INTEGRATING 3D AND 2D COMPUTER GENERATED IMAGERY FOR THE COMICS MEDIUM

A Thesis

by

RUBEN DELUNA JR.

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 2004

Major Subject: Visualization Sciences

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Approved as to style and content by:

Karen Hillier (Chair of Committee)	Mary Saslow (Member)
Donna Hajash (Member)	Phillip J. Tabb (Head of Department)

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ABSTRACT

Integrating 3D and 2D Computer Generated

Imagery for the Comics Medium. (December 2004)

Ruben DeLuna Jr., B.S., Texas A&M University

Chair of Advisory Committee: Prof. Karen Hillier

Advances in 3D computer technology have led to aesthetic experimentation within the comics medium. Comic creators have produced comic books done entirely with 3D models that are then assembled digitally for the printed page. However, in using these 3D objects in a comic format, the creators have developed art styles that do not adhere to the paradigms established by this traditionally 2D medium. More successful results can be achieved by integrating 3D computer generated imagery with traditional 2D imagery, rather than replacing it.

This thesis develops a method of combining rendered 3D models with 2D vector graphics to create a comic book art style that is consistent with the traditional medium, while still taking advantage of the new technology.

DEDICATION

For my grandmother,

Maria Reyes Torres

March 10, 1927 – August 6, 2002

who taught me that a few sheets of paper

folded in half can be a comic book

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CHAPTER I

INTRODUCTION

The term “comics” is most often associated and used interchangeably with “comic books” and “comic strips,” which fails to recognize that the term actually refers to the medium as a whole and not any specific framework (McCloud 1993). In its purest form, the comics medium is essentially descended from two higher art forms, literature and art, but with the intention of integrating the two to convey meanings and ideas that could not be created by either of these art forms alone (Magnussen and Christiansen 2000). However, despite this, comics maintain a stigma of being a tainted medium due largely to its association with being a children’s medium and the comic market obeying the rules of commerce, where marketability often overrules its worth as art (Magnussen and Christiansen 2000). In many cases, the goals and direction of the medium are dictated by technology as well as commerce. From the advent of mass production and the printing press to the digital distribution of online comics on the internet, technology has played a part in how comics are viewed by the reader as well as how they are created by the artists. One relatively new form of technology, three-dimensional computer generated imagery (3D CGI), has yet to find its place in the comics medium. The use of 3D CGI in comics has been explored over the last ten years but with little success, and has yet to become a mainstay in comic production and aesthetics.

This thesis follows the style and format of the *American Journal of Education.*

Scott McCloud (2000, p. 143) states that integrating computers in comic production often "helps or hinders the goals of the artists without significantly changing the nature of these goals". However, 3D CGI creates an opportunity for artists to evolve the current aesthetic goals of the comics medium by building upon, but not being restrained by, the rules of the current paradigm.

Analyzing the foundation of modern comics requires establishing what characteristics define the medium. Defining what constitutes a comic not only refines the scope of what formats are currently applicable within the framework, but also the origins of the medium. Will Eisner (1985, p. 5) defines comics as simply "sequential art", however this would include everything from comic strips to Monet's sequence series paintings, diagrams and stained glass windows, all of which qualify as art in sequence (McCloud 1993). If this broad definition of comics is used, then the origins of the medium are virtually untraceable, with possible foundations lying in Egyptian and Greek paintings or Japanese scrolls. Scott McCloud (1993, p. 9) offers the refined definition of comics being "juxtaposed pictorial and other images in deliberate sequence, intended to convey information and/or to produce an aesthetic response in the viewer". However, many feel that this definition is still too malleable in that it attributes text as another image, allowing it to be wholly absent. The role of text in the medium is largely debated, stemming from concerns on the illustration's ability to convey a narrative on its own. Amy E. Spaulding (1995) argues that illustrations are not subordinate to the words and that the narrative in any comic story is shared. She also states that it is accepted that an image can stand alone, and the reader is expected to comprehend plot and

characterization development even if not explicitly stated in words. Defining comics is somewhat relative to the context in which it is used, but should never serve to restrict any type of art style or literary method from the process. For the context of this research, comics will be defined as images in a deliberate sequence, with or without text, used with the intention of conveying a story or an idea in a printed medium.

More specifically, the scope of this research will primarily focus on one of the more popular forms of the comics medium: the comic book. With over 4000 news agents and comic specialty shops in the United States, American comic books usually attract a readership that is largely males between the ages of eight and 28 years (Magnussen and Christiansen 2000). This demographic reflects a lack of diversity amongst comic book readers and produces an active readership in the U.S. below 500,000 (McCloud 2000). McCloud (2000) believes the limited readership may result from the lack of gender and racial diversity amongst comic creators, as well as the majority of mainstream comic books today being limited to the superhero genre. However, it is the opinion of this researcher that comic books should not be confined by allowing a specific genre to dictate formulas for character development and solid storytelling.

It is fairly accepted that the turning points in comic production and distribution revolve around technical advances. The most pivotal event came with the advent of the printing press in the mid 15th century, which would eventually lead to what are perceived as the modern forms of the comics medium: the newspaper comic strip and the comic book (McCloud 1993). America's first comic strip entitled *The Yellow Kid* would appear in newspapers in 1895, and the first American comic book, *Famous Funnies*, would

print in 1934 (Sabin 1996). Also by the turn of the 20th century, a four-color printing process made color available in newsprint and allowed for the use of flat primaries in comics. With the new color technology came increased costs, but the more attractive comic art also boosted sales (McCloud 1993). By the 1970's, color printing technology would allow for more than just flat primaries to be utilized and the decade would also herald the origins of computers producing art. Computing capabilities in the 70's allowed the filtering of real world images or imitations of the real world, as well as the production of images only a computer could create. This led to the 1980's in which graphical user interface on computers would allow for the introduction of CGI to comics, despite the hampering of slow processing speed and power (McCloud 2000).

The processes involved in the production of a comic book include penciling, inking, lettering, coloring, and page layout and until this point all of these jobs had been done by hand. In June 1985, *Shatter* the "first digitally produced comic book" was published by First Comics, Inc.. In early issues, the images were drawn on the computer using a mouse, but eventually would be drawn using a stylus. The images were then printed out and colored traditionally by hand, requiring an enormous investment of both time and expense (Szadkowski 2000). In 1990, *Batman: Digital Justice* was released by Pepe Moreno which would be at the forefront of integrating 3D modeling with 2D art. The book utilized 3D modeling programs as well as raster and vector painting programs to create a completely digital product that took over a year to complete (Szadkowski 2000). However, despite resurgence in Batman popularity, *Digital Justice* went by virtually unnoticed. The 1990's would see independent comic companies, namely Image

Comics, become the first to utilize computerized coloring in comics (Sabin 1996). By the year 2000, computers would be standard for mainstream companies in the finishing of comics, being used for lettering, page layout and coloring (McCloud 2000).

The year 2000 brought many more experiments in the use of CGI in comic books. Crossgen Comics eliminated the need for inking the penciled artwork by making it a digital process. Also in 2000, the independent company Digital Broome Studios published three different series of comics, each utilizing CGI in different ways. The comic book *Saffire* would use 2D art with 3D textures mapped on top, however this technique was abandoned after the first issue. Digital Broome's *Vagabond* started with traditional watercolor paintings that were scanned in and then digitally painted over and enhanced with 3D supplements. The book *Skinners*, also released that year, would be one of the firsts to be completely composed of 3D models (Szadkowski 2000). With 3D CGI becoming increasingly more popular in movie and television formats, larger companies such as DC Comics soon began experimenting as well in 2000. *Superman #154* used a 3D model for one of its characters and would have it interact with traditional hand drawn 2D characters.

Recently, more books have been created done completely using 3D models. This includes a four-issue series of Spider-man books titled *Spider-man: Quality of Life* published in 2002, with artwork by Blue Dream Studios. The project would be one of the largest comic CGI projects to date with more than 400 frames and nearly 100 pages total. In 2003, Max Comics published *U.S. War Machine 2.0* using all 3D models, and employing some shortcuts by using the same main model with different textures to save

time and cost. However, it is the opinion of this researcher, that the major flaw in these past attempts at integrating 3D models into the comic medium is that artists light, shade, and present the models as they would in an animated movie, and seem more intent on displaying the 3D technology than adapting it for integration into the 2D style that is prevalent in comic book images today. The result is an end product that abandons the 2D fundamentals of the medium and lacks the stylization that makes comics aesthetically pleasing to readers.

Another advance in technology raises the question of whether printed comics will remain a viable medium in a digital age. The internet allows for the display of comics that are all digital, eliminating production costs of a tangible product as well as the subsequent distribution costs (McCloud 2000). McCloud offers that the internet holds more options than ever for comics to grow and evolve and makes the assumption that the comics medium will be completely transferable to the web. However, some raise the question that if various web opportunities such as interactivity, sound or motion are added, is it still considered a comic (Magnussen and Christiansen 2000)? Defenders of the print medium state that there are distinct advantages that print holds over internet comics, both to the readers and to the creators. Print comics are more convenient and portable than online comics that require a computer for internet access. Consequently, print comics are also cheaper to the reader in that they require no hardware to access and are easily accessible to anyone (McCloud 2000). Another advantage is that reading off a computer screen is unpleasant in long duration and print comics offer a sensual experience and the control of being able to touch the paper. Internet comics also create a

problem for creators in that they lose the ability to use the page as a whole for full page layouts (Magnussen and Christiansen 2000). Pacing of the story and quality of the image also becomes controlled by the speed of the internet connection and the quality of the readers' computers, and not by the creator.

Despite these points, some question how long print comics will hold these advantages over web comics, questioning if touch is really a necessary component in the comic reading experience, or if digital comics really create an unwanted separation and loss of intimacy between the reader and the creator (McCloud 2000). The general conclusion is that web comics will not make print comics extinct, instead they will both exist and grow side by side. The internet remains just another tool in the comics medium and not an exclusive next logical step, leaving print a very viable medium for the development of 3D CGI in comics (Magnussen and Christiansen 2000).

Problem Statement

The purpose of this research is to improve the integration of 3D and 2D computer generated imagery so that the integrated style remains aesthetically consistent with the fundamentals of the comics medium. The objectives of this research include defining the mechanics of these fundamentals by examining traditional methods of comic aesthetics, storytelling, production, and layout. Examples will be developed for print to demonstrate the potential for the integration of 2D and 3D mediums in American comic books.

CHAPTER II

ANALYSIS OF THE TRADITIONAL COMICS MEDIUM

Before developing ways to better integrate 2D and 3D computer generated images in the comics medium, it is necessary to have a thorough understanding of the traditional medium. More precisely, the current comic book paradigm must be dissected to understand the rules and narrative techniques specific to the genre. There are currently several pieces of literature on comics, however Will Eisner's *Comics & Sequential Art* (1985) and Scott McCloud's *Understanding Comics* (1993) remain the most thorough and credible sources available. While there are large amounts of diversity in the style and subject matter depicted in comics, there exists a core foundation that is common to most types of comic books. Analyzing this foundation includes understanding the balance between words and pictures to dictate a narrative, as well as breaking down a typical comic book page and understanding the importance of storytelling tools such as panels, balloons, and text. Further analysis will show how these tools can then be used to affect and control the passage of time and motion in a comic book narrative. Page content will also be analyzed to obtain a general understanding of how composition, visual elements such as color and line, and character design have been utilized in the medium. The results of this analysis will establish a set of guidelines to use while implementing the methodology.

The Dynamic Between Words and Images

Comics have long struggled to find legitimacy in both the visual art world and

the literary world. Comics are unique in their blending of the two genres, leading McCloud (1993) to believe that trying to group comics in one category or the other does not do the medium justice. Instead, he feels that the combination of images and words together can transcend what either genre is capable of doing on its own, and thus comics should be treated as its own art form (McCloud 1993). The extent to which words and images are combined and utilized in comics can vary greatly even between individual panels on the same page. These different combinations have been categorized by McCloud (1993) in *Understanding Comics* as follows:

Figure 1a is an example of a "word specific" combination, in which the primary importance is placed in the text. Images serve only as illustrations, with the main narrative delivered through the words. Alternatively, figure 1b depicts a "picture specific" combination in which the primary information is contained in the images and the text adds very little to the overall narrative. A "duo-specific" combination is one in which the images and the words depict basically the exact same idea, neither enhancing the other in any way (see fig. 1c). The example in figure 1d shows a "parallel" combination in which the words and images are seemingly independent from each other with no logical connection. Figure 1e is an "additive" combination where the images and words do serve to enhance each other. Either the image of the man in pain or the dialogue could convey the idea that he has a headache on their own, however the two together serve to better illustrate the idea. The example in figure 1f is a more abstract usage in which the text becomes an integral visual part of the image and functions not only for literal interpretation, but also aesthetic interpretation. This type of combination

is labeled a visual “montage”. Finally, figure 1g represents the ideal combination of words and images, and is the most common combination found throughout comic books. The “interdependent” combination uses both image and text to convey an idea that neither could accomplish alone (McCloud 1993). In this example, the text prompts the question “does this guy look like a C.E.O. to you?”, however in order to answer the question it requires the reader to view the visual associated with it. All of these combinations are legitimate in the comics medium and each offers distinct ways of advancing a narrative. Understanding these different types of balances between words and images is at the core of creating a comic.

Dissecting the Comic Book Page: Panels

Before focusing on content, it is important to realize that there is a general framework involved in creating a comic book page, and the key component in that framework is the comic book panel. Scott McCloud (1993, p. 98) describes the comic book panel or “panel frame” as “the single most important icon in comics”. Comic panels not only serve to divide up action on a page, but they also show that time or space is being divided on the timeline of the overall narrative. Above all else, comic book panels are a means of control for the creator in that they dictate the flow of the story and how the sequence of images unravels for the reader (Eisner 1985).

FIG. 1.—Different combinations of words and imagery (After McCloud 1993).

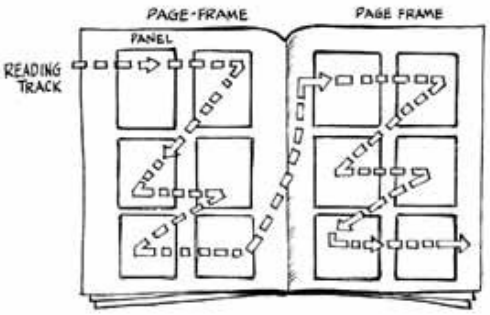
Eisner (1985) points out that panel framing is not limited to only the individual panels on a page but can also entail using the entire page as a frame itself. Page framing gives the opportunity to break a story into larger segments of time, and within that group into even smaller segments of time using panels (Eisner 1985). It is very common for pages to be segmented in an interesting way by making the last panel a "cliffhanger" in an attempt to

make the reader anticipate turning the page. Readers will assume a natural page flow from left-to-right and top-to-bottom; panel arrangements on a page are generally designed under this assumption. However, this flow can be altered and controlled by the creator for either aesthetic purposes or sometimes to create ambiguity (McCloud 1993). Figure 2a gives a general overview with a typical comic book page, while figure 2b depicts an interpretation of reader flow, as well as panel and page framing examples.

Almost just as important as panels is the space inbetween them referred to as "gutters". McCloud (1993, p. 63) maintains that often times the most important actions happen between the panels, calling for reader involvement to provide "closure" by mentally constructing a seemingly continuous timeline. Jumping from the events in one panel to the next panel can often require the reader to essentially fill in the blanks, and it is this potential to involve the reader that makes the gutters such valuable narrative tools.

Panel shapes are also not limited to simple rectangles. On a comic page, panel frame presentation and shape can influence the reading experience, as they become less like a tool and more like an integral part of the art. Will Eisner (1985) offers a few examples of different uses of the panel border in *Comics & Sequential Art,* working under the assumption that the content within a simple rectangle implies a relatively ordinary event in present tense. Figure 3a shows the use of a wavy or distorted panel border which often times is used to depict something as a dream, a flashback, or something happening in the past tense. Figure 3b illustrates the potential for panel

a) A typical comic book page



b) Reading a comic book page

FIG. 2.— Dissecting a comic book page (After Quesada 2004; Eisner 1985).

borders to be integrated creatively into the art as a way of showing both confinement and being aesthetically more interesting than a simple rectangle. Figure 3c is an example of how panel shape can be used to amplify an emotion in the content of the frame. In this case, a person's angry scream is made more powerful by an erratic projecting border.

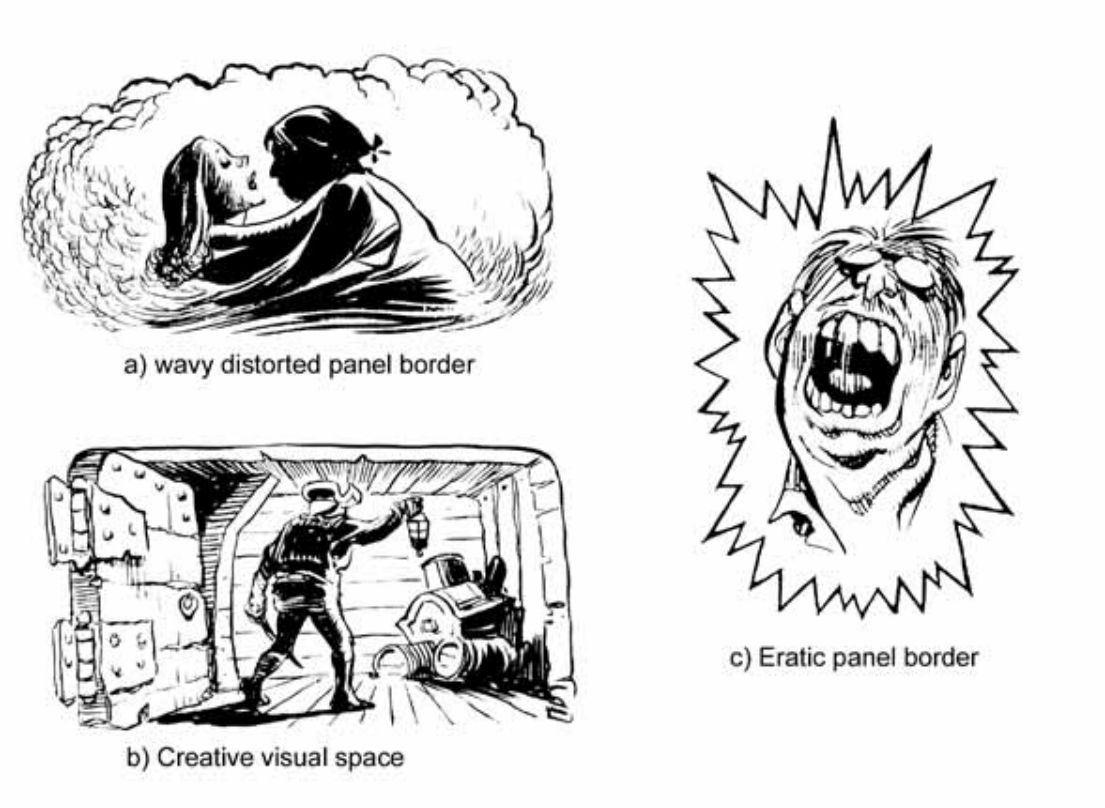


FIG. 3.— Examples of variable panel shapes (After Eisner 1985).

