

Dream of the Techno-Shaman



by Trent Grover

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TABLE OF CONTENTS

ABSTRACT	i
INTRODUCTION	1
TRIBAL ART	4
COMPUTER ART	9
INSPIRATION	15
INTENTION	25
PROCESS	28
CONCLUSION	32
FIGURES	34
BIBLIOGRAPHY	50
ACKNOWLEDGEMENTS	52
APPENDIX A: <i>Ars Electronica</i>	53
APPENDIX B: <i>Generative Pattern in Tribal and Computer Art</i>	74
APPENDIX C: <i>Maya Embedded Language (MEL) Scripts</i>	89

ABSTRACT

This written component documents my thesis exhibition, *Dream of the Techno-Shaman*, created in partial fulfillment of the degree requirements for the Master of Fine Arts degree in Integrated Visual Arts. This multimedia installation was completed and exhibited at the Design Center's Gallery 181, on the Iowa State University campus in Ames, IA, during July of 2008.

The following text details my creation process in its entirety, from initial inspiration to final exhibition. This begins with a brief introduction to tribal and computer art, followed by discussion of the inspiration I found in the similarities between these seemingly disparate genres. These similarities span all characteristics of importance to the fine art community, including their formal properties, conceptual content, and underlying socio-cultural context. More specifically, key similarities include extensive use of generative pattern, exploitation of the incorporeal, prominent use of multimedia expression, and an emphasis on interaction and collaboration.

Dream of the Techno-Shaman is my attempt to highlight and explore many of the similarities between tribal and computer art, as well as their associated cultural impact, in the form of an immersive multimedia installation. Its large scale and heavy use of both physical and virtual components necessitated a wide range of traditional and digital production processes. Ultimately, this installation successfully exploits the unique potential of computer technology to reengage with tribal processes through interactive and immersive multimedia art.

INTRODUCTION

When I first entered graduate school to pursue my Master of Fine Arts degree in Integrated Visual Arts, I had only a vague conception of the studio work I planned to explore. My background was primarily technical, having earned an undergraduate degree in Computer Science and subsequently worked for several years as a full-time technology and software developer. Though my technical work required creative problem solving and often reflected hints of artistic interest, I soon decided that I would be more satisfied in a field that combined my technological knowledge with more artistic expression.

At the time, I was pretty familiar with the cutting edge of both technologically based artwork and computer research, and was generally underwhelmed with the results. Though many digital artists created interesting work, they most often applied established technology and techniques repeatedly to slightly different content, rather than developing and incorporating innovative uses of technology. On the other hand, computer researchers demonstrated substantial technological advances, but were purely concerned with capability and completely ignored aesthetic or conceptual artistry. In this, I saw a challenge: could I find ways to bridge the gap between these two disciplines? That is, could I create computer artwork that was advanced both in its technological proficiency and its artistry?

In my initial attempts, I fell into some of the same traps that snare other digital artists, who, as a whole, tend to focus on technology at the expense of content. In concentrating on the technological components to my artwork, I struggled to find cohesive content or style. My work varied widely from one image or animation to the next as I amassed additional technical abilities; however, over time certain trends started to appear.

One notable trend was the appearance of or allusion to established tribal motifs. Two of my virtual sculptures, *ID* (Figure 1) and *Blood Rites* (Figure 2), as well as a carved wooden sculpture, *Flow* (Figure 3), incorporated abstract compositions based on Polynesian tattoo motifs. I created a three-dimensional digital bust of a Maori warrior (Figure 4), complete with custom facial tattoos, and a video game character based on the mythic Raven of the Pacific Northwest (Figure 5). One of my photographic manipulations, *Cave Scratchings* (Figure 6), incorporated petroglyphs. I even designed and began carving a twelve foot tall totem pole.

