THE ANIMATOR'S EYE:
AN APPROACH FOR OBSERVING AND INTERPRETING THE EXPRESSIVE QUALITY OF MOVEMENT FOR BEGINNING ANIMATORS

A Thesis

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ABSTRACT

Life is indispensable to the animator's art. Animators look to our physical world to gain insights into how movement occurs. Often animator's employ live action reference, the study or analysis of movement on film/video, as a tool to uncover the subtleties, variations, and complexities found in movement, that on first glance may otherwise be invisible to them.

In viewing live action reference the animator must identify the distinctive elements of the movement and then interpret those elements in the movement of their animated characters. But how does the animator identify these elements? Animators have utilized a subjective process in identifying these movement qualities, but this process can yield unsuccessful results given the lack of a formal system of analysis, particularly with beginning animators.

The major contribution of this thesis is the development of an alternative approach for the observation and analysis of human movement for animation utilizing Laban Movement Analysis’ Effort, a framework for observing the quality of movement. With this Effort based approach the beginning animator is presented with several benefits: they are given a vocabulary by which to communicate the expressive language of a movement, they are provided with a concise system of analysis, and this system grants them more liberty in breaking from the live action reference but still retaining the quality of
movement found in the performance.

The animator utilizes the Effort vocabulary in interpreting the overall quality of the movement in the live action reference. These qualities form the foundation of the animator's movements. The animator begins to animate in a normal or traditional approach but the Effort functions as a conceptual guide for how the character moves.

This thesis is focused toward the beginning animator who has had some exposure in the technique, terminology, and basic processes of animation. Expressive human (human caricatured) movement will be observed and interpreted in this thesis. The movements will be external bodily movements. The type of expressive movements that will be discussed will be based upon three emotional states: anger, joy, and sadness.

To demonstrate how Effort can be utilized in the creation of animation, actors create several expressive movements. These movements function as a live action reference to be analyzed using Effort. Following the Effort analysis, the Effort qualities found in the actors' performances then are applied to an animated character. The animated character then is animated in light of the Effort qualities, thus conveying an interpretation that expressively resembles the actors' intent.
DEDICATION

BLESSING, AND HONOUR, AND GLORY, AND POWER, BE UNTO HIM THAT SITTETH UPON THE THRONE, AND UNTO THE LAMB FOR EVER AND EVER.

REVELATION 5:12
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I’m grateful to God and my Lord and Savior Jesus Christ for my experience over the past several years. I’ve seen him do some marvelous things before my eyes, and in my heart. From my heart to yours, I desire God’s best for each and every one of you. For you all to know and receive the gift of God through Jesus Christ, in that you might all have abundance of life. That fullness of love, joy, and peace, would abide with you forever.

Thank you all for contributing to this research, but most significantly thank you for sharing your lives with me.

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>II</td>
</tr>
<tr>
<td>DEDICATION</td>
<td>IV</td>
</tr>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>V</td>
</tr>
<tr>
<td>VITA</td>
<td>VI</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>IX</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>X</td>
</tr>
<tr>
<td>CHAPTER 1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Problem Statement</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Intent</td>
<td>2</td>
</tr>
<tr>
<td>1.3 Scope of Thesis</td>
<td>2</td>
</tr>
<tr>
<td>CHAPTER 2. THE SIGNIFICANCE OF OBSERVATION AND THE INTERPRETATION OF</td>
<td>3</td>
</tr>
<tr>
<td>LIFE</td>
<td></td>
</tr>
<tr>
<td>2.1 The Disney approach to interpretation</td>
<td>4</td>
</tr>
<tr>
<td>2.2 Animation prior to live action reference and analysis</td>
<td>5</td>
</tr>
<tr>
<td>2.3 The significance of movement interpretation: Disney and action</td>
<td>7</td>
</tr>
<tr>
<td>analysis</td>
<td></td>
</tr>
<tr>
<td>2.4 Difficulties with the Disney interpretation approach</td>
<td>10</td>
</tr>
<tr>
<td>CHAPTER 3. LEARNING TO SEE</td>
<td>12</td>
</tr>
<tr>
<td>3.1 An alternative approach to interpreting live action reference</td>
<td>12</td>
</tr>
<tr>
<td>3.2 Laban Movement Analysis Basic Definition</td>
<td>12</td>
</tr>
<tr>
<td>LMA theories of movement</td>
<td>12</td>
</tr>
<tr>
<td>3.3 LMA applications</td>
<td>13</td>
</tr>
<tr>
<td>CHAPTER 4. LEARNING THE VOCABULARY OF EFFORT</td>
<td>15</td>
</tr>
<tr>
<td>4.1 Effort</td>
<td>15</td>
</tr>
<tr>
<td>4.2 Space: The focus of the performer’s attention</td>
<td>16</td>
</tr>
<tr>
<td>4.3 Weight: The amount of energy the performer exerts</td>
<td>18</td>
</tr>
<tr>
<td>4.4 Time: The performer’s urgency to make a decision</td>
<td>21</td>
</tr>
<tr>
<td>4.5 Flow: The amount of tension in the performer’s movements</td>
<td>23</td>
</tr>
<tr>
<td>CHAPTER 5. EFFORT QUALITIES FOUND IN EMOTIVE BASED PERFORMANCES</td>
<td>26</td>
</tr>
<tr>
<td>5.1 The significance of observing and interpreting emotions</td>
<td>26</td>
</tr>
<tr>
<td>5.2 Application of Effort theory</td>
<td>26</td>
</tr>
<tr>
<td>5.3 Analyzing emotive performance using effort</td>
<td>27</td>
</tr>
<tr>
<td>5.4 The Motion Capture session</td>
<td>27</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4: EFFORT QUALITIES</td>
<td>15</td>
</tr>
<tr>
<td>5: EFFORT QUALITIES FOR MOTION CAPTURED PERFORMANCES</td>
<td>37</td>
</tr>
<tr>
<td>6: EFFORT QUALITIES FOR ANGER, JOY, AND SADNESS</td>
<td>39</td>
</tr>
<tr>
<td>Figure</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>2.1:</td>
<td>LIVE ACTION REFERENCE</td>
</tr>
<tr>
<td>2.2:</td>
<td>RUBBER HOSE ANIMATION TO SOLID ANIMATION</td>
</tr>
<tr>
<td>3.1:</td>
<td>LABAN MOVEMENT ANALYSIS CATEGORIES</td>
</tr>
<tr>
<td>4.1:</td>
<td>DIRECT SPACE EXAMPLE</td>
</tr>
<tr>
<td>4.2:</td>
<td>INDIRECT SPACE EXAMPLE</td>
</tr>
<tr>
<td>4.3:</td>
<td>LIGHT EXAMPLE</td>
</tr>
<tr>
<td>4.4:</td>
<td>STRONG EXAMPLE</td>
</tr>
<tr>
<td>4.5:</td>
<td>SUSTAINED EXAMPLE</td>
</tr>
<tr>
<td>4.6:</td>
<td>SUDDEN EXAMPLE</td>
</tr>
<tr>
<td>4.7:</td>
<td>FREE FLOW EXAMPLE</td>
</tr>
<tr>
<td>4.8:</td>
<td>BOUND FLOW EXAMPLE</td>
</tr>
<tr>
<td>5.1:</td>
<td>AN ACTOR'S INTERPRETATION OF ANGER #1</td>
</tr>
<tr>
<td>5.2:</td>
<td>AN ACTOR'S INTERPRETATION OF ANGER #2</td>
</tr>
<tr>
<td>5.3:</td>
<td>AN ACTOR'S INTERPRETATION OF JOY #1</td>
</tr>
<tr>
<td>5.4:</td>
<td>AN ACTOR'S INTERPRETATION OF JOY #2</td>
</tr>
<tr>
<td>5.5:</td>
<td>AN ACTOR'S INTERPRETATION OF SADNESS #1</td>
</tr>
<tr>
<td>5.6:</td>
<td>AN ACTOR'S INTERPRETATION OF SADNESS #2</td>
</tr>
<tr>
<td>6.1:</td>
<td>ANGRY ANIMATION #1</td>
</tr>
<tr>
<td>6.1:</td>
<td>ANGRY ANIMATION #1 SPACE ANALYSIS</td>
</tr>
<tr>
<td>6.3:</td>
<td>ANGRY ANIMATION #1 WEIGHT ANALYSIS</td>
</tr>
<tr>
<td>6.4:</td>
<td>ANGRY ANIMATION #1 TIME ANALYSIS</td>
</tr>
<tr>
<td>6.5:</td>
<td>ANGRY ANIMATION #1 FLOW ANALYSIS</td>
</tr>
<tr>
<td>6.6:</td>
<td>ANGRY ANIMATION #2</td>
</tr>
<tr>
<td>6.7:</td>
<td>ANGRY ANIMATION #2 SPACE ANALYSIS</td>
</tr>
<tr>
<td>6.8:</td>
<td>ANGRY ANIMATION #2 WEIGHT ANALYSIS</td>
</tr>
<tr>
<td>6.9:</td>
<td>ANGRY ANIMATION #2 TIME ANALYSIS</td>
</tr>
<tr>
<td>6.10:</td>
<td>ANGRY ANIMATION #2 FLOW ANALYSIS</td>
</tr>
<tr>
<td>6.11:</td>
<td>JOY ANIMATION #1</td>
</tr>
<tr>
<td>6.12:</td>
<td>JOY ANIMATION #1 SPACE ANALYSIS</td>
</tr>
<tr>
<td>6.13:</td>
<td>JOY ANIMATION #1 WEIGHT ANALYSIS</td>
</tr>
<tr>
<td>6.14:</td>
<td>JOY ANIMATION #1 TIME ANALYSIS</td>
</tr>
<tr>
<td>6.15:</td>
<td>JOY ANIMATION #1 FLOW ANALYSIS</td>
</tr>
<tr>
<td>6.17:</td>
<td>JOY ANIMATION #2 SPACE ANALYSIS</td>
</tr>
<tr>
<td>6.18:</td>
<td>JOY ANIMATION #2 WEIGHT ANALYSIS</td>
</tr>
<tr>
<td>6.19:</td>
<td>JOY ANIMATION #2 TIME ANALYSIS</td>
</tr>
<tr>
<td>6.20:</td>
<td>JOY ANIMATION #2 FLOW ANALYSIS</td>
</tr>
<tr>
<td>6.21:</td>
<td>SADNESS ANIMATION #1</td>
</tr>
<tr>
<td>6.22:</td>
<td>SADNESS ANIMATION #1 SPACE ANALYSIS</td>
</tr>
<tr>
<td>6.23:</td>
<td>SADNESS ANIMATION #1 WEIGHT ANALYSIS</td>
</tr>
<tr>
<td>6.24:</td>
<td>SADNESS ANIMATION #1 TIME ANALYSIS</td>
</tr>
<tr>
<td>6.25:</td>
<td>SADNESS ANIMATION #1 FLOW ANALYSIS</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