The borderless panel, as shown in figure 4a, is used to imply an open or infinite space. Another technique utilized in comic books that explores this idea of having no confines is the splash page. A splash page uses the entire page as the frame, capturing usually only one giant panel image and extending the picture to where it "bleeds" off the page (see fig. 4b). Eisner (1985) suggests that the splash page is usually reserved as an introductory shot to grab the reader's attention and get them interested in the story or establish a mood. While often times this remains true, single splash pages and often double splash pages, consisting of two juxtaposed pages creating one giant image, are

used throughout a storyline. This usually indicates an important moment in the narrative, or in some cases just a visually stunning moment. Amy Spaulding (1995) supports this conclusion saying that pictures within a story gain importance as the image bleeds into the margins.

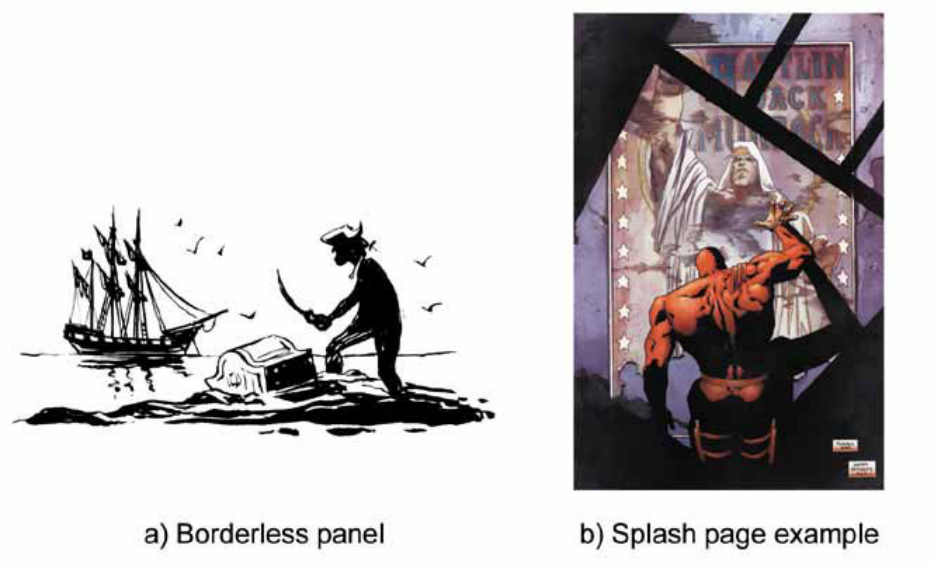


FIG. 4.— Examples of images without panel borders (After Eisner 1985; Quesada 2004).

Dissecting the Comic Book Page: Framing Speech

The comic book panel is the tool used for framing visual imagery, but the balloon is used for framing text, such as speech, thought, or narration. McCloud (1993, p. 134) likens balloons to an attempt "to make sound visible", and Spaulding (1995) adds that a balloon can be used to replace the need for quotes. Essentially, there are two main types

of balloons: dialogue balloons with pointers indicating who is speaking and thought balloons with bubbles indicating who is thinking (see fig. 5a). Like the previous framing tool, these balloons are primarily a means of control for the creator. Placement of the balloons in a scene becomes crucial, not only to the flow of the overall narrative, but also because it determines the order in which dialogue is spoken. Readers interpret balloons within a panel the same way as they read a page, left-to-right and top-to-bottom (Eisner 1985).

FIG. 5.— Various uses of framing text within a comic (After Eisner 1985; Lobdell and Waid 1996).

In much the same way that panel shape influences how readers interpret the content, the outline shape and size of balloons can influence how the text within is perceived. Plain regular shaped balloons are perceived as simple speech in a regular tone. As seen in the second and third examples in figure 5a, changing the shape to a cloudy balloon often indicates thought, whereas sharp balloon edges are used to indicate sounds from electronic devices (Spaulding 1995). Unconventional ways of using the border of a dialogue balloon to convey emotion are being invented all the time, with the only limitations on these shapes being the imagination of the comic creators. Dialogue balloons may have icicles dripping from the bottom to signify a cold, detached statement, or they may be made bold or given a thickened outline to give the appearance of power or anger. The color of a balloon's background is another attribute in balloons that can be manipulated, although this is not as common as altering balloon shape. Typically, the text is printed on a white background for simple speech, however changing this color is a good indicator of emotion or a way to differentiate the speech of certain characters from others (Spaulding 1995). Figure 5b is an example in which the character depicted in this sample panel, is an omnipotent being and his dialogue is made more powerful by changing the balloon background color to yellow and creating bold balloon outlines.

The balloons themselves are not the only ways of conveying information in a comic. There is often information carried in the pointers used to connect the dialogue balloons to the character speaking. A hook shaped or straight pointer is used for simple speech, however jagged pointers can imitate an electronic speech, or wavy pointers can

signify a weakened or stupefied speech (Spaulding 1995). In certain comics, balloons are not used at all, with the text printed directly on the background and relying solely on pointers to convey the dialogue. Often times this choice is aesthetic, and depends a lot on how well the text can be separated from the background (Spaulding 1995).

The last traditional forms of framing speech in comics is through the use of narrative text, and a similar form of this, the caption or lexia. Narrative text is often presented in small dialogue boxes in a comic panel, most of the time with no form of pointer indicating where the speech originated. This narrative text is usually established at the beginning of a story and may be an omnipotent telling of the story if done in third-person. If it is made clear that the story is being told in first-person, usually the main character or a supporting character in the story is the one conveying these narrative thoughts, and this attribution should be held throughout the rest of the story. Sometimes there can be more than one stream of narration from multiple characters in the story at once, and the creator usually must rely on different colored narration boxes or different types of text to distinguish one from the other. Narration boxes can be told in the past tense, with one of the characters looking back on the story they are recounting, or in the present tense with the narrative text basically taking the place of thought balloons. The success of this interpretation depends on the presentation of these narrative boxes, and it is the job of the comic creator to make these distinctions clear in the reader's mind.

Captions or lexias are often presented in the same way as narration blocks, usually enclosed in a rectangular box with no type of pointer to attribute the source of this information. However, there is a big difference between a lexia and the typical

narration block. Spaulding (1995, p. 94) defines the lexia as being "caption information coming strictly from the author" and is completely separate from thought or dialogue. The information contained in a lexia is used to fill in information for the reader that they can not get from the dialogue or images, such as the passage of time or location. Boxes of text such as "Meanwhile…" indicates that the location has changed from the previous scene and that the presented events are happening at the same time. The example in figure 5c indicates a change of location and injects a tone of foreboding into the narrative by saying "Not far enough away… in New York City…". These lexias are crucial for transporting the reader through different scenes and time periods in a narrative story.

Dissecting the Comic Book Page: Text

The text on a given comic book page is typically even more important than the framing around it. Text, or words, is another method of visualizing sound and is mostly used in speech or thought bubbles or for sound effects. McCloud (1993) states that while the typical alphabet is used for this, comic creators are constantly thinking up new symbols and combinations of text to visually represent sound.

Eisner (1985, p. 27) believes that text within dialogue or thought balloons is intended to reflect the "nature and emotion of the speech". Decisions on what this text should look like essentially revolve around the degree of difficulty involved in reading it. Legibility becomes a large factor, and because of this simple block capitals are most often used. Spaulding (1995) states that studies have shown that many people find all

capitals easier to read if the handwriting is unfamiliar to the reader. She believes that this may be because there are usually fewer idiosyncrasies of personal style involved in capital letters than in lowercase letters, making this type of writing less confusing to the reader. Spaulding (1995, p. 174) also points out that traditionally this text is hand-lettered by artists to emphasize that the comics medium is "as much an artist's as a writer's form of storytelling".

While handwritten lettering is often the case, in instances where the artist may wish to imply dignity or a more formal presentation of speech, then a set-type font may be used instead (Eisner 1985). Using a certain set-type font is usually less personal, but can be appropriate in some cases. Similar to this choice, is the choice to hand-letter various types of speech in different ways than a standard legible type. Often times this merely results from an artist's own personal style or aesthetic choice, but can also be used to enhance or reflect the personality of the character speaking or thinking the text (Eisner 1985). In figure 6a, the text and the dialogue balloons are used to distinguish characters from one another. This horror comic features both vampire and human characters. The human characters speak in normal hand-lettered text and dialogue balloons, however the vampire characters speak with a gnarled text and jagged shaped balloon to differentiate them and to make them appear scary. Choosing the type of lettering used in framed speech is a powerful tool to create a personality for a character.

FIG. 6.— Example of uses of text in comic panels (After Niles 2003; Smith 2002).

The second general use of text in a comic book panel is for sound effects. Often times in doing this, the text strays from simply conveying speech or a sound and becomes more visual in nature. This type of text begins to imply action or emotion, not only in a literal translation of the words but also by visual interpretation. Spaulding (1995) refers to words and text becoming a part of the graphic composition as lino-text or lino-language. A common practice in comic books is the use of onomatopoeias such as “blam” or “pow” in which the word’s pronunciation mirrors the sound or impact associated with the word. This text is often presented in bold letters, outlined in black, and colored vibrantly to make it stand out from regular text, as well as the background (Spaulding 1995). This convention is so common in comic books, that a villain in DC

Comic's *Green Arrow* (Smith 2002) named "Onomatopoeia" was created to essentially mock it by only speaking in onomatopoeias (see fig. 6b). In any case, there are no limitations on the presentation of lino-text. Usually, when used as sound effects, they are presented based on aesthetic preferences and in ways to best try to illustrate the sound or emotion.

The Passage of Time in Comics

After learning the basic components involved in designing a comic book page, universal storytelling devices, such as the passage of time in comics, must be analyzed before looking at specific panel content. McCloud's *Understanding Comics* (1993) offers the best breakdown of the way time operates in a comic, and he offers insight on how time passes both within a panel and between panels.

A single panel is not a set increment of time. The amount of time passing in one panel can be as long or as short as the comic creator wishes and is often controlled by the content within that panel (McCloud 1993). Two of the key indicators of how much time is passing within a panel are dialogue or word bubbles and motion. It is important to understand that a single scene in a comic panel does not function as a photographic snapshot of one moment in time. If there are dialogue balloons in the scene, then time is elapsed by the amount of time it would take for each character to say each piece of dialogue. Hence, not even each character in a single panel is depicted in the same moment in time, because their physical and oral reaction is in response to the preceding dialogue or action in the panel (McCloud 1993). In figure 7a, this example shows how

dialogue can effect the time in a scene. Here, this scene lasts as long as it takes for each character to say all seven balloons of dialogue, and in turn, each character is responding to the previous dialogue or action when read from left to right. Consequently, creators are always looking for ways to bypass and control this time rule. Figure 7b is an example from the comic graphic novel *Blankets* by Craig Thompson (2003) in which dialogue and sound effects are overlapped and used, not so much for meaning, but as a means of showing that an indefinite amount of time is passing.

In the event that there is no dialogue in a panel, other indications of time are required from the comic creator. These types of panels can indeed represent a single moment of time even with a narrative block present because, if told in the third-person or in the past tense, then that narration is assumed to exist outside of time (McCloud 1993). However, it should not automatically be assumed that a single panel image is one moment in time. Sometimes panels like this rely on the action depicted to determine the elapsed time. For example, if a panel shows a character throwing a punch, then the panel lasts the amount of time it would take that character to do so (Eisner 1985).

Action is also crucial to the passing of time between panels. For example, if a piece of paper begins burning in one panel and the next panel shows just ashes left, then the time that passed between the two panels is the amount of time it takes a piece of paper to burn. This relies heavily on the reader's ability to provide closure between the panels (McCloud 1993). However, McCloud (1993) indicates a variety of ways to control the way time flows by manipulating the panels themselves to divide time differently.

FIG. 7.— Examples of how time passes in comics (After McCloud 1993; Thompson 2003).

Figure 8 shows the different ways McCloud (1993) believes that panels can influence how a reader interprets time in a comic. The first example in figure 8a uses a blank frame to indicate that there is a pause and moment of silence between the first character's statement and the second character's response. The exact amount of time that the pause takes up lies in the interpretation of the reader. Figure 8b tries to manipulate

the amount of time the reader incorporates with that pause by presenting the pause in a borderless panel. The borderless panel gives the feeling of timelessness, because the scene is no longer bound by the confines of a set segmentation of time, serving to potentially elongate that pause indefinitely. Figure 8c uses multiple pause frames to physically draw out the length of time, giving an indication that this pause lasts longer than a single moment. The idea is that more segmentations of time in the form of panels will indicate to the reader that there is more time between the statement and response to be segmented. Using this same mentality, even the width of the paused panel can influence how the reader interprets the moment. Figure 8d makes the middle panel physically wider than the other two panels as a way of making that pause seem longer. This functions by making the time segments in the statement and response panels seem shorter by comparison to the middle panel. It also functions by placing a larger physical gap between the first and last panel, which would potentially be interpreted by the reader as a longer amount of time having elapsed between the statement and response. Again, the use of panels in the passage of time in comics is another means of control for the comic creator. These are some of the most common ways to manipulate time in a comic. There may be other creative ways of doing so as long as they are interpreted correctly by the reader.

FIG. 8.— Panels as a means of controlling time in comics (After McCloud 1993).

Capturing Motion in Comics

McCloud (1993, p. 108) states that as far back as the Futurists in Italy, there has been an artistic movement to create a "systematic decomposition of moving images in a static medium". The idea of capturing motion in a single image is one that is seen all throughout comics. The methods commonly used today to depict motion in a panel have built upon attempts in the past such as French artist Marcel Duchamp's *Nude Descending a Staircase #2*, painted in 1912 (See fig. 9a). Duchamp's work attempts to show motion by depicting the action of descending a staircase much like overlapping several consecutive frames of a film sequence. The introduction of the single motion line in early comics is another technique that serves as a cornerstone for simulating action and power in modern comics (McCloud 1993). McCloud (1993) provides examples of the most common ways of showing motion used today in *Understanding Comics* (see fig. 9).

Figure 9b is an example of showing motion using motion lines. It consists of a single running character in an action pose with lines trailing behind him indicating the path of motion. The quantity and presentation of these lines varies and is often greatly exaggerated in modern comics to emphasize speed. Figure 9c shows the same character running but motion is shown using a streaking effect. The streaking effect involves the character leaving a blurred streaked trail behind him and traces of this streak in his aftermath defined by motion lines. Sometimes, there may be no motion lines at all, and they may instead be replaced by one long blurred streak. The effect that is trying to be achieved in this instance is similar to a photographic image of an item in motion coming

out blurred. Figure 9d is an example of using multiple images to show the path of motion a character has traveled within a panel. This technique usually involves having the current position of the character in a solid bold color and the "ghost images" of where the character previously was positioned slightly faded out. This gives the illusion of breaking down a path of motion into even smaller time segments. The final example in figure 9e involves blurring parts of the picture, which has become popular in modern comics where computer software is more commonly used in creating and coloring an image and such an effect is easier to achieve. There are two different ways in which blurring parts of the image can simulate motion, blurring the character in motion and blurring the background. When blurring the character in motion, he essentially appears as a giant streak without a solid physical posed form. However, the background is not blurred, simulating the character moving swiftly through the scene. In contrast to this, the other method is to have the character appear solid and in an action pose while the background is blurred and appears to be rushing by the character. Both ways are effective, but the creator runs the risk of making parts of the image blurred and indiscernible (McCloud 1993). In large, decisions on depicting motion in a frame are aesthetic and narrative choices made by the comic creator to best suit the action.

Certain techniques also exist for implying motion between panels. Generally, this relies largely on the reader's ability to provide closure between the action in one panel and the next. A primary example of this type of motion would be two consecutive panels with a character initially in a starting position and changing to a different position in the scene in the following panel. This type of motion assumes that the reader will interpret

that motion. Lee and Buscema (1978) support this exercise in motion between panels by explaining that often times action in between panels can be seen as a cause-and-effect response or as exaggerated anticipation and follow-through poses between panels. These are just some of the more common means of showing motion in a comic book. Deciding which method best depicts action is subjective and comic creators are constantly evolving new ways to capture movement in a still image. Again, the use of these types of motions depends on the choices made by the comic creator to best suit the narrative situation.

Visual Elements in the Content of the Comic

After analyzing the general components used in constructing most comics, it is important to get a basic understanding of how various visual elements in the content of a comic can influence the story and reader involvement. This includes looking at how line, color, and art style can not only affect the aesthetics of the comic, but also serve to establish a mood and emotion in a single scene or an overall narrative.

