The Importance of Visual Effects in Film Narrative and Film Theory

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The Importance of Visual Effects in Film Narrative and Film Theory

A Dissertation
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Master of Fine Arts
Digital Production Arts

by
Cassidy Lamm
May 2018

Accepted by:
Dr. Eric Patterson, Committee Chair
Dr. Jerry Tessendorf
Dr. Barton Palmer
Abstract

The focus of this work is to explore the ways in which visual effects have been given a key role in the narrative of film. It explores the history of digital compositing and film theory, discussing how new technology has changed the way audiences relate to, evaluate, and enjoy film. With this idea in mind, two separate live action shorts began production: one with invisible computer graphics (CG) elements (effects that replicate reality) and one with obvious CG elements. In this paper I will present how the storyboarding, filming, modeling, surfacing, fx, animation, and compositing are crafted in relation to visual effects and realism.
Acknowledgments

First, I would like to thank my family and friends for their encouragement and support in all of my endeavors. They gave me the courage and the opportunity to pursue my dreams.

Second, I want to thank my DPA family for their continuous support and dedication over the last three years. They have always kept me laughing, kept me sane, and kept me inspired.

Third, I would like to acknowledge the cast and crew who worked really hard to bring this work to life: Dr. Eric Patterson and the Fall 2017 DPA 8150 class, for their valuable time and effort in filming both shorts, creating the assets, and compositing the previz. Thank you also to the actors Chance Cochran, Kelly Burns, Dan Hale, and his daughter. I would also like to specifically thank my friends: Thaddaeus Wasynger, for his FX, XGen, and bear talents; Walter Fulbright, for his rigging expertise; Dan Raitz, for sharing his animation skills with me; and Zachary Shore, for his animation and surfacing help. This project would not be possible without their hard work and dedication.

Finally, this thesis would not be possible without my committee. I would like to thank Dr. Eric Patterson for his mentorship and for inspiring me to pursue visual effects; Dr. Jerry Tessendorf for challenging me to a new level of production and confidence in my work; and Dr. Barton Palmer, for motivating me to think about and appreciate film in a whole new way.
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Chapter 1

Introduction

I have always loved film. Whether it’s going to the movies, staying in to watch Netflix, or popping in a DVD, I love being immersed in a good story and transported to a new reality. In today’s world this sense of engagement with film often includes visual effects which are “any imagery created, altered, or enhanced [in the computer] that cannot be accomplished during live-action shooting” [9]. Many of these effects are often revealed in the special features section of DVDs, “giving away” the magic of the film makers and making audiences more aware of what goes on beyond the set.

Some effects are obvious, such as in Marvel movies where explosions, magic, and CG characters frequently collide to create action packed entertainment before our very eyes. For example, in Taika Waititi’s film Thor: Ragnarok, there are several instances of obvious effects that audiences could easily recognize. One such moment is when one of the characters, Scrapper 142, has a flashback of her last interaction with the antagonist Hela as depicted in Figure 1.1 below. One look and we are saturated with digitally composited imagery. In fact, when asked, many audience members could probably identify that most of these elements were completed inside the computer screen rather than on camera. They might argue that Hela, the figure in green, is played by the actress, but that everything else such as the winged horses and the fiery sky is computer generated. In actuality, 100 percent of this shot is touched by visual effects as every character in this sequence, even Hela, is completely digital [21]. However, even with pre-conditioned audiences, many of the visual effects or VFX, for short, still remain unnoticed by the perception of most.
These effects are often referred to as “invisible” and are not so easy to recognize. For example, in Alejandro González Iñárritu’s movie *The Revenant*, there are no big green monsters nor lightning-wielding hammers. At a glance, it is just a slightly gruesome story about an injured man seeking revenge on the American frontier in 1823. However, out of the total 156 minutes of the film, over 122 minutes were VFX shots [31]. Many of those shots consisted of frames like the one pictured in Figure 1.2. When examined, nothing stands out as altered or digital, and it looks like it could have been shot as-is in a real location. However, this frame was actually originally shot to look like Figure 1.3. Here we see that the main goal of the VFX team was to cover the ground and mountains with snow to match the rest of the scene as it was originally filmed. Unlike “obvious” effects, invisible effects are meant to pull the audience towards realism. Iñárritu sought a specific environment and look for *The Revenant*, one that ironically required almost 80 percent of the film to be altered in one form or another. This means that the majority of the shots had to be imagined and finalized outside of the camera. This phenomenon has become the case for many other films as well. In fact, visual effects are not merely a tool for directors, they are an essential player in the way that directors tell their stories.
1.1 History of Effects

When examining the importance of effects in storytelling, I wanted to first take a look at its history. How did Hollywood get to a place where the majority of a live action film consists of effects,
both visible and invisible to the everyday viewer? And to what degree has visual effects shaped the stories of films in the past? To answer these questions, I looked at the importance of effects across the last century of cinema in three separate films: *Citizen Kane*, *Star Wars: Episode IV - A New Hope*, and *Jurassic Park*. These are all films that used special effects in which the altered or created imagery was created through optical or mechanical techniques.

### 1.1.1 Citizen Kane

Though the effects were mostly invisible, Alejandro González Iñárritu’s film *The Revenant* was still nominated for an Academy Award in the category “Best Achievement for Visual Effects”. Historically, this has not always been the case. For example, Orson Welles’ 1941 classic *Citizen Kane* was also reliant on effects to tell much of its story. Many of the sets in the film such as Kane’s estate Xanadu, the opera house, The Inquirer building, and the campaign arena were achieved through matte paintings and live action miniatures. These separate elements were filmed and then rephotographed together onto a new piece of film using Linwood Dunn’s invention: the optical printer. This gave Welles the freedom to craft the style of the film and the location for his characters without worrying about extensive live-action sets or backdrops. Figures 1.4 and 1.5 illustrate how Welles, Dunn, and matte painters Mario Larrinaga, Chesley Bonestell and Fitch Fulton created Kane’s most memorable sets [17].

Effects were also used to enhance the cinematography. Orson Welles wanted deep focus shots throughout the entire film, juxtaposing his characters within their environments. Whenever possible this was accomplished through the camera work of Gregg Toland; however, for specific sequences the lighting conditions or the location called for actors in the scene to be filmed separately and then pieced together in the optical printer [24]. This technique was also used to establish long takes through sequences such as the opera house where miniatures were used in between live action plates to give the structure its height as the camera cranes up.

To my amazement, it is estimated that “more than 50 percent of the film’s total footage involves special effects of one kind or another”. Linwood Dunn even stated that in some reels the percentage is as high as 80 percent, the same as *The Revenant* [4]. These effects were vital in bringing C.F. Kane’s world to life, and gave Orson Welles more freedom in the way that he could tell his story. However, even with 50-80 percent optically printed footage, it was not even nominated for an effects Oscar as the majority of the changes were invisible [28].
Figure 1.4: Citizen Kane: Xanadu background matte painting and midground miniature mountains with stop motion trucks and machinery [17]

Figure 1.5: Citizen Kane: Xanadu final shot with live action foreground [17]
1.1.2 Star Wars

In the 1960s, several studios had shut down their effects departments due to a significant drop in movie attendance and a climate change in Hollywood. Many industry professionals thought that special effects was a “bygone era” that drew to a close with science fiction in the late 50s. It appeared that stop motion, led by Ray Harryhausen, was going to be the way of special effects for the foreseeable future [22]. However, the landscape of effects changed completely once George Lucas and his team at Industrial Light and Magic entered the scene. This is why the next SFX film that I chose to look at was his 1977 *Star Wars: Episode IV - A New Hope*. This film started a chain reaction in the effects industry...and it was all because of a story.

Much like Orson Welles, George Lucas had a very specific, hands-on vision for his film. He wanted to created a space opera that brought back the adventure-filled science fiction fantasies from his childhood. Special effects played a huge roll and many were pioneered specifically by the team at ILM in order to achieve his vision. According to effects supervisor John Dykstra, “[they] developed lighting systems, camera movement, model systems, and were advancing and changing the construction techniques of the models and their scale” as the shots were being filmed [29]. During production Dykstra also invented the Dykstraflex, the first computer-controlled camera that was used extensively during the space battle scenes. One of the most memorable uses of this motion control system is the opening sequence shown in Figure 1.6. In this sequence, a Rebel Runner ship is being pursued by an Imperial Star Destroyer which occupies almost the entire screen. For this shot they used a combination of blue screen, detailed miniatures, and a 24 mm lens camera that could go incredibly close to the models and hold horizontal focus [6].

*Star Wars* took the optical and mechanical effects of the time and pushed them to a new realm. It used a combination of miniatures, pyrotechnics, matte paintings, stop motion, and computer graphics in order to create over 360 shots. When those techniques were not enough, they invented new methods that started a visual effects race within the industry. Like in *Citizen Kane*, effects were a vital part of the story; however, in *Star Wars* most of them were visible, creating a fantasy universe that could not have been filmed straight out of camera. Also unlike Kane, *Star Wars* received the Academy Award for Best Visual Effects.
Figure 1.6: Star Wars: Opening Shot [19]

Figure 1.7: Star Wars: Motion Control Camera with Millennium Falcon Miniature [19]
1.1.3 Jurassic Park

Once discovering that effects enhanced the sets and camera work of classic films in the 1940s and drove innovation in the 1970s, I wanted to look at the story that pushed the move from special effects to visual effects, from optical compositing to digital compositing. Computer graphics had slowly been working its way into film for the last twenty years. It was in Star Wars’ Death Star visualizations in the 70s and in the first CG character in Young Sherlock Holmes in the 80s. Moreover, James Cameron’s 1991 Terminator 2: Judgment Day had been the first film to have all its CG effects, including a fully chrome T-1000, digitally composited. However, it was not until computer animation hit the big screen T-Rex style, that Hollywood “awoke to the possibilities of computer graphics in visual effects” [6]. Thus, the third and final film that I looked at was Steven Spielberg’s 1993 Jurassic Park.

