PRODUCING AN ANIMATED TATTOO VISUAL EFFECT

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PRODUCING AN ANIMATED TATTOO VISUAL EFFECT

A Thesis
Presented to
the Graduate School of
Clemson University

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

by
Zachary James Trabookis
June 2012

Accepted by:
Timothy Davis, Ph.D., Committee Chair
Tony Penna, M.F.A.
Jerry Tessendorf, Ph.D.
ABSTRACT

Throughout society tattoos have established a mode of expression for individuals that allows them to communicate without verbal means. This form of interaction may appear somewhat static to the observer, but significant meaning and emotion are often conveyed. With the advent of visual effects tools available today, tattoo representation can be enhanced by including motion. This thesis presents a solution for illustrating this form of visual communication using two-dimensional compositing and three-dimensional techniques in a short animated film entitled “Legion.”
DEDICATION

This thesis is for all family members and friends who supported me with constant motivation and direction during my time in the Digital Production Arts Master’s Degree program at Clemson University. To my parents, Chris and Gerri Trabookis, thank you for your loving guidance in helping me toward a dream career in motion pictures or gaming. To my parents-in-law, John and Elizabeth Ferrie, thank you for encouraging your children to seek higher education. To my loving wife, Kendra, thank you for your patience, assistance, and inspiration throughout this odyssey.
ACKNOWLEDGMENTS

I would like to recognize the Digital Production Arts (DPA) program at Clemson University for its achievements in providing an opportunity to help individuals pursue a career in film or gaming. The experience earned while in this program provides a solid foundation for three-dimensional animation and practical production work within a small team environment.

A special thank you to the faculty of the DPA program for ensuring their students are well prepared for a career in the entertainment industry. Thank you to my Thesis Advisor, Dr. Timothy Davis, for his constant dedication to the DPA program and seeing that I finish what I started. His compositing and programming experience have directly influenced my career decisions and interest. Thank you to Assistant Professor, Tony Penna, for his experience in theater lighting; he showed me a practical solution to painting with light color, both in real life and the digital medium. Thank you to Assistant Professor, David Donar, for his experience with storyboarding and animation, both in traditional and digital format; he reminded me that the story drives the film more than the technical medium does. Thank you to Director, Dr. Jerry Tessendorf, for his technical experience working in a real-world production environment to help continually improve the DPA program.
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CHAPTER ONE
INTRODUCTION

For thousands of years, the human race has deliberately and permanently marked the skin with a multitude of forms of visual expression. The purpose of these markings can represent “rites of passage; protection from evil; to display group identity; proof of status or wealth; medical therapy; beautification; memorial; and even to guarantee entry into the afterlife, to name only a few” [Green03]. Researching the customs of multiple cultures indicates a variety of different tattoo symbolism and meanings. Even though these cultures may attribute meaning to the individual tattoo illustration, in some instances, no meaning is defined.

A common struggle for many novices desiring a tattoo is finding the right imagery or representation for the illustration. Before visiting a local tattoo shop, many artists recommend reading two books written by Terisa Green: a) The Tattoo Encyclopedia: A Guide To Choosing Your Tattoo, which informs the customer about tattoo symbolism [Green03], and b) INK: The Not-Just-Skin-Deep Guide to Getting a Tattoo, which answers common questions concerning the application process [Green05]. Once a customer has decided on an illustration, he or she can then approach a tattoo artist who can customize the look and desired symbolism further. Many artists have developed distinctive artistic techniques and cultural inspiration; therefore, comparable shopping to find suitable imagery is advisable.

As inspiration from both the book and the movie, The Illustrated Man, this thesis will extend tattoo symbolism, exploring the mode of movement to help deliver an
alternative form of visual communication (Figures 1.1 and 1.2). The animations of the
tattoos aim to suggest the past history and the internal struggle of the person who wears
them. The objective of the short film Legion paints a depictive explanation for this

![Figure 1.1 Book cover for The Illustrated Man (1951), written by Ray Bradbury, illustrated by Jim Burns [Bradbury51].](image)

character’s past and shows the way he handles it. The use of two- and three-dimensional
software applications, i.e., Adobe Illustrator and Photoshop, Apple Shake, and Autodesk
Maya, are used to produce this tattoo visual effect. Adobe Flash and Pixologic Zbrush
were also considered but not utilized for this project due to time constraints.

The upcoming chapters focus on historical research and the technical process for
producing the animated tattoo effect created in the short film Legion. Chapter 2
highlights traditional methods for tattooing by explaining skin durability, style and
meaning, and common design elements needed for tattoo creation. Chapter 3 describes
the technical procedures implemented in creation of the tattoo appearance and movement,
while Chapter 4 involves applying the tattoo effect to a character in the short film *Legion*. Chapter 5 concludes by reflecting on the work produced, suggesting alternative usages and applications for this animated tattoo effect in future developmental work.

Figure 1.2 Official movie poster for the 1969 Sci-Fi thriller, *The Illustrated Man*, directed by Jack Smight and starring Rod Steiger in the title role [Smight06].
CHAPTER TWO

BACKGROUND

To explain the unique qualities that constitute a tattoo illustration, this chapter emphasizes skin durability and industry design elements. Also included is a historical explanation of the ways different cultures use tattoos, and in particular how tattoos entered Western culture. This background provides a foundation for future development in the third dimension to recreate and achieve the desired imagery.