McCloud (1993) maintains that attempting to depict an emotion or feeling with something as basic and simple as a line is vital to how the reader perceives the story. Spaulding (1995) supports this claim that line work and the way an image is drawn in a comic can carry a lot of weight. However, she believes that most often, line in comics

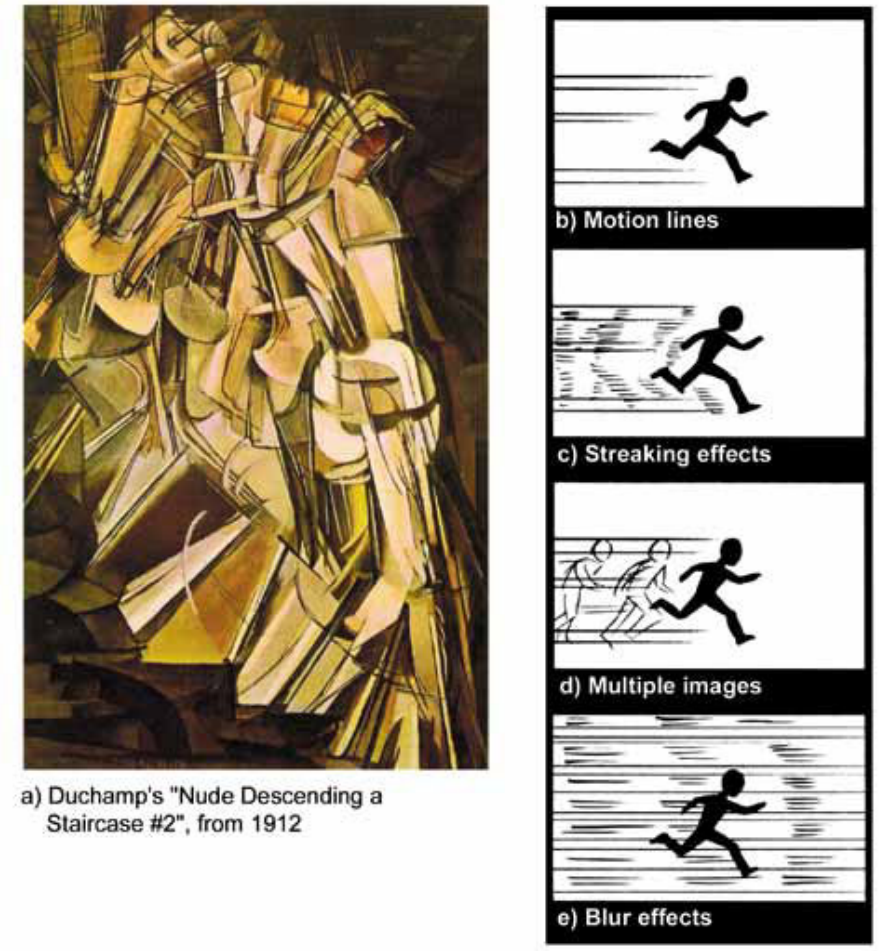


FIG. 9.—Examples of depicting motion in a static image (After McCloud 1993).

are dictated by the image needing to be easily interpreted by the reader. Typically final comic images are drawn in ink, but even within that one medium there are several different techniques that can influence the tone of the art. Figure 10a shows an example of the artwork used in the *Dick Tracy* comics having thick bold lines, angular characteristics, and a heavy use of black ink to depict a "grim and deadly world of

adults" (McCloud 1993, p. 126). In strong contrast to this, figure 10b shows examples from the work of R. Crumb where the sketchy and sporadic use of line implies a frantic or neurotic tone. Lastly, figure 10c is taken from the work of Krystine Kryttre and uses heavy black ink, frantic lines and strong negative space to give this image a "mad and crazy" feel (McCloud 1993, p. 126). Line choice in comic artwork is essentially about conveying meaning, expression, mood, and tone in the simplest way possible.

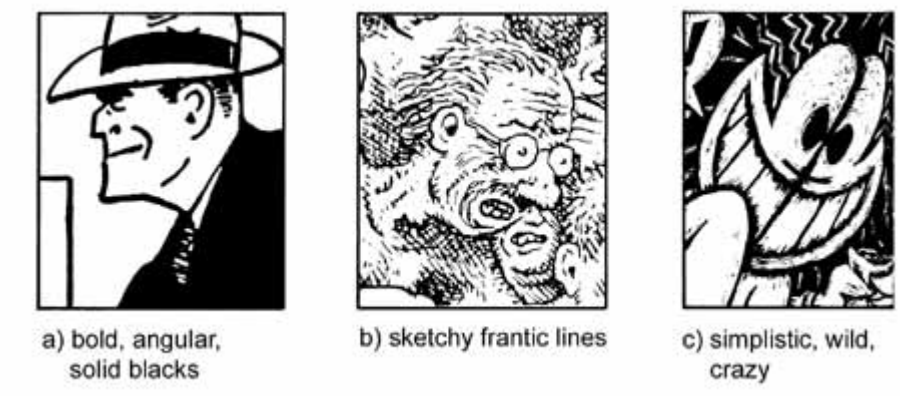


FIG. 10.—Line in comics (After McCloud 1993).

Color can be used in comics in much the same way as it is used in various other forms of artwork. When color comics first started being printed in the early 1900's, the use of color was limited by what technology would allow the artist to do. However, modern printing abilities allow creators unlimited possibilities in exploring color to its fullest to convey mood. Comic coloring initially also used to be about branding, as

comic creators would choose bright primary colors for their characters so that readers would begin associating these colors with their favorite characters (McCloud 1993). Modern comics utilize color in much more subtle ways to create a depth in comic environments. Whereas lines communicate much more directly, color has more possibilities by allowing form on a page. Color in a comic can also be more functional, such as being used to unify the design of a page by choosing a similar color palette throughout each panel. Color can also be symbolic in terms of the narrative, or even be used to differentiate or personify a character in a story by what colors he or she wears (Spaulding 1995).

Color and line together attribute to the overall style of a comic. The spectrum of different styles being used in modern comics ranges from almost photorealistic to pure exaggerated caricature to almost abstract. There are no limits on how an artist can present the characters and environments in a comic narrative. Different drawing styles and even the use of different mediums can set a tone for the overall comic. Figure 11a and figure 11b are both depictions of DC Comic's Superman, however they are done in very different styles. Figure 11a is taken from Alex Ross's work in *Kingdom Come* (1996) and is done in a painterly style where the characters and backgrounds are depicted very realistically. By contrast, the example by Ed McGuiness in figure 11b is done for the ongoing *Superman* (2000) comic book and is a much more bold, stylized, and cartoon-like take on Superman. Neither depiction is any more correct than the other, but the important factor is that the art styles tend to reflect the seriousness of the stories they accompany. Much in this same way, the darker art style seen in figure 11c is from

the vampire comic *30 Days of Night* (2003). This style uses ink and a more chaotic painterly style to emphasize the dark horror aspects of this story. Characters are cloaked in shadow and maintain a ghostly appearance. The ultimate goal in any comic project is for the artwork style to match the story, characters and tone of the comic. This is such an important fundamental that artists will often change up their styles between projects as the story demands it. Art style should not only be aesthetically pleasing, but also allow the reader to have an idea of the mood in the comic before reading a single word.

FIG. 11.—Various art styles in comics (After Waid 1996; Loeb 2000; Niles 2002).

Character Design in Comics

The way characters and anatomy are drawn in comics varies greatly from project to project. Just as with art style, comic characters can range from very anatomically correct to cartoon caricatures of the human form. Most times this is determined with artistic merit by the type of story being depicted, however there are comics who depict human anatomy based solely on visual appeal. In the 1990's, comic books went through a period of very art-driven marketing in which exaggerated curvy women and muscle-bound men were the primary means of selling a product (Sabin 1996). Comic book male heroes are often idealized and drawn as very angular and broad, tall, chiseled, and handsome. Comic book heroines also have the tendency to be idealized and are made to be the opposite of men in that they are depicted as very smooth, soft, and curvy (see fig. 12). While today's comics are still rooted in this slight exaggeration of the human form, not all comics rely just on visual appeal but also on the appeal of the stories. This allows artists to stray from the stereotypical depiction of men and women superheroes in comic books, and focus on drawing the characters in ways that better tell the story. Often times, comic creators will even downplay the visual appeal of the characters to emphasize the importance of the content in the story. In short, the only limitation on an artist is to simply depict the human form in a way that makes the figure recognizable as human to the reader. Choices in aesthetics and the degree of exaggeration should be used to make the form interesting and dynamic, but in the end should be to best serve the tone of the narrative.

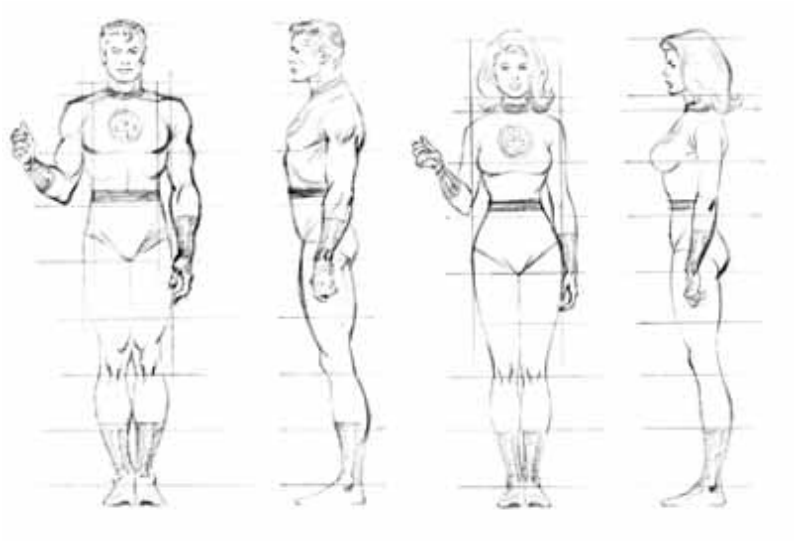


FIG. 12.—Traditional depictions of hero and heroine anatomy (After Lee and Buscema 1978).

The gestures and posture of characters is also an important storytelling tool and a way to personalize a character or emphasize an emotion. Eisner (1985) believes that posture and body language are intuitive to readers and an artist must capitalize on this innate ability. By breaking down the human form to its most essential shapes, an artist should capture body posture in the simplest way that still evokes an associated emotion in the human mind. Unlike film that can use hundreds of intermediary actions to depict body language, a comic artist must do so in a select few key positions. Often times, body language will override or dictate the way that dialogue is interpreted. Posture and gestures can change the meaning of dialogue, insinuate emotion, and inflect auditory nuances in the way speech is read in a comic (Eisner 1985). Eisner's (1985) examples of

the many ways “I’m sorry” can be interpreted in figure 13 represents how gesture can influence this reader perception.

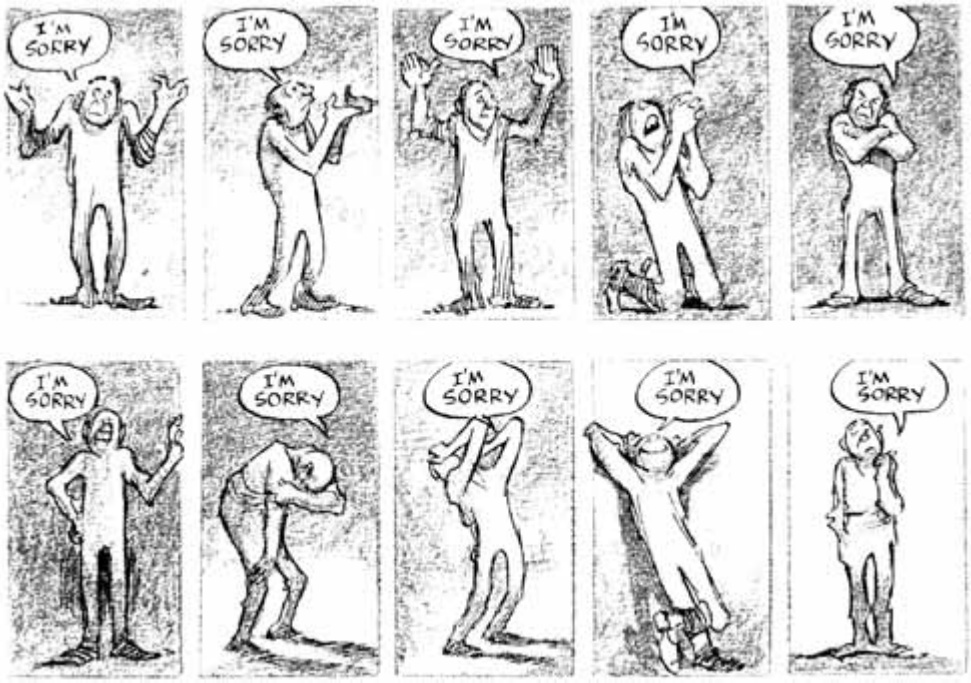


FIG. 13.—Body language and gesture as a means of changing meaning (After Eisner 1985).

In addition to relying on body gestures, comic artists also have the many expressions of the human face at their disposal to depict character. Facial positioning functions in much the same way as body posturing, using the eyebrows, lips, jaw, eyelids, cheeks, and mouth to project an emotion of a character. Eisner (1985) states that the movement of the face has to be more subtle, but at the same time tends to be more universally recognizable to all types of people. Faces are also very powerful in storytelling in that it is the face that makes a person individual. Most times, this is the main tool an artist has to make characters in a story distinguishable from one another (Eisner 1985).

Depicting the human anatomy in a comic is simply another way of conveying ideas and tone to the reader. As long as the anatomy is perceived as human and the gestures are interpreted correctly, there is no limitation on how characters can be drawn.

Composition

The final step in piecing together a comic page is to consider the overall visual composition of both the page and the individual panels. Composition of the frames on a page help pace the story and aid a comic's visual appeal by creating an interesting, dynamic, and aesthetically pleasing page. Traditionally, comic books were only concerned with composition within a panel, using very standard block panels that were all the same size on a page (Lee and Buscema 1978). In modern comics, artists and comic creators have realized the potential to use the page creatively as a whole in more appealing page layouts. Composition on a page mainly serves to control the flow of the

narrative and to make the story easily interpreted by the reader. Composition should be clear and generally uncluttered on the page. Panel layout can call attention to more important events on the page, dramatically establish a scene, or in some cases even supplement the action within the panels (Spaulding 1995). Figure 14a shows an example in which the content of the panels on a page depicts a man falling off a building. The composition is made more interesting by positioning the panels in a way that simulates their fall down the page, thus amplifying the impact of the fall.

Composition within individual panels follows the same basic rules. The goals in creating well designed panel content are to be aesthetically pleasing to the reader, and to deliver the message of the panel clearly and interestingly (Lee and Buscema 1978). Marvel Comic's Stan Lee and John Buscema (1978) stress the importance of simplicity and not cluttering a panel so that the action is clear in the reader's mind. Placing figures in a panel in an eye-pleasing way is often innate to the comic creator, however, as a general rule normally the important elements of a panel are grouped together instead of scattered across the image (Lee and Buscema 1978). Figure 14b and 14c show example panels that have been diagrammed to show this grouping of the important figures in various comic panels. In these two examples, the motion depicted has a clear line of action and the figures are positioned in such a way that they fully utilize the potential for each frame.

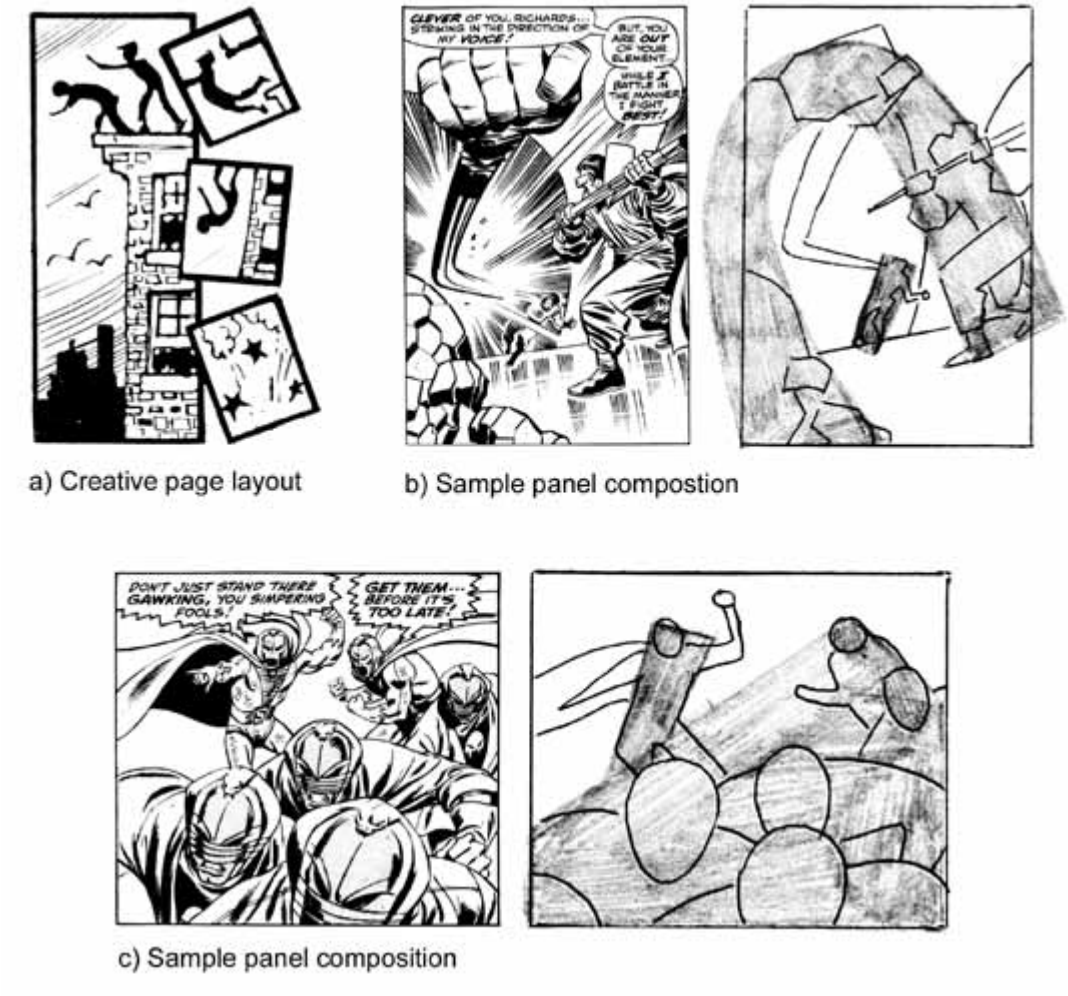


FIG. 14.—Composition on a page and inside panels (After Lee and Buscema 1978).

Eisner (1985) talks about how each panel essentially mimics framing for camera angles used in television and movies. In this line of thinking, creating a composition for a comic frame is much like setting a camera angle for a scene in a movie in that the artist decides what the reader is allowed to see. A panel showing a character in full figure requires no imagination and asks nothing of the reader. A medium shot of a character gives the readers generous hints about the character, but asks them to complete the image in their minds. And a close-up is often times the most ambiguous way to frame a character in that it asks a lot of the reader to deduce the characteristics of the character depicted. There is also the opportunity to assist the narrative by making scenes more or less dramatic simply though the perspective through which it is viewed (Eisner 1985). As seen in figure 15, placing the "camera angle" differently can cause the same scene to be interpreted different ways. The first view in figure 15a places the camera low in what is called a "worm's eye view" (Eisner 1985, p. 90). This type of angle will convey an involvement in the action, and in this particular case cowering or fear of an impending threat. Conversely, by placing the camera high in a "bird's eye view" the reader suddenly becomes uninvolved in the action and a sense of safety or detachment can be created (see fig. 15b). The ability to solicit this type of response from a comic reader through visual cues provided by the artist are at the very core of comics.