Initially, Spielberg wanted to use traditional stop-motion/go-motion techniques as well as animatronics for the entirety of the film. He wanted his dinosaurs to look like real, living, sweating animals and not just sci-fi monsters. Dennis Muren, Steve Williams, and Mark Dippé, leaders of what would eventually become the visual effects team at ILM, wanted to see if they could accomplish his vision more realistically with CG. They worked behind the scenes, creating test after test until the “CG skin looked 100 percent real and appeared as though it was actually being lit by sunlight” [6]. Then, they showed Spielberg a shot of a Tyrannosaurus Rex pursuing a herd of Gallimimus through a sunlit field. He was sold. On the other hand, Phil Tippett, head of stop-motion, was terrified and exclaimed “I’ve just become extinct!” [27].

Jurassic Park didn’t let go of special effects by any means. In fact, most of the close up dinosaur shots are done with puppets and animatronics like the one shown in Figure 1.8. Dennis Muren also created a compromise that allowed Phil Tippett’s stop-motion crew to use their talents: the Dinosaur Input Device. The DID was a hybrid process in which the stop-motion crew created an armature of lightweight aluminum, animated it to the scene, and covered it with sensors that would collect the data of the movement so that it could later be rendered by Pixar’s RenderMan software [27]. For long shots and full-body shots of the dinosaurs Spielberg wanted to use computer animation. Thirty percent of those were done through the DID process such as the raptor scene shown in Figure 1.9.
Figure 1.8: Jurassic Park: Animatronic Raptors [19]

Figure 1.9: Jurassic Park: CG Raptors [19]
There was only 6 minutes of computer animation in the 126 minute film, but it changed everything in the effects industry. Jurassic Park won an Academy Award for “Best Visual Effects” in 1994 and many other studios in the industry took notice. Stop-motion shops went digital, studios shut down their optical printers after 60+ years, and directors began had more freedom to tell their stories [27]. Effects supervisors were excited for the inclusion of CG because they “wanted to do things that were more natural looking and had regular camera movements that looked more like real-world photography” [6]. While special effects like stop-motion, animatronics, pyrotechnics, miniatures, and the like were still valuable and absolutely necessary in film-making, they were no longer limitations. This marked the beginning of visual effects and digital compositing.

1.1.4 Narrative in Effects

While examining these three films, it is easy to see that effects have had a significant importance in the narrative of film in the last century. Whether the effects are invisible like in Citizen Kane, or whether they are obvious like in Star Wars and Jurassic Park, they were vital to the making of the film. They took down the barriers and limitations of filming on a live-action set and drove innovation to create new and better techniques to accomplish the director’s vision.

Answering the questions posed earlier, it appears that Hollywood has nearly always had the ability to produce a high percentage of effects shots, both obvious and invisible. What has changed over the course of the century is the techniques and tools by which it has created those shots. In essence, the transition from optical to digital and the move from mostly special effects shots to mostly visual effects shots. With the rise of visual effects, there has also been a change in the knowledge of the effects industry. While many audiences may not have been aware of the effects going on in Citizen Kane, interviews, awards shows, and behind-the-scenes footage allow current audiences to be much more aware of the “magic” behind today’s films. In fact, they expect it.

However, with great magic comes great responsibility. While effects are extremely important in the narrative of film, visual effects supervisor Mark Dippé, one of the leads on Terminator 2 and Jurassic Park, warns that there is a point where “VFX [can be] too much of a good thing” [14]. This is especially true in films with obvious effects such as Star Wars. It had 360 effects shots, most of which required the audience to suspend their disbelief that it was not actually filmed live. George Lucas wanted viewers to believe that they were with Luke, Han, Obi-Wan, and Leia on the Millennium Falcon or flying with the Rebel forces as they attacked the Death Star. In comparison
Gareth Edwards’ *Rogue One*, the 2016 “predecessor” in the narrative of Star Wars, has over 1,700 effects shots. *Rogue One* is two hours and thirteen minutes, only seven minutes longer than *Star Wars*, yet there are five times as many effects shots for the audience to take in.

Robert Legato says it this way: “I think a lot of the problem with CG effects work today, even if its amazing work, is that you know it’s not real...[Y]ou’re not wrapped up in the same emotion as if it were real—the suspension of disbelief is shattered through no fault of the artist...One thing I’ve found with all the films I’ve worked on is that once you really believe it could have been actually filmed live, then you become much more emotionally wrapped up in what you’re looking at. You no longer think it’s fake, or miniature, or computer generated” [6].

The question then becomes this: if there is indeed a line where VFX doesn’t work for an audience, where is it?

1.2 Realism in Film Theory

According to Robert Legato, the problem with CG is when the audience knows it’s not “real”. At first, this can be a confusing concept to break down. What is reality in film-making? Many directors are creating fictional stories with fictional places and fictional characters. Some are even creating fantastical worlds that only exist in their imagination. How is anything considered real, much less the altered images that visual effects brings to the film?

In order to help define the line where VFX no longer works, there has to be a better framework for studying reality in relationship to film. This is why I began to research the history of film theory. I chose to look at three film theorists: André Bazin, V.F. Perkins, and Stephen Prince. These three theorists look closely at the “realism” of films in their time and each form their own theories on what that truly means.

1.2.1 Bazin

The first film theorist that I chose to study is André Bazin in his collection of essays *What is Cinema?*. Bazin views film as an art form rather than as an institution and describes “[p]hotography and cinema...[as] discoveries that satisfy, once and for all and in its very essence, our obsession with realism”[2]. Film has the ability to directly reproduce and capture reality, something that other art forms such as painting, sculpture, and drawing cannot achieve. This is the foundation for his own
theory on the teleological development of film - one that describes cinema as following an inherent pattern towards realism. Thus, every technical or aesthetic aspect that has been added to the film object over time (such as sound, color, and effects) has the sole purpose of making the cinema reflect life itself.

One of the aspects that Bazin champions in a film is depth of focus. In fact he says that it “brings the spectator into a relation with the image closer to that which he enjoys with reality. Therefore...its structure is more realistic”[2]. When directors use shallow focus, they direct audiences to look where they want them to because they are emphasizing one part of the image over another. According to Bazin, this is unrealistic. He wants the director to use deep focus so that the audience can decide where to look and be a spectator in the scene as they would in real life. He also likes long takes as opposed to quick cuts and montages. In a long take, the viewer is allowed to look and accept the images before them as they please. However, in a montage sequence, the images are often meant to be viewed together to contrive a particular meaning, “ruling out ambiguity of expression” [2].

The best way for a film to represent reality, as Bazin defines it, is for there to be no barriers between what the audience perceives and what occurs on screen. Moreover, he prefers that there be no barriers between what occurs on screen and what was filmed. In a truly authentic film, directors would film with “raw, natural settings, exteriors, sunlight, and nonprofessional actors” and also achieve depth of focus and long takes...without the use of effects [2]. However, this appears to be contradictory. In order for Citizen Kane to achieve depth of focus and long takes, Welles had to use special effects along with specialized sets and lighting. For this reason, Bazin clarifies that there are two paths towards realism: one which achieved his desired sense of raw naturalism in sets, lighting, and acting and one which “restores to reality its visible continuity” [2].

Where do visual and obvious effects fit in this path towards realism? According to Bazin, the choice ultimately lies with the director. For each shot, the director must choose to film it as it exists in reality or to add in effects. Each time the director adds an effect, either visual or special, he or she must recognize that “it induces a loss of awareness of the reality itself, which becomes identified in the mind of the spectator with its cinematographic representation” [2]. Using this knowledge one might argue that Bazin, though he died before visual effects came into existence, would vouch for the use of special effects over visual effects as they are filmed and lit on a real camera and there is less representation for the audience to interpret than there is in CG. He would also insist on only
using effects, or representations as he calls them, when absolutely necessary. This is not just for
the sake of the audience, but for that of the director as well. Bazin warns directors that once they
begin to ignore reality, they might get to the point “when [they are] no longer able to tell where lies
begin or end...and [they are] no longer in control of [their] art” [2]. In other words, if a director is
not careful, his vision can get lost in all of the representations (effects).

1.2.2 Perkins

Writing 30 years later, in the midst of a tremendous attendance drop in movie theaters,
V.F. Perkins has a very different framework for judging film in Film as Film. He believes that
Bazin’s theory is too narrow and only makes sense if the audience “identif[ies] the cinema’s ‘essence’
with a single aspect of the film - photographic reproduction” [20]. However, this notion is not one
that can be defined for every person. It also limits the director, or film-maker, to only one type
of film-making and inhibits their vision. Perkins also disagrees with Bazin’s theory that cinema
follows an inherent path towards realism. If this is taken as the basis for criticism, the film-maker
is restricted to create only realistic subject matter with little editing, sound, color, deep focus, and
as few effects as humanly possible. Perkins writes with a completely different mindset, arguing that
“as the cinema has absorbed more aspects of reality it has increased the film-maker’s powers of
selection” [20]. Thus, sound, color, and effects is not a move towards realism, but another set of
possibilities with which a film-maker can work with.

According to Perkins, the reality of film comes from within a film itself and is not related
to anything outside of it. He believes that “a film remains credible so long as we are not led to
question the reality of the objects and events presented [20]. The director has created his own
reality within the film, whether it be similar to ours or not. However, Perkins does require that a
film be cohesive. The director must stick with the film’s own reality - its environment, its characters,
its rules- throughout its entirety so that when people watch it, they believe what they are seeing.
Therefore, the success of a movie is directly related to the directors ability to “offer enough reality
to make the spectator disregard what is missing” [20].

Since he is writing in the 1970s, Perkins applies this to films with obvious special effects as
well. When directors wish to tell stories with fictional worlds and characters, it is vital that they
consider the credibility and cohesiveness of each shot. When the audience views a film, “they need to
be able to sense which elements of [their] common experience apply and which are in suspension” [20].
One this balance is established, it should be kept throughout the remainder of the film. Thus, adding effects is acceptable as long as they are placed meaningfully and structured across the film in a way that makes sense to the audience, and even more so, the narrative.

This is the meaning that Perkins states that the most successful films (in his eyes) places on an image: that “their sole function is to maintain the narrative” [20]. The bottom line for directors is cohesion, but that cohesion should be founded on their vision. Does adding this effect, this type of editing, this scene, etc. maintain the narrative or veer from it? If the narrative is credible and if every decision is made based on keeping its authenticity, whether that authenticity is based on our own reality or not, then the audience should not have a problem suspending their disbelief when called upon to do so. Audiences will “value most the moments when narrative, concept and emotion are most completely fused” [20].

