphically record the pulse and blood pressure of patients, as well as Harold Edgerton, who went on to design the first successful underwater camera. Austrian born Max Fleischer became the first to create animation using *rotoscope* – a process which involved "producing animation through tracing live action footage frame by frame" (Kitagawa & Windsor, 2008, p. 4 - 5).

Although the potential of motion capture technology was only discovered by the CGI industry in the 1980s, it has since grown from strength to strength (Kitagawa & Windsor, 2008). It is now also used in "the fields of music, fine art dance / performance, sign language, gesture recognition, rehabilitation / medicine [and] biomechanics" to name a few (Furniss, 2000, p. 1).

Literature Review

The following is a summary of the key points from the literature I have reviewed with particular focus on my areas of interest.

In *A Bright Shining Lie: Synthespians – Why we don't like them and their future role in cinema*, Matthias Zabiegly outlines people's reaction to synthespians, or digital actors, as well as focusing on why early experiments like *Final Fantasy: The Spirits Within* (2001, Square Co.) and *The Polar Express* (2004, Castle Rock Entertainment), which used synthespians as central characters, have not worked and "how future applications of that technology could be used for more prosperous outcomes" (Zabiegly, 2007, p. 2). He explains audience reaction to lead digital characters through the theory of the 'uncanny valley' and, evoking the reactions received by the films shown by the Lumière brothers in 1890s, compares it to the level of acceptance of this new technology.

Zabiegly (2007) begins by explaining that perceptually realistic images are those images that appear real because of the way they are modeled, textured, animated and composited into live action footage. Audiences accept them as real (in spite of having no real-life references) as we believe that if those elements were real and did exist, that is what they would look like (Zabiegly, 2007). The only area, however, where this task of "manufacturing perceptual realism on screen" has not been entirely convincingly executed is when photo-real humans move from backgrounds and 'crowd scenes' to the foreground, in close-ups, having to communicate feelings and emotions (Zabiegly, 2007, p. 4). Recalling Japanese roboticist Masahiro Mori's theory of the uncanny valley, he explains

why the closer technology comes to producing photo-real humans in motion, the harder it is to portray this movement convincingly.

In *From Shadow Citizens to Teflon Stars: Reception of the Transfiguring Effects of New Moving Image Technologies*, Lisa Bode states that, “Mori (1970) noticed that when the appearance of his robots was only slightly humanoid people thought they were cute; they anthropomorphised them, filling in the gap between machine and human with their imaginations. However, when the robots came too close to human appearance, people suddenly found them ‘creepy’ "(Bode, 2006, p. 176). These humanoid robots were said to have fallen in the uncanny valley of dis-familiarity. Zabiegly (2007) points out that mainly due to the limitations of current technology it has been difficult to achieve a perfect photo-real look for CG characters. And although many CG artists seem to be getting closer to creating a *still* of a perfectly photo-real human, it is when these characters are animated that this illusion fails miserably.

He explains that “one of the things the human eye is trained to do is recognising human animation pattern”, so when something *that* realistic is animated, the human eye is able to recognise even the smallest inconsistencies, thereby making it appear inaccurate (Zabiegly, 2007, p. 4). Briefly mentioning motion capture, he indicates that these systems do produce data which almost always has to be re-worked by hand, and is not of a consistent quality.

Zabiegly (2007) next details and compares the reception of the Lumière brothers’ first films in the 1890s to that received by *Final Fantasy*. Although many members of the audience were amazed by the new technology seen in the

Lumière films, many found the portrayal of human characters on screen uncomfortable and unconvincing. He explains that due to “the technological limitations in reproducing colour, sound and also playing back the film back at the right speed”, many felt the actors appeared lifeless (Zabiegly, 2007, p. 6). This observation is echoed by Lisa Bode, who quotes Russian author, Maxim Gorky who, after his first viewing of their work on screen in 1896, wrote, “their smiles are lifeless, even though their movements are full of living energy. … Their laughter is soundless, although you see the muscles contracting in their grey faces” (Bode, 2006, p. 174).

Zabiegly (2007) concludes that in both cases, it seemed the technology needed further development before successfully portraying human characters convincingly on screen, and that, like the first Lumière brothers’ films, this new technology “needs some time and more development to really meet the standards to cross the uncanny valley and reach a point where it is no longer questioned by the audience but genuinely enjoyed” (Zabiegly, 2007, p. 7). Greg Pair draws similarities between motions capture’s reception to that received initially by CG, noting that with improvements in both output and the technology, it too will eventually be seen as a new medium rather than a replacement for traditional media (Pair, 1999, as cited in Furniss 2000, p. 2).

Giving a few examples of the potential uses of photo-real digital actors, Zabiegly (2007) then details how they have been used not just to create faceless crowds, but to bring back deceased actors, as seen in *Superman Returns* (2006, Red Sun Productions), as well as portraying actors at different ages and forms, as

recently (and notably after the publication of his essay) seen in the photo-real rendition of Brad Pitt in *The Curious Case of Benjamin Button* (2008, Paramount Pictures) and the hyper-realistic rendition of Ray Winstone in *Beowulf* (2007, ImageMovers).

Although presenting a very quick overview, Zabiegly (2007) does, I feel, manage to cover a broad range of topics around photo-realism and its implications in his essay. Taking a fairly neutral approach, he gives an historical insight into the absorption of new technology, suggesting that it seems entirely possible that, given enough time, "technology will be advanced enough to produce digital actors that people accept as real" (Zabiegly, 2007, p. 9) as echoed by Michele Pierson, who states that new technology has the potential to "one day produce images that are so realistic distinction from the real world will be impossible" (Pierson, 1999, p. 167 as cited in Creed 2002, p. 132).

In *Motion Capture,* Maureen Furniss presents a summary of some of the historical, technological and aesthetic notions surrounding motion capture and its relation to entertainment and fine arts. She also clearly states that her focus is directed more towards the way spectators respond to digital actors rendering a more realistic movement (through the use motion captured data), and the application of this in both entertainment and fine arts as opposed to questioning the *authenticity* of animation produced with the aid of motion capture or comparing it to other, more established animation techniques.

Furniss (2000) starts by briefly mentioning the current uses of motion capture, clearing up some of the ambiguity surrounding the various terms that seem to

encompass the practice and art of motion capture. She states that this is not just because the technology is so recent, but also due to the many different areas in which it is utilised, providing examples such as the “in the field of music, fine art, dance/performance, sign language” as well as computer animation and special effects for live-action films (Furniss, 2000, p. 1).

Addressing what she says is the most basic question around the topic of motion capture, she recalls Dyer, Martin and Zulauf’s (1995) definition of *motion capture* (explained above) before listing a number of phases commonly involved in the motion capture process – which include studio set-up, calibration of capture area, capture of movement, followed by clean-up and post-processing of the data generated.

The next section of her article focuses on questions of motion capture and artistry, explaining that many in the entertainment industry view motion capture in a negative light - “it seems America remains less accepting of mocap than other countries”, and that there seems to be an inherent “lack of respect within the mass art of animation” (Furniss, 2000, p. 3). She quotes Bob Kurtz, who said, “Animation is about creating an illusion of motion that doesn’t otherwise exist. Mocap doesn’t involve the same artistic input and creativity” as an example of the negative connotation surrounding motion capture. Bouldin (2001) takes a similar position, commenting that “the term ‘motion-capture’ has the implications of the actual body (or at least its trace) being held captive by the inanimate” (Bouldin, 2001, p. 51 as cited in Creed, 2002, p. 6).