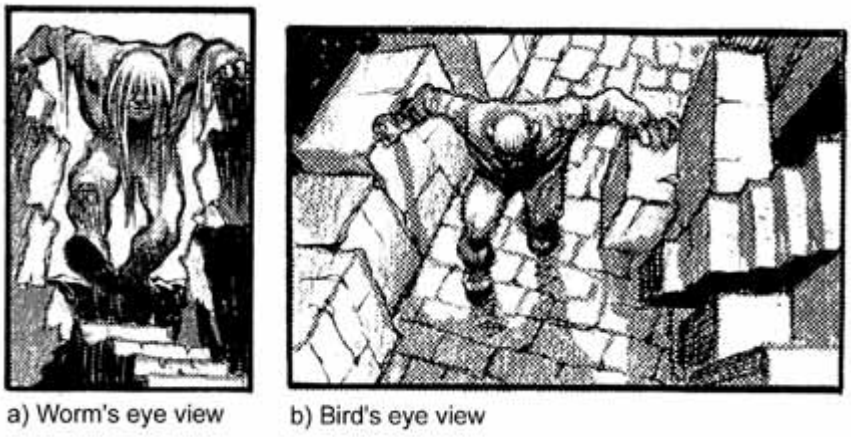


FIG. 15.—Establishing a "camera angle" in a comic panel (After Eisner 1985).

It is necessary to have a thorough understanding of these guiding principles that have been used in producing traditional comics. While art styles and means of production may have changed over the years, the same core components in a comic page are still present, and the aesthetic rules still hold up today. With a rise in technology, computers have been able to aid in producing comics but the medium still generally operates within the confines of this existing paradigm. For the purpose of this research, the sample comic pages created will also work under this general paradigm, taking some license to explore the aesthetic possibilities available in integrating 2D and 3D CGI. However, before being able to improve on how 3D CGI has been used in comics, it is important to get a better understanding of its history in the medium.

CHAPTER III

CGI IN COMIC BOOKS

Computers were first introduced into comic book production in the 1980's, beginning with simple 2D paint and draw programs. In its earliest stages, computer usage in comics was less about producing superior artwork, and more about breaking new ground and producing comic artwork unlike anything that had been done before. The following examples will show the evolution of CGI in comic books, as it develops from simple 2D digital images to books created completely in 3D.

Shatter

The comic book *Shatter*, published by First Comics Publishing and created by artist Mike Saenz and writer Peter Gillis, is often credited with being the "first digital comic". Released in 1985, the book was created wholly on a Mac Plus computer with only 1mB RAM. Charlie Athanas, who would take over the artistic duties on the book after the first eight issues, said that the book was drawn in the computer using a mouse until the last couple issues when the creators were able to acquire a stylus pen (Szadkowski 2000). Editorial Director of the book, Rick Oliver, stated in *Shatter* #4 that by the end of the comic's print run, technology had evolved enough to allow the artist to do his drawings by pencil first, then scan them into the computer, reworking them digitally. While the comic was drawn in the computer using Mac Paint and Mac Draw, the process was not truly completely digital. The black and white line drawings done in

the computer would be output using a printer and colored by hand in the traditional manner. At the time, this was not feasible to do in the computer.

While *Shatter* is viewed as a groundbreaking experiment in comic art, digital production in the 1980's did not necessarily produce better quality comics. In fact some readers of *Shatter* stated in letters to the editor that they still preferred hand-drawn art as opposed to the more rigid, cold, computer-generated art. Editorial Director, Rick Oliver, also stated that during the first few issues the creators neglected the story while focusing on the artwork, leading several readers to be confused by the plot. Figure 16 shows some example panels from the first issue of *Shatter* featuring the main character. These examples show the water color-style coloring of the book and its contrast to the jagged bold lines of the computer. In this book, line and shadow are done in the computer and the shading style resembles a low-resolution halftone screen, but may in fact be the result of the capabilities of a dot-matrix printer. The aliased lines are a sharp contrast to the smooth pen lines that can be achieved when using a traditional ink brush on paper, and the quality of the printing is in many ways obsolete by today's standards. While the artwork was constrained by the technology at the time, *Shatter* still opened many comic creators' eyes to the potential of using the computer in comics and is still viewed as a revolutionary experiment in comic book production. This book would pave the way for more experimental uses of 2D and 3D CGI in comics in the early 1990's.

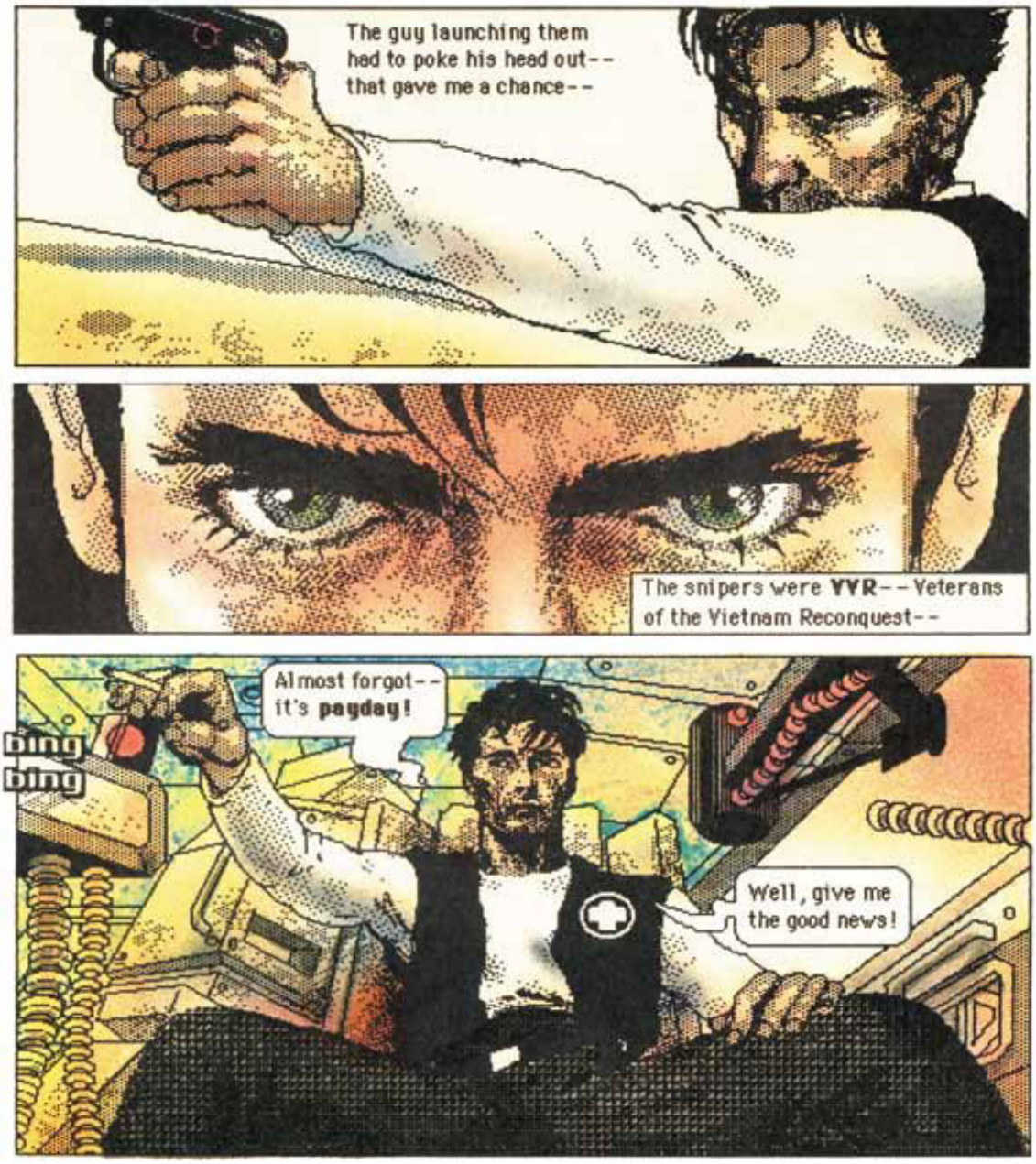


FIG. 16.—Sample panels from *Shatter* (1985), artwork by Mike Saenz (After Gillis 1985).

Batman: Digital Justice

Mainstream comic book company DC Comics would make its first venture into the world of 3D graphics with *Batman: Digital Justice*, a book created in 1990 with art by Pepe Moreno. Computer capabilities having improved quite a bit since *Shatter*, the release of *Digital Justice* was created using Macintosh II computers with an 8 bit/32 bit color board, 8 mB RAM, 45 mB hard disk, and an overall color palette of more than 16 million possible colors. Artist Pepe Moreno used a variety of programs to create the book, including CAD programs, 3D modeling programs, Image Studio, Studio/8, Adobe Photoshop, and Quark Xpress for layout (Szadkowski 2000). Notably, *Digital Justice* was one of the first comic books to use both 3D models and vector based drawing programs.

In this book, the characters are drawn using 2D paint programs, while a majority of the environments are 3D models. The two are then composited together in a scene. A couple of characters in the story exist only in the computer, and these characters are created using 3D models to differentiate them from the 2D surroundings. Figure 17a shows two examples of the Joker and Batman models used in the story. The models are simplistic and very polygonal, lacking any kind of smoothing to the rough edges of the shapes. Figure 17b shows a sample panel in which 2D characters are composited on top of a 3D background and integrated with 3D robots flying overhead. While the 2D digitally painted characters work well on their own, the integration with the 3D backgrounds is not seamless. Often, there are compositing problems in that some of the characters remain aliased around their edges, or a slight white border still exists around

the figure. The varying levels of complexity in how some of the figures are rendered also prevents the scene from appearing consistent. The human characters are detailed and softly painted, while some of the surroundings and robotic characters are more simplistic and angular. The overall quality of *Batman: Digital Justice* reflects the evolution of the 2D computer software available, however the use of 3D models was still in its early stages. 3D modeling would become more accessible and easier to do over the next decade as the software improved and would be used more prominently towards the end of the 1990's. Meanwhile, comic creators would find other ways of using 2D graphic software in comic books.

Digital Broome

A comic book artist with Wildstorm Studios named Mat Broome founded his own production company in 1996 called Digital Broome. In addition to doing work in television and advertising, Broome said his company aimed to "bridge the gap between 2D illustration and 3D models" in comic books (Szadkowski 2000, p. 1). Digital Broome's first digital book, *Saffire*, released in 2000, experimented by doing all the artwork in 2D, and then adding 3D textures to surfaces using grayscale bumpmaps.

a) Examples of 3D modeling

b) Example of the integration of digital 3D models, vector, and raster images

FIG. 17.— Sample panels from *Batman: Digital Justice*, art by Pepe Moreno (After Moreno 1990).

Figure 18a shows an example of this technique through a panel from *Saffire* in which the character's clothes have a cloth texture and the rocks and debris around him

have a stone texture mapped. Figure 18b shows another example from *Saffire* in which the bubbles in this underwater scene were created in 3D first and then composited and touched up digitally in 2D. While the texture maps did add a layer of depth to the objects, the end goal of the comic was to make the 2D and 3D aspects indistinguishable from each other. However, it is the opinion of this researcher that the 3D filters were not integrated in a subtle way, drawing attention to 3D bumpmaps. The texture mapping technique was used very prominently in the first issue, however it became more subtly used in later issues. Digital Broome would also produce two other comics in 2000 that would take advantage of 3D CGI. *Skinners* (see fig. 18c) would be done completely using 3D models. Broome stated that the artwork was completely done by one artist from concept sketches to the final models and renders so that nothing would be lost in the translation from 2D to 3D (Szadkowski 2000). Another book, *Vagabond,* would also be released that year from Digital Broome in which the artwork is painted by hand first, scanned into the computer, and then altered digitally (see fig. 18d). The resulting artwork maintains the painted look and uses the technology subtly to successfully supplement the 2D artwork.

Other comic companies in 2000 were using computers more as tools to assist in the steps traditionally done by hand. Crossgen comics was still doing all their drawings by hand, but was utilizing computers for lettering, inking, coloring, and layout. Crossgen Art Director Brad Peterson would state that he believed doing comic artwork in 3D "loses that 'happy mistake'" and the "real world imperfections" that come with doing a

comic by hand (Szadkowski 2000, p. 3). However, independent companies like Digital Broome would continue to push the boundaries of 2D and 3D CGI in comic books.

FIG. 18.—Examples from comics created by Digital Broome (After Broome 2000).

Superman: End Game

The year 2000 would also see mainstream DC Comics make another attempt at using 3D models in its comics. The public worry over the new millennium and "y2K"

would offer a chance to do a "technological threat" storyline in the Superman comic books set against the backdrop of the new millennium. The storyline called for the villain, Braniac 13, to be a tangible digital threat and the comic creators wanted the look of the character to reflect its digital origins. The resulting Braniac 13 character was modeled in 3D and composited with an environment and human characters drawn completely by hand. The storyline would originally unfold in the comic books *Superman Y2K* #1, *Superman* #154, *Adventures of Superman* #576, *Superman: Man of Steel* #98, and *Action Comics* #763. All of these books would later be compiled in a trade paper back collection *Superman: End Game* (2000). The character designs for the Braniac 13 character were done by Ed McGuiness, artist for *Superman* #154, and the model was built to reflect his style. However, since the storyline spanned over five different Superman comic books, this also meant there would be five different artists. The same Braniac 13 model was used in all five books, even though the 2D styles of the artists were not all the same. Due to budgeting and time constraints, a different model was not built for each artist in his own style. In the first few issues featuring the Braniac 13 character, the compositing of the 3D character into the 2D surroundings was extremely noticeable. However, as the series matured, the artists began to integrate the character more into its surroundings by shading it less realistically and by reworking parts of the character in 2D once composited. Mixed reader reaction most likely led to the attempts at better integrating the 3D models with the 2D surroundings. Still, overall the character seemed out of place and did not make a convincing fit into an environment done completely in 2D (see fig. 19). While DC Comics made strides attempting to integrate

2D and 3D CGI, in the following years, rival comic company Marvel Comics would focus on creating its own CG comics done completely in 3D.

FIG. 19.—A 3D model is integrated into various 2D Superman books (After Loeb 2000).

Spiderman: Quality of Life* and *U.S. War Machine 2.0

In 2002, Marvel Comics teamed up with Blue Dream Studios to work on *Spiderman: Quality of Life*, a comic book series done completely with 3D models. The end product would be over 400 frames and 100 pages done using Character Studio software and Discreet's 3D Max 4. In an interview done with Silver Bullet Comics, Art

director Scott Sava said that the job was very compartmentalized, with different people modeling buildings and characters, rigging and designing characters. However, the final frames were lit, posed, and laid out solely by Sava. The look of *Spiderman: Quality of life* is more cartoon-style in nature and the shading and lighting makes the characters resemble claymation (see fig. 20). With overly bright colors and plastic-like surfaces, the comic feels more playful and less realistic. The use of a non-photorealistic shading style was likely a deliberate attempt to make the comic resemble a cartoon or animated movie.

FIG. 20.—Example panels from *Spiderman: Quality of Life* (After Rucka 2002).

In 2003, Marvel Comics' subsidiary mature readers company, Max Comics, would release *U.S. War Machine 2.0*. This book was also done completely using 3D models, however the look is very much in contrast to the look of *Spiderman: Quality of Life*. *U.S. War Machine 2.0* is done in a more photorealistic shading style, using more natural skin tones and ray tracing reflections in metallic surfaces to give the comic a more grown-up mature feeling that matches the subject matter (see fig. 21). While both comics work in their own respects, they both are attempting to use rendering styles that are not complimentary to the traditional comic book styles. The styles used on these two examples attempt to make comics mimic 3D animated movies or cartoons instead of trying to adapt the 3D technology to be used as a 2D medium in comics. Comic creators are still searching for a way to better integrate the new 3D technology into the 2D style already associated with comic books.

Eventually, the mentality for using computers in comic production will have to shift to expediting or enhancing some of the steps that were typically done by hand, instead of abandoning these steps all together. Often times in the previous examples, the use of 3D technology in a comic book is done as an experiment or a publicity gimmick. In these cases, the comic creators deliberately want to draw attention to the use of the 3D technology and its capabilities. In doing so, creators seem to lose perspective by making the comic all about the technology and not about the quality of the artwork or the story. It is the opinion of this researcher, that the artwork and story should be the focal point of

FIG. 21.—Example panels from Max Comic's *U.S. War Machine 2.0* (After Austen 2003).

a comic and the sole focus should not be on the technology. This can be accomplished by using 3D models as supplements to the production process to aid the artists and enhance the 2D comic medium. Integrating 2D and 3D computer technology should allow comic book artists to maintain aesthetic control and produce a higher quality end product that is still consistent with the current comic paradigm.

CHAPTER IV

METHODOLOGY

After analyzing the foundations of the genre and the way 3D and 2D CGI have previously been utilized in comics, a ten-page sample comic was created to demonstrate the potential for the better integration of these technologies. The entire finished project can be viewed in Appendix A. The methods for developing the resulting artwork for the ten-page sample and the creative pre-production process will now be explored.

Preliminary Development Goals

The purpose of this experimental project is to be able to use 3D models in a comic book format while still maintaining some 2D stylization that is consistent with traditional comic art. The developed process will allow the comic artist to take advantage of all the benefits of 3D CGI, while keeping creative control over the look and feel of the characters and settings. The process also prevents the 3D models from being just "cold, computer-created" objects by injecting a degree of hand-drawn elements to the final artwork, in a manner consistent with current comic book style. Another major goal for this work is for the 3D and 2D CGI elements to be integrated almost seamlessly. The reader's focus should be on the characters and their story, and not on the use of the technology. An appreciation for the artwork as a whole should serve as a means for drawing the reader into the story and not as a distraction.

Before beginning this project, it was important to develop the story to be told. While the story is not the primary focus of this experimentation, it was important to this researcher to tell a story that had elements of drama, action, and characters that readers could potentially empathize with in a small number of pages. The tone of the story also dictates the visual representation of colors, line art style, panel pacing, and page design in a comic. All aesthetic choices are made to support this tone and to create an art style that supplements the story. A brief synopsis of the story is first necessary to understand the production process.

Teacher follows the main character, an adventurous young woman named Maria, as she returns to her old village to help care for her ailing mentor and father-figure. Her teacher and his wife acted as parents to Maria when she was abandoned as a child, and it is these ties that bring her back home. When her teacher's condition becomes worse, Maria learns of a potential cure that is contained in the blood of a beast that lives high in the mountains. Maria faces the dangers of the monster to retrieve the cure, but in the end it is ultimately not enough. However, with the passing of her teacher, Maria is left with one final lesson on the value of life.

Once the initial story was developed, the first step in the production process was to develop a script and rough storyboards. Preliminary considerations included telling the entirety of the story concisely in an amount of pages that is less than half the page-count of a typical comic book. The story was scripted to ten pages in an effort to keep it within the scope of this project. Aiding in the effort to keep the story concise, was the decision to utilize a "rhyming, fairy tale-like" narration process. By positioning the

dialogue and narration to be read in verse, it created an overall flow that seemed better suited for telling a complex story simply and quickly. The resulting script reads more like a poem, which also lends itself to the abstracted sense of time, place, and fantasy in the world created for these characters.