1.2.3 Prince

Stephen Prince, in his article *True Lies: Perceptual Realism, Digital Image, and Film Theory*, discusses the implication of visual effects for film theory and for representation in cinema, “particularly for concepts of photographically based realism” [23]. Writing in 1996, Prince has already seen the rise of digital compositing and computer graphics in films with obvious effects such as *Terminator 2*, *Jurassic Park*, *Forrest Gump* and even the first full CG animated movie: John Lasseter’s 1995 *Toy Story*. Like Perkins, he disagrees with Bazin and theorists who believe in the image as purely a reproduction of reality. However, Perkins disagrees because he believes that it highly limits the director and the appreciation of film. Prince disagrees because, in the age of CG and visual effects, Bazin’s theory has severe contradictions. In fact, he says: “The obvious paradox here - creating credible photographic images of things which cannot be photographed - and the computer-imaging capabilities which lie behind it challenge some of the traditional assumptions about realism and the cinema which are embodied in film theory” [23]. For many films, particularly those with obvious effects, there is no “reality” that the audience can relate back to. For example, in the film *Terminator 2*, there is no purely chrome, fully alive character that can ground the image of T-1000. His “reality is a function of complex algorithms stored in computer memory rather than a necessary mechanical resemblance to a referent” [23].

Because of our ability to manipulate the frame we no longer have the same photographic relationship with our referent, thus it is hard to compare film to the realist ideals of theorists such
Bazin, Cavell and Kracauer. This is why Prince suggests a framework which he terms perceptual film theory: one in which an image “structurally corresponds to the viewer’s audiovisual experience of three-dimensional space” [23]. In other words, it obeys the laws of photographic reality closely as possible. For example, in the film Jurassic Park, as discussed previously, the first CG test was the scene with actor Sam Neill being chased by a herd of dinosaurs. For this sequence to be “perceptually real”, the dinosaurs must be anchored with realistic surface texture, color, lighting (shadow, highlights, reflection), motion speed, motion blur, and direction [23]. These aspects must also match those of the live action filming that was done with Sam, the time of day according to the environment of the scene, etc. This theory of perceptual realism takes Perkins’ notion of cohesion and pushes it further to include VFX.

1.2.4 Takeaways from Realist Film Theory

Bazin, Perkins, and Prince all have different ideas about what a film should and should not be as it relates to realism. They each create their own definition for what realism of an image is and furthermore, what its purpose is. They also discuss how their theory translates into an audience’s perception and evaluation of a film. In the profession of visual effects, these concepts are vital. Film-makers need to be in the habit of studying how audiences perceive film and how film relates to realism. Without this knowledge, their visions may go unnoticed or horribly awry.

After studying these film theorists, reading visual effects supervisor interviews, and watching film in general, I believe that Robert Legato was correct. There is a line where VFX no longer works. According to Legato, Bazin, Perkins, and Prince, the line is where the audience no longer believes that what they see is real. Though they each define “real” differently, they all believe that once the viewer no longer believes in what is being shown on screen, the image has failed. How then, should directors and VFX professions proceed in order to prevent this from happening? Though all three theorists studied here have different ideas on the subject, there are a few key takeaways that can be applied:

1. The film-maker/VFX supervisor must be in control of his vision.

2. Narrative drives the effects, not the other way around.

3. CG effects should be grounded in realism.
Bazin says that the film-maker (whether or not that is the director) is in control of bringing his or her own vision to life. If they do not protect the narrative or the authenticity of the film, then the effects may overpower it. In fact, VFX supervisor Paul Franklin says that some directors have “trepidation about diving into the digital effects world...afraid that visual effects guys are going to wander in and overwhelm them with jargon and flashy toys” [6]. On the other hand, the director has to be willing to put in the work that effects requires or they may not be good enough to sell the realism of the story. They must take control and keep the balance, one that lies foremost in the narrative. According to Perkins, the story is king and should not be compromised by any aspect of the film, including visual effects. Thus, they should only be added with the authenticity of the narrative in mind.

When effects are chosen for a shot, they should be grounded in some form of reality that the audience relates to, either within the story itself or within the physical world. Prince says that “building 3D cues inside computer-generated images enables viewers to correlate those images with their own spatio-temporal experience, even when the digitally processed image fails in other ways to obey that experience” [23]. Even if the narrative is not based in the physical world, having the effects behave with properties of the physical world will help sell the image. Overall, all three properties point back to the narrative of the film and ensuring that its authenticity is kept in visual effects.

The items presented here are not all-encompassing, final, or restricted in any way. All of them can be broken while making a VFX film that is still successful and appreciated by many, just as there are films that were highly popular in the time that all three theorists were writing that did not meet their criteria. There are no real “rules” when it comes to the reality and judgment of film; however, each film-maker/VFX professional must make his or her own judgment on what makes a good, “realistic” VFX film. These are the three that I choose. On this subject, I think the experts say it best...

Even “the most realistic of the arts...cannot make reality entirely on its own because reality must inevitably elude it at some point. Undoubtedly an improved technique, skillfully applied, may narrow the holes of the net, but one is compelled to choose between one kind of reality and another” [2] - André Bazin
1.3 Realism in Visual Effects

Once defining a new framework for “realism”, one that encompasses ideals from all three theorists, it was time to put it to the test against current film-makers. Using the three takeaways defined above, films with visual effects, both obvious and invisible, can be examined. The directors for this new framework define reality not as “something to be captured in the purest way possible by the camera lens but rather as something to be constructed” [10]. In order to study directors within visual effects, it is important to first separate visual effects into its two categories: visible and invisible. Each of these type of effects has two very different goals within the film and thus, so must the director.

When examining directors of visual effects in Live Action films, one has stood out as particularly effective: David Fincher. Fincher has used visible and invisible effects within his films, maintained control over both types of effects, used them to support the narrative, and grounded them in the physical reality of their films. For this reason, I chose to do an in-depth study on the visual effects of a few of his films.

1.3.1 Invisible Effects

The goal of invisible effects is be “mistaken for a live-action plate” [11]. This means that any effect that does not require the audience to suspend their disbelief that the event was shot on camera, without any digital or optical enhancement, is an invisible effect. Invisible effects usually fall into two categories. The first are effects that look like they were shot as practical effects on set and the second consists of effects that seamlessly blend into the scenery. A few examples of each category are listed in Table 1.1 below. Directors often choose to use invisible effects to “enhance the visuals of the story as well as present visually a dramatic action that otherwise would be impossible to manage” [11]. Present technology has gotten to the point where it is difficult to tell the difference between what’s real and what’s artificial. In invisible effects, this is the key to success. The more realistic the portrayal of the VFX, the greater their illusory power.
<table>
<thead>
<tr>
<th>Practical Effects</th>
<th>Seamless Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrotechnics</td>
<td>Set Extension</td>
</tr>
<tr>
<td>Machinery</td>
<td>Fluid and Particle Effects</td>
</tr>
<tr>
<td>Scenery</td>
<td>Plate Cleaning</td>
</tr>
<tr>
<td>Makeup</td>
<td>Character Animation</td>
</tr>
</tbody>
</table>

Table 1.1: Invisible Effects

1.3.1.1 Fincher

David Fincher is well known for how he uses CG in a film, at least to those in the industry. However, to the general audience most of his films appear as if little to no VFX is used at all. For example, his 2010 film *The Social Network*, a film revolving around college students and lawsuits, has 1,000 VFX shots while Gareth Edwards 2014 film *Godzilla* only has 960 [15]. Most of Fincher’s effects go by unnoticed because they are invisibles. Though 1,000 effects may seem excessive for a film like *Social Network*, Fincher is very meticulous with his effects. In fact, he is much like the director described by Bazin and Perkins, one in control of his art. Caution, there are spoilers ahead.

One of the invisible effects that Fincher employs is CG blood. In fact, in his films *Zodiac* and *The Girl With the Dragon Tattoo*, all of the blood is CG rather than squibs. His narratives are all about details and his characters are very meticulous and careful in everything that they do. This is where using CG blood over practicals can often come in handy. It allows Fincher to control the flow and brings out the personalities of his characters by getting the take that he wants. Fincher has a tendency to shoot take after take after take, averaging around 27 takes per scene and going up to over 50 for key moments [15]. By using visual effects, Fincher does not have to worry about cleaning up the practicals and getting the right take. He can shoot as many times as he wants until he gets the performance that fits the narrative.

Some may call his type of direction too controlling; however he has a very specific goal, particularly for invisible effects: to enhance the narrative. For example, in *The Girl With the Dragon Tattoo*, the main character Lisbeth must rush to pursue a murderer on her motorcycle as shown in Figure 1.10. While the VFX crew could have easily stuck with the stunt driver for the final shot, as they had for the majority of her motorcycle shots, it did not serve the story. Though Lizbeth normally wore a helmet, she had no time to put it on. She was in hot pursuit and was not
thinking about her own safety. In that moment she just wanted to kill the murderer, the guy who
had also imprisoned her love interest. Thus, Fincher had the stunt driver’s head replaced with a
digital double of Lisbeth’s as shown in Figure 1.11. In this film he also uses effects for tiny details
such as the part in her bangs and the sticky notes all over the walls as her and her partner collect
evidence. This is so that continuity is maintained between shots and does not distract the audience.
The key to Fincher’s effects is that “they’re not there to be recognized, they’re not there to impress,
they’re there to immerse” [15].

Figure 1.10: Dragon Tattoo: Final Shot [7]
1.3.2 Visible Effects

In obvious or visible effects, there are two possible intentions: to create a world that does not exist or to create a shot that could not have been created practically on camera. The first consists of effects that were addressed earlier, such as those in *Thor: Ragnarok*. The Marvel Universe is a thrilling yet fake world, and many of the effects within them are not ones that audiences have ever seen/will ever see in real life. The second type of obvious effect are those that cannot be shot physically on camera and cause the audience to suspend their disbelief that it is a live action plate. Examples include murder scenes, bear attacks, etc. Even though these effects may appear photorealistic as dictated by the setting of the story, the general audience would not believe that the actor actually shot someone live on camera or set a bear on Leonardo DeCaprio. Due to the subconscious visibility of these effects, directors must have specific goals within these scenes.
1.3.2.1 Fincher

In obvious effects, Fincher has many of the same goals. In his 1999 *Fight Club*, the narrator is coerced into killing himself by shooting a gun into his mouth as shown in Figure 1.12. This effect was a close-up shot that also had a slow motion component. To get the correct movement, the VFX team shot 180 lbs per square inch of air into the actor’s mouth and captured it with 5 panovision film cameras [16]. It was then compositied over the background with fake blood. Thus far, all the steps are as physically accurate as possible. However, Fincher also decided to view the bullet through the mouth...which is not possible. Though in *Fight Club*, it works. This is because in obvious effects the director has much more freedom. The goal is no longer to be mistaken as live action footage and disappear. Because of this Fincher could create his own reality.