Furniss (2000) follows with quotes and examples which support the other side of

the argument, explaining that “in motion capture, a significant amount of the creative process occurs during post-production process, when data is manipulated to become animated imagery” (Furniss, 2000, p. 4). She compares it to disc jockeys mixing records to create new and original musical compositions, or the recording and mixing of pre-recorded music and dialogue together during music recording sessions. She is, however, quick to acknowledge that this comparison is only based on “a way of conceptualising how motion capture might work” (Furniss, 2000, p. 4).

Addressing the issues surrounding the acceptance of motion capture as an aspect of animation, she quotes Dr. Norman Badler – “motion capture is basically 3D rotoscoping. If you accept rotoscoping as a form of animation then you have to accept motion capture”, further comparing it to the use of reference footage, where artists study the movements of a live performer frame by frame to create animated movement (Furniss, 2000, p. 4).

Next, Furniss (2000) details different ways motion capture can be utilised in animation – in real-time, with or without secondary animation of hands and face, usually added in post-production, or just as a way of capturing broader body movements, which are later modified during post-production. An animator’s workflow often involves the visual recording of the animator rehearsing the characters’ movement before beginning to key frame (Cantor & Valencia, 2004). Motion capture provides the ability of tracking these movements in a digital format which can then be used and referred to as required (Cray, as cited in Furniss, 2000).

Furniss follows by presenting a fairly detailed explanation of three different motion capture systems used (namely mechanical, optical and electromagnetic), by summarising and comparing their strengths and weaknesses and specifying aspects such as workflow, mechanics as well as the finances required before presenting a list of other motion capture technologies available. She also explains how motion capture itself can be divided into different categories, into "areas of body movement, facial capture and hand gestures" (Furniss, 2000, p. 6). It is important to note that the recording of facial movement and hand movement is often captured separately and these methods will not be utilised during the production of my short.

She concludes by signalling the increase in popularity of motion capture and its eventual assimilation into the entertainment industry as the technology becomes faster and is able to address issues which are often the reason the technology of motion capture itself is seen in a fairly negative light.

In Final Fantasies: Computer Graphic Animation and the [Dis]Illusion of Life, Vivian Sobchack scrutinises, what she says is the seemingly impossible but underlying and symbolic desire in the history of animation to produce photorealistic human characters and why this hasn't worked in the past. Sobchack (2006) uses the 2001 movie, *Final Fantasy – the Spirits Within* as an example to explain her theory of 'deathlife' or the dis-illusion of life (in contrast to the illusion of life – or 'lifedeath'). Animation, she says, seems to have a contradictory effect as seen in relation to the photo-real zombies in *Final Fantasy* – as if, in animation, they are rendered lifeless (Sobchack, 2006).

She notes that audience perceptions change when viewing photo-real characters in animated films to one of un-connectedness and explains this change in the scale of our values by asking two questions, 'What do we want from animation?' and 'What does animation want from us?' (Sobchack, 2006, p.172). Using examples of successful animation movies like *A Bug's Life* (Pixar, 1998), *Shrek* (Dreamworks, 2001) and *Finding Nemo* (Pixar, 2003), which, she points out have moved away, "both in narrative and representation, from character realism of any kind but emotional", she explains that most spectators want emotional substance from animation (Sobchack, 2006, p. 173).

With regards to the second question, she questions whether animation, often viewed as a subset of cinema, wants to achieve the "perfect illusion, not of the outside world", but in its own image (Sobchack, 2006, p. 173). Recalling Andre Bazin's essay, *'The Myth of Total Cinema'*, Sobchack (2006) introduces the concept of achieving a sense of *integral irrealism*, which she says is the "total creation" of reality as seen in the animated world, as opposed to the myth of total cinema, which, as viewed by its various inventors, was the "total and complete representation of reality" (Sobchack, 2006, p. 173).

The next section of her essay uses the concepts discussed above to detail the fundamental problems with *Final Fantasy*. Detailing the complex narrative, she says that the CG film appears to be warring with itself, "attempting, on the one hand, to *re-create*, through the simulation of cinematic photorealism, perfect computer generated human beings", while at the same time, trying to "*create* and animate an imaginative and irreal world in, and through its own CGI imagination"

(Sobchack, 2006, p.173 - 174). In other words, the film asks the viewers to accept two different, mismatched modes of acceptance (Sobchack, 2006).

She also discusses the notion of unlimited development, commenting that many felt the hyperrealism of the characters made them both 'too real' and 'not real enough' at the same time. She comments on how, in the pursuit of achieving photo-realism, the characters have been awarded great attention to detail towards their creation, in terms of facial spots, eyelashes and wrinkles, but ironically, in the course of the film, it is these minute details that come to focus. The film forces us to scrutinise a level of detail, she says, that would normally be lost in either a live action film or a stylised animated film.

Sobchack (2006) uses the attention to detail given to the central character, Aki Ross's hair as an example to explain the above. Criticising the time, effort and finances spent on not just rendering it photo-real, but on animating Aki Ross's hair, she questions the authenticity of the movement, calling it a "photorealistic failure" (Sobchack, 2006, p. 179). She declares that although her hair is not constantly in the foreground, "it is what we look at", along with the spots and freckles – all just "irrelevant detail" (Sobchack, 2006, p. 180). Similarly picking up on the irrelevance of such detail, Plantec (2007) explains why the films' central character is not able to connect with audiences. "As she moves, our minds pick up on the incorrectness. And as we focus on her eyes, mouth, skin and hair, they destroy the illusion of reality" (Plantec, 2007, p.1).

She concludes by stating that, with reference to the characters in the movie, in animation, they are deemed almost lifeless – and the audiences are forced to

focus on the ‘dis-illusion of life’ instead of either the narrative or the performance (Sobchack, 2006).

In *New Media Worlds*, Thomas Lamarre looks at how the advent and the subsequent standardisation of digital animation has led to the creation of new kinds of media worlds, thereby affecting and consequently changing not just animation, but cinema itself. He uses the example of *Final Fantasy – the Spirits Within* which was, at one time, publicised as the “ultimate digital cinema” to present a critique of the notions presented in Lev Manovich’s ‘*What is Digital Cinema’* (Lamarre, 2006, p. 132).

Lamarre (2006) points out that in ‘*What is Digital Cinema*’, Manovich states that “given enough time and money, one can create what will be the ultimate in digital cinema”, where all the frames are painted by hand, purely from scratch (by hand) in a computer, “indistinguishable from live photography”, thereby aiming to produce the look and feel of cinema, without live photography (Manovich, 1999, as cited in Lamarre, 2006, p. 132). He highlights the similarities in the statements made by the creators of *Final Fantasy*, who maintained that no reference models were used in the generation of the cyberstars for the movie - they were built completely from scratch (Lamarre, 2006).

He points out that although audiences seem fairly comfortable with this boundary being crossed when it comes to producing backgrounds, special effects and even secondary (non human) characters, it is when this occurs with the physical representation of human characters – with photo-real characters, we expect to see cinematic realism in their automation as well.

“Live action cinema has created certain expectations about how photo-real images of humans can and should move”, which results in those same expectations crossing over when we see “photographically realistic characters”, expecting them “to act and move in accordance with the physical laws observed in our world” (Lamarre, 2006, p. 133). In other words, when new media tries to reproduce reality, we don’t just judge the verisimilitude of the cyber star’s appearance, but also their movement – which is where, he says, both Manovich and *Final Fantasy* fall short, as both tend to award greater attention to photography as opposed to movement.