Animation is always inspired by life, whether through an image, a sound, a feeling, or any other experience. When it comes to animating characters that resemble or are based upon human subjects the animator must bring their aesthetic skills, technical ability, and a keen ability in the observation of life and analysis to their work if it has a hope of truly expressing something significant. The animator’s ability to observe and analyze or interpret movement are components necessary for successful animation. Animators have utilized live action reference, “the filming of actors performing scenes planned for cartoon characters before animation begins”, as a tool to help guide and inspire their animations since the foundational years of the art.

1.1 Problem Statement

In viewing live action reference the animator’s must identify the distinctive elements of the movement and to then simulate those elements in the movement of their animated characters. The issue of concern with the animator’s analysis is by what process is the animator determining these elements or qualities of movement? One of the early processes that animators utilized in achieving realistic movement was the rotoscope
process, in which animators traced actors movements from filmed footage frame by frame. Another process called for the animator to interpret the live action reference based upon subjective observations, this approach was developed at Disney animation studios in the 1930’s. Both methods have proved to be successful throughout the history of animation in achieving movements that resemble the live action reference. Neither method has a system in place to describe the performer’s quality of movement, rather the animator must intuitively try to interpret the qualities seen in the human performer to that of the animated character. This can be problematic especially if the animator is not able to specifically pinpoint the qualities of movement found in the human performer. This difficulty can be especially problematic for the beginning animator who is still developing observational and analytical skills. The animator may match the performer’s poses but still not capture the likeness of movement. With rotoscope based methods the animator may capture the shape of the movement but may miss the emotional or expressive intent of the performer.

1.2 Intent

The intent of this thesis is to present beginning animators with an approach for interpreting human (or human caricatured) expressive movement for animation. The approach presented here aids the animator in analyzing or interpreting the human performer’s movement based upon a set of movement factors. With this approach the animator will be able to identify the expressive intent of the performer. By enabling beginning animators to strengthen their ability to interpret observations of movement,
they should develop animations that simulate the expressive movement qualities found in the human performer more clearly and have a basic vocabulary by which they can discuss the language of movement.

1.3 Scope of thesis

This thesis is focused toward the beginning animator who has had some exposure in the technique, terminology, and basic process of animation. Expressive human (human caricatured) movement will be observed and interpreted in this thesis. The movements will be external bodily movements, and not involve facial features or intricate actions. The type of expressive movements that will be discussed will be based upon three emotional states: anger, joy, and sadness.

The rationale behind limiting the scope of this thesis is due to the limitless influences or variables to consider in achieving the intent. Movement can be classified as non-verbal communication which could encompass tone of voice, facial movement, pupil size, bodily movements, proxemics, smell, and touch\(^3\). All of which could be studied in isolation. The content in this thesis will be upon three general conceptions of emotional states. The variations in the three emotional states should provide a broad enough palette for beginning animators to learn the presented approach because they can be defined within the basic Effort core. The concepts outlined in this thesis, will clearly have some application to personality, inanimate, or animal movement observation.
CHAPTER 2

THE SIGNIFICANCE OF OBSERVATION AND THE INTERPRETATION OF LIFE

When it comes to the development and advancement of character animation Walt Disney animation holds a significant place in the history of animation. The advents of the Disney studio have saturated the animation industry and over time have still proven to be a standard in animation excellence.\(^4\) Disney animators' utilization of live action reference was particularly notable given that they sought methods that resisted the rotoscope technique from referenced movement and developed methods in which reference served as inspiration.\(^5\) Rotoscoping lacks the directness and clarity in movement because the live action camera records many nuances in movement that may distract from what the animator intends to convey.