2.1 Brief History of Tattooing

The origin of tattoos remains a mystery due to incomplete historical and archaeological records found on fossilized human remains; the earliest concrete evidence is found on human skin preserved only where mummification was applied. One of the more famous tattooed mummies is a Bronze Age man known as “Otzi,” who dates back to 3300 B.C. (Figure 2.1). Upon examination “his skin bore clear evidence of dark blue tattoos in several locations: groups of parallel lines near the lumbar area of the spine as well as the ankles, and a cross on the inside of one knee” [Green03]. Speculation exists as to whether the skin markings were a form of therapy, an ethnic identifier, or body art.
Western culture came to recognize the word “tattoo” around 1777, tracing the derivation back to British explorer Captain James Cook after his 1769 expedition to the South Pacific (Figure 2.2). The explorers and sailors immersed themselves in the culture of Polynesia, bringing back their own tattoos and tattooed natives. Other European cultures were not foreign to the ideals of tattooing. The 4th century Roman emperor Constantine I banned tattooing of the face because it was considered to be a defilement of God’s image [Green03]. Celtic tribes displayed animal body markings to denote family or tribal symbols (Figure 2.3). In Ancient Greek society, tattoos were used to “identify slaves,
criminals, and mercenaries and also occasionally used as punishment” [Green03].

Asian cultures pursued more of an artistic and spiritual endeavor with the tattoo style. The purpose of these illustrations was to provide protection: “from possessing mystical powers to simply warding off bad luck, the symbols include ancient designs that are drawn from calligraphy, numerology, the world of natural animals, and that of mythical ones, such as dragons” [Green03]. Around 1700 this culture implemented strict laws to enable only the nobility to display wealth. This environment led to the origin of the “bodysuit,” where the middle class beautified their skin; initially they covered the back, then gradually extended to the shoulders, arms, thighs, and eventually the entire body. The bodysuit tattoo is an extensive tattoo with similar pattern, style, or theme that covers the entire torso or body (Figure 2.4).

Figure 2.4 Tattoo bodysuits created by Horiyasu [Shock11].
Other areas of the world, spanning from Nepal to Jerusalem, focused on religious themes. Gods and goddesses of Hinduism, along with birds and flowers, were ideals for the tattoo illustration in Nepal. North America indigenous people “carried much of the same cultural, spiritual, and symbolic significance observed in other cultures,” but they used their tattoos (Figure 2.5) to display “identity and achievement, acquire spiritual strength and protection, gain entry into an afterlife, and achieve relief from physical ills” [Green03]. Although different cultures seem to represent tattoo symbolism in various ways, the same principle applies to that of permanence and visual expression.

Figure 2.5 North American Haida tattoos representing the thunderbird (left) and raven (right) after Swan [Gilbert00].

The Tahitian process, tatau, which means “to mark,” was implemented by employing “a rapid tapping, as the set of needles, looking like a small rake, was hit with a stick to drive ink under the skin” [Green03]. The New Zealand Maori process of moko, or carving the skin before applying pigment, is composed of symmetric curved lines, spirals, and other designs (Figure 2.6). The symbolic significance of this style has lessened through the clashing of cultures and political and religious organizations. Although this practice is still exercised today, it is more of an inaccurate and harsh application.
With the advent of the electric tattoo machine in 1891, the artist was able to control needle depth, speed, and force providing him/her with a greater level of control when applying the ink to the skin (Figure 2.7). Another breakthrough in tattoo equipment evolution is the use of hectograph stencils to give the artist an outlined roadmap to begin lining or shading the tattoo or promote the usage of more sophisticated designs [Aitchison09]. The advancement in pigments provides all spectrum colors, which allows the artist to achieve unique tone palettes. The short film Legion focused on the current electric tattoo machine application process to ensure that the final look was clean and more versatile with the color pigments available.

**Figure 2.6** Traditional *moko* ink application [Tattoo11].

**Figure 2.7** Modern electric tattoo machine ink application [Capobianco09].
2.2 Skin Permanence and Care

Tattoos are essentially pigments that are inserted into the dermis level, below the epidermis level, of the skin to remain there permanently (Figure 2.8). Understanding why certain pigment colors change more quickly than others and how the skin renews itself constantly will provide an overall organic quality to the appearance of the final tattoo [Green05]. Terisa Green explains that pigment that is deposited too deeply into the dermis level “may be more difficult to see clearly, might be accompanied by scarring, or could be more readily carried away. Pigment that only reaches the epidermis gets sloughed off over time” [Green05]. Current electric tattoo machines are designed to deliver the right amount of pigment a specific distance into the dermis skin level to prevent scarring. The machine consists of a hollow reservoir tube carrying needle groups; both the tube and needles are coated with ink. The needles travel up and down

**Figure 2.8** Skin cross-section showing epidermis and dermis layers [Green05].
the tube a small distance to penetrate the epidermis layer of the skin to place the pigment into the dermis layer.

The permanence of the ink depends mostly on the healing process for the affected skin. After the ink is introduced into the skin, the immune system will attempt to capture the pigment foreign bodies and carry them away from the dermis layer. Likewise, the epidermis layer will eventually shed the old skin cells by ejecting any pigment found. When tattooing the illustration on the skin, the artist will apply Vaseline occasionally, wiping “away excess ink and body fluids, dipping the tattoo machine needles and tubes into the ink container to pick up more ink, repeating this process until the tattoo is complete” [Green05]. The tattoo artist gauges whether or not the pigment has successfully been introduced into the dermis layer to avoid scarring, which may occur through repeated layering. After the tattoo has been completely applied, the artist will clean it with alcohol, apply a final coat of Vaseline, and bandage the area to prevent infection and promote healing.

Tattoos do alter over time since the skin is constantly changing by shrinking or stretching, becoming injured, or aging. Certain colors like red are more likely to fade than other colors like blue [Green05]. The Ultraviolet (UV) rays from the sun are the number one culprits for causing tattoos to fade or blur. Rapid stretching and shrinking of the skin through stretch mark areas like the arms, thighs, buttocks, hips, lower back, and abdomen can also distort the tattoo. This work takes such factors into account to accurately reproduce their effects on the tattoo imagery.
2.3 Subject Matter, Semantics, and Style

The semantics of a tattoo design have changed throughout history, but one can interpret and/or extend the symbolic meaning upon choosing the subject matter.