The same principle can be applied to the ice cave scene in *Fight Club*. This sequence is mostly CG with animated penguins and was definitely not filmed in an ice cave. However, it fits with the narrator, Jack, and his meditation at that point in the film. It is also an essential “slide” into Jack’s view of Tyler’s life. When the audience is confronted with obvious effects, the director has a freedom; however, he or she must also “realize the potential impact of digital elements on the spectator’s investment in a film’s narrative and representational frameworks [25].” The audience has to identify with the hero of the story on a narrative level. The more time they are confronted with obvious digital replacements, their investment in the hero character wanes at times that they should be exhilarated. Fincher’s obvious effects are successful in *Fight Club* because the audience is invested in Jack and Tyler and the world that they live in. In this way, “Fincher has a keen grasp of how digital aesthetics can influence the way an audience experiences a film, and often his decision about when to use them mirrors, and is mirrored by, the themes of the narrative in which they appear” [26].
1.4 Conclusion

As seen through the study of David Fincher, “realism” in visual effects is both achievable and essential. It cannot be something strictly photographic as Bazin suggested, nor can it be completely free of physically real qualities. Instead, it is a blend of the two that depends entirely upon the narrative of the film and the type of effect, whether invisible or obvious. Fincher is able to craft films that the audience accepts as real because he offers enough effects based in realism to make the audience suspend their disbelief. Indeed, obvious effects “in VFX-intensive films in particular remains credible insofar as Hollywood cinemas realistic worlds are anchored in some version of ordinary reality” [30]. Thus, using the three takeaways from film theory: a director in control of his art, effects driven by the narrative, and CG elements anchored in realism, the image remains meaningful to the audience. In essence, as long as the effect stays true to the elements of the story as the director sees fit, the “visibility” and artistic style can be pushed.
Chapter 2

Development

After studying visual effects and film theory, it was time to use the research to conduct a brand new visual effects project. Unlike the films studied previously, this project would not have a million dollar budget, a production team, or VFX houses bidding for shots. Instead, this project would be low budget, student-organized, and the VFX development process would be done primarily by a beginner’s visual effects and compositing class. The goal of the development process was to create a narrative, storyboard it out, film it, create the assets for all of the required CG aspects, and make a rough composite of the shots. The rough composite would provide a proof of concept for the effects and how they would fit into the narrative. These goals needed to be met while incorporating all of the key elements: a director with goals for visible and invisible effects, a defining narrative, and effects based in the realism of the story.

For the sake of the production in its entirety, I had to put myself in the director/VFX supervisor role that needed to keep the vision of the narrative in mind. However, in the development period the roles of producer, director and VFX supervisor were given to students within the class. This meant that I needed to keep in constant communication with these students to ensure that the story pitches, storyboarding, and filming were done with the incorporation of the key elements. To avoid confusion, I will refer to myself and Dr. Patterson, professor of the class, as the executive producers for the duration of this chapter. Here were the roles for the class as defined by Dr. Patterson:

- Producer - Breakdown of script; planning; communication; making sure we have everything
that we need; making sure each lead is talking to each other; entering things in Shotgun for
schedule, assets, etc).

- Director / Assistant Director - Guides and protects the narrative and themes. / Executes
these on set through effective planning and leadership.

- Story Supervisor - Considers, discusses, and revises the story as needed early in pre-production.

- Director of Photography (DP) - Plans shot list via breakdown of screenplay. Plans blocking
of camera and talent using overheads / layout diagrams.

- Storyboard Artist - Discusses composition, camera movement, timing, etc. with DP and draws
visual representations of these camera framings and movement.

- Location Manager - Find locations; apply for permits or permission as needed; ensure avail-
ability, timing, and transportation.

- Casting Director - Work with Director and Story Supervisor regarding character goals. Publish
call for talent; contact talent agents; plan and host casting auditions; decide and arrange with
talent for availability. Works with Assistant Director to schedule talent for production days.

- VFX Supervisor - Script breakdown for effects; scout and plan for shooting; ensure all clean
plates, extra plates, light probes, etc. are captured.

- Production Art - Research and find reference materials; devise concept for artistic aspects for
production design, wardrobe, set, etc.

2.1 Story

For the purpose of the class, the students were asked to pitch loglines, a one sentence synopsis
of their story idea, and then vote to decide their favorite ones. Once these were narrowed down,
the students whose loglines were selected were then asked to flesh out their stories so that class
could vote again. Listed below are a few of the submitted loglines that the class and the executive
producers narrowed the list down to.

1. Two opposing soldiers encounter each other in the woods. Both raise their weapons.
2. A group of balloons tries to find their old clown.

3. A large skeleton creature stalks a woman at night... to return the credit card she dropped.

4. A girl is told she has to eat her vegetables before she can go play, but her vegetables don't want to be eaten and evade her grasp.

In order to fully understand and develop effects for both invisible and visible effects, the executive producers decided to move forward with two separate stories, one that focused its narrative in physical realism and one that had fantastical qualities. This class also took place in two separate locations, Clemson and Charleston, so having two separate stories also worked well for team dynamic. One location was in charge of development for one story while the other location was in primary development for the second story.

2.1.1 Right to Bear Arms

"Right to Bear Arms," or RBA, began as number 1 in the logline list above. This story was chosen because the executive producers wanted a narrative that had a basis in physical realism, one with the drive for visible and invisible effects like those discussed in *The Revenant*. The script for RBA is shown in Figure 2.6. As shown in the script, effects were vital in the narrative of RBA. It had gunshots, muzzle flashes, whizzing bullets, bark splinters, and a bear attack. These elements were all key in showing the two soldiers fighting against each other, the bear nearly killing them, and each of them sacrificing their own safety to help the other get away from the bear. This was the essence of the story and one that needed to be maintained throughout the film.
EXT. WOODS - DAY

SOLDIER ALPHA sits at a tree, pulling out a photo. He looks at it, sighs, then smiles slightly. He retrieves an apple.

A bullet whizzes from a gun barrel, flies through the air, and pierces the apple, exploding it just as Alpha lifts it to bite. Alpha scrambles to the ground and finds his own weapon, desperately aiming it into the woods and firing in various directions. He scurries to a different nearby tree.

BRAVO, crouching from having fired, ducks behind his own tree, as bark splinters off with a bullet scraping past. He breathes nervously, hearing more shots, then sits waiting.

They both wait in silence for quite some time.

Alpha eventually sneaks around to the area where Bravo is, spying him waiting. He draws a knife and nears Alpha unnoticed. A bear swipes, violently knocking Alpha down.

Bravo turns to see Alpha scrambling backwards as the bear advances. Bravo looks over the forest in the opposite direction then back briefly. Bravo looks away again but then turns fully facing the bear, jumping up and standing tall, arms out, yelling and growling.

The bear turns, then runs and leaps at Bravo, tackling him.

Alpha scrambles to his feet, watching with relief. He starts to run away in the opposite direction but only to retrieve his rifle a short distance away. He aims and fires at the bear, hitting it in the shoulder. The bear growls and runs away.

Alpha pauses but then walks over to Bravo, leaning to check on him.

EXT. WOODS LATER

Bravo has been bandaged around his waist and arm. He leans on Alpha as they both walk to leave the forest.
The next step in the process was storyboarding the script into specific shots and camera movements. This was done as a class project for the Clemson team; however, the executive producers were key in making sure that the storyboards maintained the authenticity of the script. They met with the team during class and after class, to work on necessary revisions and help guide the camera movements, especially for the effects shots. During the process, a list of possible compositing shots were given to the class to help them come up with the best possible way to tell the story through VFX. The list is shown below along with a few of the finalized storyboards in Figures 2.2 - 2.5.

1. set extension

2. atmospherics

3. deep compositing

4. long tracking and stabilizing shot

5. green/blue screen key

6. rig removal

7. match move

8. forced perspective

Figure 2.2: RBA: Shot 10 Panel

Figure 2.3: RBA: Shot 80 Panel
2.1.2 Hot Air

*Hot Air*, or HOT, began as number 2 in the loglines listed above. This was a story that was chosen because it had fantastical qualities that could not be told without visual effects. The script for HOT is shown in Figure 2.2. These effects were much different than those of RBA, relying on emoting balloons as the heroes rather than human beings. In this case especially, the narrative depended on the VFX to tell the story because the balloons, their appeal and their feelings, had to be convincing enough for the audience to empathize with them.
EXT. PARK - AFTERNOON

A smiling clown inflates another balloon, drawing a face on it, adding it to a bunch. The face smiles.

A young boy looks pleadingly at the clown and is handed a balloon.

The clown ties the bunch of balloons to a post.

CLOWN
Don’t let these get away, now?

The boy smiles as the clown walks away, then picks up a nail that he sees on the ground. His balloon’s face changes from happiness to surprise as he pops it violently.

The other balloons watch in terror then struggle to remove themselves from their post.

The boy chases.

The balloons follow along a fence, and the boy chases, swatting at them.

The balloons get caught in a mini cyclone full of leaves, and the boy nears. They are projected out at the last moment.

The balloons float over a stream, looking back nervously, then more relieved, as the boy cannot follow directly.

The balloons see the back of the clown seated in a chair near a trailer and begin moving toward him, smiling.

The boy, winded, runs up and jumps, reaching for the balloons. The balloons move toward the front of the clown.

The clown, half-dressed, smudged make-up, and cigarette hanging from his mouth looks mildly surprised but reaches for the balloons.

The balloons look at the boy, then the clown, then fly away.

The clown and boy, matching poses, mouths agape, look up at the balloons as they leave.

The balloons look down on them, drifting farther away, gradually smiling.
Much like RBA, the next step for the Charleston team was to create storyboards. Once again, the executive producers worked with the storyboard artists to create the best shots and camera movements for the short film, also giving them the same list about the kinds of effects that could help sell the narrative of Hot Air. A few of the finalized storyboards are shown in Figures 2.7-2.10.