The initial script was created in conjunction with storyboards in order to get a rough sense of pacing and page layout. The initial storyboard pages were penciled by hand, and would later be refined using the previously researched principles for visual storytelling. Figure 22 shows an example of how the initial storyboards relate to a finished page. Using these storyboards and the initial script, a beginning outline was in place for the creation of the ten pages.

In the storyboards, a general idea for what the characters might look like was used. However, for the purpose of creating 3D models and determining an art style, the main characters needed to be developed more completely. Analyzing the story revealed four major characters, including Maria, her teacher, his wife, and the monster whose blood contains the cure to the teacher's disease. Several character designs were drawn to determine the look of these characters, the style of clothes they should wear, and their color palettes. Figure 23 shows some of the initial sketches that were used or modified slightly for the final character designs.

FIG. 22.—Comparison of an initial storyboard to the finished page.

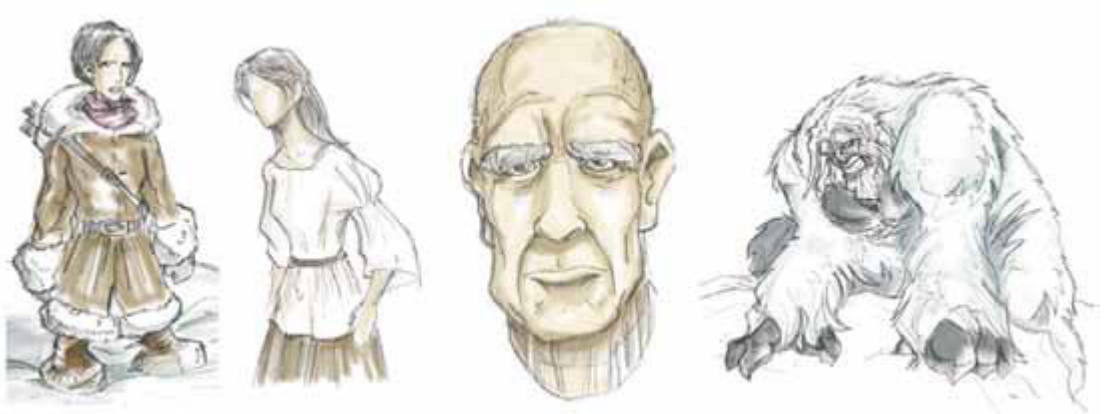


FIG. 23.—Initial designs for Maria, her teacher, and the snow monster.

With the templates for the pages and characters firmly in place, it was then necessary to refine the page layout so that it fully utilized as many of the devices for comic storytelling as possible to optimize the reading experience. While some of these devices were implemented in the pre-production stages, many were also decided upon as the finished pages were being created. The following examples reflect the use of these fundamentals from traditional comics in their finished form.

Traditional Comic Guidelines: Words and Images

Analyzing the initial storyboards showed several devices from traditional comic guidelines were already in place. In terms of the interplay between words and images, the majority of panels in the *Teacher* project appeared to be either an additive combination, where words and image supplement each other, or an interdependent relationship, where both words and image convey a meaning that neither could convey alone (McCloud 1993). Figure 24 is an example panel from page three of *Teacher* in which both types of combinations occur. The first narrative block is an example of an additive combination, where the text "With each silent step, I try to accept" reinforces the image of Maria approaching her teacher's bed with a look of concern on her face. The last two narrative blocks in this panel are examples of an interdependent relationship with this same image, in that the text gives an insight into the character's concerns not evident through the visual.

FIG. 24.—Additive and interdependent word/image combinations.

Traditional Comic Guidelines: Framing and Text

Several variations of framing were used on both panels and text. Typical panel frames were made up of simple black or white outlines, however framing variations can help add to the mood of a scene, as seen in figure 25. The first panel is frameless, emphasizing the endlessness of the woods Maria is about to enter on her journey. Frameless panels are used often throughout *Teacher*, to emphasize infinite spaces and for panels that need to emotionally resonate because of their importance to the story. The second panel in figure 25 is contained within a frame made to look like thorny tree limbs and brush. This is another variation on the framing technique where the narrow panel and the sharp-edged border creates a feeling of anxiousness and confinement.

For text, *Teacher* uses narrative blocks for framing narration and thought, and the standard word balloon for speech. Figure 25 also shows an example of the narrative blocks, which are typically a subtle orange and yellow color. The borders on these narrative blocks are tattered to resemble parchment to make the story feel old and timeless. For the purpose of this project in which everything in the final product is

digital, the text is typed rather than traditionally inked by hand. The font “Poor Richard” was used for narration, and speech was done using “Parade”. Both fonts were selected for their “old” appearance, to match the look of the story and the narrative blocks.

FIG. 25.— Framing variations and text examples.

Traditional Comic Guidelines: Text as an Image

The few times in which text is used as an image in the forms of sound effects and “lino-text” are during the fight scene on page seven of *Teacher*. Figure 26 shows a sample panel from this page in which Maria has just fired two arrows into the snow monster whose blood contains her teacher’s cure. An onomatopoeia is used to describe the sounds of the arrows wounding the monster. The word “shoonk!” is placed twice in

blood-red lettering in a font that simulates splattering. The words are outlined in white to make the red stand out more from the background blue colors. Also in figure 26 is the onomatopoeia “RRRAAAAARRRRGH”, which is meant to reflect the cry of pain the monster unleashes when he is struck with the arrows. This is an example of lino-text where letters are presented visually and integrated into the overall image. The cry of pain is done in a light blue color to match the monster and the cold tone of the entire page. The font used is rough and jaded for a harsher feeling, and the letters are staggered for added aesthetic appeal and the give the “voice” a faltering appearance instead of being a solid yell. Similar examples of this nature occur throughout this action page, generally where sound effects are needed.

FIG. 26.— *Teacher* examples of text as an image.

Traditional Comic Guidelines: Time and Motion

This project used several different methods of indicating the passage of time throughout the course of the story. Devices such as camera angle, panel composition,

and panel shape were all used to influence the way the reader comprehends the passing of time. The example in figure 27a shows two consecutive panels from page six that use overly horizontal frames spanning the width of the page to show that both time and distance are great on Maria's journey. Additionally, keeping a similar camera angle but changing the position of Maria in the composition of these frames, as though she were making the journey across the width of the page, helps add to the effect of time and distance. Similar devices throughout the story are used to depict moment-to-moment transitions, where small amounts of time pass between panels. Such instances also keep steady camera angles between panels, but vary the position of a character or object in an arc of motion so that they appear to be progressing through a scene. Another device used to depict the passing of time is a more obvious shift in the seasons. Varying the environment from one part of the story to the next, not only helps depict an overall feeling of time passing but also serves to divide the story into three appropriate arcs between autumn, winter, and the arrival of spring.

Depicting motion throughout the story of *Teacher* was typically more subtle. Most motion from characters between one panel to the next was implied and left to be a matter of "closure" for the reader to determine. This type of implied motion worked well for the majority of the pages and panels where the action was not an important fixture in the scene. However, for the action sequence on page seven in which Maria confronts the snow monster, new methods of depicting motion within a panel had to be developed that would stay consistent with the look of the rest of the pages. The method that ultimately worked best was blurring both the background images and the objects in motion. A

motion blur filter effect was already being applied to the snow in the non-action sequence frames to simulate its falling. By altering the snow motion filter, panels like the example in figure 27b were able to alter the path of motion, and in some cases even simulate motion lines. Figure 27b uses a radial zoom blur filter in Photoshop to simulate the motion of the snow radiating outward from Maria's bow. This panel also shows an example of applying a motion blur to the object in motion, as seen in the two arrows. Another device in this action sequence uses the snow that has already fallen and collected on the two characters in this scene. In given panels where Maria or the snow monster are in motion, these pieces of snow are depicted in mid-air as they are being flung from their bodies as a result of their motion. By showing these pieces caught in the path of motion, the reader should interpret this as a moment of action being captured in a single frame. These methods are used throughout all the action panels on this page, and proved to be the best choice for depicting motion and still keeping the panels consistent with the aesthetics of the story.

FIG. 27.—*Teacher* examples of time and motion.

Traditional Comic Guidelines: Color and Art Style

Color is a powerful tool in affecting the overall tone of a page or panel, and can also serve as a symbolic representation of abstract ideas or feelings. Figure 28 shows some of the many different ways that color was used in the pages of the *Teacher* project. The first example frame in figure 28a is the panel in which Maria deals the final killing blow to the snow monster after their fight. While the rest of this page has a very cold color palette featuring the whites and blues of the monster and his environment, this panel's background and frame border are both a dark red. By subtly featuring the blood-red tones in this panel, it symbolizes not only death and blood, but also the passion and determination Maria possesses in order to kill this beast. This is a very specific instance in which the color of the panel and its frame reflects the emotion of the character within it. Figure 28b is an example frame from the "flashback" sequence on page four that demonstrates how color shifts can also be used to differentiate time and location. In this case, a frame showing a time many years prior to the current events of the story is depicted in a grayscale-looking sepia tone. The younger versions of the main characters, are all rendered with the general absence of color other than the blue tone of the sky. The grayscale feeling alludes to an older time of black and white television and movies, which has come to symbolize events from the past. The blue of the sky is left unaltered for both aesthetic purposes, and to give the frame a surreal dream-like feeling, letting the reader know that this frame exists only in a past reality. Overall, both these color choices should also emotionally create a sense of history and nostalgia for these characters and this home.

As mentioned previously, the changing of the seasons throughout the course of the story depicts a passing of time, but the changes in the color palettes that accompany these seasons also appropriately affects the overall mood and tone of the story. In the first four pages when Maria arrives back home to her village, the season is autumn and the color palette is overwhelmingly saturated in warm orange, yellow and pink hues. The Fall and the changing colors of the leaves helps to signify a time of change in the lives of the characters as well. Throughout pages five through eight, the reader sees that winter has set in, and the bleak colors of white, gray, and blue emphasize the bleak nature of the character's situations. At this point in the story, Maria's teacher is near death and her chances for retrieving his cure look grim. The final three pages begin to see the end of the bleak winter colors, and ends with the final page depicted in figure 28c. In this page, Maria begins to realize the positive effects her teacher had on the lives of everyone he knew and the gradual arrival of spring, along with warm and bright colors, hints at the promise of a better tomorrow.

Color also played a symbolic part in the palettes of the main characters. Maria is usually depicted wearing a shade of green to symbolize growth and the way her character matures from beginning to end. Maria is also the only character in the story who wears green, as a means of separating her from everyone else and emphasizing how different she is from the rest of the village who are all dressed commonly in earth tones. The teacher is clothed only in a white gown to emphasize his pale and sickly complexion, but is wrapped in a crimson red blanket foreshadowing his inevitable death. His wife is depicted in the earthly colors of orange and brown to symbolize her strong

and dependable motherly role over both Maria and her ailing husband. And lastly, the snow monster is primarily white, gray, and blue to blend with his surroundings, but also to symbolize a cold animal nature.

FIG. 28.—Examples of the use of color in *Teacher*.

The art style for *Teacher* was determined by several factors. The capabilities of the shader being used on the 3D models leant itself to a certain type of supplemental coloring that did not rely heavily on line art outlines for form. The dependence on a few primary levels of shading for most objects, leant itself to a clean painterly look done over line art. The style in which the 3D models were "sculpted" would also determine

the look of the overall project. Keeping this in mind, the characters were modeled to exaggerate certain expressive proportions such as the eyes, creating characters that were clearly fictional but not so much so that they were not grounded in life. In general, the 3D models for the characters and environment pieces were also kept fairly simple to be consistent with the simplified shading style being used. And lastly, the personal art style of the artist contributes a great deal to the overall tone of the book. While this can be consciously modified to accommodate the feel of the story being illustrated, it is ultimately this unique stylization that makes the end artwork personable.

Implementation Procedures

Once all the pre-production elements and story devices were in place, the production of the finalized frames began. In general, the production process for a typical frame on the *Teacher* project consisted of two major steps: rendering scenes with 3D models and then integrating 2D vector and raster images on top of these renders to add detail and stylization. For this project, Alias Wavefront's Maya 5.0 software was used for modeling, rigging, and rendering any object or character done in 3D. For the 2D aspects of each frame, the work was done using a combination of Adobe Photoshop 6.0 and Adobe Illustrator versions 9.0 and CS. A preliminary consideration was also made that the final ten pages produced would ultimately be for a print format. Finished frames would be laid out for final page format in Illustrator at a proportionate comic book page size of 10 inches by 15 inches, at a print resolution size of 200 dpi, and in CMYK color format.

Modeling and Rigging

The first step in the production process was to create the 3D models that would be needed to tell the story in *Teacher*. Some general guidelines were implemented to determine what objects were modeled in 3D and which objects and details would be added afterwards in 2D. Deciding which objects would be 3D and 2D depended on four main factors: degree of use, degree of visibility, degree of difficulty to model, and degree of difficulty to "animate". In general, the set-up commitments required to model, rig, and pose a 3D object or character are resource heavy, unless that object is going to be heavily used and rendered from many angles. As a matter of efficiency, time and resources would not be spent on modeling objects or characters that would only appear in a few frames when those objects could be added in more simply in 2D afterwards. Similarly, if a character or object was not the main focus of the frame or was largely obstructed from view by another object, that object was usually added in 2D. In the case of the *Teacher* project, degree of difficulty to model an object usually referred to similar objects used in massive quantities, such as snow flakes and leaves. Rather than modeling several objects that were all slightly different, creating large quantities of simple objects was typically easier to do in 2D. In relation to this, the degree of difficulty to "animate" a 3D object refers to rigid-body versus soft-body movement. This final general guideline was that anything that had properties of soft-body fluid motion would be done in 2D. Simulating fluid surfaces like liquid, cloth, hair, or fur can be difficult and computationally heavy to do in 3D. The decision for this project was that the artist

would have a much greater degree of control over the look and feel of these soft-body objects, if they were simulated by hand in 2D.

With these guidelines in place, construction began on the primary models needed for the story. Due to the heavy degree of use throughout *Teacher*, the main characters of Maria, her teacher, his wife, and the snow monster would all be primary 3D models. Additionally, the background environments of the village, the teacher's room, the teacher's outer room, and the snow monster's environment were all primary sets modeled in 3D. Some secondary models included miscellaneous objects, such as cups, candles, trees, or Maria's bow and arrows. As a matter of efficiency, secondary background characters, such as the various people in the village, were ultimately derived from variations on primary models. The models created for Maria, her teacher, and his wife were all modified to create generic man, woman, and older woman models for use in crowd scenes. In a similar fashion, the Maria, teacher, and wife models were also modified to serve as younger versions of themselves for the flashback panels on page four.

All the character and environment models were created using a combination of low-count polygons and subdivision surfaces. The models that make up the teacher's bedroom, as seen in figure 29a, are good examples of a typical 3D environment set used for this project. Since the production procedure included covering over parts of the rendered models with 2D images, this allowed a margin of leeway in the construction of the character models. Shortcuts taken for efficiency in the creation of these models could essentially be hidden in the final version of the image. With this in consideration, the

character models created for this project were not designed to use typical skinning procedures, where joints would be rigidly or smoothly bound to complex geometric objects, causing them to deform when the joint is bent. Figure 29b details the final 3D model used for Maria in which her lower and upper arms, lower and upper legs, hands, feet, torso, head, and hair are all separate pieces of geometry. Separate pieces of simple geometry were also used to create the models used for Maria's teacher and his wife, as seen in figure 29c and 29d.

The decision to make each part of the body its own separate piece of geometry directly relates to how the characters would be rigged. A skeleton was set up in a typical fashion to mirror that of the human body, but instead of skinning these joints to the body geometry, the geometry is parented to its relating joint. In the example shown in figure 29e, the upper arm geometry is parented to the shoulder joint and the lower forearm geometry is parented to the elbow joint. Using this method, when the joints are moved, the associated geometry is attached and moved along with them. As seen in figure 29e, the resulting geometry around the elbow and other joints are noticeably segmented much like that of a marionette. While this method does not create character models whose "skin" deforms at the joints as it would in real life, for the purposes of this project, it is the most efficient and effective way to set up a working model and rig. Skinning joints to geometry and painting weights to simulate correct deformation is a lengthy and complicated process. Placing 2D images on top to "connect" these segmented joints is simpler, and can create a continuous look while masking the simplicity of the models. This procedure worked well for creating the character models in all but a few cases.

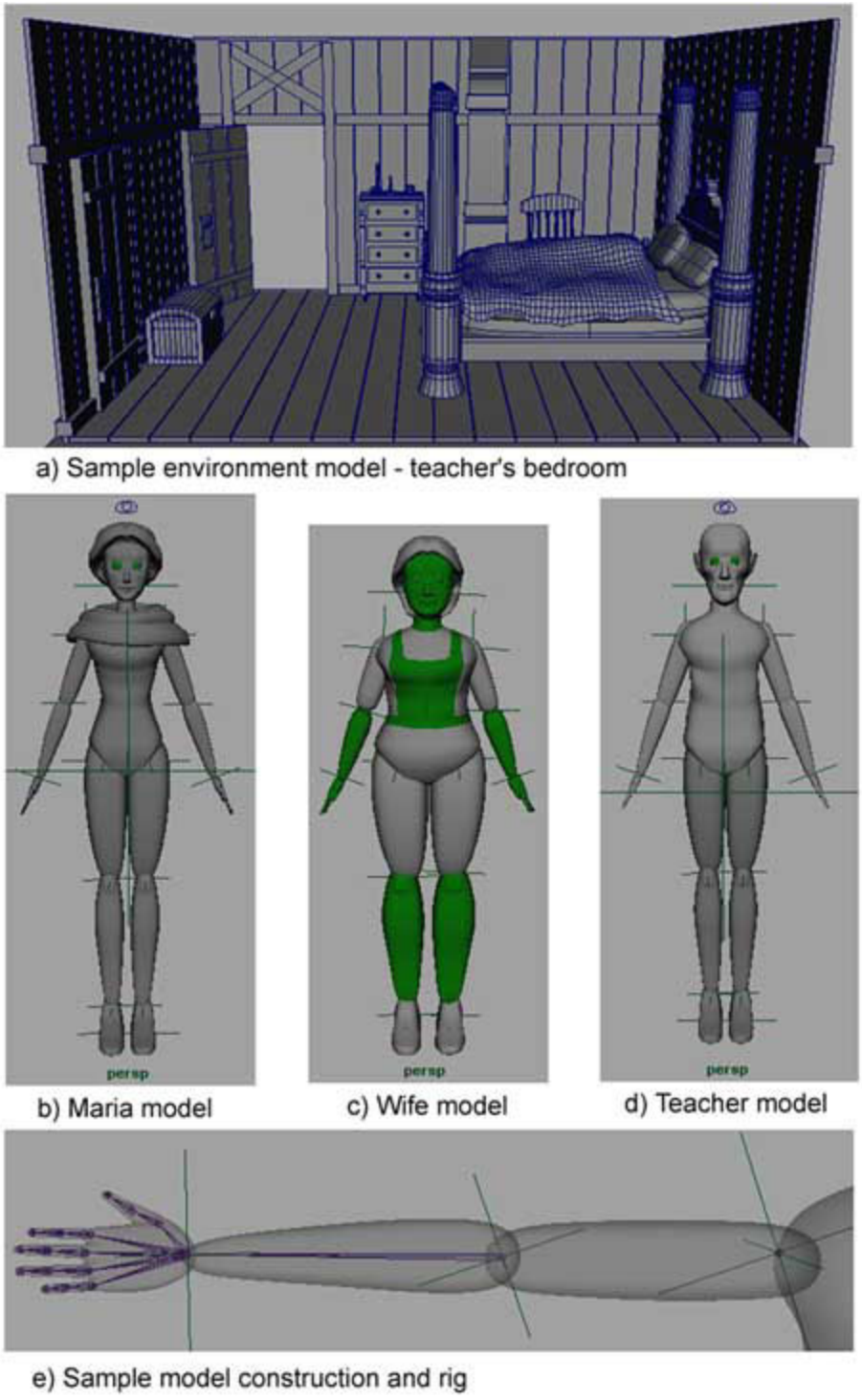


FIG. 29.—Models and rigs on the *Teacher* project.