No matter the established meaning in one culture, the obvious meaning derived from a historical fact, or the original source of a particular image, people will and do ascribe their own meanings to their designs [Green03].

Terisa Green’s book, The Tattoo Encyclopedia, provides general and widely accepted knowledge of common tattoo symbols using data gathered from archaeology, anthropology, psychology, religious studies, history, and experience from professional tattoo artists. It is a great resource that aids in the design of a tattoo in order to gain incite into the symbolism defined. Figure 2.9 shows an excerpt of the Praying Hands image from this book.

**PRAYING HANDS**
The image of two hands in a position of prayer is part of Christian tattoo iconography. The hands represent communication with God, ranging from rote recitations to more specialized requests. They are generically associated with personal spiritual activity. Most images of praying hands, in tattoo art and otherwise, derive somewhat from the famous portrait done by German artist Albrecht Dürer (1471–1528).

Figure 2.9 Excerpt from The Tattoo Encyclopedia of Praying Hands symbol [Green03].

Once a subject matter and meaning are defined, the tattoo artist can then employ a style to the design in virtually unlimited artistic directions. Guy Aitchison mentions that Japanese tattooing has always been about flow and placement on the body. Traditional American tattooing explores the language of the line, seeking ways to say the most with the least. Tribal tattooing simplifies the compositional equation and zeroes in on
positive/negative relationships that balance between the tattoo and the skin in between. Biomechanical and Organic tattooing place heavy emphasis on the illusion of depth in the design and placement. Black and gray tattooing explores the subtleties of the whole range from dark to light [Aitchison09].

With all of these different design options, the individual wearer can express his/her distinct style, making the visual message clearer to the observer with an aesthetic tattoo quality. Figure 2.10 shows six different styles of tattoo design. See Appendix A for more information on tattoo styles.

**Figure 2.10** Six major variations of tattoo styles [Surles08].
2.4 Traditional Design

To construct an authentic tattoo illustration that will later be used on the computer, the 3D artist must consider traditional methods of tattoo design. This knowledge can be difficult to acquire due to the secret nature of the industry. Often tattoo shops will provide apprenticeships to share their experience and techniques necessary in delivering the true tattoo look requested by customers. This approach can be time-consuming for the 3D artist, but can provide greater insight needed in planning out an illustration effectively. Today, alternative methods of learning the tattoo technique are available through books and electronic media. The website www.tattooeducation.com provides such types of learning resources.

Guy Aitchison, the author of Reinventing The Tattoo - 2nd Edition, provides abundant insight into the design, work in second medium, work from reference, digital tattoos, application technique, and step-by-step processes needed for tattoo apprentices in today’s industry. Even though he includes a wealth of knowledge for tattoo creation, this work focuses mostly on the design aspects. The eight areas of tattoo design that he mentions include flow and fit, positive/negative relationships, contrast, priority, reserve, lines and edges, depth, lighting and luminosity [Aitchison09]. Refer to this book for further understanding of the eight areas of tattoo design.
 CHAPTER THREE

LEGION: A SHORT FILM

In order to effectively demonstrate the new form of visual communication, the animated tattoo effect was applied to a short film through all production stages – pre-production, production, and post-production. Each of these phases is discussed in the following sections giving special emphasis to the production considerations of the animated tattoo.

3.1 Pre-Production Art Direction

The story consisted of a tattooed man, similar to Bradbury’s *The Illustrated Man* [Bradbury51], walking alone in an isolated desert environment. The tattoos on his body represent the decisions and mistakes of his past. As the man walks through the desert, he notices the tattoos gradually coming alive and attacking him. The man struggles to fend himself from this torment and falls to the ground with the delusion of hope being near. At the climax of the story, a rainstorm rolls in cleansing him of his troubles by washing the menacing tattoos from his body. When the rain clears, the man arises and notices that the rain has cleansed him of his past. The man continues to walk forward, but does not realize that a small concealed tattoo begins to resurrect itself on his back. The story demonstrates that a person cannot always escape mistakes of the past.

For each storyline beat, a drawing was produced to visually communicate the action of the scene and then assembled into a sequenced storyboard with other drawings (Figure 3.1). An animatic sequence was then created to visualize the movie with rough
Figure 3.1 Clips from the animatic film showing the main storyline beats.

motion, timing, and dialogue/sound applied. The motion defined the way the actor and the tattoo characters would act in this type of situation and setting. The timing was adjusted for each shot in the sequence to maximize its effectiveness within the story. Initial dialogue and sound were added to heighten the mood of each shot. Eventually, the dialogue and sound were improved through the actor’s performance and drum recordings provided by student orchestra musicians. Editing the film at this stage prevented unnecessary work during production.

The application and meaning developed from the tattoo effect were important to the production and therefore required careful consideration. Some of these rendering decisions, live-action or 3D media, for the film were considered before the production
stage to ensure a reachable delivery date. The main character, tattoo characters, and environment setting decisions are listed in Table 3.1.

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<tbody>
<tr>
<td><strong>Main Character (Vincent Way)</strong></td>
<td>A complete backstory was created to determine the tattoos needed to describe his past. To prevent the overhead of creating a full 3D character, a live-action character was utilized; a script was created to familiarize the actor with the storyline and to provide direction cues for shooting the production.</td>
</tr>
<tr>
<td><strong>Tattoo Characters</strong></td>
<td>The backstory guided the animation of the tattoos through interaction with the main character and any necessary sounds associated with them. Location on main actor, design, and meaning were outlined for each design.</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>The background was developed to create a sense of isolation. Much of the environment was out of focus to direct the audience’s attention to the struggle between the tattoos and the main character.</td>
</tr>
</tbody>
</table>

**Table 3.1** Pre-production decisions for main objects in film.

The main character’s appearance as a tall young man emphasizes characteristics of dominance (through height) and rebellion (through early adoption of the tattoo culture). The archetype is that of a hero with a sordid past who now faces personal battles. The inner struggle is portrayed through a seemingly real battle with the tattoos that cover his body. A student theater actor, Grayson Powell, was cast to play the role of Vincent Way in the film (Figure 3.2).
A brief description of the backstory was used to introduce the main character’s history (Figure 3.3). Some of the details of this preamble were cut from the film due to time constraints.