![Figure 2.7: HOT: Shot 20 Panel](image1)

![Figure 2.8: HOT: Shot 90 Panel](image2)

![Figure 2.9: HOT: Shot 140 Panel](image3)

![Figure 2.10: HOT: Shot 153 Panel](image4)

### 2.2 Filming

Once the storyboards were finalized, it was time to prepare for the filming process. First, the Casting Directors from both shorts had to publish a call for talent and then host auditions for the separate roles. In RBA, three actors needed to be casted, one for the part of soldier Alpha, one
for soldier Bravo, and one to play the part of the bear so that the actors could have someone to react against when being attacked. Both of the actors playing soldiers needed to be able to act in tense situations, give a realistic performance of being attacked by a “bear”, and portray the sacrifice required to carry out the narrative. The actor playing the bear needed to be able to replicate bear movements, the weightiness of a bear, and come to terms with wearing a tight green suit throughout the day so that he or she could later be replaced with a CG bear. On the other hand, HOT needed actors to play a clown and small child. The clown would need to happily give the balloon to the child and then reappear haggard and unkempt, scaring off the balloons later in the scene. The child would need to give off an innocent, friendly vibe to get the balloon, then become “evil” towards the balloons and chase them maniacally across the setting.

This led to the job of the location managers, who had to find the appropriate location for the filming. For RBA, the narrative called for a heavily wooded area with obstacles for both soldiers to hide behind and a place for the bear to run in. After careful scouting, the location manager settled on a local residence with a lot of land and a wooded area like that pictured in Figures 2.11 and 2.12. For HOT, the setting needed to be more open and quaint, one that would not cause the audience to question why a clown was out there selling balloons to a small child. It also had to allow the child to chase the balloons across a large area, let the balloons get captured in a whirlwind, and let the girl get stuck across a body of water as they flew towards the clown. This led the location manager for the Charleston team to get a permit to film in Hampton Park in Charleston as shown in Figures 2.13 and 2.14.
The Directors of Photography for both shorts needed to plan out the shots in each of the locations as specified by the location manager. Using layout diagrams they placed the actors and camera in the correct placement in the shot to make the filming process run more smoothly. The Production Artists were also needed to research the contexts of the shorts and then gather the appropriate props and wardrobe elements required. For RBA, the production required two weapons, camouflage-like clothing for the soldiers, an apple, and a backpack. In this case two airsoft guns were used in place of real guns for safety purposes. For HOT, the Production Art team needed a clown suit, a rusty nail, and a cigarette. Finally, VFX Supervisors from both shorts had to create a script breakdown for the effects. This consisted of combing meticulously through the storyboards to determine what equipment was needed and how the effects should be filmed. In this area, the executive producers worked specifically to ensure that everything was correct.

2.2.1 RBA

The shot list for RBA is shown in figures 2.15 and 2.16. In this short, there are several different kinds of effects and each comes with its own kind of challenges in filming. The types of effects are listed below:

1. CG Bear
2. Apple explosion
3. Gun shots
4. Muzzle Flashes
5. Bark Splintering

6. Slow Motion Bullet Track

7. Flying Debris

First of all, the bear actor would need to wear a green suit that could later be keyed/rotoscoped out for the CG bear. Keying is the process of “extracting an object from its background and combining it with a different background” while rotoing is the process of creating “imagery or mattes on frame-by-frame basis by hand” [3]. In the case of RBA, the green “bear” would be keyed out of the filmed background with the other actors so that the CG bear could replace him. This also meant that every shot that had the bear in it needed a clean plate, a plate that “differs from the primary plate only in that it does not contain the subject,” just the background [3]. To ensure the best possible results for the class, most of the effects shots with the bear were shots in which the camera does not move. This way, a clean plate could be used most effectively. If this production had access to motion capture capabilities out in the woods, more moving shots would have been added, so that the green suit could be tracked within the background. That being said, there was one shot with free camera movement in which the bear runs across the frame that was included for complexity.

The apple shot needed to filmed so that the apple explosion could later be added. It was decided that the actress playing Alpha should use a real apple that could later be matched in modeling and surfacing for the chunks and pieces flying out of her hand. This would provide an easier solution than rotoing out a tennis ball between her fingers and creating the red shadows/reflections in her hand. All of the gun firing effects could be accomplished through muzzle flashes and smoke in post-production, all the actors needed to do was make the appropriate kick back motions for it to like a realistic gun shot. Bark Splintering and flying debris would later be done through Houdini particle simulations, once again the actors just need to portray their parts in the movement convincingly. The slow motion bullet track would be accomplished through the use of a Phantom drone because of its gimbal and stabilization, taking out unwanted vibration throughout the movement. The footage would later be re-timed to give the slow motion effect.

Once these effects were planned out, the call sheet was created. This was a sheet that was passed out to everyone on the production team and had the date, time and location of the filming. It also contained names and numbers of important team members, a schedule of when each shot
was going to be filmed, thumbnails of the storyboards for reference, the VFX breakdown and a list of equipment needed for that day along with wardrobe and props. Below is the list of equipment needed for RBA.

<table>
<thead>
<tr>
<th>Alpha</th>
<th>Bravo</th>
<th>Misc. Equipment</th>
<th>Filming Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beanie</td>
<td>3D Camo</td>
<td>Pad and Pen</td>
<td>Black Magic Mini Ursa</td>
</tr>
<tr>
<td>Jacket</td>
<td>Black Underclothing</td>
<td>Clipboards</td>
<td>Silk Screen</td>
</tr>
<tr>
<td>Sturdy Pants</td>
<td>Camo Facepaint</td>
<td>Copies of Shot Schedule</td>
<td>Reflector</td>
</tr>
<tr>
<td>Distinctive Boots</td>
<td>Safety Pins</td>
<td>iPad with Animatic Loaded</td>
<td>2 1x1 LED Bank Lights</td>
</tr>
<tr>
<td>Photo</td>
<td>Assault Rifle</td>
<td>Green Screen</td>
<td>Mic Boom</td>
</tr>
<tr>
<td>Sniper Rifle</td>
<td>SSD Card</td>
<td></td>
<td>Sound Boom</td>
</tr>
<tr>
<td>Backpack</td>
<td>Memory Card Adaptor</td>
<td></td>
<td>Lenses</td>
</tr>
<tr>
<td>Reversible Vest</td>
<td>MacBook Pro</td>
<td>Laser distance measer</td>
<td>Rails</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical Tape</td>
<td>Slate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Green Suit</td>
<td>Color chip chart</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pano head</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Two tripods</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DSLR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Phantom Drone</td>
</tr>
</tbody>
</table>

Table 2.1: Wardrobe, Props & Equipment List
# Shot List

<table>
<thead>
<tr>
<th>Shot #</th>
<th>Location</th>
<th>Shot Type</th>
<th>Camera Movement</th>
<th>Shot Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>ext</td>
<td>LS</td>
<td>Tilt up</td>
<td>Alpha sitting by tree, pulling out picture.</td>
</tr>
<tr>
<td>20</td>
<td>ext</td>
<td>MCU</td>
<td>Stationary</td>
<td>Alpha looking at photo, reaction, apple sequence</td>
</tr>
<tr>
<td>20</td>
<td>A/B/C</td>
<td>Insert</td>
<td>Stationary</td>
<td>Alpha grabbing backpack and gun, puts on the items.</td>
</tr>
<tr>
<td>30</td>
<td>ext</td>
<td>MS</td>
<td>Dolly backwards Tracking Alpha</td>
<td>Alpha running towards camera, shooting in various directions.</td>
</tr>
<tr>
<td>40</td>
<td>ext</td>
<td>MS</td>
<td>Stationary</td>
<td>Alpha runs behind tree, peaks out.</td>
</tr>
<tr>
<td>40 A</td>
<td>ext</td>
<td>Insert</td>
<td>Stationary</td>
<td>Tree line, glimmer in the forest</td>
</tr>
<tr>
<td>50</td>
<td>ext</td>
<td>MS</td>
<td>Stationary</td>
<td>Alpha reacts to being shot at.</td>
</tr>
<tr>
<td>60</td>
<td>ext</td>
<td>MCU</td>
<td>Stationary</td>
<td>Bravo behind tree aiming at Alpha.</td>
</tr>
<tr>
<td>70</td>
<td>ext</td>
<td>MS</td>
<td>Stationary</td>
<td>Alpha turns behind tree to shoot.</td>
</tr>
<tr>
<td>80</td>
<td>ext</td>
<td>CU/OTS</td>
<td>Stationary</td>
<td>End of barrel aiming and firing.</td>
</tr>
<tr>
<td>90</td>
<td>ext</td>
<td>POV</td>
<td>Tracking</td>
<td>Bullet flying through forest towards Bravo.</td>
</tr>
<tr>
<td>100</td>
<td>ext</td>
<td>MCU</td>
<td>Stationary</td>
<td>Bravo reacting to being shot at, ducks behind logs.</td>
</tr>
<tr>
<td>110</td>
<td>ext</td>
<td>LS</td>
<td>Stationary</td>
<td>Empty field/forest.</td>
</tr>
<tr>
<td>120</td>
<td>ext</td>
<td>MLS</td>
<td>Stationary</td>
<td>Alpha leaves tree.</td>
</tr>
<tr>
<td>130</td>
<td>ext</td>
<td>MCU</td>
<td>Stationary</td>
<td>Bravo peaks over log.</td>
</tr>
<tr>
<td>140</td>
<td>ext</td>
<td>LS</td>
<td>Tracking</td>
<td>Alpha sneaks through the forest.</td>
</tr>
<tr>
<td>150</td>
<td>ext</td>
<td>LS</td>
<td>Stationary</td>
<td>Alpha comes in slowly to the foreground, Aims at bravo, turns to bears.</td>
</tr>
<tr>
<td>Time</td>
<td>Type</td>
<td>Shot</td>
<td>Camera Movement</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>------</td>
<td>------</td>
<td>-----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>160</td>
<td>Ext</td>
<td>OTS</td>
<td>Stationary</td>
<td>Bear growling at alpha.</td>
</tr>
<tr>
<td>170</td>
<td>Ext</td>
<td>OTS</td>
<td>Stationary</td>
<td>OTS of bear and Bravo turning around.</td>
</tr>
<tr>
<td>180</td>
<td>Ext</td>
<td>OTS</td>
<td>Stationary</td>
<td>Bravo deciding to leave, leaves comes back and fires at bear. Bear charges towards Bravo.</td>
</tr>
<tr>
<td>180 A</td>
<td>Ext</td>
<td>OTS</td>
<td>Stationary</td>
<td>Continuation of 180, Bear attacks Bravo, Alpha in background, <em><strong>rack focus</strong></em>*</td>
</tr>
<tr>
<td>180 B</td>
<td>Ext</td>
<td>LS to OTS</td>
<td>Tilt up, Follows Alpha walking towards Bravo</td>
<td>Behind shot of Alpha, bear in background, Tilt up when Alpha stands up, Alpha turns to leave, stays and shoots the Bear. Bear runs away. Alpha starts to walk towards Bravo.</td>
</tr>
<tr>
<td>190</td>
<td>Ext</td>
<td>CU</td>
<td>Stationary</td>
<td>Bravo lying on the ground, Alpha's feet comes into camera.</td>
</tr>
<tr>
<td>200</td>
<td>Ext</td>
<td>OTS</td>
<td>Stationary</td>
<td>OTS of Alpha giving Bravo a hand up</td>
</tr>
<tr>
<td>210</td>
<td>Ext</td>
<td>MS</td>
<td>Stationary</td>
<td>Alpha picks Bravo up, They both walk out of the forest.</td>
</tr>
</tbody>
</table>
2.2.2 HOT