For more visible and complex body parts, such as the hands and torso where a segmented look would be more difficult to conceal, the associated joints were in fact rigidly bound to the associated geometry.

The head and face of each character were also modeled as one piece of subdivision geometry. Typically, when animating the features of the face, blend shapes are used to deform a neutral base geometry into several different types of expressions. Again, 2D details would be added to the finished renders, allowing shortcuts to be taken with the range of facial expressions. A limited set of blend shapes were created to simulate mouth movement and expression. Some of these expressions are seen in figure 30 and included only the range of expressions that were needed at different parts of the story. No teeth, tongue, or gum structures were set up inside the mouth cavity as that could be added more simply in 2D. Similarly, blend shapes were not created to control brow motion because a greater range of control and variety could be obtained by simply adding the eyebrows in 2D. This method not only saved time when setting up these character models, but also allowed the artist to have an unlimited amount of freedom in capturing subtle nuances in the facial expressions that would be hard to capture with a limited amount of facial blend shapes.

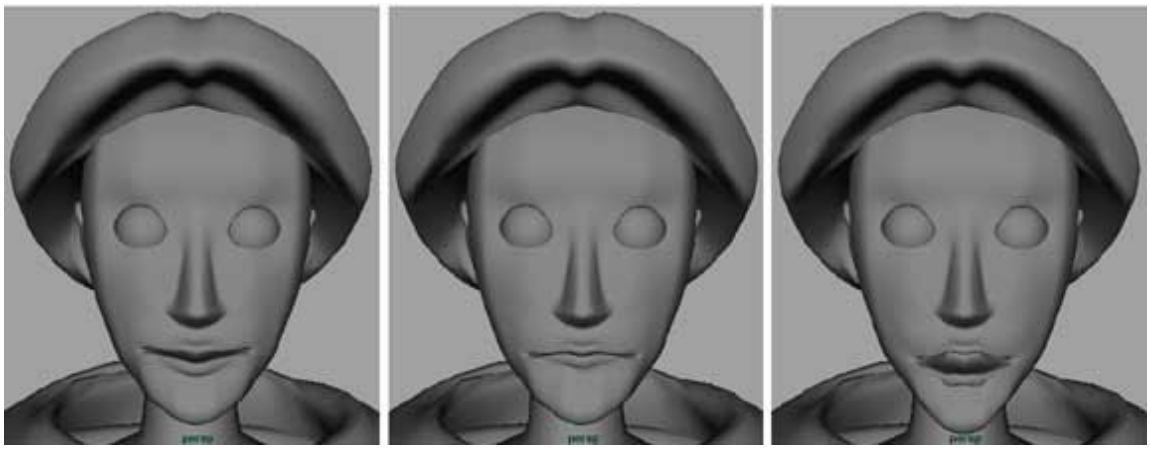


FIG.30.—Limited use of blend shapes for the Maria character's mouth.

Shading the 3D Models

To create a look that reflects a traditional comic book style, the 3D models were then shaded using a non-photorealistic (NPR) shader. The shader used in this project is titled *Non Photo Realistic Shader v0.6.* This shader was written by Yinako Minako and was downloaded for public use from HiEnd3d.com. The NPR shader generates a shading network in Maya which creates a dark outline around the boundaries of the geometry, while controlling the inner shading with a set gradation on a color-step ramp. This concept is commonly used in "toon shaders" or "cel shaders" that simulate the look of a cel shaded cartoon. Figure 31a shows that the default ramp settings this NPR shader uses to control the color gradation are blended evenly, creating a smooth airbrushed or painted look. However, for this project, if the added 2D vector elements were to blend more seamlessly with the 3D models, then the shading would need to have more of a

hard edged gradation. Figure 31b reflects the alterations made to the NPR shader ramp to create this more hard-edged shading style.

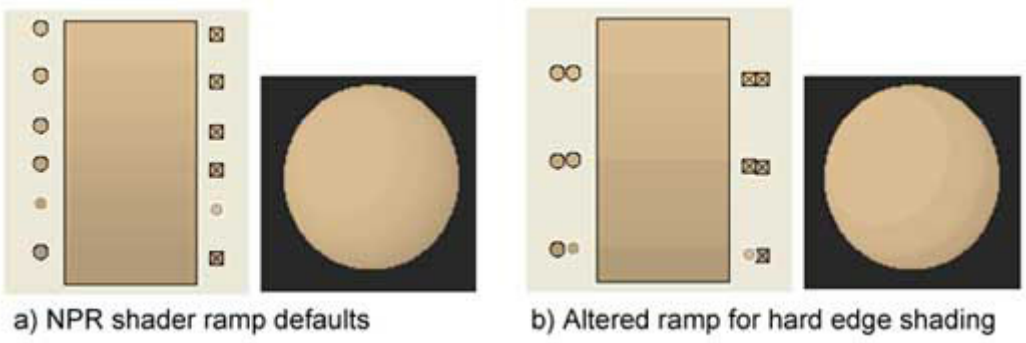


FIG. 31.—Alterations to the NPR shader to simulate a toon shader.

This NPR shader is best suited to the goals of this project because it provides a great amount of control over the final look of the rendered object. The shader allows an artist to limit the color palette of a shaded object to as many as ten or as few as two color steps. For the purpose of this project, most applications of this shader limited the number of color step gradations to three or four colors. Figure 32 shows how a finished model looks when both a standard lambert shader are applied as well as the NPR shader. The final renders with this shader applied to all the 3D models provides the foundation on which the 2D process begins.

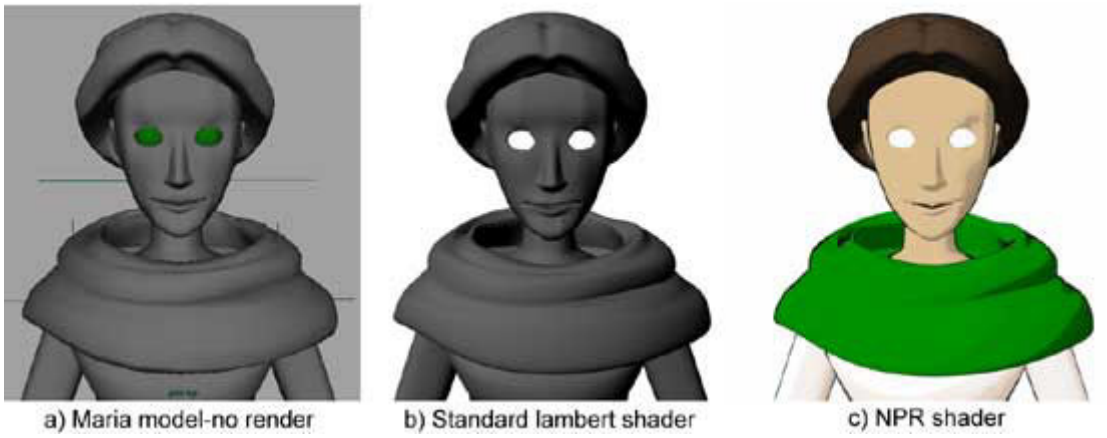


FIG. 32.—Shaders applied to the Maria character model.

Procedure for Integrating 2D images

With the 3D models completed and the shading method in place, production on the project pages began. The general process for creating a comic page in this project is similar for all ten pages. The page structures were first laid out in Adobe Illustrator using the designs in the storyboard as guidelines. Determining the sizes for the panel frames first allowed the rendered 3D scenes to be cropped to their correct sizes for placement on the page. The size these frames filled on the page also determined how large the 3D scenes would be rendered. Since Maya's renders default to 72 dpi, filling large amounts of space on a 10 inch by 15 inch, 200 dpi page usually required fairly large renders. Next, each 3D scene was set up in Maya by posing the characters correctly and positioning the camera to closely match the storyboard. The scenes were rendered at appropriate sizes, cropped in Adobe Photoshop to fit the frame structure that was laid out, and then pulled into Illustrator and placed on the pages in their according spots.

Rendering a typical 3D scene could potentially require three passes: a character render, a background render, and a shadow render. Figure 33a shows a render of just the wife character using an alpha channel. An individual character pass with an alpha channel is made if the background is either going to be produced in 2D after the render, or, is a 3D background that requires a post-render filter. Some backgrounds, like the sky, are done entirely in 2D and placed behind 3D renders. In the case of the example in Figure 33, the background is a cottage rendered from a 3D model. The cottage was rendered in a separate pass so that it could be blurred separately when composited to create a depth of field effect. Had the background layer not required a post-render filter, the entire scene could have been rendered in one pass. A shadow pass was not required for this example, as no cast shadows are within view from this camera angle. If a scene required a shadow pass, the NPR shader can accommodate shadows in a scene render. However, if the shadow overlapped an object with post-render 2D details added in, the shadow pass would have to be done separately and composited on top afterwards

For the purpose of this project, foreground characters and objects were composited with background images using Photoshop before being placed on the page in Illustrator. Versions of Illustrator prior to Illustrator CS did not support the recognition of alpha channels in rasterized images. For this reason, compositing layers of 3D renders had to be done in Photoshop, although these steps could now be done using Illustrator CS.

Once a foreground render is composited with its 2D or 3D background, the 2D details are applied in Illustrator. Since the 3D renders are the foundation on which the

final artwork is built, the look of the 2D vector details were made to replicate the 3D style and not vice versa. The decision was made to use vector graphic images to supplement the 3D renders because the look generated by vector graphics is crisper for color print publications and can be made to closely resemble the NPR look of the 3D renders. Vector graphics allowed the integration of the 2D and 3D aspects into one coherent style for the final images. Figure 33c shows a finished comic panel with 2D details such as eyes, eyebrows, skin wrinkles, and clothes contours added in. In addition to these, soft-body objects that would flow and change position in various scenes were added, including hair extensions and the character's blouse sleeves. These 2D details not only complete the character, but they are also used to conceal overlapping geometry at the joints of the characters. Figure 33b and 33c shows that 2D vector shapes were added to conceal the shoulder and elbow joints making the character complete.

Generally, the pencil or pen tool was used in Illustrator to apply the details on top of the renders. By creating solid vector shapes with boundaries that coincide with the boundaries of the models in the renders, the shapes can blend seamlessly with the underlying renders. To do this, the colors for the vector shapes are taken directly from the 3D renders. Illustrator CS allows color values to be taken directly from rasterized images, like the 3D renders, using the medicine dropper tool. Using this technique, the vector shapes can mimic the gradient "color-step" look created by the NPR shader. An Illustrator vector shape can be divided into several portions, and then these portions can be colored to match the gradation pattern of the shaded model. Since the models are rendered with a hard edged change in color, this make the transition from 3D drawing to

2D vector shape more seamless and easy to align. By using the same three or four colors in the vector shapes that are used by the shader on the models, an artist can create visual consistency overall.

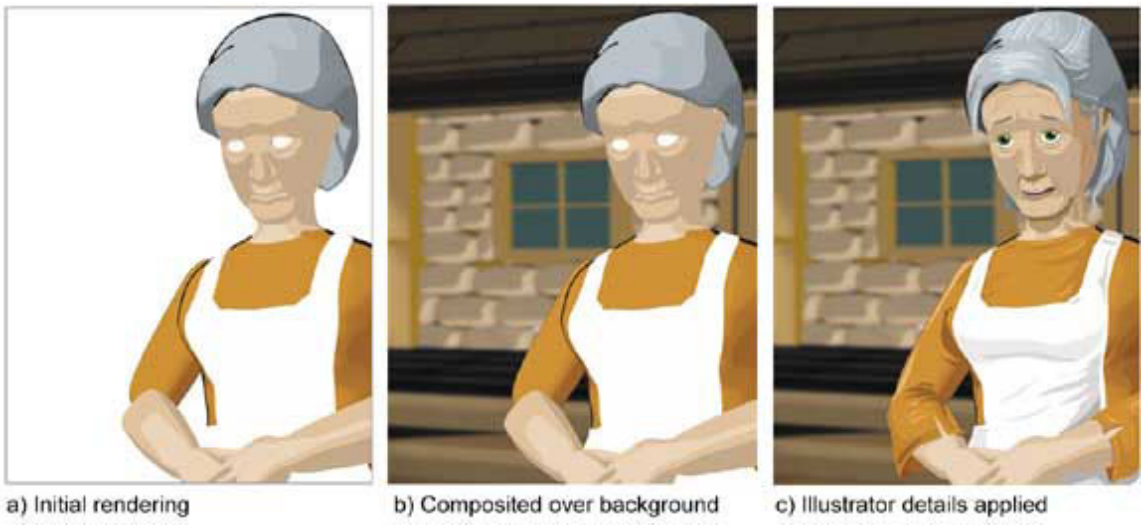


FIG. 33.—Process for applying 2D elements to a typical panel.

The process is fairly straight forward for simple panels like this one. However, for more complicated scenes requiring several different objects and several different layers, the process becomes more difficult. Figure 34 shows the many layers involved in creating the third panel of the first page where the reader is first introduced to Maria's village. This panel contains the title and credits for this comic project and was done in a splash page format as a way to grab the readers' attention at the beginning of the story and draw them into the world of these characters'. Figure 34a shows the original 3D

renders of the foreground objects that were all done as models. Maria was rendered separately with an alpha channel and composited on top of the environment consisting of a ground plane, trees, and rocks. In this case, the shadows for the rocks were rendered with the scene. Next, a 2D background is created in Illustrator and composited behind the foreground, as seen in figure 34b. The mountains were also done as 2D vector shapes, then rasterized in Illustrator and blurred to achieve a depth of field effect. Figure 34c shows a 2D sky with clouds created in Photoshop and composited behind the mountains. 2D details, such as bushes, tree bark, and rock details, are also added to the foreground objects using Illustrator. The 2D details added to the ground plane Maria is standing on had to be exported separately as a rasterized image, composited under the Maria layer with alpha channel, and then brought back into Illustrator. Again, since Illustrator CS can now recognize the alpha channels in rasterized images, this step could have been made easier by performing this compositing in Illustrator. Next, figure 34d shows the 3D buildings in the village being rendered and composited into the scene, along with the 3D renders of the various village people. The village was rendered all in one pass, however the individual people were all rendered separately and composited individually. These objects were also given a slight blur for a depth of field effect. Figure 34e shows the various shadow passes performed on the objects. The shadows for the village were calculated and rendered in 3D by setting up mock sunlight to cast shadows on the scene. The shadows for the mountains are “faked” since the mountains are 2D. The shadow for the Maria character also had to be “faked” because in the end render she would be wearing a 2D cloak, so a calculated 3D shadow of her original

model would not match her silhouette. Figure 34f shows the final image with the end 2D details added on top. These details included foreground brush and leaves, and Maria's cloak and dress. Details for the people in the village were also added using vector shapes, which were rasterized, and blurred to match the depth of field effect given to the 3D renders.

This procedure for applying the 2D vector graphics on top of the 3D renders worked well for most comic panels in this project. However, special cases existed which required slight modifications to this procedure.