"Vincent Way has recently awoken from unconsciousness, finding himself in a run-down shack in the middle of the Mojave Desert. Upon awakening, he sees the love of his life, Mindy Hart, dead (or nearly dead) in a pool of blood beside him. He is numb to this discovery, not reacting emotionally. He looks over his surroundings (as best he can; his vision and mind are still fuzzy from his condition), gets up, and stumbles out into the desert. With his mind still coming out of unconsciousness, he trudges onward, oblivious to the fate of Mindy and the urgency of his own situation."

**Figure 3.3** Preamble for the backstory of the main actor in the film (written by Kevin Human).

The goal of the film was not to articulate the entire backstory of the main character, but to display the conflict between him and his tattoos. A concept design for the character (Figure 3.4) was generated to ensure all tattoos fit properly; only the upper half of the body was employed due to time limitations. Each tattoo was detailed with

**Figure 3.4** Concept design for main character.
backstory for preferred design, location on body, and common symbolism from tattoo history (Figure 3.5). The aesthetic design qualities, mentioned in Chapter 2, were not fully taken into account when creating the tattoos for this film. Most of the tattoo designs were researched online, with some created locally by an art student and a tattoo artist. Due to limited funding available to pay a local tattooist to create the custom illustrations needed for this character, the quality of the original tattoos designed by the team did not appear authentic.

**Tattoo 7: Suicide king**

**Character’s history:**
- Location: left arm, shoulder to elbow
- Design—after moving to Las Vegas, he defined himself as a career gambler. Motivated by a night of big winnings (around 5-7 thousand dollars), he went out to a professional studio to get his design done. He wanted it to represent his position as a masterful career gambler. It was sort of a boast, a salute to his current and perceived future success. Before this tattoo, he had been struggling financially.

Tattoo Encyclopedia says:
...playing cards used in tattoo imagery are generally aces or face cards...symbols of good luck and also fate...

This tattoo is highly stylized, sharp, and ornate. “Why don’t you pass the time by playing a little solitaire?” Age 21

**Figure 3.5** Concept design for Suicide King tattoo.

Only a few of the tattoos were enhanced with sound effects to avoid confusion and audio clutter. Some of the major tattoos that caused harm to the main character (Figure 3.6) were accompanied by audio effects to enhance the mood (e.g. Jester – Evil Laugh, Tear Drop – Whisper Voices Inside Character’s Head, Snake – Rattle). Two student musicians, David Agee and Derek Smith, composed an original score for the rain effect using cymbals and chimes, as well as the crescendo of a drum and bell sounds that
beat throughout the story. These audio effects were used throughout pre-production and post-production stages.

![Outline sketches for Jester (created by John Bryson, Clemson University) and Portrait Sun (created by Sean Adkins, Tattoo Wearhouse) tattoos.](image)

**Figure 3.6** Outline sketches for Jester (created by John Bryson, Clemson University) and Portrait Sun (created by Sean Adkins, Tattoo Wearhouse) tattoos.

The film was set in the Mojave Desert to create a sense of isolation for the main character. The goal was to emphasize the main character and his struggles with the tattoos, while background elements were defocused to avoid distraction. The flat desolate grounds of the desert provided this sense of remoteness (Figure 3.7).
Figure 3.7 Cracked Earth for Mojave Desert concept background [Bowers99].

3.2 Production Filming

After camera angles were determined from the animatic created in the pre-production stage, a shot list breakdown was created showing all the camera angles (Face and Tattoo Close-Ups, Side and Front Angles, and Crane). Figure 3.8 lists only a few examples from this shot list, which provided information concerning recorded elements at each moment in the production shoot. Minimizing filming time was crucial at this stage due to the actor’s limited availability, weather and lighting conditions, and resolution setting along with battery life for the camcorder. Each shot was recorded using a Canon
HD20 High Definition Camcorder set on True HD (1920 x 1080 / 24 FPS) resolution to maximize detail for the tattoo close-up shots for post-production work.

**Figure 3.8** Sample shot list for *Legion* movie showing all camera angles.

Since computer-generated tattoos were to be composited on the actor's body, test videos were recorded with varying types of markers to determine the best setup. The actor was asked to remain relatively motionless during the close-up tattoo shots to focus attention on the tattoo effects rather than the main character of the film. Markers with pronounced contrast seemed to track better within the Shake compositing package. In
Figure 3.9, the left image shows green round markers with black Sharpie crosshair patterns. These markers did not adhere well to the actor’s skin; therefore, a modified square version was created, as seen in the right image. This version provided the same green and black sharp contrast along with better adherence to the skin, though some markers were reinforced with tape.

![Figure 3.9 Markers used to perform tracking in Shake.](image)

To produce effective tracking for placement, the computer-generated tattoo images required a minimum of four markers. Figure 3.10 shows an example set of four markers that were tracked in Shake using a single MatchMove node. The ideal tracking position for these markers was the center of the black crosshair. Each marker that could not meet

![Figure 3.10 Four markers tracked in Shake for one tattoo.](image)
the ideal tracking position required manual positioning within the compositing application. Such a situation may occur if a marker is temporarily occluded from the camera. Once all four positions were successfully tracked, a Rose and Dagger image was resized and attached to the foreground input of the MatchMove node (Figure 3.11).