This, he says, is especially noticeable in the film’s central character, Aki Ross, “a completely digital woman who was to be indistinguishable from a real women” (Lamarre, 2006, p. 132). Justifying the use of motion capture to animate the photo-real characters, Lamarre (2006) explains that, especially with photo-real characters, our expectations of these cyber-stars to move while obeying the laws of the physical world and be affected by mass and gravity would increase. He adds that this however, still didn’t take away from the appearance of hollowness in the animated characters, as their photo-real appearance makes even small discrepancies in animation, normally easily forgiven and largely un-noticeable in stylised characters, more noticeable.

In *The Cyberstar – Digital Pleasures and the end of the Unconscious*, Barbara Creed comments on the increasing rise in popularity of the computer generated cyber-star, detailing where it has been used successfully, where it hasn’t so far, as well as the future consequences, if any, of audiences being able to relate to a

cyber-star.

The major section of her essay focuses on the “possibility of creating a virtual actor, of replacing the film star […] synonymous with cinema itself”, questioning if these will compete with living actors for roles in live action cinema (Creed, 2002, p. 130). Creed begins by outlining some possible advantages of a digitised film star, describing the virtual actor as potentially being “a studio’s dream: capable of performing any task, continuously available, cost effective – and no scandals, unless, of course, the digital star is given an off-screen life” (Creed, 2002, p. 130). The use of CG to re-create stars could be very lucrative, as many could continue performing, at any age or shape, well after their ‘living counterparts’ are unable to do so (Creed, 2002).

Shifting her focus on cyberstars being able to deliver emotional performances, she recalls James Naremore, who defines acting as “nothing more than the transposition of everyday behaviour into a theatrical realm” (Naremore, 1988, p. 21 as cited in Creed, 2002, p. 131). In support, she cites examples where cyber-stars have been used in the background, as faceless extras, thereby successfully enacting everyday, ordinary behaviour. She also evokes the experiment performed by Kuleshov, the Russian director, where he “intercuts the expressionless face of an actor with different scenes in order to create the illusion that the actor was performing with great emotions when in fact his expression did not change from one scene to the next” and how “audiences praised the actor’s wonderful ability to express” different emotions in accordance to the images shown (Creed, 2002, p. 131).

Next, she questions whether cyberstars can deliver anything more than wooden, non subtle performances, stating that many film theorists have felt that cyberstars will neither be able to capture the attention of audiences nor be identifiable. She questions if a connection will ever be made if audiences know the cyberstars on screen have no unconscious – not having shared human experiences as a living star (Creed, 2002).

Finally, Creed (2002) focuses on the potential implications of constructing the new cyberstar with regards to their physical appearance. She quotes theorists who have stated that one of the reasons of cinema's popularity is the primal need to watch something pleasurable on screen – it is not just seeing any figure; rather, a more glamorised, idealised and stylised erotic star, thanks to the ease with which this can be achieved with digital actors (Creed, 2002).

In terms of how the articles above relate to my research project, I felt that although most seemed to focus on the negative aspects of photo-realistic representation within the digital realm, they did serve to explain why photo-realistic human characters may not have worked convincingly. And although most critics did not appreciate that movies like *Final Fantasy* can be seen as 'early experiments' in the pursuit of achieving believable photo-real CG characters, I felt it further helped to solidify my decision to move away from photo-realism in my short. My primary focus is on performance, and being able to successfully portray emotions through digital actors, rather than trying to mimic reality through their physical appearance.

Further, although Sobchack (2006), Lamarre (2006) and Zabiegly (2007) mention

animated features that have successfully used stylised characters to portray emotions convincingly, none of them have explored the possibilities and implications of combining motion capture with stylised characters and why this might achieve better results, which is another reason I want to conduct this research. Furniss (2000) on the other hand provides a more useful, practical and technical insight into the different aspects of motion capture, how it can be used, as well as exploring some pipeline considerations.

Methodology

For the practical component of my research project, and certainly for the exploration of my research questions, I have produced a 3D animated short, in the form of a music video, outlining the story mentioned earlier. The duration of the short is 2.35 minutes and the soundtrack used is: *Perhaps, Perhaps, Perhaps* (Life in Mono 2006 – Universal Music Operations), written by O. Farres and J. Davis, performed by Emma Bunton and published by Latin-American Publishing Co.

All software required for the completion of the practical component was available at AUT. I used the motion capture laboratories and green screen facilities available for my motion capture shoot. For creating the animated short, I used a combination of key-frame animation and motion captured animation – combining both methods in some scenes, and solely relying on the former for others. Some scenes with two characters have used a combination of both methods – where one character has been fully animated using key-frame animation, while the

other has been animated using motion captured data and then refined with the help of keyframes.

Software Used

For the motion capture component, I used Optitrack's optical motion capture system for full body motion capture. The system includes 8 FLEX: V100 cameras, as well as Arena Motion Capture software, which can be used by a single user, exporting in MotionBuilder friendly formats such as BVH and C3D. The aforementioned are types of motion capture files capable of storing hierarchical or skeletal-based data and optical data respectively which can then be imported into MotionBuilder (McNezmo, n.d.). Although the Optitrack motion capture system did present a few limitations, discussed later, I found it to be relatively stable, with its relative ease of use and user friendly interface which allows single user operation proving to be quite an advantage.

Built for complex real-time 3D character animation, Autodesk MotionBuilder was used for a large part of the animation, not just because it provides faster viewer feedback, but also because its boasts powerful motion capture data manipulation tools. Autodesk Maya was used for the creation of all the 3D assets, including the models of the four characters, all sets and props as well as to complete and finesse the remainder of the animation. Adobe Photoshop was used for texturing as well as limited concept design and After Effects was used to create the final edits of both the 2D and the 3D animatics.

Production Pipeline

I first developed the initial story into a music video format to fit the time constraint

set by the soundtrack. Once the character designs were finalised, storyboard panels were used to create a rough 2D animatic to work out the structure and pacing for the short. The animatic was created with the selected soundtrack using Adobe Photoshop and After Effects. A considerable amount of time was spent in developing the look of the characters, especially the three antagonists, so that they would not only ‘fit in’ together but so that their personalities would also come across visually (Cantor & Valencia, 2004). Once the models for the four characters were completed, they were textured and rigged using Autodesk Maya. With fully controllable 3D puppets and placeholder sets; all scenes were blocked out in Maya to create a 3D animatic. Here, particular attention was given to the camera angles and framing. Finally, the rigged characters were animated using both Maya and MotionBuilder.