For years in the animation industry, animators drew from the human model, but the static observation was inadequate, because the animator's concern is movement and movement is a language in itself.\(^6\) Reference benefits the animator because it presents the animator with movement possibilities, an anatomical reference, a guide for movement, and a well of inspiration. Depending upon how much the animator relies upon the reference, the live action reference can inform the animator about the overall character, gestures, attitudes, and intricacies of an action.\(^7\) The animator can include, disregard, or expand these actions in any fashion to achieve their desired result. The
animators ability to interpret live action reference, rather than copy it, benefits the animator in creating performances that have clarity and direction.8

The animator must then take the reference footage, which is rich in movement, and use their subjective choices to strengthen, subordinate, and eliminate nuances of the movement into a focused statement of action.9 By sticking closely to rotoscoped action the animator yields much of their control over to the reference footage, by interpreting it the animator can impart a more personal or artistic expression in the movement.10

2.1 The Disney approach to interpretation

Upon studying live action film in the action analysis classes, Disney animators could see the benefits of utilizing live action reference as a guide to their animation and as an inspiration. Animators up to that time employed the rotoscope process as a means of achieving realistic animation, but the results proved to be visually stiff next to characters with caricatured movements. Rotoscope also limited the animator’s ability to impart their input into the performance.

Rotoscope, for some time, had proven to be the method for animators to study movement frame by frame but Disney developed a system of taking the frames of film from the reference and printing them on sheets of photographic paper comparable to the Disney animators drawing sheets.11 These photographic sheets were called Photostats and they could be placed at the animators drawing desk, and could be flipped through and studied minutely by the animators.12 These Photostats enabled the Disney animators to develop an approach to interpreting live action reference (APPENDIX A). The goal of their approach was to re-interpret what they saw in the live action reference.
Our job was to make the cartoon figure go through the same movements as the live actor, with the same timing and the same staging, but, because animatable shapes called for a difference in proportions, the figure and its model could not do things in exactly the same way. The actor’s movements had to be interpreted in the world of our designs and shapes and forms. 

![Image](image.png)

Figure 2.3: Disney Photostat approach.

The animator chooses only those actions that relate to the point of his particular scene; then he strengthens those until they become the dominate action, with everything else either eliminated or subordinated. What appears on the screen is a simple, strong, direct statement that has clarity and vitality.

Through the study of live action the animators’ art developed a richness, crispness, and force that wasn’t there before. “Once a movement was understood it easily could be incorporated into cartoon terms (Figure 2.3).” By studying the movements of the live action reference, animators could obtain the qualities of weight and timing, but then could exaggerate gestures and expressions, utilizing squash and stretch.

2.2 Animation prior to live action reference and analysis

The perception in the foundation years of the animation industry, particularly in the 1920’s, was that animation was a cartoonist’s medium based upon gags or jokes with no
particular motivation to produce expressive or believable animations.\textsuperscript{17} Attending art school or the study of anatomy or movement seemed superfluous to the animator’s training because the industry at that time, generally, did not foster a pursuit of expressiveness but stereotyped figures and movements.\textsuperscript{18} There was no drive to observe from life and learn objectively or subjectively what it revealed about movement. There was very little movement utilized in the characters actions during this time, animations were essentially comic strips set to time. Movement only facilitated the bridging of gags or punch lines and there was little investment in personality or emotion.

Two reasons why the expressive quality of the animations during this era were not as developed can be linked to finances and the rapid production process. To study from life, even life drawing, cost money and may not have seemed practical to some animation producers who believed that animators should already know how to animate.\textsuperscript{19} Rapid production schedules also impacted upon the expressiveness of this era’s animation quality.\textsuperscript{20} To manufacture the animation product at rapid rates led to advents in cycling, repeating actions, and holding single drawings. All of these advents reduced the amount of drawings needed to communicate the idea, thus producing a more efficient yet not as expressive animation. Animators’ reliance was upon more stock ways of achieving animations, as one animator put it:

Stock methods of doing things are careless animation; very often, moreover, they are based on no observation at all. Frequently, some animator will animate not something he has observed, but something he has memorized that some other animator has done. In such cases, it is a matter of one animator copying another, memorizing a lot of stock stuff.\textsuperscript{21}

Donald Graham, a lecturer and instructor of Disney action and analysis classes in the 30’s
said, "Suppose [a] duck walks into a room, the animator may have a stock walk for him- or five stock walks for him—but none of them fits the mood exactly, so he uses the one that’s closest to the mood." At the Disney studio though, there was a desire to advance the state of animation to a state of more sophistication, polish, and expressiveness in movement.

Walt [Disney] wanted his drawings that were animated to seem to be real things that had feelings and emotions and thoughts, and the main thing was that the audience would believe in them and that they would care about what happened to them... and he used to stress that.\(^{23}\)

2.3 The significance of movement interpretation: Disney and action analysis

"The illusion of life is a rare accomplishment in animation, and it was never really mastered anywhere except at the Disney studio."\(^{24}\)

In 1936 at the Walt Disney studio action analysis classes were implemented under the instruction of Don Graham. Graham was brought in initially to instruct animators in figuring drawing, but his involvement increased with Disney’s interest in instructing younger animators in action analysis. Action analysis aided the younger animators in their abilities to observe and analyze movement, thus advancing the quality of animation from its assembly lined or mechanical approach in the 1920’s and early 1930’s.\(^{25}\)

In a renowned memo by Walt Disney to Donald Graham, Disney, in anticipation of the task for more realism, stated this:

It wouldn't be bad if you made up a list of the qualifications of an animator in order of importance. Then all these men could see what it takes to be an animator, and could check on themselves to see how nearly they approach the desired perfection. The list should start with the animator’s ability to draw; then, ability to visualize action, breaking it down into drawings and analyze the movement & mechanics of the action. From this point, we would come to his ability to caricature action - to
take a natural human action and see the exaggerated funny side of it - to anticipate the effect or illusion created in the mind of the person viewing that action.  

From this memo, the importance of being able to observe and analyze movement is stated in the light of the then looming production of Snow White. Snow White and the animation productions that followed it, at the Disney Studio, exhibited a quality of animation that resembled a studied yet exaggerated interpretation of realism. 

The training programs at Disney during those formative years emphasized the animator’s ability to observe life and caricature the essence of the movement to fit the context in which they were animating. A method that the Disney training program utilized in observation and analysis was having the animators watch films of Charlie Chaplin or filmed actions in slow motion. Animators also analyzed expressive animations at the studio, and were encouraged to discuss their process and observations. Animators were also to consider subjectively the motivations for movement, because their interest was to create animations that expressed something, not replicate actual motion. 

Art Babbit, an influential animator at Disney studios during the 30’s stated, “I learned more about animation from Don Graham than I ever learned from any animator, because he taught me to analyze....You realize that only the slightest little offbeat element in a person’s movement makes him a distinctly different character.”
During the production of *Snow White*, live action footage was used greatly throughout the picture (Figure 2.1). Dwarf footage and live action reference footage was recorded for all the main characters utilized. Animators' caricatured the live action based actions through exaggerations, like using squash and stretch, altering proportions, timings, and revising actions. The dwarfs generally don’t exhibit any sense of being rotoscoped, but appear to be expressive entities. An approach animators utilized in animating with live action was to use live action as a means of solving how mechanically a character would perform a movement through an objective analysis of the movement. The animation was still shaped by the animator, though the animator was inspired by life and expressed that inspiration in their art.
The rubber hose drawings of the 1920’s expose the latitude that the animators had in maintaining volume of form. Their movements lacked a strong sense of realistic weight. Thirty years later, Disney animation illustrated sophistication in acting, consistency of volume, and movements that have weight (Figure 2.2).