![Figure 3.11 Tracking test with Shake node tree.](image)

Another production challenge was the melting effect for the tattoos during the rain scene. While this effect could have been accomplished using computer graphics (CG), the simpler approach of filming the effect with natural lighting and ink dynamics was pursued instead. Washable finger paint was chosen to create the tattoo since it runs off the body slowly when wet, allowing the effect to be captured in real-time (Figure 3.12). The finger paint was applied to the actor using an airbrush and tattoo stencils. Once applied to the body, the running ink effect was used directly as video during post-production compositing. At this stage the tracking test and tattoo melting effect were complete, allowing production to proceed in filming various shots with the actor.
The background scenery in the film was mostly CG with the exception of the moving cloudy sky and the rain scene where the main character was lying face down on the ground. Since compositing the main actor touching the ground would have been difficult in post-production, a section of cracked Earth was formed using concrete tiles and sand. The concrete tiles were made using a QUIKRETE WalkMaker Country Stone Pattern (Figure 3.13), long and wide enough for all actor performances included in the rain scene shots. Sand was used to fill the cracks between these stones to create a setting similar to the Mojave Desert, as well as to ensure that the sand adhered to the actor’s skin for authenticity (Figure 3.14).
The use of a blue screen facilitated the replacement of the recorded background with CG backgrounds and moving sky for the desert scenery. Figure 3.15 includes two shots from the film showing both the original plates on left and final composited images on right. The blue screen was evenly lit throughout the shoot to ensure proper chroma-keying in post-production. Shooting the film outside in the shade helped create the overcast look necessary for simulating realistic lighting conditions for a cloudy day.
3.3 Post-Production Compositing

Post-production involves combining all footage from the video shoot and CG elements to produce a final rendered result. The Shake node tree for a single shot depicted in Figure 3.16 shows many nodes interconnected through input and output connections starting at the FileIn node for the video footage and ending with the FileOut node for the final rendered film. The main groupings for this node tree consist of video shooting, tracking information, chromakeying, quick paint markers, crush look, tattoo look, and layering to final output. Many of the other shots in the film are similar to the node tree in Figure 3.16 with the exception of the rain scene, where rain and cloud movie clips were utilized. The following description will explore the detail of this node tree more fully.
Figure 3.16 Shake node tree for Suicide King shot.

The FileIn node at the top of the tree is used to import the desired frames from the video shoot for the current shot. A chromakey process was used on the blue-screen footage to replace the blue with CG background (Figure 3.17). The process used two Key nodes to create an alpha channel with opaque white for the character’s silhouette. The initial color keying was performed using a Primate_v2 node with its alpha output connected to the final Keylight node through its HoldOutMatte input. In Figure 3.18, the
Figure 3.17 Production blue-screen footage for Suicide King shot in Shake.

top image shows the alpha channel result from keying the blue hue using the Primate_v2 node; this alpha channel was used as the HoldOutMatte input for the Keylight node, which included the actor’s silhouette in the foreground for the final chromakeying. In this same figure, the image at the bottom shows the final chromakeying once all blue has

Figure 3.18 Chromakeying process for Suicide King shot in Shake.
been removed from the background for the current frame using the Keylight node; this node was used to remove additional blue spill in the transparent foreground elements, such as hair on the outside of the actor’s body.

All tattoos requiring tracking were set up for the four-point tracking Stablize node’s reference pattern, search region, and track point (Figure 3.19). The square markers previously mentioned were placed within the reference pattern where the tracker searched for the sharp contrast marker in subsequent frames. The search region was set to a small size since the actor did not move excessively between frames, resulting in faster tracking time. The track point was adjusted manually when needed to keep it on the center of the black crosshair. To speed up the tracking time, various proxy modes were used instead of the base mode; alternatively if the tracking point repeatedly jumped erroneously, the base mode was set to ensure more detail in the search region. A LumaKey node was also used to increase the contrast of the markers with respect to the surrounding skin to aid with tracking.

Figure 3.19 Tracker breakdown showing square marker used in Shake.
Offset tracking was utilized in cases where one or more markers were missing from view, as seen in Figure 3.20 where three markers for the Ankh tattoo are located off-screen. The top image shows the Suicide King tattoo tracking for all four markers. After all tracking was completed, these Stabilize nodes were used to remove markers using a QuickPaint node on the actor’s skin, as well as transformations for the animated tattoo image.

![Figure 3.20 Four-point tracking for Suicide King (top) and Ankh (bottom) tattoos in Shake.](image)

With the initial chromakeying and tracking of the footage complete, the next task was to remove the square markers from the actor’s skin. The first step was to use a
feathered RotoShape alpha mask for each marker and apply the recent tracking to create a hole in each frame of the original footage’s alpha matte, as seen in Figure 3.21. A

Figure 3.21 Tracked RotoShape alpha mask (top) used to create holes in the alpha matte for each frame of the original footage (bottom) to remove of all markers.

Move2D node was used to offset the chromakeyed footage along with a Screen node to overlap the marker with skin footage (Figure 3.22). Once the skin was aligned to cover the hole created by the RotoShape node, a QuickPaint node was used for touch-up using the Move2D as source for the skin, as seen in the top picture of Figure 3.22. All four QuickPaint node markers were then combined with a MultiLayer node. Each marker used different Move2D and QuickPaint nodes to ensure that each skin replacement was unique.
Figure 3.22 Move2D using original chromakeyed footage (top) as source for QuickPaint skin touch-ups layered together using a MultiLayer node (bottom).

A KeyMix node was used to layer the original chromakeyed footage, the new QuickPaint skin layer, and the RotoShape tracking key for all frames in the shot, as seen in the top image of Figure 3.23. The final skin composite used an Inside layer node to trim any QuickPaint touch-ups that fell outside the alpha matte for the original chroma-keyed footage (Figure 3.23, bottom). The output generated was passed to additional tattoos that had remaining square markers (e.g. Ankh, Raven).
The production mimicked the art direction from the movie, *300*, where the shots were stylized with a gloomy sepia look (Figure 3.24). *Legion* used a similar technique but with only black and white to better blend the tattoo effect more naturally with the skin.