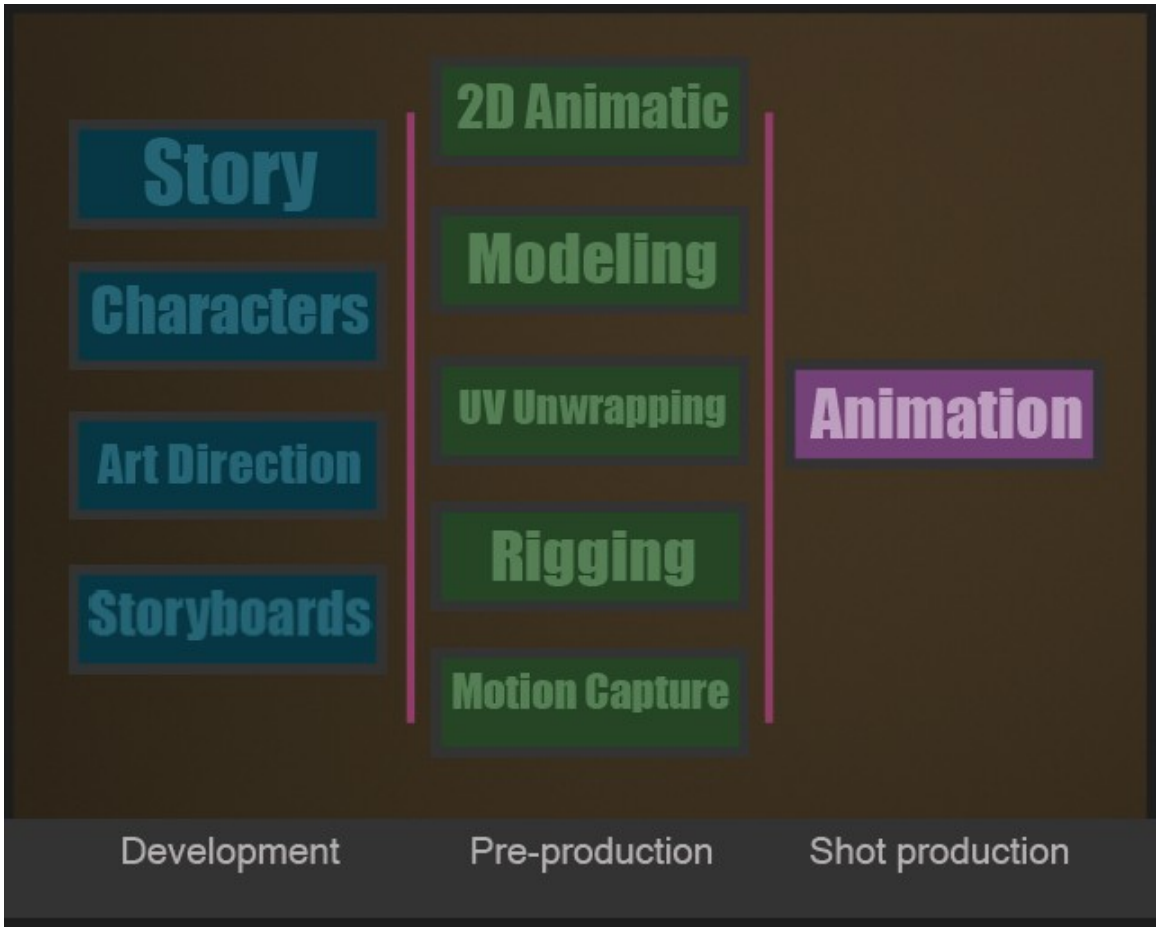

Figure 1.1 – Animation production pipeline for *Perhaps Perhaps Perhaps*

Figure 1.1 shows a visual representation of the production pipeline used. The following is a detailed account of each section covered during this pipeline, focusing on the narrative and character development, and considers pipeline integration concerns that arise when MotionBuilder is incorporated into the pipeline.

Interpretation of Story

"A weak plot with forgettable characters cannot be saved even by the most stylish design, masterful animation, or effective lighting" (Cantor & Valencia, 2004, p.12). Although not the focus of my thesis, the larger goal was still to complete an entire animated short story and as I have decided to execute the

story in the form of a music video (thereby adding a time constraint imposed by the song itself), a considerable amount of time was initially spent on shaping and editing the core story. With a complicated plot, no dialogue and the lyrics, at times, dictating the actions, it became clear that a strong focus on story elements, as opposed to technological aspects, had to be resolved during the initial development stage.

Beiman (2007) says “there are two basic types of character animation films” – situational films, where the foundation of the story begins with an event, or character driven films, where “the story works out of the character’s personality” (Beiman, 2007, p.41). Withrow and Danner (2007) stress that with character driven stories, the underlying theme is in the form of a change in the personality of the central character, sometimes subtle, sometimes more obvious. Cantor and Valencia (2004) note that with such stories, the best way to start is to give the protagonist a goal, and the process by which the “character attempts to accomplish this goal must change his locale, health, personality, possession, opinions or status through some form of conflict” (Cantor & Valencia, 2004, p.22). This conflict, Beiman (2007) says, can be within himself, or against nature.

With regards to *Perhaps, Perhaps, Perhaps*, the story is more character driven, with the central character, Adrian, leaving his ordinary and comfortable, but in this case, uninspiring surroundings to venture into a challenging and unfamiliar world. The conflicts here are both physical and external, with him facing challenging forces in the form of three antagonistic characters, as well as emotional and eventually moral (Cantor & Valencia, 2004). This internal journey

sees him grow and change into an arguably stronger, deviant, less naive character, reinforcing Snyder's (2005) declaration about a story being about the hero's journey, encompassing a form of change – from weak to strong, or the other way around.

Cantor and Valencia (2004) emphasised that creating a short isn't about taking the story beats of a feature and compressing them into a shorter time frame, but making them "simpler, more linear and extremely efficient" (Cantor & Valencia, 2004, p.3). Although I did initially struggle a lot with the time limits imposed by the soundtrack, I recognise the condensation of a lot of the story beats mentioned by Snyder (2005) in *Perhaps, Perhaps, Perhaps*. Cantor and Valencia (2004) express that "there must be moments when it appears that the hero will fail" (Cantor & Valencia, 2004, p.24). This moment, termed 'The All Is Lost' moment by Snyder (2005), is the point of false defeat, where "all aspects of the hero's life are in shambles" and there seems to be no hope – this is the point where Adrian is rejected by all three antagonists, and he faces the possibility of having to endure a meaningless job, with a mundane routine for the rest of his life, with no hope of ever getting out (Snyder, 2005, p.86). The 'Dark Night of the Soul' moment only lasts a few seconds and in this case, is the point where his attitude changes from one of defeat to revenge (Snyder, 2005). This is the second turning point, with the solution revealing itself to the protagonist, which ushers in the third act (Beiman, 2007; Snyder, 2005).

I believe that the beats addressed in Joseph Campbell's 'Hero's Journey', with regards to the three act structure hold true with *Perhaps, Perhaps, Perhaps*, as

the “first act establishes the characters and the goal or conflict” (Cantor & Valencia, 2004, p.27). The second act starts with an incident forcing the protagonist to act and contains “the bulk of the story”, with the protagonist experiencing both conflict and false defeat, and the climax (Field, 1982, p. 9). The third act is, in most cases, the shortest, and answers questions, forming the resolution. This is prefaced with some form of self discovery, which arms the protagonist with the methods of defeating his enemy, generally at the climax (Snyder, 2005). In *Perhaps, Perhaps, Perhaps*, the central character goes from one extreme to another - Adrian transforms from being a naïve, desperate, seemingly weak individual to a deceitful, potentially dangerous and vengeful murderer. The story is used to reveal this change in character.

Character Research and Development

Withrow & Danner (2007) state that crafting a character’s personality is “the true core of character design”, adding that the visual aesthetics of the character should be influenced by and further corroborate his/her personality, as long as those choices make “sense within the context of the story” (Withrow & Danner, 2007, p.24). In terms of the visual design of the central character, it was essential that he appear harmless and comparatively unappealing, blending into both his environment and with his fellow colleagues. This meant that in terms of his physical appearance, his proportions were neither exaggerated nor overtly stylised, his seemingly uninteresting personality further complimented by the use of monochromatic colours which were a few shades darker than those used to colour his environment. In other words, Adrian was designed to not stand out –

not just physically, but also symbolically, thereby increasing the shock value of the unexpected ending.