As the desire to create more naturalistic characters came to fore the animator’s skill level had to elevate to create characters that conveyed an “illusion of life,” whose movements embodied a sense of thinking and feeling.

2.4 Difficulties with the Disney interpretation approach

Disney animators had years of action analysis training that helped develop their skills in movement analysis, where a beginner may lack this faculty. Since the Disney approach does not directly offer a movement vocabulary for the beginning animator to help guide them in the language of movement analysis, the beginner may be apt to adhere closely to the live action reference and produce an animation that lacks the same feeling found in the performer’s movements.
The Disney approach, though effective, may lead beginning animators to create animations that exhibit a rotoscoped likeness to the live action reference rather than animations that capture the same kind of feeling the performer is portraying. Beginning animators are less experienced in being able to deduce what aspects of the performer’s movements are significant to capturing the prevailing feeling.
CHAPTER 3

LEARNING TO SEE

3.1 An alternative approach to interpreting live action reference

In developing an alternative to the Disney approach it’s essential that this approach enable the beginning animator to impart their subjective interpretations of what they observe and that the approach offer solutions to the main difficulty of the Disney approach. This is the lack of a system to help the beginner in deciding which movements are significant in capturing the quality of movement found in the performer’s movements.

3.2 Laban Movement Analysis basic definition

“Laban Movement Analysis (LMA) is a theoretical framework for observing qualitative and quantitative changes in movement, ranging from conversational hand gestures to complex actions.” This framework was developed by Rudolph Laban, and his intention was to express movement that satisfied a need.

LMA theories of movement

LMA has expanded and developed from the time Rudolf Laban introduced the concepts, theories, and observations that have help shape the analysis of movement. LMA can be seen as a collective body of knowledge for the understanding of movement (Fig. 3.1). The LMA areas are Effort which reveals the variables within the energy of a
movement, in other words it’s the quality of an action or a movement. Space, includes information about a mover’s reaching space known as the kinesphere. Body concerns how the whole body is organized/connected, and Shape involves the forms the body makes, what initiates the change of the body (whether innate or environmental influences), and determining what is the major quality that is instigating the change.

![Diagram showing Effort, Shape, Space, and Body]

Figure 3: Laban Movement Analysis categories.

3.3 LMA Applications

Laban Movement Analysis’ (LMA) origins have predominately been rooted in the field of dance choreography and notation, but LMA has been utilized in computer graphics animation for the past fifteen years. LMA has been used to describe how humans move for scientific visualization, in drawing parallels between LMA concepts and practice found in computer animation, and Effort combinations in animation performance.

Leslie Bishko’s research, from her thesis Qualities of motion: expression in animation and the influence of dance, has brought the associations and parallels between computer animation and LMA to light. Bishko’s research unveils the potential application
of Effort combinations in the creation and interpretation of movement in animation. Laban observed that certain Effort combinations can be associated with expressive meanings. For instance a movement can have a gentle quality with a combination of indirect + light + sustained. This combination could take on another interpretation with the substitution of one of the effort qualities, such as substituting strong for light and the movement could exhibit a tormented attitude. Bishko took this theory, among other LMA theories, applied it to computer animation and established connections and parallels between LMA and computer animation. Bishko’s applications of LMA have linked theories generally privy to dance to computer animation, and offered animators access to insights that can potentially elevate the expressiveness, and richness of movement of the animator’s art.

In this thesis, Effort will allow beginning animators to interpret their reference based upon four movement factors that can describe the character of a movement. Where rotoscope and the Disney approach rely on the specific placement of anatomy as a means of interpretation, Effort is not based upon placement but upon the overall expressive quality of the movement.
CHAPTER 4

LEARNING THE VOCABULARY OF EFFORT

4.1 Effort

When people move, they move based on an inner attitude, Laban described these conscious or unconscious attitudes as Effort; composed of motion factors of Weight, Space, Time, and Flow. Effort theory was initially developed by Laban in collaboration with F.C. Lawrence, their book entitled Effort deals with work and industry. Laban studied work habits of factory workers, to determine efficient and inefficient movements in that setting. Laban began to see similarities or connections between the person and his relationship to space and time. Laban’s ideas were further developed in other books like The Mastery of Movement, where he began to articulate and form much of the Effort theory.36 Laban saw how a person yields or rebels to these factors as ways of uncovering their inner attitude. Given the opposing quality or yielding/unyielding attitude of these factors Laban indicated a couple of elements for each motion factor (Table 4.1).

<table>
<thead>
<tr>
<th>Motion Factors</th>
<th>Effort Elements</th>
</tr>
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<tbody>
<tr>
<td>Space</td>
<td>Indirect/Direct</td>
</tr>
<tr>
<td>Weight</td>
<td>Light/Strong</td>
</tr>
<tr>
<td>Time</td>
<td>Sustained/Sudden</td>
</tr>
<tr>
<td>Flow</td>
<td>Free/Bound</td>
</tr>
</tbody>
</table>

Table 4: Effort qualities.

16
4.2 Space: *The focus of the performer’s attention*

The differences between someone threading a needle, and waving away flying insects can be seen as follows: In threading a needle, the mover’s attention is focused on getting the thread through the eye of the needle. While waving away a swarm of insects is not pinpointed but open or general in execution. These examples illustrate the space qualities of *Direct* and *Indirect*, respectively.

- Indirect actions can be seen as multi-focused or peripheral; being consumed or overwhelmed by the enormity of space. Direct actions can be narrow, focused, or pinpointed. Direct actions can be seen as having a positional goal in space while Indirect actions can be described as actions that don’t have a specific positional goal but involves rotations of the joints in the body.  

In the performer’s movement in Figure 4.1 there is a linear quality exhibited. The performer’s attention is Direct because of the specified direction of the actions. The performer’s movement is driven in a specific direction, in this case at screen left and high.

![Figure 4.1: Direct Space example (Choreographer Melanie Bales. Performer Christina Providence).](image)
The performer’s movements in Figure 4.2 are more flexible in quality and less goal driven. Spatially this movement is very Indirect. The performer moves with broad expansive arm movements, none of which clearly seem to indicate a focused area in space. The movements are not very linear but very flexible.

Figure 4.2: Indirect Space example (Choreographer Melanie Bales. Performer Christina Providence).

Assessing the action

In assessing the Space qualities, an observer should consider:

- Whether the mover’s actions are heading in a specific direction or not? Determine where the mover’s scope of attention is. Are they focused on something, where it requires their undivided attention? Or do they lack direct focus, and their attention is wide or peripheral?
Some significant points regarding the motion factor of Space

**Space:** The focus of the performer's attention

**Indirect:** Flexible, meandering, wandering, multi-focus
   Examples: Waving away bugs, slashing through plant growth

**Direct:** Single focus, channeled, undeviating
   Examples: Pointing to a particular spot, threading a needle

4.3 Weight: *The amount of energy the performer exerts*

Weight can be revealed through the intensity of energy the mover utilizes. It ranges from *light* actions (going with the pull of gravity) to *strong* actions (going against the pull of gravity). Light actions can be seen as delicate or sensitive, while Strong are solid or forceful. Weight can be equated with force. The differences in the perception of Weight between a balloon and an anvil when a human tries to push them are as follows: The balloon, when set in motion, moves delicately when the pushing force is applied to the balloon, there is very little resistance to that force. The anvil resists the pushing force. The mover exerts more energy when pushing an anvil than flicking a balloon. The anvil would require Strong force, while the balloon would require Light force. In both of these examples acceleration is a visual perceiver of the Weight factor. When pushing the anvil the mover decreases in acceleration producing a slow deliberate motion, because of the mass of the object thus conveying a sense of significant mass.\(^{38}\) When pushing the balloon though, the mover accelerates and produces a quick action that conveys a lighter mass.\(^{39}\)

The Weight factor is not body weight, but the relationship to gravity. Light tends to have less muscle tension and the Weight is more extended or spread out with an expanding quality to it. Strong tends to have muscle tension, a focus around the center of
the body, with movements near the center and actions that are constricted. Light also has the tendency to be directed upwards, while Strong is directed downward.\textsuperscript{40}

Figure 4.3 illustrates an example of the Light Weight quality. The performer’s movements are delicate and Light due to the acceleration. The performer’s arms have very little resistance in the Indirect gesture of the arms. There appears to be very little tension in the gesture, the quick acceleration achieves much of Light quality.

