THE FLOOR IS LAVA

A Non-print Media Project

Presented

to the Faculty of

California State University, Chico

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Interdisciplinary Studies

Project Management in Motion Capture Based Production

by

Christopher Adamson

Spring 2014
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APPROVED BY THE DEAN OF GRADUATE STUDIES
AND VICE PROVOST FOR RESEARCH:

Eun K. Park, Ph.D.

APPROVED BY THE GRADUATE ADVISORY COMMITTEE:

Sharon Barrios, Ph.D.
Graduate Coordinator

Clarke H. Steinback, Ph.D., Chair

Jeff Trailer, Ph.D.
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The Floor IS Lava, an animation short created by myself and talented 3D production artists from the Applied Computer Graphics program at Chico State, was successfully made in an efficient ten weeks instead of the normally projected year. To successfully create the animation short I applied my accrued knowledge of 3D production software, project management tools/techniques, and personal investigation of management in production settings.

The Production tools and techniques that were used to create this animation, such as motion capture and 3D modeling soft and hardware’s, are those that you would find in any major production house such as Autodesk Maya and Optitrack Motive motion capture software. The industry-standard project management tools used in this project are also seen in production houses such as Shotgun and in non-production settings such as MS Project. The way in which project management and production techniques
complement each other is why this project was completed successfully in this strict 10 week deadline.

To legitimize my research, I have conducted thorough investigation in the film and game industry by personal employment at a freelance motion capture studio where I worked with companies such as Disney and Comedy Central; in-depth discussions with people such as Demian Gordon Lead motion capture supervisor of many major films; and personal research in project management and productions that utilize motion capture systems. Additionally, I have observed the flawed and successful management techniques that are an industry standard.
CHAPTER I

INTRODUCTION

As a graduate from the Applied Computer Graphics program at Chico State, I was over-all pleased with the knowledge and skills I learned in developing and creating animation shorts, especially in some of their more advanced production classes. However, I always felt that there was a need for a management influence for the organizations of these shorts. With project management influences matched with more advanced production tools such as motion capture, I felt we could take the normal year long process of developing and creating animation shorts and create them in a much shorter amount of time. Upon reflection, I developed the focus of my graduate studies to create an animation short in 10 weeks with strict deadlines, proving that integrating project management and advanced production techniques to be successful. For example, a project management tool known as a Gantt chart gave me a visual representation to show a student with her assigned task in the production not meeting its strict deadline the animation short could potentially not be completed on time.

My project uses Industry standard computer graphic technologies such as motion capture systems and 3D development software. This project write up is intended to be read by a producer or production supervisor running a motion capture based production. However, anyone enthusiastic about learning a more organized managerial approach to create an
animation short is welcome to read my findings and hopefully find some useful tools that can be implemented into their practices.

Purpose of Project

The purpose of my project is to create a *Pixar* style animated short such as *La Luna* using the skills I have learned throughout my graduate studies in project management and motion capture. As a graduate from the Applied Computer Graphics program I have witnessed the skills developed in this program and seen the need to integrate some sort of organizational management techniques. The integration of management skills matched with the talented undergraduate students of this program will with no doubt allow more work to be produce helping to secure future production based careers.

I will prove the successful application of project management in a motion capture based production, and discuss how my team and I successfully created a student ran animation short in 10 weeks, a feat normally accomplished in one year. I also hope this write up can be used to assist the future Applied Computer Graphics undergraduate students seeking a way to develop an animation short in a more organized, timely fashion.

Significance of Project

The film and game industry is a multi-billion dollar money making giant. Accordingly, the need for extreme organization and business minds practiced in project management coexisting with artistic personnel such as animators and concept artists, has left a gap needed to be filled in communication and understanding for each other.
Research and my personal experience at Mobile Motion plus discussions with my mentors has revealed the true feelings for the “corporate people,” there is no respect for each other: the business minds do not understand the creative process meanwhile, “creatives” (person with ability or power to create) do not understand the purpose of turning a project in on time and under budget.

My project mimics a major film production in a small scale using students as my employees. I used project management techniques, such as leadership and management scheduling tools, to guide my team in successfully creation of *The Floor IS Lava*. I also trained my team advanced production techniques such as motion capture to help insure we meet this strict 10 week deadline. The successful completion of this project is due to me being the project manager/director integrated with my undergraduate background in the Applied Computer Graphics Program which gave me the organization skills mixed with the creative mind understanding to successfully complete *The Floor IS Lava*.

Animation shorts created by Applied Computer Graphics historically were complete in two to three semesters. My project was successfully completed in 10 weeks, showing that project management and advanced production techniques can complete a film project in less time with fewer resources.

Scope of Project

The production of the *Floor IS Lava* took 10 weeks to complete. However, in order to complete this project in such a short amount of time, vast number of hours of studying, researching and testing different technological practices such as motion capture
and Autodesk Maya’s camera sequencers were not part of the actual production time of *The Floor IS Lava*. The amount of time studying production and project management techniques, and the actual creation of *The Floor IS Lava*, was broken down into four components throughout my graduate studies: (Summer 2012) Learning Motion Capture and project management techniques used in major film and game industry; (Fall 2012) Applying and teaching motion capture knowledge to small teams of students in Chico State Game Studios with learned project management techniques; (Spring 2013) Manage small team of students with different expertise in the 3-D production pipeline to complete the animation short The Floor IS LAVA; (Summer 2013) Real life work experience in a production house to see success and flaws in project management within a real world practice.