Beiman (2007) states that “secondary characters are often used to help tell the hero’s story” (Beiman, 2007, p.47). And although the three antagonists have limited on-screen time, they collectively form the second most important character in the story. Their actions in the story almost mirror each other, together “representing a significant and interesting challenge for the protagonist” (Cantor & Valencia, 2004, p.65). Although each of the three are different, due to time constraints their characters have to be developed rather quickly, which has forced me to rely heavily on visual stereotypes to reinforce their personality. And in spite of each of them having their own goals, they are all “influenced by the central character” (Withrow & Danner, 2007, p.24).

Specifically, when all three antagonists are first introduced, their actions are choreographed so they move together, performing the same action – in this case taking / opening Adrian’s portfolio, lifting it up and then moving it down to look at him. They are introduced in the same order – possibly also as a sign of the increasing seriousness of what he later does for them, with the order only being flipped right at the end, when he is rejected, symbolising a full circle. Additionally, all the three ‘objects’ of seduction used by Adrian are circular shaped – the doughnut for Paula, the CD-Rom containing tax information for Simone and the condom for Ryan - all rings symbolising not only the circle of Adrian’s journey but also the increasing degree of depravity of the three characters.

As mentioned above, it was crucial for the three antagonists to be more visually

appealing than Adrian, not just symbolically, in terms of what they might offer him, but also physically so they would be recognised as villains straight away. Referring to developing secondary characters in their limited onscreen time, Withrow and Danner (2007) state that “often the most straightforward way to develop these roles is by appealing to simple stereotypes – easily recognised, even clichéd characters” (Withrow & Danner, 2007, p.24). Consequently, all three, largely influenced by popular Disney villains, had their physical characteristics grossly exaggerated so that their motivations and personalities would not just be apparent but also come through a lot quicker.

Modeling in Maya

A considerable amount of time was also spent in the modeling and rigging of all four characters – each posing their own unique challenges. Considering the original line-up of the four character models [as shown in Figure 1.2] I felt that not only did both Simone and Ryan not translate well as 3D mannequins, but they also looked visually out of place, especially when compared to Adrian. Keeping their overtly embellished physical characteristics, both Ryan’s and Simone’s *heads* are altered drastically, as shown in Figure 1.3 and 1.4 respectively. While Ryan went through two major facial overhauls, Simone on the other hand was completely remodelled, with both updated models looking a lot less caricaturised than they had originally meant to be. Figure 1.9 shows the final versions of all four characters, with intermediate textures.