![Figure 4.3: Light example (Choreographer/performer Robin Anderson).](image)

Figure 4.4 illustrates how Strong Weight is expressed by the decrease in acceleration. Tension, resistance, struggle can be perceived in the performer’s Direct movement. As the performer moves screen left his movements decline in acceleration, producing a sense of mass.
Assessing the action

In assessing the Weight qualities, an observer should consider:

- Is the mover accelerating or decreasing in acceleration? Weight in movement observation is most readily visible in acceleration and deceleration of the body.

In animation these terms are called slow out and slow in respectively. For movement to appear to be strong or of great force it begins to move gradually because there is some resistance. For something to appear Light there is immediate reaction and little resistance.

In animation, Weight is expressed by the space between key frames.

Some significant points regarding the motion factor of Weight

**Weight:** The amount of energy the performer exerts

**Light:** Buoyant, delicate, easily overcoming gravity, marked by decreasing pressure
  Examples: Dabbing paint on canvas, the movement of a feather

**Strong:** Powerful, having an impact, increasing pressure into movement
  Examples: Punching, pushing a heavy object, expressing a firmly held position

**Animation association:** Slow in/Slow out
4.4 Time: The performer’s urgency to make a decision

Time is comparable to a readiness to make a decision, either suddenly or with sluggishness. The elements of time are Sustained actions (going with the progression of time) and Sudden actions (going against the duration of time). Sustained actions can be personified as calm or lingering, while Sudden actions are excited or immediate. Sustained and Sudden actions are distinct from the measurable aspects of time; the measurable (quantitative) duration of something. These elements characterize the quality of the movement rather than being definitive. For example, Sustained does not mean slow. It means a slow tempo of movement. Sustained actions tend to have large expanded body movements, while Sudden can tend to encompass small movements or isolated gestures.41

Figure 4.5 illustrates the quality of Sustained movement. The performer’s actions appear to be very lingering. The performer goes through a long duration to complete the Direct + Light movement. In her actions there is a tendency to use large expansive body movements, such as the arm movement.

Figure 4.5: Sustained example (Choreographer/performer Kristin Hapke).
Figure 4.6 illustrates the quality of Sudden movement. Sudden time is conveyed by the Direct + Light actions of the performer (Figure 4.6). The performer's actions also display a tendency of Sudden time, in which actions are small or isolated and a short span of time and distance is involved in the movement. In this case the small yet quick kicking actions.

![Figure 4.6: Sudden example (performer Christina Providence).](image)

**Assessing the action**

In assessing the Time qualities, an observer should consider:

- Are the performer's movements small or large? Sustained movements have a tendency to encompass large expansive body movements, while Sudden has a tendency to be isolated. Determine if the actions are small isolated gestures or large body movements. Decipher the pacing of the actions, whether immediate or belated?
Some significant points regarding the motion factor of Time

**Time:** The performer’s urgency to make a decision

**Sustained:** Lingering, leisurely, indulging in time

Examples: Stretching to yawn, stroking a pet

**Sudden:** Hurried, urgent

Examples: Swatting a fly, grabbing a child from the path of danger

### 4.5 Flow: The amount of tension in the performer’s movements

Flow is tied with feeling or how someone feels in movement. The elements for Flow are *Free* (going with the continuity of movement) and *Bound* (going against the flow of movement). Free can be seen as easy going, outgoing, or fluent actions while Bound is controlled, restricted, or withheld. Free perpetuates movement while Bound is prepared to stop at any moment; very much in control. Free Flow movements can have a tendency to be off balance, swinging, or spreading out while Bound may be held, isolated, and be in balance. Flow describes changes in muscle tension, for example in a Free Flow movement the limbs may appear to be in a state of free fall with no muscle tension in opposition.

Figure 4.7 illustrates an example of the Free Flow movement quality. In this Free Flow movement the performer’s movements are almost like a wave. The performer’s swing of the body appears to be very fluent. It’s as if energy is flowing throughout the joints in her body uninterrupted, until the energy has ceased. The movements are initiated by the pelvis, and this action flows freely throughout the body. In animation this can be equated to follow-through.
In Laban’s writings Free Flow is generally seen in movements that originate in the trunk (torso) of the body and gradually flow out through the arms, legs, or head. It’s as if the energy in the body, like a current of electricity, flows unhindered to the outermost reaches of the body and out into the environment.

With Bound Flow the opposite transfer of energy occurs. Instead of the torso initiating the flow of energy and it spreading outward, the extremities (such as arms or legs) initiate the flow of energy inward. With Bound Flow the energy may initiate with the hands, the tension then travels to the forearms, the upper arms, the shoulders, and to the torso. Free Flow is a release of energy and Bound is a withholding of energy.

Figure 4.8 illustrates the Bound movement quality. The performer’s movements are withheld, and strictly controlled. The performer’s actions are quenched and there is not a real build up or release of energy.
Assessing the action

In assessing the Flow qualities, an observer should consider:

- With Free Flow, are the actions initiating from the torso and spreading out to extremities? With Bound Flow, are the extremities moving but the torso is held?

Some significant points regarding the motion factor of Flow

**Flow:** The amount of tension in the performer’s movements

**Free:** Uncontrolled, abandoned, unable to stop in the course of the movement

  Examples: Waving wildly, shaking off water

**Bound:** Controlled, restrained, able to stop

  Examples: Moving in slow motion, tai chi, carefully carrying a cup of hot liquid

**Animation association:** Follow-through
CHAPTER 5

EFFORT QUALITIES FOUND IN EMOTIVE BASED PERFORMANCES

5.1 The significance of observing and interpreting emotions

"In animation, creating the ‘illusion of life’ boils down not to mannerisms and naturalistic movement but to emotion. The audience empathizes with emotion."\textsuperscript{46} The intent and purpose of the animator is to communicate by utilizing the language of movement to provoke feelings, thoughts, and ideas in their audience. Emotional expression is a significant aspect of a character that is used to connect the character with an audience.