**Problems and Limitations**

*The Floor IS Lava* started off with limitations before it even began. In the spring of 2013, I performed extensive research in various project management and leadership techniques in the production industry leading to my first hurdle to overcome: Major production houses don’t want to share the “Formula” for creating a multimillion dollar movies or games. In addition to not wanting to share management and pipeline structure in fear other companies mimicking their practices, there are very few articles that pertain to this exact field. This led my research in a way of actual employment in a production house. At these production houses and at animation conferences I conducted conversations on the way their production pipelines and management techniques in the field enhanced the quality of their productions in the shortest time possible. Examples of
companies I talked to range from ones who use motion capture in their pipelines like Sony Entertainment to people who create motion capture systems like Natural Point. Much of my research leads me to advancing technologies in the field that minimized their production efforts such as motion capture.

With my further research and understanding of the need for motion capture I knew this had to be part of my project The Floor IS Lava. Luckily, the Applied Computer Graphics Program at Chico State had just purchased a motion capture system which I learned and worked with people directly from industry to help integrate the use of this system in the program. The integration and availability of motion capture at Chico was a blessing. However, when integrating this high precision instrument and teaching it to undergraduate level students along with the lack of information on how to even blend and use motion capture in a production pipeline lead me to almost a whole semester worth of additional research. These complications were overcome with proper organization and management of milestones in the learned project management software to production fazes that I set up for the first semester’s research.

The Applied Computer Graphics Program is a unique field in which you learn the basics in the production pipeline from story development and concept art to 3D modeling and programming. I then chose undergraduate students from this program with various disciplines such as a 3D modeler or animator to fill different aspects of my animation short. The problem with choosing people with one or two disciplines is they might be great at that one thing they focused on but learning new techniques not yet practiced in the program was a very intimidating factor. Working with these students to
overcome their comfort zones and learn something new was a hurdle I did not see overcoming at first, but in the end was successfully achieved.
CHAPTER II

REVIEW OF LITERATURE

Major Research and Guidelines for Project

My major research began when I learned that my undergraduate studies program of Applied Computer Graphics was receiving a motion capture system. I knew at this point that I wanted to pursue my Masters of Arts in Interdisciplinary Studies, focusing on project management and something in the 3D production field. When learning that the Applied Computer Graphics Program was purchasing advanced technology in motion capture, and knowing that these systems are a growing norm in the industry for any major production house to use, I knew where my 3D production focus needed to be.

I started my research the summer before the beginning of my graduate classes reading books like, *The Animator’s Motion Capture Guide: Organizing, Managing, and Editing* (2004). Books like this taught me everything you should know about motion capture systems like the first associated, primitive uses of motion capture: “Rotoscoping was used in the 1940s by Disney in the film Snow White and is a process where animators trace over film of actors acting out the scenes” (p. 2); when it should be used, “Motion capture will give you realistic-looking motion, but if your project needs very stylized, cartoon-like motions, motion capture may not be your best choice” (p. 22); any user input and where the animations have a predetermined outcome. An example of a
linear project is a movie, TV commercial, or cinematic sequence in a video game” (p. 23) also, I learned the flaws and benefits of this growing technology, “Managers may feel a $380,000 motion capture session is too expensive, but when compared to the overall cost of a project, sometimes around seven million dollars or more, the actual cost of the motion capture is minimal compared to the results” (pp. 23-24).

Later on that summer I was taught first hand by David Washburn and Nicholas Bishop, motion capture lead and technician at 2K game studios, on how to run a motion capture shoot. For example, they taught me how to setup the talent, or person used in performing organic motions, to be recorded by a motion capture system. Nick and Dave also taught me the basics of hooking up the recorded motion capture data from a live person to a character made in a 3D space, a process known as retargeting.

In my graduate studies I took MBA level classes which covered project management like MGMT 444 Managing Project Teams and 644 Seminar in Project Management. In these management classes I was taught how to complete complex projects in a time frame which could not be met unless working with large groups organized by the project management tools taught. I also attended classes which covered various leadership techniques, for example: implementing these techniques can be shown in the beginning stages of The Floor IS Lava when I had my group use a brainstorming process called “nominal group technique” to come up with the story itself. This leadership technique gave my team the sense of personal ownership of the project in the end making them want to complete it, with the highest quality, in the time given as I did.

The Applied Computer Graphics Program at Chico State has a class in which the students create an animation short in a team over a two semester span. Learning the
organizational ways of project management, backed by positive leadership techniques, as described above which would allow me to motivate my team, I created and animation short in 10 weeks. While conducting my animation short I used a staple grain of a book in the project management field known as the PMBOK Guide or Project Management Body of Knowledge (2014) which gave me the step by step techniques that I used in the creation of The Floor IS Lava. For example, one of the first steps is the creation of a project scope in which you clearly state the goals and what we strive to achieve in the final results of a project. Also, various scheduling methods like a work breakdown structure or WBS which shows you the major benchmarks in a project and the steps it takes in completing each one of these benchmarks.

Furthermore, I gained industry experience showing the need for motion capture in the major film and game industry. I worked at Mobile Motion Mocap where we did shoots for major companies such as Disney and Comedy Central. Here I learned the true profits that can be made and production benefits of integrating motion capture systems into a production pipeline. For example, I worked with Demian Gordon who was a motion capture supervisor on films such as Rise of the Planet of the Apes and The Matrix Reloaded. While working alongside Demian I learned the need for a more organized approach in the production field, the way “the big wigs,” and the more creative people like the mocap artist get along, again demonstrating the need for a more stable way for the “creatives” and corporate personnel of a company to interact.