The shot list for HOT is shown in figures 2.17 and 2.18. In this short, there appeared to be less effects than RBA, however the main characters for the short, the balloons, are all CG. This meant that almost every shot would consist of animating the balloons to the acting of the live action plate and that the actors must perform without anything to reference and react against. There were a few other effects as well, shown in the list below:

1. Set Extension
2. Whirlwind Effect
3. Glasses Reflection
4. Balloon Pop

For HOT, the production team decided that most of the shots would be filmed without any real balloons in the scene. This would allow more freedom in the animation of the balloons and their expressions which was absolutely necessary for the narrative. It would also be really difficult to track real balloons within a sequence and place unique animated expressions on each of them afterwards in post-production. Another reason not to use real balloons was that if they did not move as desired, it would be hard to key/roto out a translucent object, particularly one that moves so sporadically.

The one trick to getting a CG balloon right on filming day, was getting a good light probe, which is an “omnidirectional, high dynamic range image that records the incident illumination conditions at a particular point in space” [5]. With this light probe, the CG balloons would appear to be lit the same way that the scene is lit on the day of filming. This was especially important since the balloons had transparent and reflective properties.

The whirlwind effect would be done later on with a Houdini simulation, as would the balloon pop. Once again, the most important filming aspect for these shots would be the actors reacting appropriately to the action going on in the scene. Thus it was vital that the storyboards and animatic (timed out storyboards) for the Charleston team be finalized and completely fleshed out before filming day so that the actors knew exactly what the balloons were supposed to be doing in that scene and how they should respond. The VFX breakdown used for the call sheet is shown in Figure 2.19.
Shot List - Final:

0. Intro - No shot

10. Clown with balloon, he blows the balloon up and turns it around, the balloon smiles. Pan over, title displayed.

20. Medium shot, clown holds the balloons, the girl approaches and he gives her a balloon, then exits stage right.

30. Medium-close shot of clown walking up to the fence and tying the balloons off

40. Close shot of girl holding balloon, she notices the nail on the ground

50. From nearer the direction of the girl, see the nail on the ground.

60. Close up of balloon, he sees what she is doing and reacts

70. Over the shoulder of the balloon and girl, see her reaching towards nail

80. Low shot of girl's hand grasping the nail - more profile than head on

90. Close shot of girl holding balloon

100. Balloon's expression, zoom in

110. Girl pops balloon

120. Medium shot, girl notices the other balloons, who then attempt to escape the fence.

130. Low perspective shot, girl chases balloons along the fence. She strikes at them and misses, they react as they move.

140. Balloons move into a wind vortex, are trapped before being launched upwards, out of the vortex

141. Girl strikes at balloons, zoom out.

142. Balloons move towards/over the river
143. Bird’s eye view, balloon frames the corner and girl beneath halts as they escape.
144. Girl attempts to grasp the balloons
145. Pan and zoom away from girl
146. Balloons move towards clown
147. Establishing far shot of the clown’s trailer.
148. Balloons bump into the back of the clown
149. Balloons’ reaction
150. Extreme close up of the clown’s face, with the cigarette in his mouth
151. Cut back to the balloons’ changed reaction
152. Close up of the girl’s hand, pan up to her face.
153. Close up of the balloons, girl approaching in the background, they fly away.
154. Clown sees them heading up, reacts.
155. Close up of clown’s face, pan up as he gets up.
156. Bird’s eye view of the clown and girl, zooming/moving out as balloons move away.
Figure 2.19: HOT VFX Breakdown & Call Sheet
2.3 Rough Comp

Once filming was complete, the footage was taken off the Black Magic Ursa Mini and stored onto a server. It was then taken into DaVinci Resolve, an editing and color correction software, to do a quick color correction across all shots and edit/re-time them appropriately. This gave the final time line for both shorts, the correct frames for each shot, as well as the color palette for grading the CG elements in the rough composite.

Unfortunately, this is also the stage where the last half of the footage was lost for RBA. Due to some unknown error with copying over the footage, all of the scenes with the bear were lost and had to be re-shot. This presented several challenges for the VFX development team because on the original filming day, the weather was 74 degrees and cloudy. This provided a perfect filming day for effects as there weren’t any shadows or bands of lights cast on the actors that needed to be matched. Also, the green suit was evenly lit so that it could be keyed out as originally intended. However, on the re-shoot day, the weather was sunny with clouds moving across the sky. This caused the sun to shine through the trees, leaving heavily lit and shadowed areas on the ground. Also, the green suit was now multi-colored and would be difficult to key out. This would have to be addressed with extensive roto.

2.3.1 VFX

For the purpose of this production, the rough composite was created by the class in order to generate the assets and create a proof of concept for the effects. For the purpose of the class, it was their final class project. Each person in the class took on at least one shot from each short and both locations shared assets. In this way, the executive producers would be able to see what assets worked and what didn’t work in order to move forward with the project once the class was over.

For RBA, one of the major assets was the bear. This was the only asset that was not generated from within the program as the team was short on time and resources. After careful consideration and searching, a suitable model was found online, complete with a rig and xGen fur [1]. After ensuring that it would work with Maya 2016 (with a LOT of tinkering), our primary 3D modeling and animation software, the executive producers passed it around to the entire team for animation. Another asset that was needed for RBA was the bullet for the slow motion bullet track. This was modeled and surfaced by a student and then passed around to use for the apple
In HOT, the major assets were the balloons. For this asset, the most important part was to figure out how to create the facial expressions so that they could be animated in each shot. One of the students volunteered to do this with animated textures. He created multiple eyes, blinks, and mouths on separate layers in Substance Painter, a 3D painting software. He then sent everyone on the team a substance file so that they could export the specific faces they wanted for their shot. Each student also had the same balloon model and rig, though they were modeled and rigged by separate students.

Using these assets, the students were given a couple of weeks to complete their shots. This involved tracking the camera motion in Nuke, the team’s primary compositing software, exporting the camera motion into Maya, animating the asset (balloon, bear, etc) to the action of the footage, lighting the scene, rendering it out, and compositing it together back in Nuke. Once all of the rough compositing shots were collected from each student, they were placed back into the timeline in resolve and exported into a video file. Below are a few of the results from each short:

Figure 2.20: RBA: Rough Comp Shot

Figure 2.21: RBA: Rough Comp Shot

Figure 2.22: RBA: Rough Comp Shot

Figure 2.23: RBA: Rough Comp Shot
2.4 Conclusion

There were a few challenges realized through the rough cut. First of all, in RBA many students had issues keying out the green suit due to the lighting conditions in the reshoot footage. Instead, they did their best to animate the bear to cover the green suited actor for the majority of the shots. This was the process that was originally intended for the animator: following the actions of the bear actor as both soldiers react to his movements. However, the bear actor made huge sweeping movements with his arms, something that the bear rig and an actual bear could not achieve. There were also a lot of clean plates lost and never recovered with the reshoot footage. This meant that the bear shots would need to be accomplished with extensive roto work.

Secondly, the balloons did not have a cohesive shader throughout the rough composite. Though all students had the same model, they chose to use their own shaders as the students in Clemson preferred the rendering software Arnold and the students in Charleston preferred RenderMan. The balloons also used different lighting across all shots which made them look like they have different material properties in every shot. The faces, as given, were also a little hard to use as the class had to know exactly what expressions they wanted to export beforehand (eyes, brows, and mouth) and then key frame those images to the diffuse/base color of the model.
There were other changes that needed to be made, but these two were the most noticeable at the end of this stage. With the rough composite, the development team proved that this project could be done with the assets that were generated and that it had a lot of potential given a bit more drive.

Only now, it was time to move to the director’s chair.
Chapter 3

Pre-Compositing

Climbing down off the executive producer pedestal and into the director’s chair might seem like a step down, however, it was actually quite a bit more responsibility. Especially considering that it was the director’s job to protect the narrative, control her art, and direct every decision. In order to complete this stage successfully, the director (myself) would have to communicate effectively with team members, evaluate assets within the narrative, and do so on the producer’s time line and budget. In the pre-compositing phase the goal was to get all of the assets ready for post. This included models, textures, rigging, animation, FX, and color correcting the footage.

The first step was creating a place for them in pipeline. Thus, two shows were created according to each short, one project titled rba and one titled hot. Each project consisted of an assetGen ptask and a prod ptask. The assetGen ptask contained all of the assets for the shorts, including their modeling, surfacing, and rigging phases. The prod (production) ptask consisted of all of the shots for each short. In total RBA had 30 shots and HOT had 27, including both title sequences. For RBA, only 5 shots needed animation and lighting while in HOT 23 shots needed animation and lighting. This meant that each short needed to be set up differently and each shot needed to be set up differently within both shorts. However, two ptasks that every short had in common were raw, where the raw footage was going to be stored, and comp.