**Figure 3.23** KeyMix node using original chromakeyed footage, QuickPaint skin, and RotoShape tracking (top); final skin composite with Inside node using original chromakeyed footage and KeyMix node output (bottom).

**Figure 3.24** Battle scene from *300* © (2006) Warner Bros. Pictures.
tone. The images in Figure 3.25 show the different stages of the look created using Brightness, ContrastLum, and Monochrome nodes. The original chromakeyed footage after all markers were removed was darkened using the Brightness node. The look was further refined using ContrastLum to create the actual 300 appearance. Finally, the color was removed using a Monochrome node to blend the tattoo effect work more cohesively with the skin.

Figure 3.25 Various stages in creating the 300 look using Shake.
Creating the tattoo look started with drawing key poses by hand, scanning them into digital format, and using Illustrator to create the vector line work and Photoshop to assemble the animation. The example in Figure 3.26 shows a couple of the Suicide King tattoo’s extreme poses in Photoshop along with the animation timeline for this application. A series of Portable Network Graphics (PNG) files with the rough tattoo animation were then exported from Photoshop.

![Figure 3.26 Extreme poses for the hand-drawn Suicide King tattoo along with Photoshop animation timeline.](image)

These PNG files were then imported in Shake to create an alpha channel ready for the additional processing. To create the alpha matte for the tattoo, a combination of Invert, ContrastLum, Reorder, and SetAlpha nodes were utilized. Figure 3.27 shows a graphic comparing RGB channels on the top half of the image with the Alpha channel on the bottom half, indicating that the Alpha matte was successfully added to the original tattoo animation.
To simulate the natural curves found along the contours of the skin where tattoos were applied, Maya was used to create proxy geometry for each tattoo location similar to the actor’s body, thus circumventing the need to model a full CG character. In Figure 3.28, the proxy geometry was constructed using the production footage as a template.
attached to the image plane for the rendering camera. This proxy geometry was not further animated since the actor remained relatively motionless during these close-up tattoo shots. A Lambert shader was created that used the updated tattoo animation with Alpha matte as texture and image sequence option enabled (Figure 3.28, top). Some of the tattoo animation textures for these shaders required adjustment to fit the UV mapping properly, as well as to create a smoother animation by introducing in-between frames. The Maya UV Editor (Figure 3.28, bottom left) provided a way to export the selected UV shell as a graphic.

A separate Shake file was used to perform these animated texture adjustments, as seen in Figure 3.29. The use of an Over node helped layer the animated texture and UV shell graphic to maximize the space for the texture; a Move2D node was used to modify the

![Figure 3.29 Adjustments for the animated texture using Shake.](image)
animated texture within the UV shell graphic. In Figure 3.29 bottom, the timing setting of the FileIn node for the animated texture was adjusted by setting the speed to blend mode. This process resulted in the creation of in-between frames for the pose-to-pose animation, resulting in a smoother animated texture for the tattoo. The output was rendered without the UV shell graphic, and was again imported into Maya to update the texture for the current Lambert shader. All frames were then re-rendered using Maya for the specific tattoo.

At this point, the CG animation file was imported into Shake along with original tracking data previously gathered. After some initial blurring, the sequence was input into an Inside layer node with the Monochrome output footage to produce the inside skin layer for the tattoo. The output tattoo was further adjusted with film grain (Figure 3.30).

**Figure 3.30** CG tattoo animation blurred and tracked (top) along with inside skin layer (bottom).
A MultiLayer node was used to combine the InsideSkinLayer, Grain, and tattoo animation tracking with the layer settings shown in Figure 3.31. The tattoo animation was then resized and translated using a Move2D node. Using the Inside node, any part of that tattoo image outside the Monochrome node alpha was clipped to prevent it from bleeding outside the actor’s body. The tattoos visible in the shot were layered using a chain of Over nodes (Figure 3.32), which passed its output to DilateErode and Blur nodes to complete the tattoo look.

**Figure 3.31** Layer settings for MultiLayer node for Suicide King tattoo.

**Figure 3.32** Tattoo composite showing Inside and Over nodes in Shake.
The background scenery was the final piece in creating the composite for this shot. The CG-generated Mojave Desert and video-recorded sky were imported, resized, and positioned before applying the monochromatic color transformation, similar to the process used for the actor (Figure 3.33). The CG background required one-point tracking through a Stabilize node to follow the character’s slight movements (Figure 3.34).

**Figure 3.33** CG Background original (top), and same with 300 look applied (bottom).
Figure 3.34 Stabilize one-point tracking for matching the background to the character’s movements.

The final nodes in the process placed the character over the background and added film grain to weaken the High Definition (HD) footage. Other background elements, such as video-recorded green-screen rain, were layered over foreground and background elements using standard Over nodes (Figure 3.35). Finally, the resolution output was resized to 1280 x 720 using a Resize node, followed by a FileOut node that rendered a Quicktime movie to disk using the H.264 codec.

Figure 3.35 Final composite for the Suicide King and Ankh tattoos on CG background.
CHAPTER FOUR

RESULTS

To evaluate the effectiveness of the visual effects produced for the short film *Legion*, this chapter shows some of the final plates along with comments for improvement. This analysis will hopefully inform future techniques in compositing tattoos for film. Shots presented focus on the major visual effect hurdles for the film: tattoo animation, tracking, and rain scene production.