To legitimize my research I found an article, The Determinants of Box Office Performance in the Film Industry Revisited (2013), which illustrates how movies that are produced under the category “Sci-Fi,” or science fiction, tend to generate more money.
Sci-Fi movies generally use some forms of motion capture. Table 1 shows just how much money you might find in a major box office film. The films highlighted used a form of motion capture in their creation. Now imagine the extreme organization that goes into making these billion dollar films and you can understand why I chose project management integrated with motion capture as my focus for my masters’ studies.

Table 1

<table>
<thead>
<tr>
<th>Rank</th>
<th>Movies Gross Revenue US $</th>
<th>Movie Titles</th>
<th>Release Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2,782</td>
<td>Avatar</td>
<td>2009</td>
</tr>
<tr>
<td>2</td>
<td>1,843</td>
<td>Titanic</td>
<td>1997</td>
</tr>
<tr>
<td>3</td>
<td>1,328</td>
<td>Harry Potter and the Deathly Hallows – Part 2</td>
<td>2011</td>
</tr>
<tr>
<td>4</td>
<td>1,123</td>
<td>Transformers: Dark of the Mon</td>
<td>2011</td>
</tr>
<tr>
<td>5</td>
<td>1,119</td>
<td>The Lord of the Rings: The Return of the King</td>
<td>2003</td>
</tr>
<tr>
<td>6</td>
<td>1,066</td>
<td>Pirates of the Caribbean: Dead Man's Chest</td>
<td>2006</td>
</tr>
<tr>
<td>7</td>
<td>1,063</td>
<td>Toy Story 3</td>
<td>2010</td>
</tr>
<tr>
<td>8</td>
<td>1,043</td>
<td>Pirates of the Caribbean: On Strange Tides</td>
<td>2011</td>
</tr>
<tr>
<td>9</td>
<td>1,024</td>
<td>Alice in Wonderland</td>
<td>2010</td>
</tr>
<tr>
<td>10</td>
<td>1,001</td>
<td>The Dark Knight</td>
<td>2008</td>
</tr>
</tbody>
</table>


Related Media Productions

As you have seen, motion capture is a major part of the film industry today.

The integration of project management with its extreme organizational benefits and ability to spread out work in an achievable way is what helped me to complete my project, *The Floor IS Lava*, in a timely fashion. This section will go over more on the
history of motion capture in films, and what you might expect from motion capture in the
future.

Some may argue, according to the article *History of Motion Capture for
Computer Character Animation* (2007) that motion capture is simply to "record the
movement of a performer" (para. 3). For example, what Eadweard Muybridge (1830 -
1904) the first photographer who captured a moving image, or Étienne-Jules Marey the
first person to use video when analyzing human and animal movements; however, what
we see in today’s modern films and the way I have applied motion capture to 3D
characters is a relatively new process in the field. This developing process drove me to
close my studies in motion capture, with the tools the Applied Computer Graphics
Program has given me and my growing knowledge in the field of project management
and motion capture I could become a pioneer like Muybridge and Marey.

The first major film to use motion capture was *Final Fantasy: The Spirits
Within*. Although it was not recognized as much as other major films, it was the first
major film to use motion capture in its production to create organic moving computer
generated human characters. The first major film to be recognized by the motion picture
academy as a major achievement of performance capture (motion capture) was, *Lord of
the Rings, The Two Towers*. The character Gollum/Smeagol who plays a major role in
this film was played by a motion capture actor named Andy Serkis. Andy was recorded
by a passive motion capture system, the same technology I used in my project *The Floor
IS Lava*.

Another feat in motion capture was the creation of *Polar Express* as it was the
first feature film shot entirely in motion capture. This milestone shows that motion
capture can be beautifully combined with the Pixar-esque emotional feel that 3D animated productions consistently portray. Even though animations made with motion capture can produce lifelike films such as the *Lord of the Rings* or *Polar Express*, motion capture has its limits which is it can only make and record purely organic movement. Therefore it is difficult to animate a stylized movement as seen in Pixar’s *Wall-E* compared to Gollum in the *Lord of the Rings*.

Recent history has shown that motion capture is a growing tool in the major film industry not only as post-production like the example above but also a pre-production. Pre-production is a step in the production pipeline where the major camera angles and story is developed before spending the majority of a budget on the final shots you would see in theaters. Motion capture is used in this process to give you a sense of how a battle scene or a heavy movement intensive shot would look, more importantly if it strikes emotional cords in the viewer.

I believe we can look more into the future of motion capture by looking at a motion capture feat of a film, *Avatar*. As previously shown *Avatar* grossed close to $3 billion in the box office so there has been talk of it being the first of a trilogy. This potential trilogy alongside the creations of *The Hobbit*, a prequel to *The Lord of The Rings*; and a third trilogy for *Star Wars* in the works shows; the need for talented motion capture artist and supervisors in the foreseen future.