Figure 1.2 – Original models of Simone, Paula, Adrian and Ryan

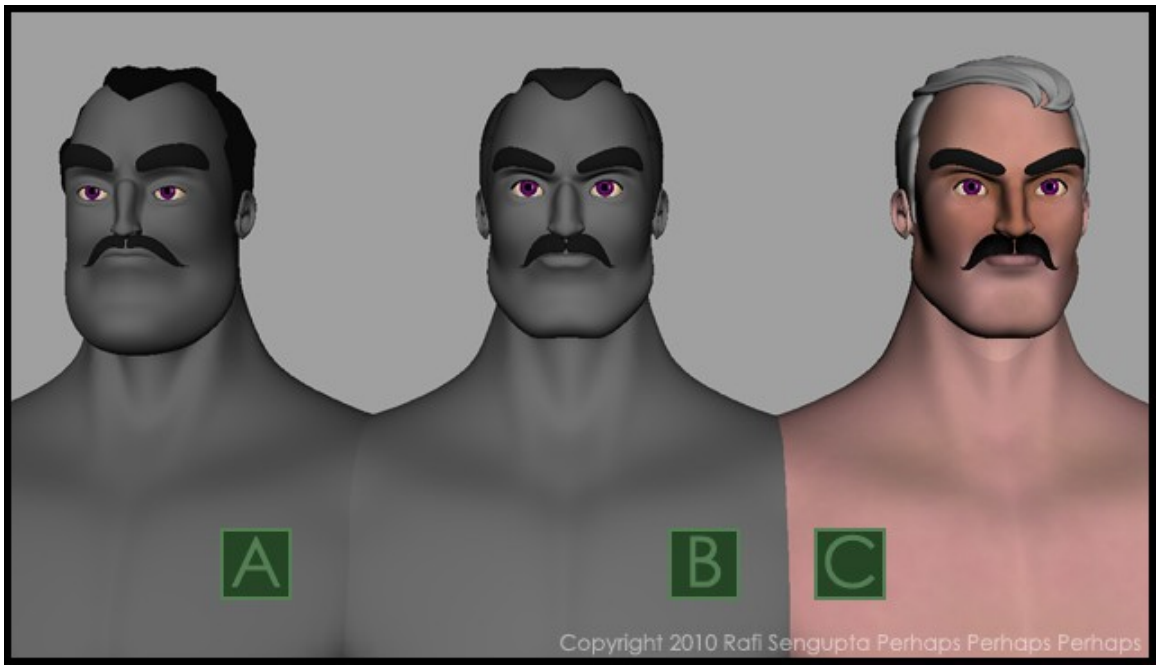

Figure 1.3 – Original [A], updated [B] and final [C] versions of Ryan

Figure 1.4 – Updated [A] and original [B] versions of Simone

Rigging in Maya and MotionBuilder

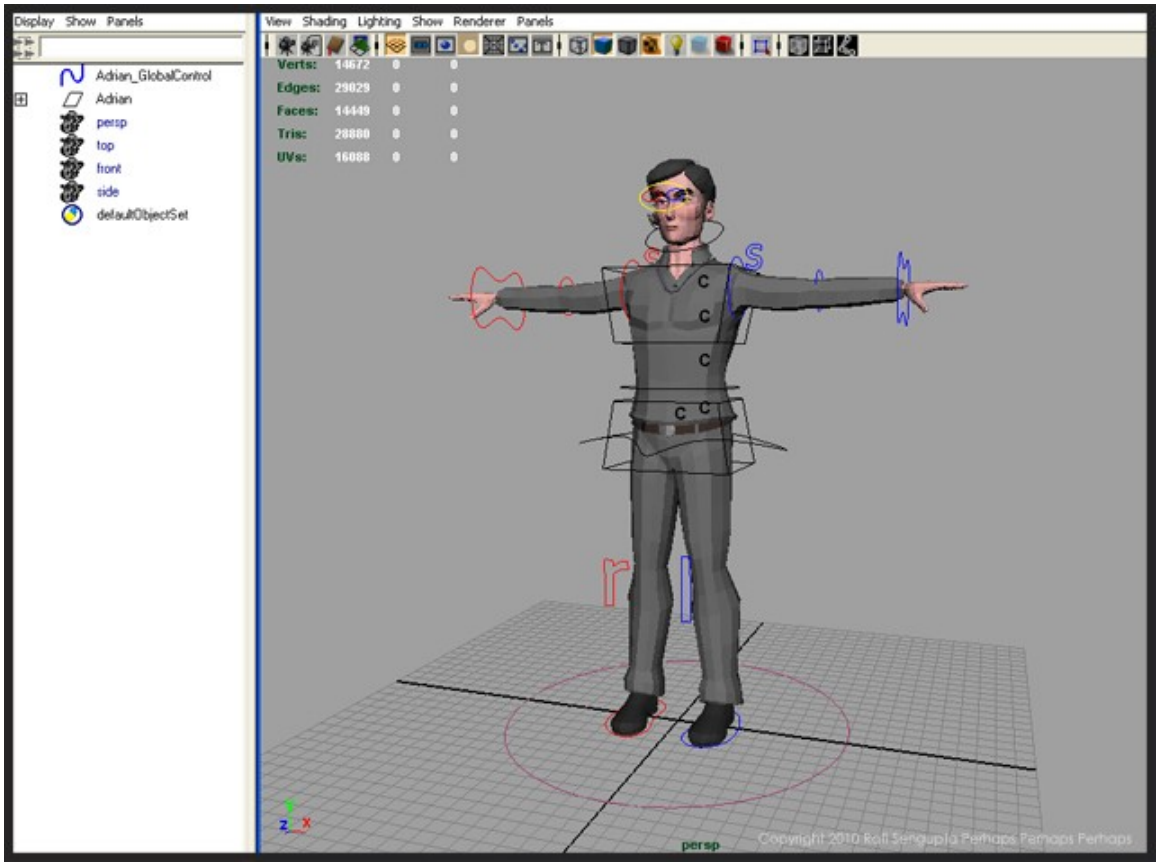

Figure 1.5 – The Maya version – featuring an IK/FK rig

Since the motion captured animated data is transferred directly to the joints in MotionBuilder, a pipeline using MotionBuilder for animation can bypass the time-consuming and often complicated process of creating an IK/FK rig in Maya. However, having no previous experience with MotionBuilder and wanting to have the option of using both MotionBuilder and Maya to animate, I decided to first develop a comprehensive rig in Maya for all four characters using a control curve system, and then convert that rig so it could be used in MotionBuilder. This did initially pose a problem as the animated character (from MotionBuilder) did not retain any movement when brought back into Maya as the control curves controlling those joints would override the embedded movement. An alternate

method was developed where each character had two versions – a *Maya version* – which was fully controlled with control curves and a *MotionBuilder version*, which had separated blend shapes and a simple joint hierarchy. Though time consuming, this extra step later paid dividends as I was able to avoid having to use MotionBuilder completely when either animating smaller scenes or scenes where the motion captured data had not yielded desirable results.

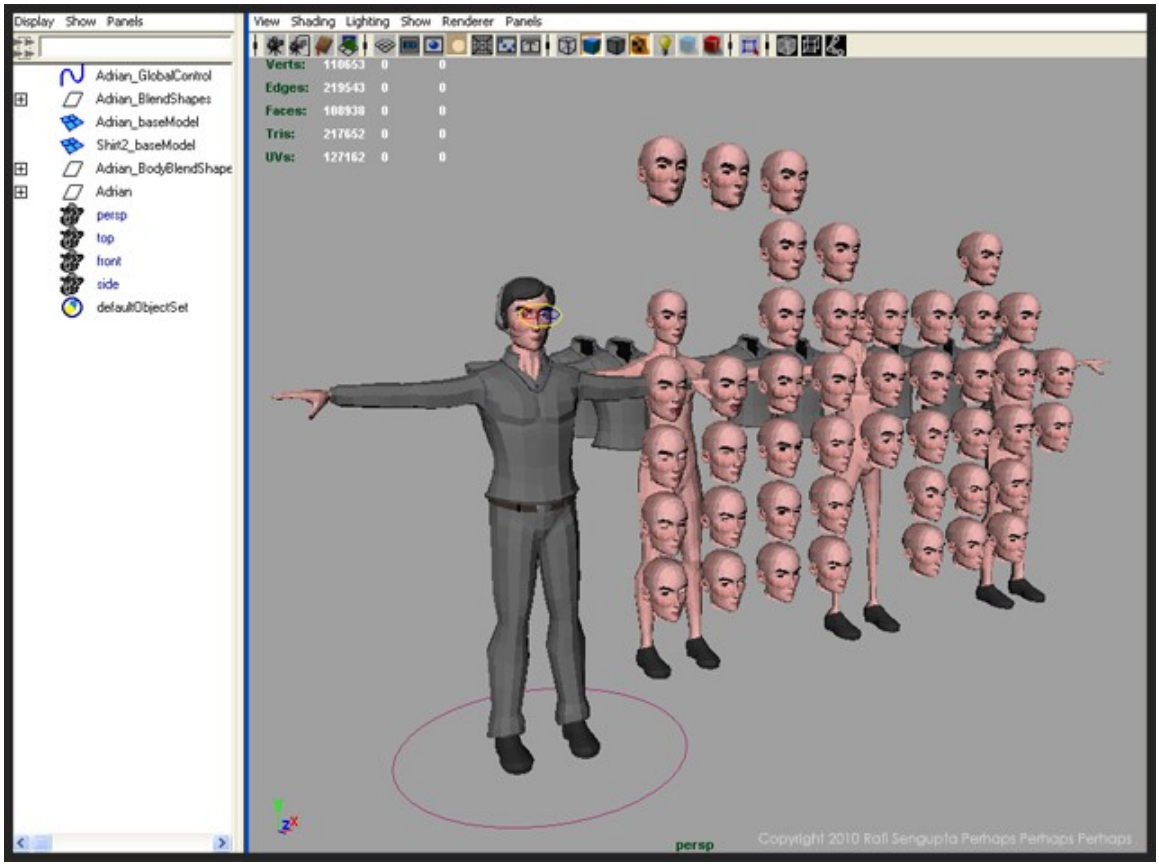

Figure 1.6 – The MotionBuilder version – with separated facial and body blend shapes

Decisions also had to be taken with regards to one of the secondary characters, Paula, whose physical size posed further rigging challenges. Initially, I had planned on using a combination of soft-body dynamics and jiggle deformers – animation tools available in Maya, for adding secondary animation to Paula. These deformers can be used to add automated secondary motion to different

character parts, such as stomach, arms, legs etc, which can then be manipulated by the animator. I however eventually decided against it as the time spent on adding these features to the rig would not have been commensurate with her onscreen time, especially as she is seated in all her scenes.

Figure 1.7 – Paula does not have any controllers built for animating her stomach / arms / dress.

Motion Capture and Animation

I had initially bought into the "preconceived notion that motion capture is not only simple but very quick and that it automatically works" (Kitagawa & Windsor, 2008, pg 13). Research not only showed that this wasn't true but also that it would take a few tries before I was able to get the footage that I wanted – not just technically but also aesthetically.

I conducted four different motion capture test sessions before holding auditions for cast members for the animated short, carefully selecting actors who bore a close physical resemblance to the characters they were to represent. The motion

capture for all relevant scenes was completed in two days, with the data cleaned first in Arena and then modified as required in Autodesk MotionBuilder. Figure 1.8 is a visual representation of the process involved in translating motion captured data from a C3D file into the simple joint hierarchy created in Maya.