The other trend in my work was of a more technical nature. Relying on my computer programming experience, I explored computer-generated artwork. *BabySitter* (Figure 7) was an interactive multimedia installation that allowed the audience to alter evolving imagery via an intuitive webcam interface. *Subconscious Debate* (Figure 8) used EEG sensors and real-time video manipulation algorithms to alter video streams based on the participants' brain response to political commercials. These works explored the potential of computer technology as a means for creating art that can respond to audience participation in real-time, which facilitates a more active dialogue between the artist, who guides the resulting imagery by creating the program that generates it, and the participant, who also guides and manipulates the work through interaction.

For awhile I continued to produce works that followed these two seemingly divergent paths, bouncing back and forth, struggling to find a unified artistic point of view. To many people, including me initially, tribal art and computer art are diametrically opposed genres. In fact, according to some definitions, computer art is simply artwork that utilizes the most advanced technologies available while tribal art is artwork that uses the least. The question I

had to address became apparent: how could I bring these two disparate modes of expression together in natural, but novel ways?

As I began to plan for my thesis exhibition, I did a lot of research on both tribal and computer art. The more I read and reflected, the more connections I discovered between the two. This process illuminated my own work for me and revealed thin threads that united my seemingly divided production history. I discovered that, while my prior work had not been as aimless as I previously feared, I could certainly do more to solidify and highlight the connections between these seemingly unrelated disciplines. My thesis installation, *Dream of the Techno-Shaman*, is the culmination and embodiment of those realizations.

The text that follows details the creation process in its entirety, from initial inspiration to final exhibition. I begin with short introductions to tribal and computer art, including their respective impacts on contemporary art, and then proceed to discuss the conception and production of *Dream of the Techno-Shaman*.

TRIBAL ART

A Definition

Tribal art, sometimes dubbed ethnographic art, is considered the artwork of small-scale nonliterate societies (Dutton 1998). These societies need not be strictly tribal in social structure, but are usually said to be descended from a common ancestor. The tribal societies most often referenced are African, pre-Columbian, Oceanic, and Native American (Chanda 1992), as they existed before appreciable Western impact on their cultures.

In *Tribal Art*, Denis Dutton is quite specific in delineating the common characteristics of tribal societies. They are isolated, both politically and economically, from the civilizations of Europe, North Africa, and Asia, and are organized in small, independent population groupings, which live a life of face-to-face social interaction and informal social control. Tribal societies typically have a low level of labor or craft specialization, and tend to subsist by hunting, fishing, and gathering or through small-scale agriculture. They possess little technology beyond stone hand tools, use oral traditions in the absence of literacy, and display slow rates of cultural change prior to European contact. Of these, small size, lack of written language, and isolation from large civilizations seem to be the essential features (Dutton 1998).

As Dutton notes, H. Gene Blocker has identified the common characteristics of the art produced by these tribal societies. These artifacts are of aesthetic interest, either sensually or imaginatively, and are subject to critical appraisal within the tribe. They are typically made by a specialized producer of art, who is often seen as eccentric or who is socially alienated within the indigenous context. The resulting objects are set apart from those of ordinary life.

They are composed within a conservative artistic tradition, although there is the possibility of novel expression within that tradition. Most importantly, they intentionally represent real or mythological objects, people, or events symbolically, rather than literally (Dutton 1998).

Of the plethora of tribal art, most Western attention is focused on transportable, and therefore displayable, artifacts constructed of durable materials. Initially these consisted almost entirely of carved African masks and figures. Like most tribal artwork, these African carvings display highly sophisticated and aesthetically powerful stylizations. Geometric design and pattern recurrence is heavily emphasized and naturalistic representation is intentionally eschewed in favor of distorted and abstracted facial and bodily proportions. This is because most tribal works, regardless of medium, tend to represent objects or ideas rather than depict them. They express conceptual realities, not physical ones.