Integrating 2D Images: Cloaks and Fur

As stated previously, the decision was made to use 2D vector images to simulate all soft-body objects which possessed fluid movements that changed from panel to panel. For small cases, like wisps of hair, the vector shapes could be added on top of the 3D renders fairly seamlessly with no complications. However, in the extreme case of the snow monster where the majority of its body is covered in fur, special considerations were made. Knowing that the end images of this character would be largely composed of 2D elements allowed the 3D model to be designed even more simply than the primary

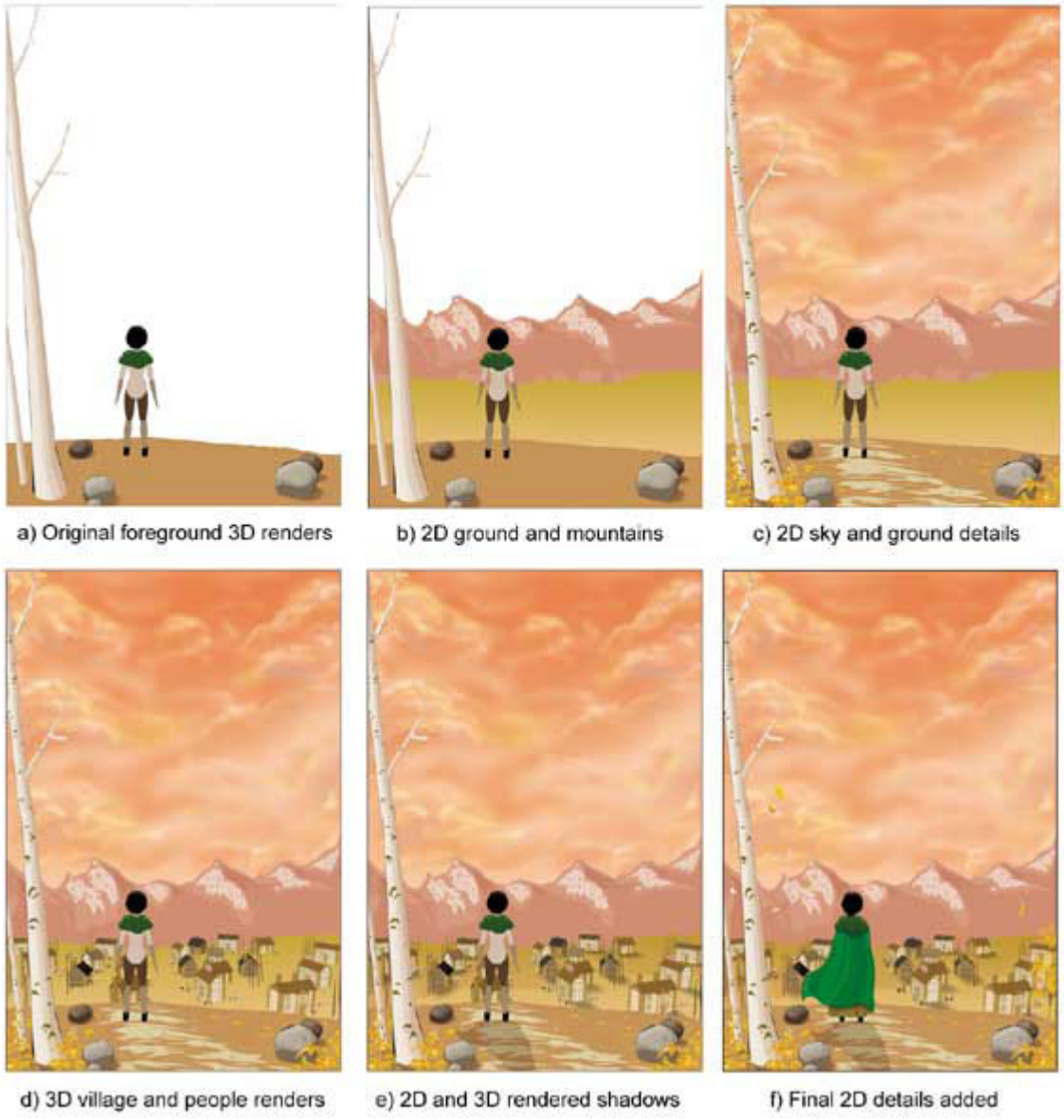


FIG. 34.—Applying 2D elements to a panel with multiple layers.

human characters. Figure 35a shows the 3D model of the snow monster as being composed of geometry that is largely overlapping and segmented. Figure 35b shows that the 2D fur added covers a large portion of the model and any shortcuts taken in the

model could be easily masked. In this specific case, the 3D body of the monster was used more as a guideline for the mass of the creature in each render. This gave an indication of how to lay the fur on the body and which direction it would go. This amount of control allows the artist to use the fluid objects, like fur, as indicators of size and motion. Figure 35c and 35d show how the added elements of fluid fur and a coat on Maria can give this panel a more dynamic sense of motion. In the end, the amount of control over the fur justifies using a technique that relies more heavily on the 2D post-render work than some of the other models.

Integrating 2D Images: Crowds

Certain panels in *Teacher* required the use of large amounts of secondary characters, in the form of crowds. By altering some primary character models, generic man, woman, older woman, and child models were created for the crowd scenes. By changing the colors of the NPR shaders applied to their skin, hair color, and clothes color, the models could be made different enough to pass as different people in a crowd.

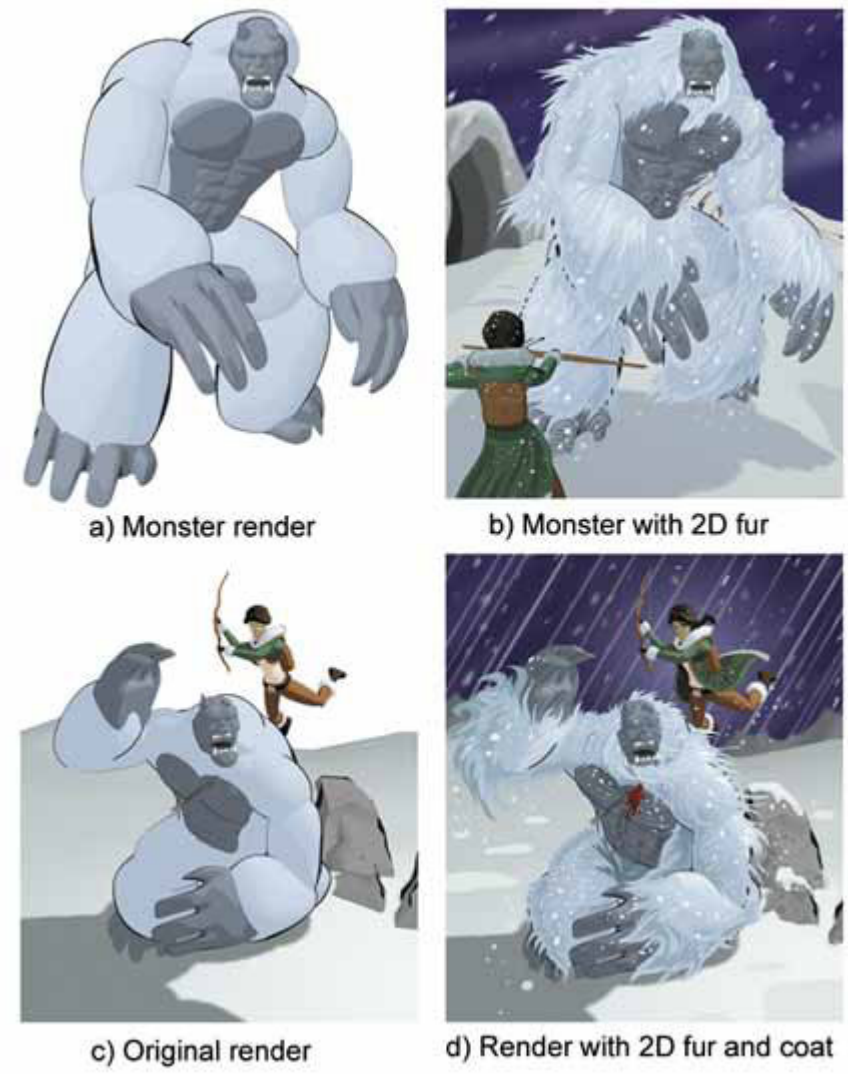


FIG. 35.—Examples of adding 2D fur.

The models were duplicated several times and posed in various poses and interactions appropriate for the given panel. In each case, given the complexity of the shading networks and the large amounts of geometry to be shaded, the computational time and power required to render these large amounts of people in one pass were too great.

Characters were rendered in sets of one to three people and composited into their scenes separately. However, when the 2D details were added to the renders, special considerations were made to these crowd scenes. Two different examples of crowd scenes existed in *Teacher*: crowds where characters overlapped and crowds where characters did not overlap. In the example panel in figure 36a, a high camera angle allows very few of the people in this crowd to overlap each other. This allowed the crowd to be composited into the scene and then the 2D details to be added in at the end all in one layer. However, for the final panel on page ten in which a large crowd has gathered outside of the house to pay their respects to Maria's teacher, multiple render passes had to be made as there were several rows of characters overlapping. Trying to add all these details at the end in 2D on top of the entire rendered crowd would create several problems. It would be difficult to convincingly add details to the characters in the rows furthest away from the camera because there would be awkward places where other foreground objects are overlapping them. So this crowd was divided into five rows of people, and the 2D details were added in multiple layers. Figure 36b shows the first row of people furthest away from the camera. Details were added in 2D, exported as a rasterized image with their alpha channels, and then composited in Photoshop on top of the back row but beneath the next row of people. This process was repeated four more times for each row of people, as seen in figure 36c through 36f. This process required more work, however it provided an extra amount of control in that foreground characters could be moved to various positions for aesthetic purposes without having to worry about the underlying images exposing parts not covered correctly by their 2D details.

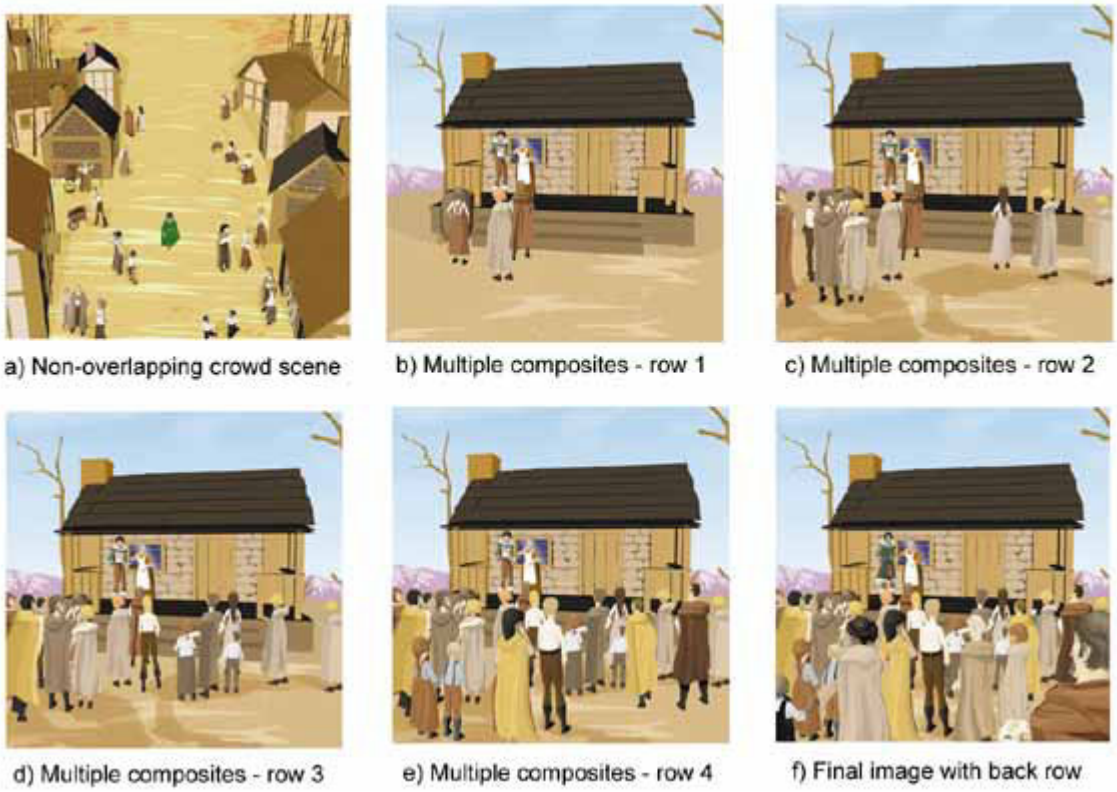


FIG. 36.—Creating crowd scenes in *Teacher*.

Integrating 2D Images: Grayscale Panels

The two panels on page four consisting of a flashback to a past time when the characters were younger is also a special case. The scenes are rendered in black and white and given a light sepia hue to imply they take place in the past, as seen in a sample from one frame shown in figure 37a. In general, the change in color palette did not affect the implementation process for adding in the 2D vector details. The only special considerations for these two panels were in the construction of the 3D models. A special model of a young Maria had to be created specifically for this scene. This model was

created by making alterations to the existing Maria head geometry to make it appear more youthful and pairing it with a body with child proportions. The models for the teacher and his wife could still be used in the flashback scenes simply by darkening their hair and leaving out some of the wrinkles applied post-render in 2D. However, the largest special consideration made for these two panels was to change all the shader colors to gray tones before the scene was rendered. These scenes could have been rendered normally in color and then converted to grayscale afterwards in Photoshop. However, a scene that looks aesthetically correct in color may have visibility problems once converted to grayscale if the colors being used have similar values. Using grayscale shaders on the models gives greater control over the final look of the rendered images. By applying individual grayscale shaders to the objects in the scenes, aesthetic alterations could be made easily. This added level of control allowed aesthetic problems to be identified and fixed as early as the rendering process.

Integrating 2D Images: Texturing

A final consideration was given to the fact that the NPR shader being used produced solid color gradations. Traditional texture or bump maps could not be used convincingly with this shading style, so any textures on objects would have to be done post-render in 2D. The few occurrences of textures in *Teacher* are subtle and done in a

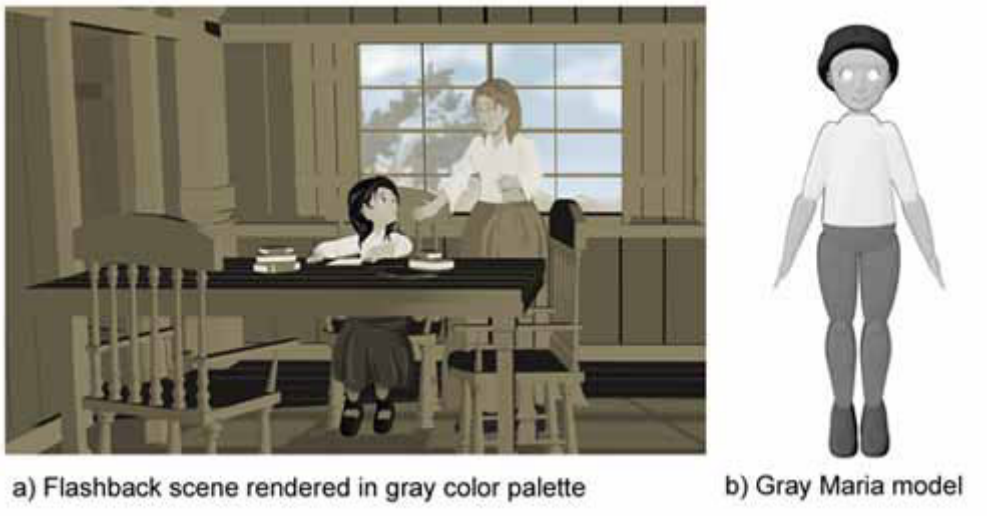


FIG. 37.—Special 3D models and shading networks for flashbacks.

2D style to assure that the additions remain consistent with the rest of the pages. Generally, textures were only applied to inanimate objects such as trees, wood, stone, or brick, and only when the camera was close enough to these objects so these fine details might be seen. Figure 38a shows a finished panel from the final page with added texture detail on the stone and wood of the house. The textures in this scene were applied as rasterized images in Photoshop and then blurred to match the depth of field effect given to the background render. These textures were not done as vector graphics because they are subtle details that would ultimately be rasterized to apply the blur effect. Figure 38b and 38c show the comparison between a background render with and without added texturing effects.

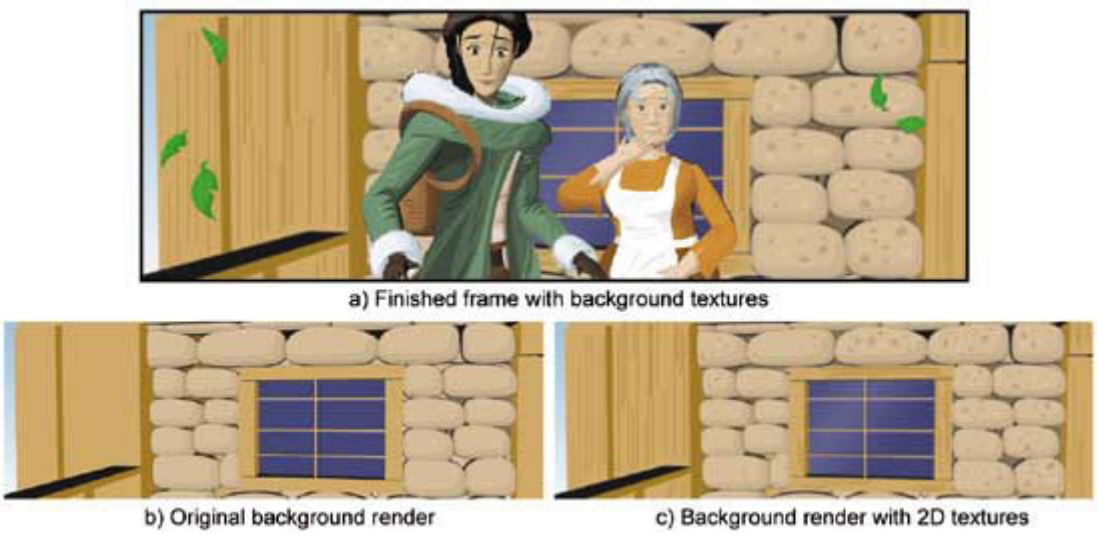


FIG. 38.—2D textures in *Teacher*.

Once all these final images were integrated on the comic pages, the layout and frame structure was refined and then words were added. Using Illustrator, word balloons were created for instances of speech and dialogue text was typed on top. Illustrator was also used to create the narration blocks from vector shapes, again using text typed on top. The positioning of these word balloons and narration blocks was dictated by the aesthetic preferences of the artist, consideration for the degree of difficulty to follow along and read, and to ensure that vital visual elements of the story were not obstructed. Once the layouts and text were finalized in Illustrator the end pages were then ready for print.

CHAPTER V

CONCLUSION

This research and the corresponding project are meant to show the potential for the use of 3D CGI in the American comic book genre. The resulting project shows that 3D CGI can be integrated with 2D CGI to form a unique and consistent look that is more closely derived from a traditional hand-drawn comic style. The implementation procedures for this project yielded results that were consistent with the goals of the research, while providing several strong points and limitations throughout the production process.

There were several strong points to the implementation procedure that demonstrate some of the many benefits of using 3D CGI in the creation process. One of the difficult tasks traditional comic book artists must face when creating a comic book is keeping characters and objects consistent looking throughout a large number of panels and several different angles of perspective. Using 3D models always ensured that characters remained consistent in appearance at all points in the comic and from all angles of viewing. Eliminating this concern frees the artist to concentrate on other aspects of the creation process. Similarly, 3D models and the use of 3D cameras can also help capture characters and objects from awkward angles in which depicting the correct perspective and foreshortening can be difficult. Another benefit of using 3D models and environments is a calculated control over the lighting in each scene. In a traditional comic book process, artists would have to either estimate the way light falls across

objects in a given scene or find a source of reference for various lighting situations. However, by using 3D environments, lights can be set up and the exact way light hits or shadows fall in a scene can be calculated and rendered as part of the outputted image. This step not only expedites the process, but also takes some of the guess work out by generating lighting and shadowing that is perhaps more realistic than an artist's interpretation. Lastly, this process can also make the production process faster. Once the models are created and rigged, setting up a given scene and posing the models is relatively quick. The 3D foundations for entire panels can be created quickly, leaving only the 2D details to be added.

However, this strong point also corresponds with one of the limitations of this process. While the production process was expedited as a result of the 3D models, the pre-production process was long and resource heavy. The time and effort needed to prepare all the models and shaders needed for this project should be considered a limitation. Another limitation is the degree of exaggeration an artist can achieve using the 3D models. While the models make every panel consistent, it also limits the amount of leeway artists have with their style and expressions. In traditional comic styles, character reactions or body proportions can be foreshortened or exaggerated beyond what is capable in real life for an added dynamic visual effect. The degree to which models can be exaggerated is notably less, unless the model is designed to have these properties in the pre-production process. However, for the purpose of this project in which the characters were meant to be rooted in some manner of real life, the limitations on stylized exaggeration did not inhibit the final results.