Stepping outside of motion capture in the film industry, we are starting to see its useful application in virtual reality video games where your body is a controller. The *Nintendo Wii* was the first to mass market the use of a motion capture technology where you would have a single remote that would be recognized by a sensor which would be
placed on your television set. This sensor would recognize where your remote was compared to it in the room you were playing a game. The sensor and remote working together would then read your movements and apply them to the character you were driving in the game, making it perfect for tennis or golf games against your friends. Later on the creation of the *Xbox Kinect* came with its advanced system which uses infrared laser projector combined with a monochrome CMOS sensor which then creates a 3D world of where you are compared to the Kinect. The Kinect uses gestural recognition to see how your body is moving and applies it to your game characters. This is yet another form of retargeting like discussed previously. More advanced game consoles come out every other year and along with them the integration of a more advanced motion capture system.

Motion Capture without a doubt has become a part of our everyday entertainment needs. The proper uses of these advanced systems require a more advanced organization technique making it an ideal fit with project management, hence the creation of *The Floor IS Lava*.

**Uniqueness of Project**

The uniqueness of *The Floor IS Lava* is that it was created by undergraduate-level students from the Applied Computer Graphics Program at California State University Chico. Teaching is not a situation you would see in the film industry, whereas in the film industry you would be working with professionals who knew exactly what it took to produce certain motion capture shots such as: a run sequence versus building a physical set to imitate a jungle gym or rocky landscape; the time frames they needed to
be completed in and how to complete them; being new at motion capture, we did not know how long it would take to record certain motion capture movements; nor had the knowledge of further cleaning the motion capture data recorded of these movements that would attach to the 3D characters you see in the end results. This meant flexibility with every body’s schedules and great organization. While designing *The Floor is Lava*, I used project management as a scheduling tool which helped overcome major obstacles in the creation of my project. I based the motion capture time frame section of my project management plan on how long it took for each student to run their own motion capture sessions which included everything from setting up a live actor “talent” to having a finalized motion captured 3D character.

Working with undergraduate students of course provided uniqueness to my project considering they too have other classes and obligations that you would not face working with a hired professional. However, overcoming this obstacle was not as hard as you might expect. It was encouraged by leadership tactics I have learned in my studies; reassuring that what we are doing is unique and will benefit the major for example we are setting a new standard for when a project can be completed; how the creation of this project will benefit my team as individuals by showing their work on personal demo reels and resumes; and they will learn motion capture, which they knew was a self-enhancing opportunity. To date, three of the six that have learned motion capture in the creation of *The Floor IS Lava* are employed in the field or are in the interview process.

In addition to the students being unique in my project setting, typically student animation shorts would take an average of a year to produce, and as stated previously my short was created in 10 weeks thanks to the integration of project management.
Management techniques have been used in the major to create games but not to create animation shorts. Project management gave me the organizational skills as described previously backed by visual scheduling representation to show my team major milestones that needed to be completed and encourage them that we can complete this goal.
CHAPTER III

TREATMENT

Beginning Stages

The research and studying of motion capture and project management was as much part of the process in creating *The Floor IS Lava* as any other. The early research and training that went to learning the process of motion capture and project management all started the summer before my graduate studies even began.