Animating the tattoo was accomplished using a combination of two-dimensional animation, three-dimensional bending, and compositing skin layering techniques mentioned previously in Chapter 3. Design of custom tattoos for the film was difficult due to the team’s inexperience of the tattoo industry’s trade design secrets [Aitchison09]. Figure 4.1 shows an adequate animation for the Suicide King tattoo with clean line work, desirable three-dimensional warping, and easily read action. If tattoo shading were applied, the desired behavior may have been difficult to visually communicate. Figure 4.2 illustrates a Grim Reaper tattoo in motion where the scythe handle penetrates a neighboring tattoo. This interaction is undesirable; therefore, the Grim Reaper animation should be adjusted to avoid confusion. An alternative approach may be to remove the neighboring tattoos and feature only the Grim Reaper tattoo as a single back piece element; this layout is a common design element for bodysuits found in Asian style tattooing (Figure A.2) but can be applied to a more Traditional American style (Figure A.1), as the Grim Reaper portrays.
**Figure 4.1** Acceptable final plate animation of Suicide King tattoo on upper arm.

**Figure 4.2** Unacceptable final plate animation of Grim Reaper tattoo on upper back highlighted with red circle indicator.
Tracking the square markers was difficult due to visibility issues on the original plate screen, size problems due to the actor’s distance from the camera, and other issues such as overlap of digital tattoos with physically airbrushed tattoos. Figure 4.3 shows unacceptable tracking due to the actor’s distance from the camera and airbrushed tattoos on the skin. Other solutions, such as using RotoShape and QuickPaint, would be difficult to apply due to large areas of skin replacement, as mentioned in Chapter 3. To completely remedy this issue, the sequence should have been re-shot, but the schedule and resources did not allow it. At the very least, this scene should have been removed from the final reel, but was kept since no other original footage worked to maintain the shot continuity of the animatic.

Figure 4.3 Unacceptable final plate tracking highlighted with red circle indicator.

Figure 4.4 shows a close-up shot of the actor’s face where only one tracking marker existed. The tracking for this shot was acceptable, but the bending of the Tear
Drop tattoo was not acceptable for this frame. This issue could be fixed by warping the tattoo image using the Maya technique along with offset tracking demonstrated in Chapter 3.

The rain scene posed many difficult challenges since it required a realistic melting effect of the tattoos. Airbrushed stencil tattoos applied with acrylic paint were used to physically represent the tattoos. Garden hose water produced a simulated light rain shower, creating a believable effect in shorter time than a computer-generated rendering. The acrylic paint produced a desirable melting effect once water contacted the tattoos, as seen in Figure 4.5. The airbrush stencils were created with outlines only and did not contain any detail for the internal design of each tattoo. This approach resulted in tattoos with completely opaque lining and shading, which eventually produced poor original

![Figure 4.4 Acceptable final plate tracking with unacceptable tattoo warping highlighted with red circle indicator.](image-url)
plates as seen in Figure 4.3. Due to time constraints, the airbrush stenciling and application process was rushed and produced unacceptable results. Further, Figure 4.6 shows a poor RotoShape and QuickMask application due to the mudding of the tracking markers during the rain scene melting effect. The tracking markers should have been removed from the actor prior to shooting the rain scene.
CHAPTER FIVE

CONCLUSION

This thesis defines a process for compositing an animated tattoo effect on a live-action plate. The workflow describes a technical means of two-dimensional tracking, three-dimensional warping, and skin layering actions. Tattoo industry design experience [Aitchison09] can improve overall lining and shading in tattoo illustrations to enhance authenticity. The use of three-dimensional software programs, such as Maya and Zbrush, for modeling and animation is a good approach to create a unique tattoo animation from the traditional two-dimensional animation seen here.

Dean Deakyne is a tattoo artist who recently entered the three-dimensional world to expand his toolset by designing tattoos using Zbrush and Maya. Figure 5.1 shows two

Figure 5.1 Tattoo designs created using Zbrush, Maya, and mental ray [Deakyne09].
sample tattoo designs created for his clients that were constructed using these three-dimensional tools. Following Dean’s guidance may result in more accurate and original tattoo animation design. Using these three-dimensional tools demonstrates an alternative approach that a traditional tattoo artist can leverage in future design work for tattoo illustrations or animations.

Figure 5.2 shows a contour line rendering of a ship and lighthouse Traditional American tattoo created in Maya and rendered using mental ray. Due to time constraints, the completion of the tattoo shading and animation were delayed, indicating that recreating the tattoo design using three-dimensional means can be more time-consuming and should be considered at the beginning of the production cycle.

**Figure 5.2** Original tattoo line design [LaCasse10], wireframe on three-dimensional model, and final contour rendering of Traditional American ship with lighthouse.

Should a production decide to use a three-dimensional workflow for creating a tattoo design or animation, mental ray provides a Subsurface Scattering (SSS) shader that can resemble realistic skin using a combination of skin layer textures. Figure 5.3
Figure 5.3 mental ray Subsurface Scattering (SSS) shader for realistic skin [Spencer10].

The complete tattoo animation process and future enhancements using three-dimensional means defined in this thesis can hopefully guide upcoming productions utilizing a tattoo design or animation. Methods defined here are suggested, but may not be practical for all projects. Compositing techniques can be streamlined if the original plates are correctly shot and properly account for tracking markers, blue-screen, and lighting considerations.

Three-dimensional designs or animations can help create unique tattoo designs if following traditional tattoo design requirements [Aitchison09] and might reduce production time. Animation of a tattoo can suggest visual communication from the individual to the audience that might relay different interpreted associations from varying views. This type of communication may be uniquely enhanced by the use of digital techniques created for this project.
APPENDIX A

STYLES FOR THE TATTOO

Many tattoo styles have been established throughout today’s industry rich with history and design elements. This section will showcase the following tattoo styles: Traditional American, Asian, New School, Black and Grey, Tribal and Biomechanical, Photorealism, and Hybrid.