Overall, this process provided a good compromise between the degree of use of 2D and 3D elements. The 3D models and renders provided a solid and consistent foundation on which to build each scene in the comic panels. The shader used provided a good deal of aesthetic control over the final look of the 3D renders. The 2D process of adding supplemental vector images on top of the renders to complete the images allowed the final product to be stylized with an artist's unique touch. The 2D CGI elements also allowed the models to be more simply and efficiently created by masking overlapping geometry. And lastly, the 2D elements prevented the final images from being "cold" and solely computer-created. It provides enough 3D CGI elements for the resulting images to be new and interesting, while still remaining rooted in the 2D style that is traditional to the comic book genre.

In conclusion, this research provides a new method for the integration of 2D and 3D CGI in American comics. Previous uses of 3D CGI in comics have yielded results that are unsatisfying to general comic readers, as they are rooted in the new technology and not in the existing paradigm for the comic genre. This experimentation is meant to provide a compromise for using the 3D technology, while remaining consistent with a style that is traditional to comics. The resulting research provides a foundation for further exploration into methods of better integrating 2D and 3D CGI elements in printed comics.

CHAPTER VI

IMPLICATIONS FOR FUTURE RESEARCH

The scope of this research limits the development of 3D CGI specifically to print comics, however it should not deter the development of 3D CGI for internet comics. The combination of rendered 3D images and crisp 2D vector images create a look that may be conducive to an internet presentation. Internet comics offer opportunities print comics do not, including possibilities for integrated sound, animation, and effects in the comic reading experience. However, researchers should address that while these added opportunities could optimize the potential of the 3D software, in doing so they may undermine the definition of what constitutes a comic.

Other possible areas for development related to this research recognizes comic book production as a deadline driven medium. Again, the scope of this research did not allow proper development of the time sensitive nature of having to create a product for a monthly release. Comic books are traditionally released once a month, and integrating 3D CGI added resource costs and start-up constraints that may not be feasible for a traditional schedule. The pre-production time needed to create the 3D models for a comic may not allow a timely release of the initial issue. However, subsequent issues would be produced quicker because the models are already created. Further research may develop a streamlined method to create comics of professional quality while still being time and cost efficient. The potential for further research can venture beyond this to include developing 3D CGI for other time sensitive mediums such as newspaper

illustrations or television news programs, all of which require product creation on a limited budget and time frame.

Another area of future research that is closely related to the time-sensitive nature of comics is creating a streamlined work flow by incorporating more people into the production process. In traditional comics, the production process is divided up with different people doing work at various stages. One artist will provide pencil drawings for a comic page, while another artist inks the pages, another artist colors the pages, and another artist does the lettering. In the *Teacher* project, all these jobs were performed by the researcher, however the potential exists for the implementation process to be segmented. Different artists could model various secondary 3D objects and environments, while another artist sets up and renders the 3D scenes, while another person applied the 2D detail to the renders. Further research could measure the success of a segmented production process.

Lastly, this method of blending 3D and 2D CGI does not have to be confined to the comic medium. Further research can be done to apply this procedure to an animated project. The 3D models and rigging structures provide the potential for the characters to move through a scene in a time-based medium. However, further experimentation must provide a way to apply the 2D application process to the large number of frames required for an animated project. The preceding method of integrating 2D and 3D CGI shows many possible uses for further exploration, not only in the comic medium but in other printed and time-based mediums as well.

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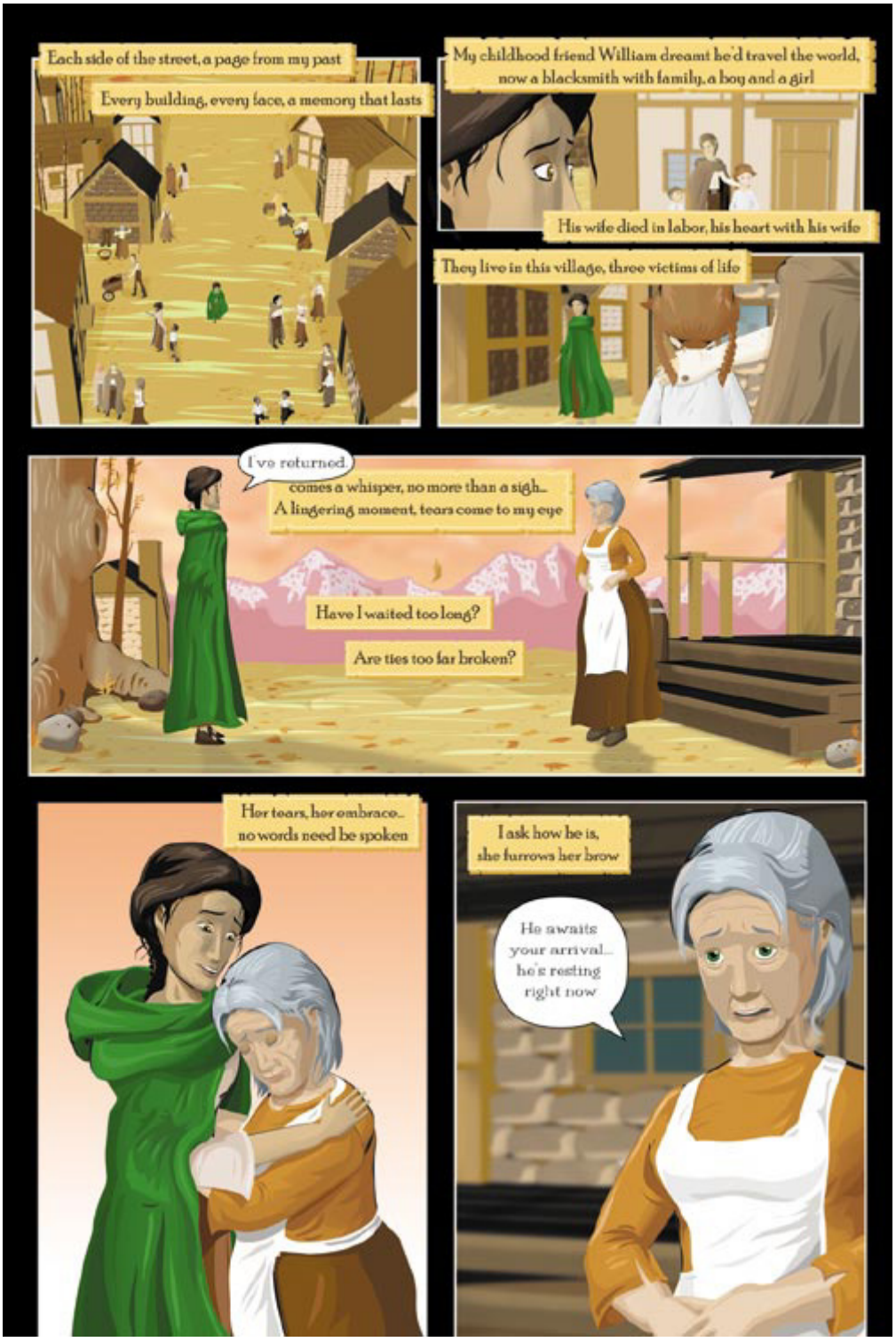
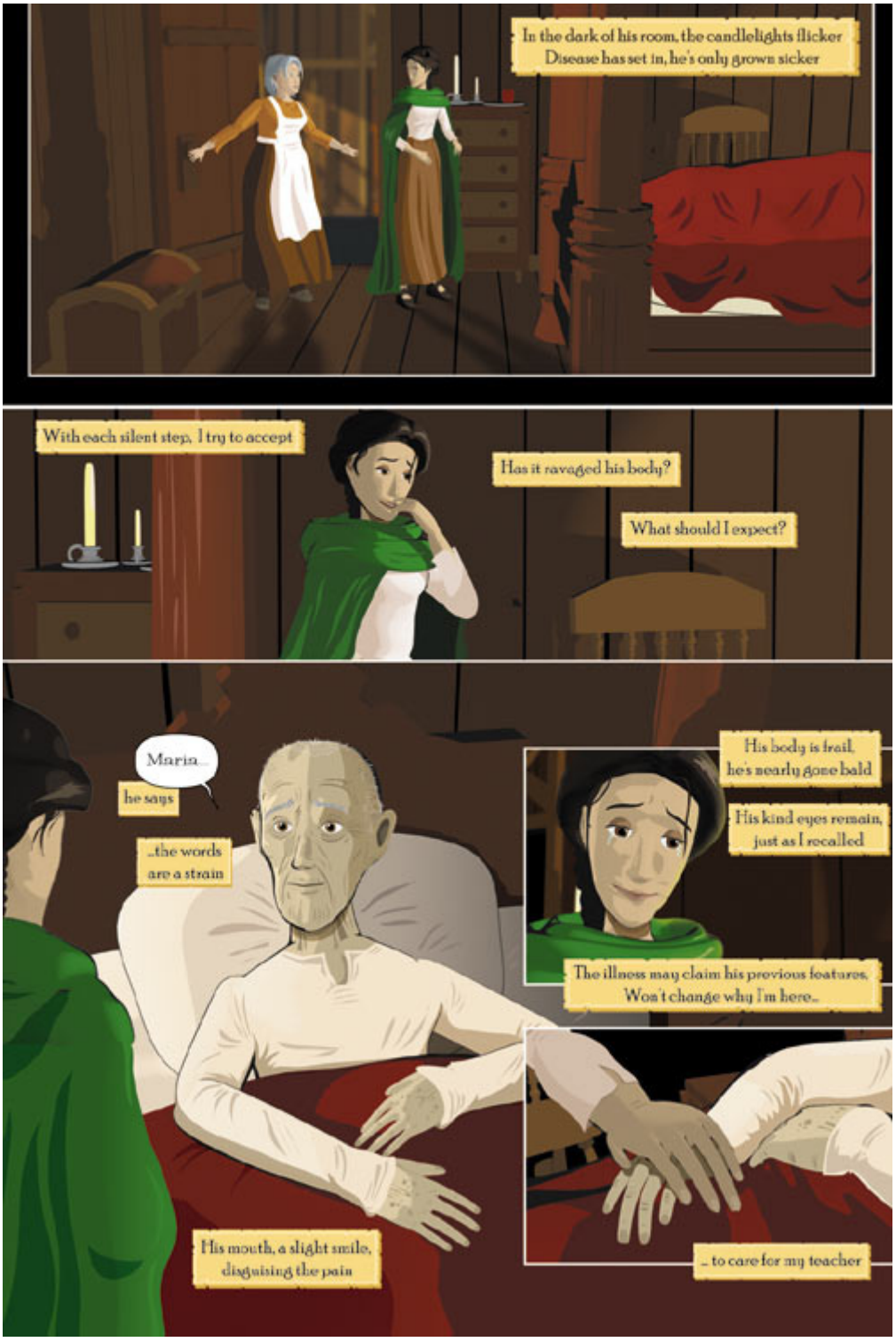
APPENDIX A


There is a village I once tried to forget
Where dreamers build houses, to live with regret
Be weary dear travelers, you enter, you stay..
Your dreams are abandoned, your life swept away.
I walked out these gates, far lands I did roam
Only one person could bring me back home
"Teacher"
by Ruben DeLuna


Each side of the street, a page from my past
Every building, every face, a memory that lasts
My childhood friend William dreamt he'd travel the world, now a blacksmith with family, a boy and a girl
His wife died in labor, his heart with his wife
They live in this village, three victims of life
I've returned.
comes a whisper, no more than a sigh...
A lingering moment, tears come to my eye
Have I waited too long?
Are ties too far broken?
Her tears, her embrace... no words need be spoken
I ask how he is, she furrows her brow
He awaits your arrival... he's resting right now


In the dark of his room, the candlelights flicker
Disease has set in, he's only grown sicker
With each silent step, I try to accept
Has it ravaged his body?
What should I expect?
Marin...
he says
...the words are a strain
His body is frail, he's nearly gone bald
His kind eyes remain, just as I recalled
The illness may claim his previous features, Won't change why I'm here...
His mouth, a slight smile, disguising the pain
... to care for my teacher


Days turn to weeks, some harder than others
Yet all that we do can't stop how he suffers
I'm reminded of times we spent in this home
How they gave me a family when I was alone
She gave me her knowledge through lesson and song
He gave me his courage and made me feel strong
Still only one question, I now must confess
How can I be strong when I feel so helpless?

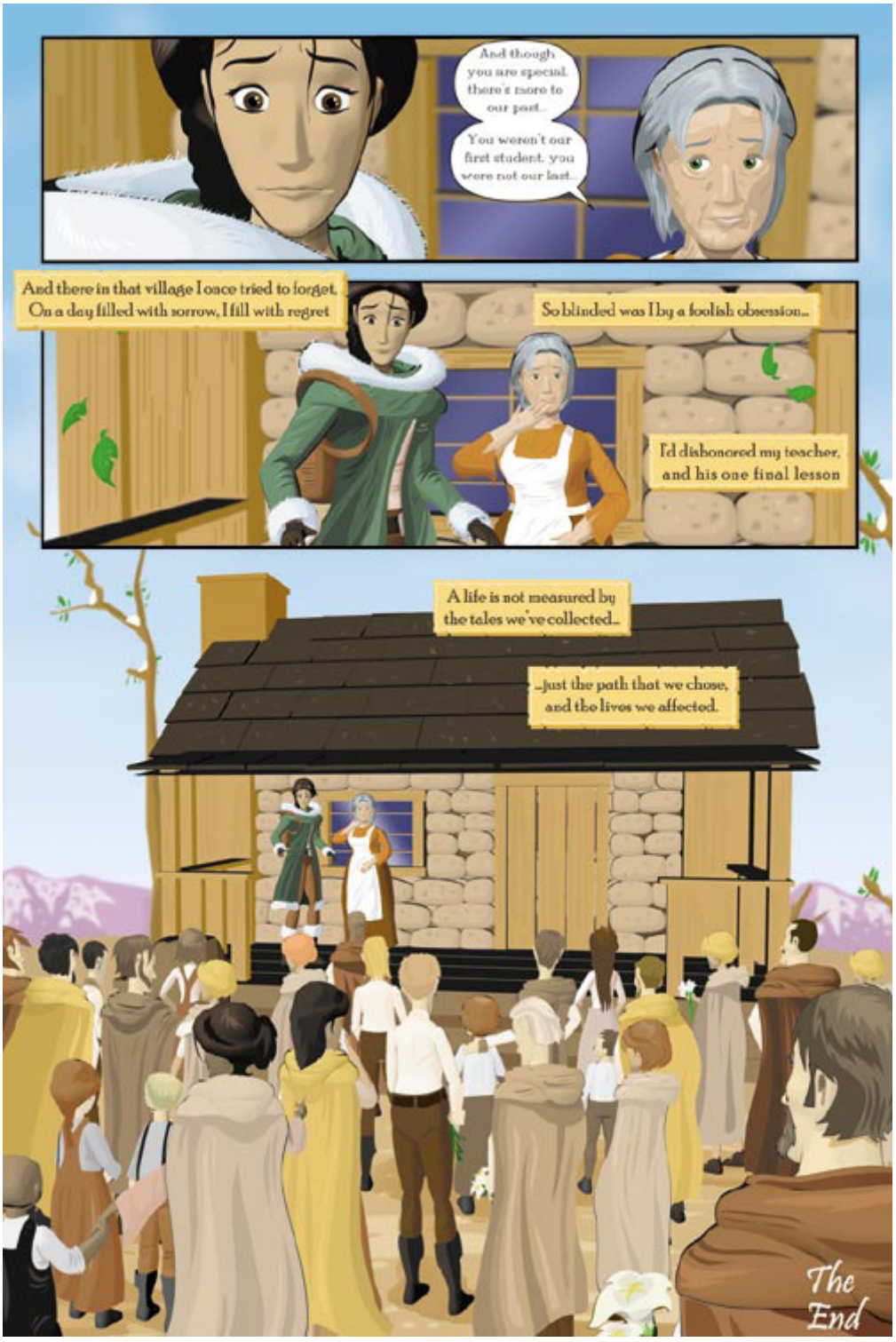

Then strangely one evening, some strength does return
I rest by his bedside, the candlelight burns
He whispers my name,
I wake with a shudder
and listen to words he tries hard to utter...
My child, there's a cure,
I wished not to say...
...the chance of success,
the dangers outweigh...
High in the mountains,
the blood of a beast...
the serum I need...
my illness's defeat...
Before he could finish,
I rose from his side
There's no other option,
no doubt in my mind
I gather my things and
prepare for a fight
To save my dear teacher...
I set out that night


I embark on my journey,
a race against time
In my heart they are with me,
the two left behind
I travel for days, the lands are unknown
The hope in my chest does nothing but grow
I arrive in the mountains, the snow in my face
What sort of vile creature could live in this place?


And there in my path it towered from high
My breath comes in troubles, I quiver inside
THWIPP
THWIPP
The fear from within soon moves through my hands
And exits through arrows to where it now stands
Arrows in air, on course for his hide
Piercing the silence, these forces collide
SHOONK!
SHOONK!
RRRAAAAARRRRGH
My body's exhausted, my muscles are burning
The life I am taking, I'll soon be returning
If each punch I land can buy one more day
...I'd fight till forever, the price I would pay
And soon, just the wind, I've killed all the sound
Replaced it with crimson now tainting the ground


And inside that crimson, the cure that I seek
My hands become shaky, my knees become weak
I have what I need to soon reunite...
a teacher with student, a husband with wife
My journey is swift, I stop not to rest
My heart races with me from inside my chest
I come to the house just as the dawn breaks
Am I far past salvation?
Is there only heartache?
The cure that I hold may help us cheat fate!
The tears on her face, they say I'm too late


Drink from that flask and ward away death!
But his body's too frail, those are his last breaths
There's so much to see! So much left to do!
But the last words I hear are simply
I love you..
If I could do it again...
I say to his wife
We'd pack our belongings and abandon this life
You've seen all the world but kept your eyes shut
We lived in a village not stuck in a rut
We had a good life, look harder and see
Our friends and our family are all that we need


And though you are special, there's more to our past...
You weren't our first student, you were not our last.
And there in that village I once tried to forget, On a day filled with sorrow, I fill with regret
So blinded was I by a foolish obsession...
I'd dishonored my teacher, and his one final lesson
A life is not measured by the tales we've collected...
...just the path that we chose, and the lives we affected.
The End

VITA

Ruben DeLuna Jr.
101 Newhaven
Victoria, TX 77904

Education

Master of Science in Visualization Sciences, Texas A&M University, College Station, Texas, 2004.

Bachelor of Science in Marketing, Texas A&M University, College Station, Texas, 2001.