When first starting my graduate studies process I obtained the knowledge that the Applied Computer Graphics Program was purchasing a motion capture system. I knew at this time that I was focusing in project management and some aspect of the 3D production pipeline. Knowing that motion capture is becoming a growing necessary tool of major production houses, not only in film houses like Weta Digital which created *Lord of the Rings* and *Avatar*, but in the game industry with sports and first person shooter games, I felt the integration of motion capture mixed with project management was a beautiful match for my project. Therefore, I decided the best way to combine these tools would be to train a group of talented undergraduate students how to use a motion capture system. Furthermore, my goal was to integrate project management in the creation of an animation short. With my background as an undergraduate in Applied Computer Graphics I saw the potential and seemingly successful Idea of creating an animation short in a short time frame while using these tools.
My first major step in the creation of my project came the summer before my
ggraduate classes when the Applied Computer Graphics Program received their motion
capture system. Since they knew motion capture was going to be part of my project they
invited me to come help install the system alongside Dave Washburn and Nicholas
Bishop, the motion capture lead and technician from 2K game studio. This firsthand
experience gave me the knowhow on the physical set up of a motion capture system.
Nicholas and Dave also gave me the basic knowledge in running a motion capture shoot.
For example, setting up the talent, or person used in performing organic motions to be
recorded by a motion capture system. Setting up talent included a more in-depth
reasoning on how you should attach the retro-reflective markers, which are the physical
balls used on a person that get recorded. For example, do not put retro reflective markers
on muscular areas because in the end it will be improperly recorded giving your 3D
character unwanted movements. Dave referred to this as “garbage in garbage out.”
They also gave me a lesson on how the inferred cameras and motion capture software works to
record and calibrate these markers in a 3D world. The easiest way to explain how these
cameras record is by thinking of a GPS system on your phone. A minimum of 3 satellites
triangulate your location on the globe giving you coordinates relative to the earth. The
same process works in a passive motion capture system three or more cameras triangulate
however many retro-reflective markers that are on your talent and calculate them onto an
“actor” or reference character in your 3D world. Nicholas and Dave also taught me the
basics of hooking up the recorded motion capture data from live talent like a human or
animal to a character made in a 3D space, a process known as retargeting.
In my first year of graduate school I attended many management and leadership class. Classes like MGMT 444 Managing Project Teams and 644 Seminar in Project Management gave me the foundation I needed to organize a group in running a complex project. In these classes I learned what the beginning stages of project management are, for example, when conducting a project you first need to develop a project scope. A project scope is a brief description of what, who, and how you are going to complete a project on time and on budget. For the creation of my project The Floor IS Lava the project scope would be: take a team of undergraduate student with various skills in the 3D production field and motion capture, then use project management as an organizational tool to complete an animation short in 10 weeks. Management classes like the ones stated above also gave me a foundation in how to develop a work breakdown structure or WBS, which is a scheduling tool used frequently in not just the production industry but across many major corporations. A WBS is used to take major task or benchmarks and break them down into segments or steps that need to be completed to reach the next major task. As an example in my project, the first major task is scriptwriting, which has to be complete before storyboarding can be start and is broken into several parts: 1st story development, after the story is developed you write the script, once the script is written you go into the editing and finalizing stages, finally after all these subsidiary task of scripting are complete then you can move on to the storyboarding task. Figure 1 shows the work break down structure of The Floor IS Lava in a program known as MS Project. The first numbers under the WBS tab indicate the main benchmarks or task and the numbers after the decimal show there subsidiary task in the sequence.
Furthermore, I took the tasks I knew it would take to complete an animation short with motion capture and broke them into a way of scheduling known as a critical chain method, which means you cannot complete one task till the next one is done. In a production setting, tasks need to follow each other and have buffers for mistakes, the critical path method does just this. Yet another plus of the critical path method and the use of MS project to show a visual representation of my task is that in this scheduling method you can organize overlapping task. You can see this being used in my project by factoring in one could start 3D modeling as soon as story boards and concept art is done but you can also start a task known as pre-visualization, which is the process of mapping out your shots and movements in a 3D space. Figure 2 shows my schedule I used in the creation of my project. This schedule was used as a visual guide to show my project team what task needed to be done and when by. Furthermore, the schedule showed my team which task was assigned to whom.
<table>
<thead>
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<th>Duration</th>
<th>Start</th>
<th>Finish</th>
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<td>Tue 3/13</td>
<td>Mon 3/18</td>
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<td></td>
<td>Story Development</td>
<td>3 days?</td>
<td>Tue 3/13</td>
<td>Fri 3/16</td>
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<td></td>
<td>Script editing</td>
<td>3 days</td>
<td>Wed 3/13</td>
<td>Fri 3/16</td>
</tr>
<tr>
<td></td>
<td>Finalizing script</td>
<td>3 day</td>
<td>Mon 3/18</td>
<td>Mon 3/21</td>
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<td></td>
<td>Story boarding</td>
<td>3 days?</td>
<td>Tue 3/20</td>
<td>Thu 3/23</td>
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<td></td>
<td>Story board finalizing</td>
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<td>Tue 3/20</td>
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<td>3 days</td>
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<td></td>
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<td>Thu 4/18</td>
<td>Mon 5/21</td>
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<td>2 days</td>
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Figure 2. The Floor IS Lava schedule.

Leadership techniques were also a big part of my graduate courses. In some of these leadership classes I learned different tactics to come up with ideas and help encourage my project team to be involved in the creation process and be as passionate as I was in the creation of *The Floor IS Lava*. I used leadership techniques in the very early stages of my project when coming up with our story. In these stages I used a technique known as, “nominal group technique” what this is, is an advanced form of brainstorming in which the group brainstorms ideas and votes on the best ideas. This technique brought my team closer together and let each individual feel like they contributed in the forming of this project. More details on how the team was chosen and skills of each individual will be explained in the next section.

These early steps in the creation of my project gave me a solid foundation on how and where I knew my project had to be conducted and created. Further sections in this chapter will introduce the more in-depth ways the animation short *The Floor IS Lava* was created.

**Developing Project Team**

The development of the project team started when I was chosen to be the lead motion capture artist for the Applied Computer Graphics programs 495 Advanced Production class. In this class you take a year to year and a half and create games for the IPhone/Android market in a student run mock game production setting. The meaning of having a production setting is in the beginning of the semester people are tested and split into different sections, like a hiring process, of the production pipeline. Examples of these different sections or departments would be modeling, concept art, tech art, rigging,
animation and many others explained more in-depth further in this section. Since motion capture was a new technology in this program and I was the only student who at this point knew the basics about it, I was chosen to take a team of 5 and integrate the motion capture system into this Advanced Production class’s pipeline. Knowing I was using motion capture as a production tool and project management as my organizational development tool, I first worked with the students to see who was going to be in this class for the following two semesters, if they were in my motion capture, “department” they would inevitably learn motion capture and could be a key player in the creation of my animation short. Furthermore, I worked with the professors of this class to see if my plan of training a group the first semester and using them to help me in my animation short would be acceptable. We came to the agreement that as long as the work that needed to be done for this course was complete, to the highest quality, there would be no problems having this select group of students help me with my project.

Next, the “hiring” process begins. Having previous experience in creating animation shorts within groups throughout my undergraduate program, I knew the type of creatives I would need to choose. Before selecting each member I informed them that I will need their participation in the creation of my animation short the following semester, knowing this it will take a lot of extra time outside of class and the devotion to learn and integrate a new growing animation tool. Students of the Advanced Production class did not seem that interested in learning motion capture and this caught me of guard: Why wouldn’t someone want to learn this awesome tool that could possibly help you get your foot in the door? Even though there was not an extreme interest in learning this new system, there were a few students who wanted to be a part of learning and trying anything
they could to help them get employed in the animation field. I knew these students, with their drive to do whatever it takes, were the perfect match in my team.