After further examination of the assets, there were several changes that needed to be made in order to be completely ready for the compositing phase. First of all, the footage given to the class were all tiffs. Though this worked for the class project, it would be best to work with the highest quality images possible, either raw DNGs from the mini URSA, or EXRs from DaVinci Resolve.
The tiffs were also color corrected in resolve before they were handed out. For this project, the director wanted to use the original coloring of the footage, composite the assets to match, and then color correct in Resolve afterwards to get a specific look. This way, the look could be changed later on.

### 3.1 Surfacing

Though the development team had surfaced all of the assets, there were a few adjustments that needed to be made to the following assets in order for them to fit within the narrative of the story and succeed as a visible/ invisible effect.

1. balloon
2. bear
3. bullet

One of the first alterations in the pre-compositing stage was that the model for the balloon needed to be changed. The UVs for the string were scaled really small so that the texture was stretched out when any shader was attached to it. Once adjusting the UVs, the string looked better, and now the textures could be fixed. As discussed previously, the student who had created the faces for the balloon on the development team suggested that the animators export the faces individually and then animate the faces of the balloon as pngs connected to the base color/ diffuse attribute of the model. This worked for the rough composite, however, the director wanted more flexibility within the shot. There were four different aspects of the balloons’ expression: eye brows, eyes, blinks, and mouths. What if the animator changed their mind about the type of expression they wanted in the middle of the shot? Also, in the Substance file, the faces were meant to be exported with the red balloon material. What if the surfacer wanted to affect the base color of the balloon without it affecting the faces?

To solve these problems, as well as the issue of having a different shader for every shot, the director exported separate facial features out of Substance Painter, rather than a complete expression. In total, there were 5 brows, 6 eyes (including the blinks), and 7 mouths. Then, three new attributes were created on the balloon geometry: current brow, current eye, and current mouth. Each attribute was keyable and had a minimum of 1 and maximum of the number of that particular feature so that
one image would always be displayed. After that, an expression was created so that the animator
could change the number on any of the attribute and it would cycle through the images. The expres-
sion for the mouth looked like this: balloon_face_mouth_01.framExtention=balloon_cylinder.currentMouth.
Once ensuring the the faces worked and animated as desired, it was time to create the textures and
shader.

The balloon shader was done with a mix shader in Arnold, a shader that allows you to use
two different shaders for an object with a mask to differ the areas where each is used. Shader 1 is
the latex material used for the actual balloon and Shader 2 is the marker material used for the faces.
To get the correct balloon-like properties out of the latex shader, the color was derived from the coat
color instead of the base color with the weight turned all the way up to 1. Also, the transmission was
set to 0.5 with the same red color as the coat color. This provided the correct look and translucency
of the balloon, however, it needed a little bit of added texture. To create this, procedural perlin
noise was added as a normal map to add a little bit of “fuzziness” to the balloon. The completed
property editor is shown in Figure 3.1. The marker shader was created by taking the aiNoise node
in Arnold, color correcting the noise to bring the contrast down and then remapping it so that the
“white” values mapped similarly to the color of the balloon. The goal of the shader was to make the
faces appear as if they were colored with a sharpie so there had to be lighter and darker areas where
the faces were more colored in. The same normal noise that was added to the latex material shader
was added to the marker shader. Also, the noise that was added to the base color was added as the
specular roughness. The completed property editor for the marker material is shown in Figure 3.2.
Figure 3.1: Latex Shader Property Editor
Finally, these shaders were combined with the mix shader. This was created by added the eyes, brows, and mouths together with two aiComposite nodes. With the facial expressions, these nodes would create a mask with whichever face the animator keyed in the attributes. Once all put together with the mix shader, the final node network looked like Figure 3.3. The string for the balloon was done primarily through a rope smart material in substance. However, since there
was a danger of the moiré effect on camera, the rope maps were only used for bump and specular roughness. Then, a light yellow/brown color was used for the base color of the rope to create the appearance of twine. The final surface of the balloon is shown in Figure 3.4. Though the balloon character was a visible effect for HOT, one that has fantastical elements and is obviously done in the computer, the surface was still based in reality. The narrative was set in a park in the normal world in which the audience can relate to. The balloon still needed to pass as a physical balloon and the faces still needed to look like the clown had drawn them on before they suddenly burst into life. As an effect, this is successfully based in the narrative.
Figure 3.3: Balloon Shader Network
The next surface that needed to be fixed was the bullet. For the rough composite, the bullet itself just had a shiny copper exterior on it. However, for RBA, this was an invisible effect. The bullet needed to look like it was actually shot from the gun and the camera was following it in slow motion. This required a little research as the director had no experience with guns. After reviewing .50 caliber bullets, the one the model was based off of, the image in Figure 3.5 was found for reference. It had to have rifling down the side once it was shot and there were areas of wear along the side and around the bottom. To create this surface, it was first taken into Substance Painter. After applying the smart copper and rust materials, the roughness was adjusted until the desired effect was reached. Substance Painter was a really quick and easy way to get wear and tear, however, it was taken back into Mari in order to put the ridges in. The referenced image was transformed into a mask, ridges black and bullet white, and then stamped across the UVs. In order to get the gradation in the ridge, the levels were adjusted and a ramp was placed on the black point in the mask. This was then exported into Maya and attached to the bullet shader as shown in the node graph in Figure 3.6 below. The final bullet surface is shown in Figure 3.7.
Figure 3.5: Bullet Reference

Figure 3.6: Bullet Shading Network
The largest obstacle in the surfacing phase was the bear. XGen provided several problem within Maya, especially within pipeline. One of the students, ironically the one who played the bear in the film, wanted to work on the fur. Thus, for this part of the surfacing, the director was actually in the director’s chair. The original groom was clumpy and not very even across the entire body. It was also not very realistically textured. This was the most important aspect of the bear. Though this was a visible effect and the audience would realize that the director did not throw a bear in with a student, they still had to believe the performance and buy into its reality. In this case, the reality of the scene around it. The woods, the actors, the gunshots, and the bullet were all true to physical reality so the bear must play to that as well. The student who did the bear fur, who would now be referred to as bear-man worked back and forth with the director. The first goal was to get the color right. The director wanted a golden brown so that his coloring would stand out from the rest of the wooded area. Sometimes with xGen this can be done by extrapolating the color of the surface, however, the original surfacing was stretched out and not made for debut. The bear-man made his own fur texture and did his own grooming, going through several iterations as approved by the director. The before and after results are shown in Figures 3.8 and 3.9. The director also took the given textures in Mari and made the eyes, mouth, teeth, and claws more grimy and realistic.

The surface phase was completed in service to both narratives. In RBA and HOT, the models are all in reference to physical reality and their properties should appear just as they would
in real life. In this phase the director’s goal for effects, both visible and invisible were the same: to not let the surface suspend the audience’s disbelief in the film.

3.2 Rigging and Animation

After the development phase of production, the director wanted to re-rig the balloon. The original rig consisted of all FK, forward kinematic, joints and was tedious to animate the string, especially since it had multiple joints. The new rig, done by another volunteer student, would now have an IK, inverse kinematic, spline that could move much easier and be a lot faster to animate. The rig for the bear was already completed and had come with the model purchased by the class in the development phase. It had basic controllers, facial controls for the eyes, brows, mouth, and cheeks, and body deformers to control to fat around his abdomen and shoulders. With both rigs completed, the director deemed that it was time to move to animation.

This was the hardest stage of pre-compositing. It was also perhaps the most important stage of pre-compositing. If the bear in The Revenant looked the exact same, but its movements were choppy, it would not work. No matter how nice the grooming looked or how many twigs the FX team had instanced in his paws, the audience would immediately deem the image as not real. This would be even more important in RBA because the team did not have any motion capture
data to fall back on. It was all in the CG animation to make the audience believe that the bear attack was actually happening. More importantly, the bear attack was vital to the narrative. If the audience did not believe that the soldier was actually in mortal danger, then there would be no drive for the soldier to risk his life and save the other soldier. This story was all about sacrifice and the animation could make or break that sacrifice.

As stated in the previous chapter, the goal in animating the bear would be to mimic the movements of the bear-man, however, only the movements that the rig could follow and that a bear could realistically follow. Also, one of the most important parts of animating the bear would be stabilizing him on top of the soldier as he attacks. The animators for the bear, the director and one other student, used a ground plane to keep his back legs stable. The front legs would need to be keyed as they moved excessively with the bear-man movements. Perspective was also a key factor in the bear attack scenes as the bear needed to appear like he was in place, right on top of the soldiers. The animators primarily watched the bear attack scene from The Revenant for reference and asked the director for feedback. A frame from shot 26 is shown in Figure 3.10.

For HOT, there was a little more freedom in the movements of the balloons, as this effect was a visible, fantastical effect, the animator (the director) could take a few liberties. It was first decided that once the balloons came to life, they could control their own strings. So while the strings
The FX for both shorts were key aspects of the films as well. For this part of the pre-compositing phase, the director worked consistently with the FX team to ensure that the FX for both shorts met the needs and goals of the narrative. For RBA, multiple FX were needed: muzzle flashes, bark splintering, flying debris, and the apple explosion. During the development phase, the bark splinter and flying debris were accomplished in Houdini and the producers agreed that they would not have to be re-done. They were realistic, had good placement in the scene, and worked
well for the narrative. It was decided that the muzzle flash and smoke would be done in After Effects by the director in the compositing phase. This would be more efficient if done effectively and would save on time so that the rest of the FX team (bear-man) could work on the apple explosion.

The first task when directing an FX team, is knowing what the effect should should like. The worst thing a director can say to an FX artist, as discovered, is nothing at all. The second worst things is “It doesn’t look right, but I have no idea why.” This is where the director has to be in control, be decisive, and be open to what the FX artist is doing. In this case, the director waited until the apple explosion looked wrong multiple times until doing research. Then, reference images like those in Figure 3.12 and 3.13 were found. The first image is an apple being shot in real time. It was so fast that no part of the apple could still be seen on the pedestal once the bullet hits, however, particles and chunks flew everywhere. The second image, on the other hand was taken in slow motion. In this image there was a lot of water vapor as the apple broke apart. The trick was that the effect happened for 21 frames, less than a second. After watching the footage and looking carefully at the research, the team decided to focus on the smoke, particles, and added chunks. The final effect is shown, without compositing, in Figure 3.14.