5.2 Application of Effort theory

To demonstrate how Effort can be utilized in the creation of animation, several actors from Ohio State University’s Department of Theater were asked to create several expressive movements. These movements function as a live action reference to be analyzed using Effort. Following the Effort analysis, the Effort qualities found in the actors’ performances then are applied to an animated character. The animated character then is animated in light of the Effort qualities, thus conveying an interpretation that expressively resembles the actors’ intent.
5.3 Analyzing emotive performance using effort

To analyze human expressive actions utilizing Effort actors were asked to perform in the emotional states of anger, joy, and sadness. The actors were motion captured in this study (as opposed to video taping them). Motion capture served as a way of focusing on the Effort qualities found in the performances, while excluding facial information, or any other peripheral information. Motion capture allows for a focus on the performer’s movements and not upon tangible or environmental distractions. The actors’ training is based upon the teachings of Sanford Meisner. The emphasis in Meisner approach is in the “Reality of doing,” which can be described as follows: the actor does not pretend but lives truthfully in the given circumstance with which he/she is provided⁴⁷. The exercises and techniques of this approach encourage the actor to live in the moment, by being alert to what is occurring in the given circumstance. The actor faithful to Meisner’s teachings will perform by instinct rather than to intellectualize a role. If the performer intellectualizes the performance it is likely that social constructs will impede upon the truth of the performance⁴⁸. By the actor bowing to instinct, the performer can’t make social judgments but will respond in truth to what is happening on stage.

5.4 The Motion Capture session

The actors involved in this study, in aid of living truthfully, created situations or scenarios in which they had to respond. These scenarios often involved props of some kind, like a typewriter, or a table. The props allowed the actors to have a task they would endeavor to do, which if the task was difficult offered the actor a situation in which they
had to truthfully respond. The props also, in line with the Meisner instruction, involved
the reality of doing. No mime is used, the actors have to actually do what is before them.

5.5 Analysis of the angry performances

![Image](image_url)

Figure 5.1: An actor’s interpretation of anger #1.

*Anger #1-Figure 5.1*

*Scenario*

The actor had brought in a typewriter that was extremely difficult to use. It would
malfunction. The actor had the task of typing a letter on this typewriter in a limited
amount of time. The actor’s goal or objective was to type a letter in a short span of time,
with the typewriter was the obstacle. In anger, an obstacle (hindrance) was one of the
prime causes of the emotional state.

*Space: The focus of performer’s attention*

The performer moves very Direct, there is a clear focus of direction in the actions.
The stomp of the foot has a spatial goal.
**Weight: The amount of energy the performer exerts**

The performer moves with a sense of force. There is a prominent sense of gravity or weight in the movement, such as when the performer stomps on the ground or pounds the table. The stomping movements exhibit a Strong weight quality.

**Time: The performer’s urgency to make a decision**

There is a clear urgency about the performer’s actions. The overall character of the timing is of Suddenness. The performer displays an erratic sense of timing, for instance, the performer’s foot is quickly tapping on the ground.

**Flow: The amount of tension in the performer’s movements**

There is very little Flow in the performer’s actions. The body moves as a solid compacted mass without ever flowing dominantly. The performer’s energy resists a Free Flow quality and is more a Bound flow. When the performer pounds on the table or stomps on the ground the action appears not to reverberate noticeably throughout the body, but instead seems to withhold the stream of energy.
Anger #2-Figure 5.2

**Scenario**

The actor created a situation in which they were angry at a friend for betrayal. The performer's task was to write their friend a note composed of smashed dishes. Only the walking section of this performance was utilized here.

**Space: The focus of performer's attention**

The performer moves very Direct, there is very little divergence from the goal.

**Weight: The amount of energy the performer exerts**

A Strong Weight quality is captured in this movement, with great resistance to gravity in each step.
Time: The performer’s urgency to make a decision

This movement is very urgent. There is quickness to the foot steps and the movements of the arms. The timing is very sudden.

Flow: The amount of tension in the performer’s movements

The movement is more withheld then loose. The performer’s arm is constricted or withheld and the torso is very rigid. The Flow is Bound.

5.6 Analysis of the joyful performance

![Figure 5.3: An actor’s interpretation of joy #1.](image)

Joy #1- Figure 5.3

Scenario

The performance of joy involved the actor recollecting past experiences with friends dancing, and having fun. With joy a carefree attitude was characteristic of its quality.
Space: The focus of the performer’s attention

The performer does not have a clear area of attention, but instead appears multi-focused. The performer’s gestures seem to not have a specific goal. The Space is Indirect.

Weight: The amount of energy the performer exerts

The performer moves with an easy going quality. There was very little resistance in the overall character of the movement. As the performer changes a direction the body quickly moves along with the new direction and is then slowed down (slow out). The performer moves with a very Light quality.

Time: The performer’s urgency to make a decision

The overall character of the performer’s movements is a Sustained quality. There is no urgency in the movements. The whole body appears to be involved in the movement, thus displaying a lingering quality to the movement.

Flow: The amount of tension in the performer’s movements

The performer’s movements appear very loose, or Free Flowing in movement. The performer moves as if the energy travels throughout the body uninterrupted, thus exhibiting a very fluent quality of movement.
Joy #2 - Figure 5.4

Scenario

In this performance of a joyful experience the actor composed a situation, in which they're preparing to surprise a friend.

Space: The focus of the performer's attention

The performer moves with a clear goal in mind. Spatially Direct.

Weight: The amount of energy the performer exerts

The movements appear to have acceleration in them, producing a very Light quality.

Time: The performer's urgency to make a decision

The performer's actions are fairly quick and Sudden. The steps don't appear to be far in distance but rather short.
Flow: The amount of tension in the performer’s movements

The performer appears to be very Bound in movement, particularly in the chest and the left arm.

Figure 5.5: An actor’s interpretation of sadness #1.

5.7 Analysis of the sad performance

Sadness #1- Figure 5.5

Scenario

This performance of sadness involved the actor sitting on a table, while placing pictures in a photo album. The pictures had some sentimental value to the actor. With sadness there is a sense of focusing on the cause of that sadness, which can be memories or recollections of the past.

Space: The focus of the performer’s attention

The performer has a very clear focus of attention. The performer’s head, arms, and torso aim at a singular location in space. This is spatially Direct.
**Weight:** The amount of energy the performer exerts

The performer moves with little to no force at all, because there is very little overall movement in this performance. When the performer moves the actions have a very Light quality to them. This delicacy can be attributed to the slow out progression of the actions.

**Time:** The performer's urgency to make a decision

The overall character of the performer’s movements is a Sustained quality. There are spans of very little movement. When the performer moves it has a lingering or slow quality about it.

**Flow:** The amount of tension in the performer movements

Flow is not dominant in this performance, but if there were any traces of it, it is Free Flow. The performer does not appear Bound, neither heavily free.
Figure 5.6: An actor’s interpretation of sadness #2.

Sadness #2- Figure 5.6

Scenario

In this performance of sadness the actor was walking into the environment and sat down drawing a picture.

Space: The focus of the performer’s attention

The performer’s actions have a linear quality to them. This is spatially Direct.

Weight: The amount of energy the performer exerts

Strong Weight is apparent in this movement. This may be a result of the body not appearing to accelerate quickly.

Time: The performer’s urgency to make a decision

The timing is Sustained.
Flow: The amount of tension in the performer movements

Free Flow is apparent in the arms, specifically the forearms and hands follow-through.

5.8 Analysis summary

The analysis of these six performances is subjective, but Effort descriptions support the interpretations (Table 5).