As previously stated I knew the types of creatives I needed to choose, which have certain skills you must know and have a passion for to even find motion capture somewhat useful or interesting. This is why when developing the outline of my project along with my core project team members I leave out people like script writers or concept/storyboard artist, who indubitably would not have a passion in the process of applying organic motion to a 3D generated character. However, when developing my core project team I knew that each member had to possess a certain skill, more developed, than the rest of their skills in the 3D production pipeline. For example, I needed an excellent character animator, meaning they needed to have the skills of character animation, if they lacked skills in other areas like 3D modeling or visual effects I didn’t mind I would fill these spots with someone who did have those skills.

My core project team and I spent our first semester of APCG 495 learning the more in-depth tricks and flaws of motion capture, like what the camera sees really matters, and if you have tennis shoes with retro reflective tape on them they would be picked up by the motion capture cameras and mess up your motion capture session. We created tutorial videos for future students of the Applied Computer Graphics program to watch in case they have an interest in motion capture. While making these tutorials we learned about each other, not only in our variety of skills and passions in the 3D production fields but how we work with each other. Differences include work ethics and learning processes; some might take offense to certain approaches in teaching and healthy criticism. On the other hand, others take their work and do not need any help then return
beautiful pieces of art. While learning each person’s niche in the production field and their different work ethics, I could start to see how I would develop my project management schedule to create an animation short in 10 weeks.

The first step in creating an animation short is the need for a solid relatable story. The Idea of *The Floor IS Lava* was created with in my core group I worked with. Since none of my core group was very experienced script writers I was put in contact with J. W. Burch, IV a creative writing major at California State University Chico. Burch was the first person I used outside my core motion capture taught creatives. He had the skill that I needed in my project at a certain time, after his work was complete however he would not be needed anymore in the production process. Burch was added into my project management schedule in the beginning script writing stages but was not used again after these stages. A script is an outline of all the productions characters and environment settings, movements and narrations and how the camera should look in these settings. The script Burch wrote will be featured in a future chapter.

After the script is written in a typical production pipeline it will go to the concept and story board artist. This process makes sense in that it gives the artist a narrative guide in how the characters and environments should be designed, yet leaving the final artistic look up to their interpretation. In my project Megan Ting and Katherine Dorland were these artists. Megan and Katherine were like the writer J. W. Burch, IV: they were not part of the core production group but still a key player for the time they were needed in the production. Also like Burch, they were added in the project management schedule for the time they were needed and did not continue on with any of the other production process, like learning motion capture. I put Megan Ting in charge of
concept art, which is the process of coming up with how the key characters and environments would look. A concept artist will give 3D modelers approved art designs. Figure 3 shows the concept art used in creating the boy character in *The Floor IS Lava*.

![Figure 3. Boy concept art.](image)

Source: Illustration by Megan Ting, Student (2013). Reproduced with permission.

Katherine Dorland was put in charge of storyboarding, which is very important. In this step you start the first draft lay out of how the characters and different camera shots interact. The way camera angles lay out can shift the emotions you feel in a sort of synesthesia way. Storyboarding also provides you with a reference to come back to while in the production phase to make sure you have completed all the necessary shots and camera angles. Many large studios like *Pixar* and *DreamWorks* have full screenings in just storyboards to ensure that emotional impacts are reached, further proving its importance. Figure 4 shows some of Katherine’s story boards for *The Floor IS Lava*. 
After storyboards and concept art is completed you can focus on the 3D modeling and texturing stages of the production pipeline. This is a major, time consuming process so it was split amongst three people: Michael Burkland, Kristin Yokomizo and myself. I assigned Michael Burkland to create the boy character seen throughout the animation. The process of character modeling starts with the orthographic concept art shown above in a 3D space. You further go on to sculpt the geometry of the character until you have the end product of what you see on screen in a process sort of like sculpting ceramics. After the geometry is sculpted to its desired form you apply textures. When texturing you think of the geometry in the way of peeling an orange if you were to lay out this skin on a flat surface, paint it a different color, manipulate the pore’s physical texture and re-apply it to the orange, you have created a UV map. UV mapping is the texturing process in which textures are applied to 3D models: the UV’s of
your 3D geometry would be like the skin of your orange. “Asset” is a term used in the production world for 3D generation objects that aren’t strictly the environment or characters in a scene. The assets you would see in The Floor IS Lava would be the shopping cart and lollipop. Kristin Yokomizo was in charge of creating the mom character and assets. I put myself in charge of creating the environments you see because I enjoy 3D modeling and texturing, and because the challenge of creating a flowing lava texture seemed intriguing. When creating environments or assets you use the same sort of process as creating a character, meaning you need to sculpt and texture in the same ways explained above.

After characters are modeled they go into a process called character rigging or character TD, worked on by Chris Barton. The process of character rigging is giving the properly made character geometry the ability to be manipulated and receive animation. You can think of a rig as the bones and tendons in your body, or as a puppet and its strings. The rigs that were created for my animation short were simple because they were attached to motion capture data and needed little clean up by an animator as most motion capture usually does. This however, is not saying that motion capture does not require an animator’s touch.