Figure 3.12: Apple explosion: real time [12]
For HOT, the only effect needed was the whirlwind. This effect was different from RBA in that there was more freedom and creativity involved. In this shot, the balloons are fleeing from the child when suddenly the wind picks up and they get caught in a gust that allows her to catch up. The effect is shown in the storyboard panels in Figure 3.15 and 3.16. Due to the nature of the story, the whirlwind could be a little more free flowing, however it needed to fit into the scene. The filming crew filmed in an area with sand and leaves on the ground and plenty of room for the wind and balloon to maneuver in. Once the FX team created a path that the director liked, the director then decided to add leaves to better ground the effect in the scene. The final whirlwind effect is
shown in Figure 3.17.

Figure 3.15: Whirlwind Panel 1

Figure 3.16: Whirlwind Panel 2

Figure 3.17: Whirlwind Effect

3.4 Conclusion

At the completion of this phase, all of the assets were created and ready for compositing. However, this stage would not be fully finished until the project was complete. Assets and animation would continue to go through changes as needed and determined by the director. It is important to note as with any production, live action or otherwise, that the stages pre-compositing
and compositing would continue to move fluidly throughout the remainder of production.

A film can only be “real” as its assets. Each effect was examined for how realistic it needed to be in order for the audience to empathize with the characters and identify with the narrative. With the RBA assets, heavy research was done in order to make sure that they fit into the photo-realistic category, however, more liberties could be taken with the HOT assets. The director had to set a clear goal of these liberties for each phase and communicate effectively to those working on that specific team. For the surfacing and animation phase, this was done fairly successfully. In FX, the director learned to be more decisive, make clearer goals, and reference, reference, reference. Only then, could the vision truly come together cohesively.
Chapter 4

Compositing

“We’ll fix it in post” - Everyone

The compositing stage was where everything came together and the realism of the effects were truly tested. Every stage up to this point was to create the assets in a way that would support and authenticate the narrative. In this stage, the goal was to place the assets in each shot and make the images “real”, or as Perkins said, to “offer enough reality to make the spectator disregard what is missing” [20].

4.1 Apple Explosion

The apple explosion went through many iterations, as did all of the shots. At first the FX team and the director thought that a CG apple would need to be surfaced for the FX simulations just in case it was needed for a few frames of the explosion. This is why, in Figure 4.1, a comparison of the raw footage apple and the surfaced CG apple is made. However, after further examination, it was decided that in real time the apple explodes so fast that the full apple cannot be seen after impact. Thus, the surfaced apple was not needed. Instead, separate particle and smoke simulations were rendered in Houdini and passed down to compositing.
The first step was rotoing out the apple as shown in Figures 4.2 and 4.3. This required cloning as traces of the apple dropping from her hand were still seen in the motion blur on the footage. Most of this could be covered by the effects, however, the redness took away from the realism when played back in real time and more work needed to be done in the shadows on her hand. Once the roto was finished, the footage was merged over a clean plate.
Figure 4.3: Apple Roto

The next step was adding all three effects. The motion of the bullet made the apple explosion a little hard to pin down at first. Since the bullet was coming from the camera, the apple FX needed to be moving in the direction of the background. This was a hard motion to visualize because of such a flat angle and also a hard motion to simulate. After a few transformations in Nuke, the FX moved from screen right to screen left rather than in just the z axis as shown in Figure 4.4. This translation and scale looked more realistic and less like the apple had just evaporated. The chunks were then motion blurred to match the focal depth in the background and retimed so that they exploded really quickly out of her hand. Finally, the effects were graded to match the scene and finalized in figure 4.5.
4.2 Bullet Track

The bullet track began as a 416 frame shot recorded on the Phantom 4 drone. It was then re-timed to a 41 frame shot in DaVinci resolve with high speed motion at the beginning and end
and slow motion in the middle. Nuke was not a fan of the re-timed footage. In fact, to track the footage for animation, several user tracks had to be added and major adjustments had to be made to the settings. For example, a reference frame had to be set and the keyframe spacing (keyframes selected and used in the solve) had to be taken down from .3 to 0.03. Even then, Nuke was unable to track the last two frames of the sequence. Luckily, the bullet was unnecessary for those two frames.

Once the animation was rendered out, the motionVector AOV was used in order to take advantage of Nuke’s 2d vectorBlur as shown in Figure 2.6. This allowed more control over the bullet such as the ability to key the motion blur during the slow motion if necessary. Next, the bullet was roto’d out of the first few frames so that it would not show up with the gun shot as shown in Figure 4.7. Once the bullet was graded to fit in with the scene, the shot was ready for After Effects.

Figure 4.6: Bullet Blur
Following a tutorial, the goal in After Effects was to create a convincing muzzle flash [13]. The muzzle flash was created by taking the fractal noise effect, applying radial blur and feathering the edges. Next, the orange and yellow colors were added with a glow effect to give the fiery appearance. To make the flash light the rest of the scene like it would in reality, the same orange hue was added to the rest of the frame with a light opacity and the grading of the fire was masked onto the front half of the gun. The final frame is shown in Figure 4.8.

The last stage in the tutorial used animated fractal noise to create smoke for the muzzle flash. Once getting the correct contrast and vertical movement, the noise was then masked to be placed into the footage. The scale of the smoke was then keyed to match the timing of the bullet, growing larger and more transparent as it continued towards the soldier in the background. A frame from the final smoke is shown in Figure 4.9.
4.3 Bear Attack

One of the major aspects to getting the bear to look realistic in the scene was lighting. Due to the weather of the re-shoot, the bear needed to have the same kind of shadows and highlights that
the bear-man had in the plate shown in Figure 4.10. While all of the other shots were able to be lit with HDR maps, this shot required three lights: a spotlight, and two area lights. The spotlight would represent the main direction of sunlight and used an aiGobo with a branches texture. Once the scale of the gobo was adjusted properly, the shadows on the bear’s back correctly matched that on the green suit. The spotlight color was adjusted to a temperature of 5000 to reflect the time of day and the main area of light was focused on the bear’s left shoulder. Next, an area light was placed towards the left side of the bear, facing his abdomen. This light had a light reddish brown color to fill in the shadows along his belly and inner legs. Finally, a third area was placed behind the bear so that he would be lit similarly to the way the bear-man was lit in the scene.

![Figure 4.10: Bear Plate](image)

The next task was getting the bear-man out of the shot. Although keying would not work for all of the green suit, it would work for most of it. The Keylight, Huekeyer, and IBK Gizmo nodes were all attempted, however Keylight appeared to get the best results as shown in the alpha channel in Figure 4.11. It took out the most amount of green suit while, at the same time taking out the least amount of the soldier’s camouflage. A roto node was then used so that the key only affected the center of the image and the rest of the alpha channel remained white. Next, a clean plate had to be made to replace the black parts of the key. Though the original clean plate was lost with the footage, there was a second shot filmed in this location once soldier Alpha walks over to pick him
up. This shot was filmed at a slightly differently angle, but since the bear covers most of the frame, it was hardly noticeable. The “clean plate” was split into two, one transformed higher to cover the bear-man’s high arm swipes and one moved lower to cover his legs with twigs and leaves. The final result of the keyed plate merged over the clean plate is shown in Figure 4.12. This “clean” plate still left a lot to be desired. There were several places where the key did not work such as the bear-man’s arms, knees, and slippers. These areas would need to be roto’d, cloned, and worked on separately. There was also green spill from the green suit onto Bravo’s clothing that needed to be taken care of.
Next, the bear was brought into the scene. The whitepoint and lift were adjusted in order to match the footage. Bravo’s leg also needed to be rotoscoped in order for the bear’s back leg to be securely placed behind it. Finally, the shadow matte AOV was added in order to ground the bear to his current surroundings. The before and after are shown in Figure 4.12 and 4.13.
4.4 Whirlwind

Once the motion for the whirlwind FX was finalized along with the leaves, it was decided that the balloons could be animated along the curve in Houdini as well. Once this was passed to compositing, there were only a few minor tweaks that needed to be added: color grading and roto on a few leaves and particles. The original plate and final shot are shown in Figures 4.15 and 4.16 below.
4.5 Balloon Escape

The balloon escape is accomplished mainly through the animation, however the balloons still needed grading in order to better match the raw footage of the shot. The original plate is
shown in figure 4.17 and the final shot is shown in figure 4.18.

Figure 4.17: Balloon Plate

Figure 4.18: Final Balloon Escape
Chapter 5

Conclusions and Discussion

After completing the development, pre-compositing, and compositing phase, the key components of a meaningful and “realistic” film could now be examined in comparison to RBA and HOT. They are listed again as follows.

1. The film-maker/VFX supervisor must be in control of his vision.

2. Narrative drives the effects, not the other way around.

3. CG effects should be grounded in the realism of the story

Throughout the separate stages, the director had to maintain the authenticity of the narrative and be in control of the effects. This also required effectively communicating to everyone working on the team and managing the assets. In this particular area, a lot was learned. The director learned to be more decisive when iterating with the FX and animation team, better at managing the time for the different stages, and more effective at communicating to members of the team. Throughout the production, more control was gained and the effects were kept in balance.

In fact, visual effects were essential to the narrative of both Hot Air and Right to Bear Arms. They allowed the director to tell two stories that could not have been told otherwise and gave more freedom in the ways that the vision was brought to life. This was true with special effects in early cinema such as Citizen Kane in the 1940s and remains true in VFX when creating new films today.

While effects were essential to both narratives, they did not drive them. When effects drive the story, its authenticity gets lost and VFX can quickly become overpowering, with lens flares

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and explosions being thrown around every which way with no real meaning to the shot. Thus, the audience loses what is real in the image and no longer believes in it. For RBA and HOT, every effect was added solely to enhance the narrative so that the image kept its meaning and the audience would invest in the characters and their plights.

The realism and meaning of the image does not lie in its photographic representation as Bazin so desired. It lies in the story. However, this does not mean that physical realism can be thrown away altogether, rather that the director has to chose which properties should be grounded in physical realism and which, based on the narrative, have more freedom in their own reality. For this production, the effects were split into visible and invisible effects in order to determine the goal for the realism of each effect. Invisible effects, those often mistaken for a live action plate, were grounded in Bazin’s photorealism as they were based on what the audience experiences every day. These included the bullet track and the apple explosion. Obvious effects, ones that required suspension of disbelief that it was filmed live, were grounded in the realism of the story. These included the bear attack, whirlwind, and balloon escape.

Overall, the components were successfully completed and the images remained real and meaningful.
Bibliography