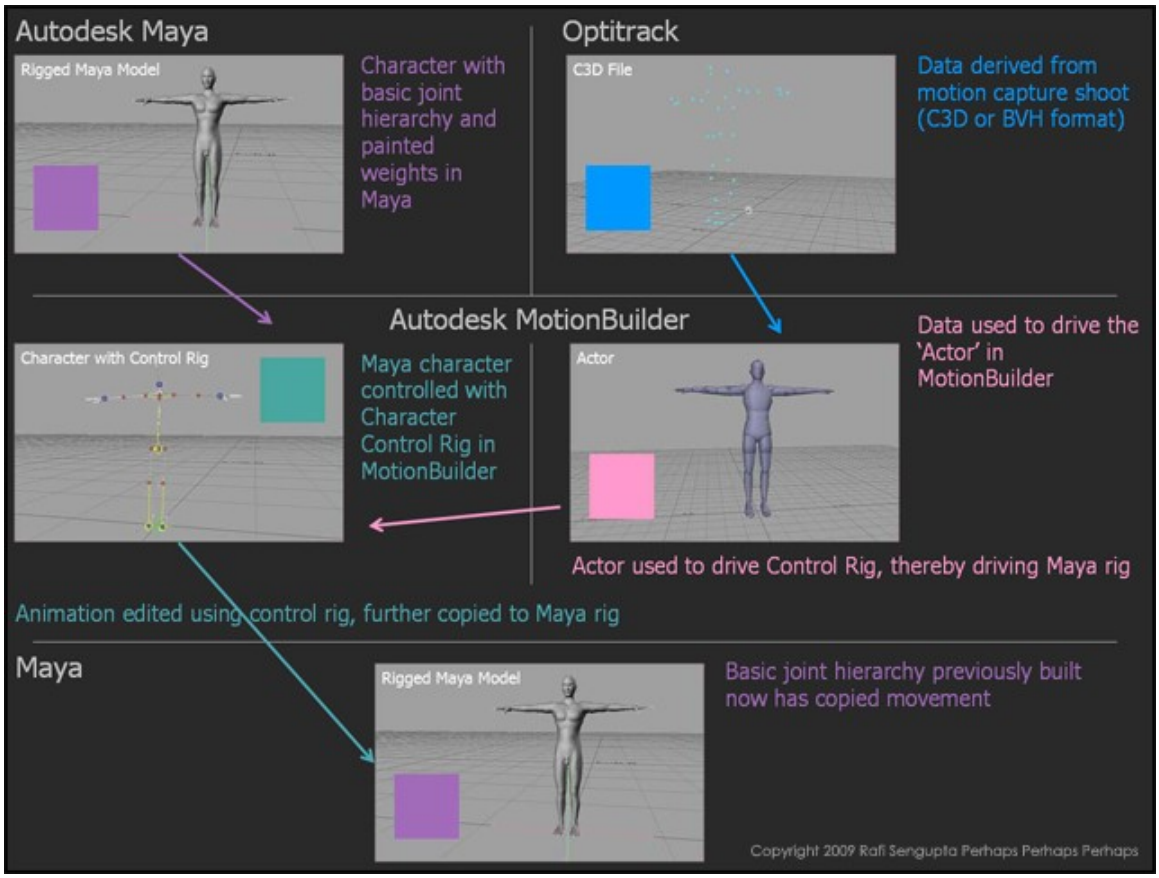

Figure 1.8 – Maya to MotionBuilder pipeline developed specifically for the short

I then created a rough 3D Animatic, testing aspects such as 'line of action', blocking out camera angles and working through continuity issues, before moving to finalising the animation. For the purposes of this research project, only Act II and a part of Act I have been animated as both acts contain scenes which combine keyframe animation with animation derived through the motion capture sessions.

Figure 1.9 – Final versions of Paula, Adrian, Simone and Ryan

Findings and Key Results

Having used a hybrid method for animating the CG characters, the following are my observations.

Faster Results

One of the biggest advantages of motion capture, when used correctly, is its ability to offer a pipeline a massive amount of unrefined animated data in a very short amount of time, making it a quick and precise way of incorporating human motion into digital characters, which can be then used as seen fit (Kitagawa & Windsor, 2008).

For example, “captured motions can be used real-time directly in a work, with or without secondary animation of hands and face in post production. The captured data can also be transformed into characters and modified completely during post-production” (Furniss, 2000, p. 4). Similar to keyframe animators filming themselves to use the footage as reference material, data acquired through a

capture session can also be used as reference material. With regards to this project, all data was captured in two days thus enabling me to incorporate the animation into all four characters relatively quickly. This proved to be an extremely fast way of blocking out the animation, and helped to weed out any narrative and continuity problems that had previously not presented themselves during the storyboard and animatic stages. It is worth mentioning that a lot of this captured footage was later rejected because it was either not suitable for the character or had too many data inconsistencies requiring an unjustifiable amount of cleanup time. However, a lot of this unused data was still used as reference material for the keyframed animation.

Geometric Similarities and Dissimilarities

Another aspect that had to be taken into consideration was finding performers who were physically proportionate to their digital counterparts. With four different characters, each with different body shapes and sizes, it was imperative to find performers who bore a close physical resemblance to the digital actors to reduce any geometric dissimilarity that may have arisen, as research has shown that this mismatch of proportions can be one of “the most difficult problems facing motion capture animators” (DeGraf & Yilmaz, 1999, as cited in Furniss, 2000, p. 7).

I was able to find three actors who were proportionally and physically appropriate to their digital counterparts, but because there was a huge difference between the proportions and physical appearance of one of my performers and the geometric appearance of her digital counterpart, I was able to see the negative effect on the final animation, ultimately deciding to use the footage as reference

material instead. [See Video 1.01 for an example of this mismatch].

Finding Appropriate Talent

In their book, *Mocap for Artists – Workflow and Techniques for Motion Capture*, Kitagawa and Windsor (2008) stress the importance of having appropriately experienced talent, adding that “the results are evident”, with the talents' confidence and personality always coming through in the data captured. They further stress that capturing people acting a different age or gender should be avoided “unless there is an extremely good overriding reason to do so” (Kitagawa & Windsor, 2008, p. 18). Giving the example of *The Polar Express* (2004, Castle Rock Entertainment), where actor Tom Hanks played the conductor and six other characters, including ‘hero boy’, Plantec (2007) explains how this left audiences with an uneasy feeling (Plantec, 2007).

I had initially planned on capturing the performance of a friend and fellow classmate who had previously dabbled in theatre as my actor for the motion capture sessions. Working through the script with him, I thought I would be able to ‘get away’ with having a young, male actor play characters of different age groups and genders.

Not only did this prove to be an acting challenge for my solo performer, who had to ‘perform’ as someone twice his age and as two females, half and four times his size, this mismatch was further emphasised during the motion capture sessions. Along with it being evident that the motion captured data would not be usable for either of the female characters it also became clear that I would have to use an age appropriate performer for my other male character. I also found

that the solo performer, having had limited acting experience, wasn't able to perform well with the soundtrack, missing a lot of the musical cues.

Armed with more research and the physical evidence to show what hadn't worked, I decided to bring in professional actors, with extensive dance and drama experience to observe what changes I would see in the performance captured. Capturing the performance of age and gender appropriate actors had an immediate positive impact on the captured footage, with all four actors bringing in their own unique flavour to their digital counterparts. After analysing the motion captured footage, it was clear that the professional actor whose performance was used to animate Adrian, was able to not only understand the concept far better, but also move more rhythmically, hitting all the right musical cues. [See Video 1.02 – for contrast between the central character driven by an amateur actor on the left and a professional actor on the right].

Hardware Related Outcomes

"Motion capture often requires performers to be recorded separately" as when the movement of multiple performers is recorded collectively, "the number of polygons available to be digitised for each performer is decreased, reducing image quality" (Furniss, 2000, p. 8). Furthermore, due to the nature of my narrative, many scenes required the performers to 'act off each other' and work together, which can adversely effect character integration when the performers are composited later on (Furniss, 2000).