The process of animation in The Floor IS Lava was spread through the entire core group, Kristin, Michael, Chris and I. However, Katherine ‘Katie’ Canadas would be my main go-to animator. I knew by working with her in the past she was a great 3D character animator. The key role of an animator in a motion capture based production is to clean the finalized animations. For example, in our motion capture system all you can record is body movements. This means the finger movements and facial gestures need to
be implemented after the motion capture data is applied to the control rig. Katie was in charge of many of the finalized shots in the animation short making sure that the fingers and hands were not in a stand still position and that the face had the proper animated gestures.

My core team and the few additions were a huge part in the successful creation of *The Floor IS Lava*. By now you should have a brief understanding of the different positions you would see in small animation houses production pipeline. Future sections will show you the steps taken in creating my animation short.

**Pre-Production: The Floor IS Lava**

At this point in my project I have developed my team. I know all the key players in my team their strengths and weakness and most importantly how they work; do they need to be constantly checked on or can they complete their task without my interruption. Having previous experience and knowledge in 3D production and knowing the duration in which it will take to complete tasks in this field I created a project schedule using MS project. An example of a task would be character modeling or scriptwriting. My MS project schedule for *The Floor IS Lava* was basic in that I didn’t have to enter cost for activities or resources (people, computers, etc.) like you would normally see in its project implementation sense all of my “employees” were students and the currency they were receiving was self-growth. I instead used MS project as a visual guide for my team to let them know if we were on schedule or behind it for our 10 week deadline. Also in my schedule I represent the task and who was assigned to them. An example of my project can be found in the previous chapter in Figure 2.
Pre-Production in any animation short starts with developing the story. In the case for *The Floor IS Lava* my core group and I sat together and came up with the idea for an animation short that would emphasize motion capture and could be completed within 10 weeks, while still having a relatable story. I promoted how we brainstormed ideas in a way of voting for the best ideas then ranking them further elaborating on these ideas. In the management field this would be known as a “Nominal Group Technique.”

Once the Idea for the short was set, we elaborated it to a scriptwriter who helped in writing a proper script. The script was then given to the story board and concept artist as explained in the previous section. After the story board artist completed their task in the designated time and I approved of the quality of their work and art design I assigned modeling task to Kristin, Michael and myself in the project management schedule. Final character or environmental models that you would see in the end productions can start being built as soon as concept art is done. The task of modeling can also overlap with the defined “pre-viz task.” The availability of having these overlapping tasks and completing portions of the pre-viz and production stages simultaneously also aided in the successful completion of my short in its 10 week deadline.

Pre-visualization or pre-viz, differs from pre-production in that pre-production is the broad scope in which all the beginning prepping process begin. In the pre-viz stage of *The Floor IS Lava* and all other animation shorts you start using the storyboards as guides for implementing the basic camera and character movements in a 3D environment, keeping in mind that the final models and characters are not yet in the scene. Instead of the final characters or textured environment you use a method called blocking out, in which you put very basic 3D models like a cube or low polygon sphere into a scene as a
sort of placeholder. In the production stages you then take these place holders and replace them with your finalized textured 3D models. We also used very generic rigged characters since our actual characters were now in the process of being created. Next, implementing our newly acquired skill of motion capture, we attached or recorded organic motions to these generic characters giving us examples of our motion captured movements. Furthermore, we used pre-viz to get a feel on how the cameras interacted with our character movements making sure that we were receiving the proper emotional impact that we needed. We spent almost two weeks in this repetitive process of re-recording motion capture data, applying it to the pre-set characters and adjusting all the cameras in their 3D space. After the whole team and I agreed that the cameras and movements all properly flowed giving us the look and feel we wanted, we moved on to the production stages of *The Floor IS Lava*.

**Production: *The Floor IS Lava***

The production stage of *The Floor is Lava* was like most productions you would see in animation shorts. In this stage we had our finalized pre-viz which gave us all of the camera angles generated in a 3D environment, character movements and sounds that would be implemented in the final renders. In the production stage you are focused on working towards the finalized look and feel of the project. To get this look you add the final assets, textured environments and moving characters you would see in the final renders. In this stage also comes the more technical side of 3D motion capture which is creating and implementing the characters rigs and retargeting them, meaning the
characters for all shots have had the motion capture data recorded, applied to them, and final animations of face and hands are set.

I assigned my group to have all modeling done, entailing the 3D models needed be properly rigged, textured and nice looking to everyone’s approval by the time the pre-viz stage was completed. I knew my team’s abilities and I knew that they could complete the task of modeling while doing pre-viz and still complete work for their other classes, keeping in mind all the members of my project are undergraduate students with other class obligations. My team didn’t let me down, we completed pre-viz and all the models were ready to implement in the scene.

While adding all of our completed models and removing the blocked out placeholders as previously talked about, we noticed a problem. While attaching our finalized boy character to the pre-vized motion captured data we saw that some motion capture used for the pre-viz’ generic characters did not work in the same way as it did attached to the boy. For example, after adding the finalized 3D environment we noticed how the boy, when jumping across the lava path, did not clear the gaps in the same way the pre-viz generic character did. This is when we went in and added the bouldering rock climbing section in the animation short, in the end getting rid of the problem by adding more actions and cameras. Luckily, I planned for these delays in the project management plan by giving the rendering task a very long duration, knowing if any task takes too long we can shorten the time of rendering. This is a technique in project management known as adding "buffers."