<table>
<thead>
<tr>
<th>Effort</th>
<th>Anger #1</th>
<th>Anger #2</th>
<th>Joy #1</th>
<th>Joy #2</th>
<th>Sadness #1</th>
<th>Sadness #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space</td>
<td>Direct</td>
<td>Direct</td>
<td>Indirect</td>
<td>Direct</td>
<td>Direct</td>
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<tr>
<td>Weight</td>
<td>Strong</td>
<td>Strong</td>
<td>Light</td>
<td>Light</td>
<td>Light</td>
<td>Light</td>
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<tr>
<td>Time</td>
<td>Sudden</td>
<td>Sudden</td>
<td>Sustained</td>
<td>Sudden</td>
<td>Sustained</td>
<td>Sustained</td>
</tr>
<tr>
<td>Flow</td>
<td>Bound</td>
<td>Bound</td>
<td>Free</td>
<td>Bound</td>
<td>Free</td>
<td>Free</td>
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</tbody>
</table>

Table 5: Effort qualities for motion captured performances

These interpretations delineate the tangible movements of the actor into four fairly intangible qualities of movement. When observing and interpreting the actors’ performances certain qualities seem to be more dominate than others, such as in the case of sadness. In the actor’s portrayal of the emotion of sadness, flow seems to be non-existent and weight seems to be subordinate. However space and time were dominating factors. The slowness of the performer’s actions in conveying sadness and the direct
focus (as if the performer is thinking of something they lost) are dominating themes in this interpretation. In the joyful and angry performances all four motion factors share a role in the interpretation. In transferring these intangible qualities to animation the animator is presented with a set of motivations in approaching their character’s actions.
CHAPTER 6

EMOTIONAL QUALITIES: APPROACHING ANIMATION WITH A BASIS IN EFFORT THEORY

Case Study: Animating based upon the Effort qualities

With the Effort qualities described for the six expressive performances, these qualities can now help define an animation (Table 6). The Effort qualities are utilized primarily in the blocking out stages of the animation. The qualities help define the tempo of the character’s actions, the attention to weight, spatial focus, and fluency in action. Once the blocking and general posing is established the animations are refined more subjectively and liberally. The Effort qualities reveal the overall character of the performance, which is adapted in the roughing out/blocking stage of animation, and then built upon with more complex actions.

<table>
<thead>
<tr>
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<td>Weight</td>
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<tr>
<td>Time</td>
<td>Sudden</td>
<td>Sudden</td>
<td>Sustained</td>
<td>Sudden</td>
<td>Sustained</td>
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<tr>
<td>Flow</td>
<td>Bound</td>
<td>Bound</td>
<td>Free</td>
<td>Bound</td>
<td>Free</td>
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</tr>
</tbody>
</table>

Table 6: Effort qualities for anger, joy, and sadness.
In animating this character, facial expressions were included to help produce a clear expressive character animation. Facial features contribute to the recognition of emotions. The face helps establish the emotional state the character is conveying, and may contribute to the appeal and strength of the performance. The timing of the facial expressions is based upon the Time Effort qualities.

![Angry animation #1](image)

**Figure 6.1:** Angry animation #1.

**Angry animation #1- Figure 6.1**

_Space: The focus of the performer's attention_

Spatially the character is focused on one particular area, and does not expand. The character has a Direct quality of movement (Figure 6.2).
Figure 6.2: Angry animation #1 Space analysis.

Weight: The amount of energy the performer exerts

The Weight is Strong and is achieved by the spacing of key frames. In this case the key frames slowly accelerate. In Figure 6.3, the foot resists the upward movement of the body creating a sense of decreased acceleration.

Figure 6.3: Angry animation #1 Weight analysis.
**Time:** The performer’s urgency to make a decision

The animated character moves with sudden timing. The foot stomp of the character is fairly quick (Figure 6.4).

![Figure 6.4: Angry animation #1 Time analysis.](image)

**Flow:** The amount of tension in the performer movements

The Flow is Bound. This is achieved by restricting the amount of follow-through in the body, maintaining a consistent pose, and withholding the surges of energy that flow through the character (Figure 6.5).

![Figure 6.5: Angry animation #1 Flow analysis.](image)
Figure 6.6: Angry animation #2.

Angry animation #2 - Figure 6.6

Space: The focus of the performer's attention

The character moves in a very linear manner. This is spatially Direct. Figure 6.7 illustrates the linearity of the arm's movement.

Figure 6.7: Angry animation #2 Space analysis.
**Weight: The amount of energy the performer exerts**

The Strong Weight quality is pronounced because of the (acceleration or deceleration) slow in/slow out technique. Figure 6.8 illustrates the character's body movement resisting acceleration.

![Angry animation #2 Weight analysis.](image)

**Time: The performer's urgency to make a decision**

The character moves are Sudden movements throughout the body. The character's arms and the pacing of the steps are fairly quick (Figure 6.9).

![Angry animation #2 Time analysis.](image)
Flow: The amount of tension in the performer movements

The Flow throughout the character’s body is withheld. The hands lead the forearms and upper arms, this reverses the free flow pattern of movement which flows from the torso to the limbs (Figure 6.10).

Figure 6.10: Angry animation #2 Flow analysis.
Joy animation #1 - Figure 6.11

Space: The focus of the performer's attention

The character moves indirectly using very expansive actions, very little narrow movements. Figure 6.12 illustrates the flexible arm and torso movements of the character.

Figure 6.12: Joy animation #1 Space analysis.
Weight: The amount of energy the performer exerts

The arms and legs Flow Lightly along with the body. This is achieved with slow out spacing. Figure 6.13 illustrates how the character's hand quickly eases out.

Figure 6.13: Joy animation #1 Weight analysis.

Time: The performer's urgency to make a decision

The Sustained timing is achieved with follow-through in the arms and the duration (Figure 6.14).

Figure 6.14: Joy animation #1 Time analysis.
Flow: The amount of tension in the performer movements

The animated character was given large sweeping arcs to capture the Free Flow driving action (Figure 6.15).

Figure 6.15: Joy animation #1 Flow analysis.
Joy animation #2 - Figure 6.16

Space: The focus of the performer's attention

The character's actions are very linear and don't involve too many rotations in other axes. This is very spatially Direct. Figure 6.17 illustrates the linearity of the arm movement.

Figure 6.17: Joy animation #2 Space analysis.
Weight: The amount of energy the performer exerts

The Light quality is incorporated by working with the slow in/slow out spacing (Figure 6.18).

![Figure 6.18: Joy animation #2 Weight analysis.](image)

Time: The performer's urgency to make a decision

Sudden timing or short durations and small distances is utilized in the animation (Figure 6.19).

![Figure 6.19: Joy animation #2 Time analysis.](image)
Flow: The amount of tension in the performer movements

The arms, torso, and head follow-through movements are minimized to capture the bound flow quality of the movement (Figure 6.20).

Figure 6.20: Joy animation #2 Flow analysis.
Figure 6.21: Sadness animation #1.

Sadness animation #1 - Figure 6.21

*Space: The focus of the performer’s attention*

The animated characters movements do not expand grandly but remain primarily narrowly focused, for a Direct quality (Figure 6.22).

Figure 6.22: Sadness animation #1 Space analysis.
Weight: The amount of energy the performer exerts

The character moves with a very Light quality, but when the hands drop down they convey a Strong quality to it. The top panel of Figure 6.23 illustrates the Light quality of movement as the character’s hands unfold, and the bottom panel displays the Strong quality added to the animation.

![Figure 6.23: Sadness animation #1 Weight analysis.](image)

Time: The performer’s urgency to make a decision

Sustainment was an aspect of the actor’s performance. Therefore the animated character’s movements encompassed a significant amount of time. When the animated character moves its hands the whole arm is utilized to conveying the feeling of a laborious or time consuming sensation (Figure 6.24).
Flow: The amount of tension in the performer movements

Free Flow is conveyed by the follow-through actions in the character’s body (Figure 6.25).
Sadness #2 - Figure 6.26

Space: The focus of the performer’s attention

The character’s movements are very linear and directional. This is spatially Direct. Figure 6.27 illustrates the arm’s linear movement.