**Traditional American**

Known for its dark outlines, clean line work, bold primary colors, and black shading, this style allows the design to withstand the test of time. The images are not meant to appear realistic and are usually one-dimensional, stylized, and use multiple layers to render a sense of depth instead of using three-dimensional perspective [Surles08]. They are simple and bold and commonly use red and gold tones. They lack detail, which makes them easy to recognize across a room (Figure A.1).

*Figure A.1* Traditional style examples showing patriotic theme, sugar skull (Mexican *Day Of The Dead Festival*), and panther symbols [Surles08].
This style was most likely developed in the late 19th century by American sailors who traveled to Polynesian islands where tattooing was common to the culture. A set of designs evolved over the years that served as a means of silent communication between seamen who did not know one another, describing their service time, their adventures, and what kinds of hazards they had survived. They also functioned as talismans to invigorate their strength or protect the sailors from the many dangers that frequently took the lives of their fellows [Surles08].

Common subject matters include: pirates, anchors, panthers, snakes, diamonds, wings, roses, pigs, cocks, lighthouses, barn swallows, and the like. Neo-Traditional is an attempt to modernize this style using the same subject matter, poses, and color schemes, but adding interest by using more modern perspectives and techniques, such as color work to heighten the drama in the design.

Asian

This style is “beautiful, powerful, and diverse, and the themes often juxtapose elegant compositions with strong imagery to render an appealing set of design possibilities” [Surles08]. These tattoos potentially consist of compositions covering the entire body, leaving only the hands, feet, and head exposed; the imagery spans large areas of the body accenting natural shapes and motion. The imagery is founded in myth and rich in symbolism, characterized by themes such as the “koi fish, the Buddha, geishas, samurais and other heroes, figures from Japanese myth, beautiful flowers, black finger waves representing water, and soft grey shaded wind bars or clouds” [Surles08] (Figure A.2). The historical perspective dates back 10,000 years in Japan where the tattoos
denoted criminal action. Eventually these tattoos transpired into an intricate modern art form around 1868 when designs became more complex and tattooing techniques more advanced.

**Figure A.2** Asian style examples showing cherry blossom, koi fish, and Japanese myth symbols [Surles08].

**New School**

This style of tattoo is mainly influenced by the Traditional American designs through the use of the subject’s symbolism. It tries to appeal to a new generation through the use of a new palette of bright colors and twists on the imagery to produce innovative, lighter, younger, funkier, and more humorous irony in the designs [Surles08] (Figure A.3). In the early 1980s, the graffiti art movement also influenced this style through the use of a bright color palette, experimental perspective, and subject matter.
Figure A.3 New School style examples showing devil girl, graffiti tribute, and revision of Traditional American skull and dagger symbols [Surles08].

**Black and Grey**

This style limits the color palette to only black and grey tones, focusing on the realism of portraiture using treatments of light and shade contrasts, also known as chiaroscuro. The imagery can be associated with skulls and demonic representations, religious pieces, portraits, tributes, and other memorial pieces (Figure A.4). “Like

Figure A.4 Black and Grey style examples showing religious theme, horror portrait, and Dark Arts symbols [Surles08].
Traditional American tattoos, black and grey tattoos are known to hold up through many years, and they are less likely to look blobby and unrecognizable as … skin ages” [Surles08]. This style is thought to have emerged from prisons where it was common to symbolize gangs, storylines of various crimes, and places of correction.

**Tribal and Biomechanical**

The Tribal style is mainly composed of black ink or shades of grey focusing on enhancing the body’s natural shapes and movement. This style promotes tattoos with more body coverage since tiny details and bold color work may not be as effective on darker skin tones. They are popular as background images to help improve the contrast for the foreground’s softer color elements in the tattoo design. Modern tribal designs do not always reflect the tribal origins’ symbolic meanings. Instead they are often altered to represent the wearer’s heritage by using personal “designs in traditional clothing,

![Figure A.5](image)

**Figure A.5** Tribal and Biomechanical style examples showing background design, bold color outer-space theme, and use of negative space pattern symbols [Surles08].
weaving, painting, pottery, or other folk art that have cultural significance” [Surles08].

The Biomechanical style is similar to the Tribal style except that it uses more color, more detailed patterns, and folds to focus on the illusion of depth (Figure A.5).

**Photorealism**

Relatively new to the tattoo scene, this style makes use of hyper-realistic dramatically colored and tweaked images usually consisting of portrait subject matter (Figure A.6). The tattoo artist will experiment with image manipulation tools, such as Adobe Photoshop, to enhance the vision of reality by experimenting with color variations to create a painterly effect and spatial dynamics by manipulating the forms similar to the New School style [Surles08]. To heighten the drama, the artist may zoom or crop aspects of the image, or add negative space elements to draw attention to certain areas. Due to technology advancements and highly skilled artists, Photorealism has helped develop a
resurgence of tattoo art in society. Joy Surles mentions that the “images are eye-catching, head-turning, bold and unique, and they are sure to provoke a reaction from viewers seeing this style of artwork for the first time” [Surles08].

Hybrids

This style combines different tattoo styles in a single image, or elements from a single tattoo style in unusual ways, to create unique but not necessarily meaningful designs (Figure A.7). It allows the artist to manipulate tired, old imagery into new and exciting forms; from rearranging elements of older styles of tattoos to create weird new styles to the juxtaposition of the flat, bold colors of traditional work with cutting-edge photorealism, the reinvention of the traditional tattoo through hybrid styles is perhaps the wave of the future [Surles08].

Figure A.7 Hybrid style examples showing juxtaposition of Black and Grey skull with Asian water and flowers, Photorealistic effects with Traditional American subject matter, and Traditional American heart-rose morph symbols [Surles08].
Combining different styles could help heighten the dramatic effect while preserving the original symbolism for the subject. Merging different elements from the same tattoo style could create unsettling effects for the viewer but allow for original imagery that keeps the same recognizable style throughout the design.
REFERENCES