Once all 3D models are locked into the scene and all the character and camera animations are finalized, we can go into the lighting stages of the production pipeline. I
have had experience in this field so I did not mind taking on the challenge. The process of lighting in a 3D environment is like the implementation of lights in your real world environments, for example, adding lamps in a room or having a flash light in a tent. Though sounding simple enough, it is a very time consuming process in which you need to mimic real world lights into your computer generated environment. You must think of how the shadows in a real world setting and your 3D generated settings would mimic it, in my case, from a super market to a lava landscape was very different. Also, you need to think of lights in ways you do not normally comprehend like, let us say lava, how does the red glow from lava effect your environment? These are things you need to add in your 3D environment through different tools and techniques to get the look and feel desired in your final renders.

Special effects are also part of the production process. In *The Floor IS Lava* you do not see very many special effects but there is one implementation of it: the lava. I also took on this task having experience with effects. I started this task by thinking how could I make the effect of a lava river that was not too computer intensive, like most effects are, and still have a great look. I started researching in different techniques and found myself back at texturing. As explained before texturing is the process of adding colors and physical looking textures to a 3D model. I found a way to make flowing lava looking texture that would not be computer intensive and gave me the desired feel I was going for.

Now that all models are in, cameras and characters are moving, lights and lava is flowing, we can move on to the final stages of my animation short.
Post-Production: *The Floor IS Lava*

At this point in my project all of the post-product and production steps are completed, now getting to the final steps of my project management schedule. These final steps include rendering and final compositing which was achieved as a team. The reason the core team all worked on these final stages was through pure excitement that we were on the final steps and could possibly achieve this feat not ever achieved in Applied Computer Graphics student projects.

The first step in post-production was rendering. The first step in rendering an animation short is going through all of your frames and cameras and finding drastic areas of movements and running test renders. A render is a process in the animation field where you have your virtual camera process all of the elements that are in its view, the 3D models, textures, lights, etc. and once you approve of the test renders for all of your virtual cameras in the scene you can start your render farm. Our render farm was John F. O’Connell, Room 133 at Chico State containing 64 computers and we used them all. We worked in sections of five, each person having their own set of 15 computers. This required excellent verbal communication and organization from the whole team. My team knew what scene they were assigned to what render settings we were working at and how the progress of each other’s renders were going. In the end we completed our renders for the whole short with very few problems. We then continued on to the compositing phase.

Compositing is the process of taking the renders from all of the digital camera shots and sequencings them in a film editing software in addition to adding the finalized edited sounds like music and narrations. We completed this step at 3AM, exhausted from rendering all night but ecstatic that we complete my project in this incredibly short amount
of time. In accumulation, it was exciting that we learned a few new production techniques that would indubitably help us in the future.
CHAPTER IV

THE PRODUCTION SCRIPT

The Floor is Lava
Story by J. W. Burch, IV

FADE IN:
INT. – GROCERY STORE – FREEZER AISLE

A child walks beside its mother while looking at the ground. The mother, only visible from the waist down, is pushing a cart.

CUT TO – MOM’S POV LOOKING DOWN AT CHILD

CUT TO CLOSER SIDE SHOT OF CHILD

Mom: “Be good and stay close to mommy and I’ll get you a treat, OK?”

The child nods and continues about its business.

The child begins to linger behind – getting lost in imagination and daydreaming.

CUT TO – MED. CLOSE-UP OF CHILD’S FACE

The child starts to hop from one colored tile on the floor to another, smiling and giggling. The child lands on a tile’s edge and teeters trying to maintain balance. The child is alarmed

CUT TO – CHILD POV

The child looks up to find that it’s mother is a distance away. The grocery store aisle has transformed into perilous landscape of cliffs and lava. Rocks protrude in various spots.

The child hops over bubbling lava from rock to rock, slipping at one point and having to reach and climb to safety.

The child’s final jump is to the shoreline where the mother is standing. Upon landing, the area returns to its grocery store appearance.
CUT TO – CLOSE UP OF MOM’S HAND GIVING THE CHILD A CANDY

Mom: “There you go darling, staying next to me wasn’t so hard, was it?”

FADE OUT
CHAPTER V

SUMMARY AND RECOMMENDATIONS

Summary

In the end *The Floor IS Lava* met its goals of integrating project management and motion capture to successfully complete an animation short in 10 weeks. The animation was submitted into the Excellence in Computer Graphics Awards (ECGA), and won 2nd place for story based animations. In addition, Chris Barton and I, two of the students that learned motion capture, obtained jobs in the related field which further proves how acquiring knowledge in motion capture enhances your career step into the production field. There is, however, a few procedures that I would change or give recommendation to further students attempting motion capture based animation shorts.

Recommendations

All though the short was completed successful there are a few recommendations I would give to anyone attempting an animation short of this caliber. First of all I would have given myself plenty of time to render: since my animation short was completed in such a short amount of time and there were adjustments in my project management schedule that limited the allocated rendering tasks time frame, my final renders were affected. If I had more time to render and schedule my project in a less pressured time frame, I might have noticed some of the side effects of a shortened render time such as lava not flowing in some shots and not having completely convincing
camera angles. Another thing I would change if I were to go back is that I would “hire” another animator. Though Katie did a great job there are parts in the animation that could have been cleaned up further with the assistance of an additional experienced animator, that Katie did not have the time to do.

Overall, The Floor IS Lava met its 10 week deadline with minimal possible revisions. I hope this project sets a new standard and a new template for anyone trying to create an animation short.
REFERENCES
REFERENCES


http://www.shotgunsoftware.com/