Figure 6.27: Sadness animation #2 Space analysis.
**Weight: The amount of energy the performer exerts**

The character’s Weight quality is Strong. The character’s spacing is not based on quick accelerations but a resistance to it (Figure 6.28).

![Figure 6.28: Sadness animation #2 Weight analysis.](image)

**Time: The performer’s urgency to make a decision**

The character’s timing is somewhat long and Sustained. The character’s feet linger back a bit before stepping (Figure 6.29).

![Figure 6.29: Sadness animation #2 Time analysis.](image)
Flow: The amount of tension in the performer movements

The character’s Flow is Free, and this is achieved in the follow-through actions in the torso to the head, and throughout the body (Figure 6.30).

Figure 6.30: Sadness animation #2 Flow analysis.
CHAPTER 7
LOOKING AHEAD

7.1 Conclusion

Life is indispensable to the animator, it’s their teacher. If the quality of animation is to rise then animators must find ways to learn from the world around them. In this thesis the animator’s ability to see qualities of human movement is the focal point. Animators need ways to enable them to see movement clearly and concisely. This thesis presents beginning animators with an approach for the observation and interpretation of expressive movement based upon Effort theory. The animator utilizes the Effort vocabulary in interpreting the overall quality of an expressive movement. These qualities form the foundation of the animator’s character movements.

Effort theory benefits the animator in the following ways:

- Effort provides the beginning animator with a vocabulary by which to communicate the expressive language of a movement.
• The interpretations are based upon movement factors which will help reduce the tendency to copy every nuance from the live action reference.

• Effort interpretations present beginning animators with a conceptual guide for their characters movements. This grants the animator more liberty in breaking away from the poses, exact timing, and gestures found in the live action reference.

• By interpreting the character of a movement the animator is not dependent upon a particular vantage point, the animator can take the movement qualities and transpose that to whatever vantage point they desire to work in.

• Effort also enables beginning animators the ability to interpret from a real time reference rather than viewing the reference frame by frame, as in rotoscope or with the Photostats.

• The beginning animator’s interpretations are subjective. The animator may observe particular motion factors as being more dominant than others.

• Effort also clarifies the action into a set of movement combinations, which can help reduce the nuances found in the live action reference.

The Effort based approach to observing and analyzing human movement is an
alternative to the rotoscope and Disney method employed in the past. The Effort based approach is distinguished because it permits the animator to observe the specific movement qualities occurring in a movement. The Effort based approach focuses the animator's attention to four motion factors and these motion factors help uncover what analytically is occurring in the movement. By observing the performer and classifying their movements in light of these categories the animator is able to specifically analyze the differences between movements that are expressively diverse. This approach permits the animator a process by which they can simulate the qualities analyzed from the live action reference to their animated characters. With this approach animator does not have to match the exact movements of the performer, but rather tries to capture the Effort or feeling/energy of the movement. By utilizing this approach the animator has the liberty to devise the type of performance they desire while maintaining a connection to human movement.

In this thesis Effort shows how it can help reveal some expressive information about performance and be utilized in animation, but other areas of Laban Movement Analysis (LMA) may need to be considered and explored to see movement in a greater degree. The four movement factors of Effort can only reveal so much information to the viewer, and that information may not be subtle enough. Movement is more rich and varied then what Effort can see, it will perhaps take exposure to more of LMA to help the animator to see in a greater capacity.
7.2 LMA and animation education

Beginning animators can benefit from basic instruction in LMA. For beginners there is a need to be able to analyze movement in clear, concise ways, in which LMA may be a warranted direction of pursuit. As this thesis demonstrates Effort can enrich the animator’s sensibilities, Effort among other LMA areas, should be considered as aspects of the beginning animator’s education. As of late, there appears to be so much literature available to beginning animators on the process of animating, from the principles of animation to the latest technological feats, yet it seems that the animator’s literacy about movement is unaddressed.

LMA should warrant consideration as being included in an animator’s curriculum. Animators could take courses in LMA, and have the opportunity to experience the concepts through performance. By having the opportunity to experience the LMA concepts physically the animators could better connect the concepts with movements.

The LMA course could perhaps benefit most if it were taken with an intro animation course. By having beginning animators introduced to LMA in the early stages of their animation education, they could begin to develop a basic vocabulary by which they could discuss movement and observe it more clearly. Intro animation courses generally help establish a comfort level with the student and animation. The student begins to learn the language of animation, the process, tools, vocabulary, and principles of animation. At this stage the student is building a foundation through class room exercises and assignments. By introducing LMA at this stage, students could begin develop their eye and synthesize that vocabulary with the animation concepts their
presented with.

By integrating LMA into the animator's curriculum, animators could have a vocabulary by which to classify movement. By having such a system in place student animators and their instructors will have an opportunity to have a dialog about movement and expression that generally may have been difficult in times past. LMA grants animators a vocabulary by which they can speak intelligently about movement.
1. The animator made a tracing over the Photostats (Figure 2.4). This tracing differs from the process of rotoscope where the nuances in movement are retained, but in this stage the animator subjectively chooses what's significant (Figure 2.5). The animator subjectively selected what was to be emphasized, retained, or removed. The animator would flip through the Photostats and subjectively delineate the actions that conveyed the type of performance they wanted to present.⁵⁰
2. The animator then moved from the Photostats and began to capture the same action in their rough drawings (Figure 2.6). Depending on the live action reference performance, the animator could match the timing fairly closely or modify it. The focus in this stage was to take the action from the Photostats and translate it into the proportions and anatomy of the characters. Notice in this example, how poses differ between the Photostats and the rough animation. The animator’s interpretation seems to be more liberal and not exact.

3. The animator would then proceed to animate normally (Figure 2.7).
refining process the animator would refer back to the Photostats to modify actions, refer to how a part of the body was moving, or utilize the reference as a model in actions difficult to draw, like in figure drawing.\textsuperscript{52}

Figure A.4: Animation refinement.

Through this process the animator interprets the live action reference into a single, strong, clear, direct statement.\textsuperscript{53} The nuance found in the Photostat was subjectively filtered by the animator’s observations and reinterpreted into the form of the character.
APPENDIX B

IMAGE AND MEDIA CREDITS

Figure 2.1 is from the DVD *Snow White and the Seven Dwarfs* (Disney Special Platinum Edition), Burbank, Calif.: Walt Disney Enterprises: Distributed by Buena Vista Home Entertainment, 2001.

The following images are from *The Illusion of Life* by Frank Thomas and Ollie Johnston (Hyperion 1995): Figures 2.2, 2.3, A.1, A.2, A.3, and A.4.

The following images are from the DVD companion to Vera Maletic’s *Dance Dynamics: Effort & Phrasing*, Columbus, Oh: Grade A Notes, 2005. Figures 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, and 4.8.

In chapter 4, the significant points regarding the Effort qualities is largely from *The Emote Model for Effort and Shape* by Diane Chi, Monica Costa, Liwci Zhao, and Norman Badler. ACM Siggraph 2000.

Table 4.1 is based upon a table occurring in Vera Maletic’s *Workbook for Effort Dance Dynamics: Phrasing*, 2000.
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