Due to the restrictions of the capturing software, only one performer's motion could be captured during a recording session. This meant that the actors had to

pretend to interact with each other – which proved to be a bit of a challenge, especially in scenes calling for characters to be swapping props, or be in very close proximity. And even though I worked with them outside the *capture volume* (which is the amount of 3D space that can be 'seen' by the system) to try and minimise the effect on the performance, I did have to spend a considerable amount of time in trying to integrate captured footage from two different characters so they looked like they were working together.

The majority of my short involves characters sitting down – which meant that performers had to be filmed sitting down. Although I felt this could have caused a problem with the quality of the motion captured, and considered placing markers slightly differently than those recommended in the software manual, I was able to find an appropriate piece of furniture which allowed the actors to be sitting on a stable, uniform surface without having any markers being blocked out [See Video 1.03].

Another possible cause for concern was the limited capture volume itself. This limitation, brought in largely by the limited number of optical cameras, in this case eight, can have adverse effects on the data captured. Due to the nature of the scenes however, where most characters are seated and relatively static, I found that the footage captured was relatively *clean*, requiring little in terms of cleanup.

New Options Presented

With key-framed animation, the animator is in complete control of the character –

the mood, pace, style and quality of the movement as well as larger aspects such as timing, position and pose are all controlled and created by the animator. However, when employing motion capture, this control shifts drastically as now the actor or performer is also *controlling* the animation, bringing their own interpretation and unique flavour to the character. Although motion capture does allow one to manipulate and alter the performance in post production, I found that a lot of this control was also taken away (Furniss, 2000). In many cases, it was ultimately still possible for one to 'recognise' the performance of the 3D puppet and associate it with the different actors [See Video 1.03].

I found that the benefits of being able to manipulate imagery "as the performance of real-time animating is taking place" certainly outweighed any challenges that could have potentially arisen because of this loss of added control (Furniss, 2000, p. 3). I noticed that the performers were able to offer different perspectives, both in terms of posing as well as style and pace that I wouldn't have been able to otherwise experiment with. This contribution from the performers proved invaluable as it gave me, as the animator, another perspective to consider when posing and animating my characters.

Software Related Outcomes

When incorporating MotionBuilder into a pipeline, the following are some rules which should be strongly considered. Since MotionBuilder does not have any modeling tools, all modeling / UV unwrapping / blend shapes and basic rig creation have to be completed before the rigged / skinned models can be imported into MotionBuilder. The models have to be created (or positioned before

final export) in a Z positive position, in the standard T-pose, with no history nodes except for skinning and blend shapes.

MotionBuilder is not able to incorporate NURBS or Sub Division surfaces, and it is recommended that all geometrical models have their transformations frozen, with any blend shapes assigned to a separate layer. I also found that although any naming convention can be used when naming the joints (in Autodesk Maya), to benefit from automatic characterisation (a powerful and time saving feature in MotionBuilder), an appropriate joint naming convention has to be used.

One of the advantages of using MotionBuilder is that it can create an otherwise complicated and time consuming *character rig* with relative ease. Solely relying on MotionBuilder to create my control rig system however also had a couple of disadvantages. It would have meant that I would have been forced to use MotionBuilder every time I wanted to animate the characters, even for simple pose / animation tests. In addition, had something gone wrong later on in the production cycle, and if I were not able to use MotionBuilder any more, I would have been stuck with having to either re-rig or update my existing character rigs with a working IK/FK and curve control system.

This was the main reason I had to develop a system where I first created a control rig in Maya, with fully functional IK/FK capabilities and blend shapes and then edited it later on to enable it to be used in MotionBuilder. As such, I had two versions of each character [see figures 1.5 & 1.6 above] – one with a control rig created in Maya and the other, with a simple hierarchy of joints, named according to MotionBuilder conventions. This proved extremely beneficial in scenes where

either the motion captured animation just did not look right or where the length of the shot meant that the time spent in capturing and cleaning the footage would not have been justifiable. In such cases, I could quickly bring in the Maya version of the character. For example, all scenes with the secondary characters in Act II were animated using the Maya versions as either the footage captured was not appropriate or the scene itself was only a few seconds long.

Conclusion

In terms of the theoretical component of this research project, I believe I have a greater understanding of the aesthetic reasons behind why characters seen in movies like *Monster House* (2006, Columbia Pictures) might have been able to more successfully connect with audiences that those seen in movies like *The Polar Express* (2004, Castle Rock Entertainment). Examples of photo-real characters crossing the uncanny valley are starting to emerge, but as explained previously, the technology itself still needs to be developed before audience are able to relate to and truly accept the synthespians they see on screen; until then perhaps one must find a balance between the two (Furniss, 2000).

In terms of the practical component of my research project, having animated Acts I and II using a hybrid method of both keyframe animation and motion captured animation, I find that I have a better understanding of the advantages and disadvantages of both, and have been able to exploit the advantages offered by both systems to my benefit.

For example, the opening scenes in Act I and the closing scenes in Act II are

both considerably long, and have been almost exclusively animated using captured data. Although the shots themselves did not require the characters to perform complicated actions, I found that using the captured footage enabled me to complete the animation with relative ease and in a considerably short amount of time. Again, as the actions in those shots were relatively static, the data generated was clean and did not require a lot of amendments during post-production. I was therefore able to concentrate on the more subtle nuances in those scenes, which ironically were done through keyframed animation.

In contrast to the scenes mentioned above, all other scenes in Act II were animated without the use of motion captured data, as the data obtained was either inappropriate or required a lot of 'hand' tweaking. For example, the opening scenes of Act II show characters exchanging and interacting with props. Although these sequences were captured, I found that in some cases it was more economical to use the motion captured footage just as reference material instead of trying to get the mocap driven characters to 'hold' and exchange certain digital props, which, at the time of the shoot were not accessible to the actors.

Considerable research also went into establishing the pipeline integration issues that one must be aware of before contemplating the inclusion of motion capture into a pipeline. Since the use of motion capture is generally limited to more large scale productions (Furniss, 2000), I had to pull together and combine the limited resources available to invent a specific pipeline that worked for this project.

In terms of what I learnt from the mocap shoot itself, I found that collaborating

with performers meant that they were able to bring in a different perspective and add a new dimension to their specific character – which proved to be very useful. For example, even though very little of the captured footage was used to animate both Paula and Simone, I found that during the shoot both the female actors were very conscious of their poses, consciously deciding to move in ways that they felt would be better suited to their digital counterparts' personalities.

With regards to the scenes I was not satisfied with, I had to weigh up the time spent on either fighting keyframes to manipulate existing animation curves against that spent re-shooting the entire scene, ultimately deciding that animating those scenes exclusively in Maya (without the use of motion captured data) was more economical and effective.

The quality of animation is ultimately proportionate to the talent and experience of the animator (Thomas & Johnston, 1981), and with limited personal animation experience, I believe the animation in *Perhaps Perhaps Perhaps*, whether driven primarily through motion capture or solely through keyframes, has a lot of room for improvement. As stated by Troy Saliba, co-director of *Monster House*, "motion capture is a tool, not a genre" (Robertson, 2006, p. 14) and although this technology does boast incredible strengths, not just in terms of speed but also in terms of affording a certain spontaneity (achieved during a live performance), there are occasions when other, more traditional systems may be able to bring in better results (Furniss, 2000; Kitagawa & Windsor, 2008). I conclude by evoking Lasseter (1987), who placed creativity and imagination over the medium used, adding that "whether it is generated by hand or by computer, the first goal of the

animator is to entertain" (Lasseter, 1987, p. 43). Ultimately it does not make much of a difference what specific technique is used to capture motion, as long as that motion captured is able to convey the story effectively to the audience.

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