This conceptual expression favored by tribal societies extends far beyond the transportable artifacts most noted by Western societies. Tribal art encompasses a wide variety of relatively perishable or ephemeral arts (Dutton 1998). Both the Navajo and Australian aborigines participate in intricate sand painting, and many cultures use body painting in a variety of ritual contexts. For most tribal cultures, ceremonial performance plays a significant role in their artistic and religious lives. These rituals tend to blend multiple artistic genres into interactive performances, which incorporate sculpture, painting, drama, dance, and music. In many cases, the art objects themselves are activated or transformed by the presence of a shaman within or among them (Errington 1994).

In general, the function of art in tribal societies is quite different from that of the Western fine art tradition. The European distinction between the fine arts and the popular or folk arts has no clear application to tribal art (Dutton 1995). Much tribal art has routine

ceremonial or ritual function. Though it has been ritually and culturally elevated above commonplace objects, it still possesses distinctly functional qualities. There is little if any art created for purely aesthetic ends.

In addition to their spiritual or ritual significance, the oral and visual arts of non-literate societies often take on the role of literature by keeping historical records alive (Chanda 1992) and documenting specific elements of tribal religion or culture (Segy 1958). As such, these artworks are invested with a greater density of meaning than in literate societies (Dutton 1998). Achieving this density of meaning requires additional care, craftsmanship, and critical discernment than would otherwise be necessary.

As a result, tribal arts are governed by systems of rules as complex as those that govern Western art forms (Dutton 1998). Almost without exception, tribal artists are members of highly conservative societies and work within rigidly formulated traditions. Many fear that any departure from the tribal style could prevent the artwork from carrying out its ritual purpose. Though social intercourse between tribes is still carried out, tribal styles are rigorously defended from contamination by outside influence (Segy 1958).

Impact on Contemporary Art

Not so long ago, tribal art was erroneously referred to as “primitive” art by the Western art community. It was in this context that tribal art began to exert influence on Western artists, initially giving rise to the artistic movement called Primitivism. Primitivism refers to the idealization of simple or primitive social behaviors. The associated artistic movement originated as a reaction to the 18th century intellectual movement known as The Enlightenment. Though the Enlightenment emphasized the application of reason, science,

and rationality to all things, it was during this time that philosopher Jean-Jacques Rousseau introduced the concept of the “noble savage.” He argued that 18th century culture detrimentally lacked an affinity with nature, passion, emotion, instinct, and mysticism. Modern society was moving away from its traditional roots and losing touch with its true primitive condition.

During the 19th century, European and American power spread over large sections of Africa, Micronesia, and North America, exposing their populations to many new native, non-urban cultures. The art of these cultures reflected different patterns of life and religion than had previously been incorporated into Western art. European and American artists who were dissatisfied with aspects of their modern culture began to search for what they were missing in these non-Western parts of the world. Their art began incorporating motifs, styles, and formal conventions found in non-Western art and artifacts. In particular, the use of exaggerated facial and body proportions, petroglyphs, animal totems, and geometric designs, became fashionable in modern art. Gauguin was the first artist to use these conventions to wide success.

At the beginning of the 20th century, African art significantly influenced several schools of emerging art. The Fauves and Cubists found value in African art from a purely formal point of view, seeing in it a perfect reduction of natural forms to their geometric equivalents. These artists, most notable among them being Pablo Picasso, appropriated and explored these formal elements with little concern for their associated tribal contexts. At the same time, the early German Expressionist group Die Brücke embraced African art from an emotional point of view, appreciating its sentimental impact (Alfert 1972). Several

significant subsequent modern artists, including Henry Moore, Alberto Giacometti, Wassily Kandinsky, and Jackson Pollack, expanded upon the use of primitive conventions.

In this context, modernists were rebelling against social and formal realism. Shallow or stereotypical concepts of the primitive were used to counter pre-modern social and artistic values without a clear understanding of the true relationship between tribal life and tribal art. Though perhaps initiated under dubious pretenses, African and tribal artifacts have now become generally accepted as works of art.

COMPUTER ART

A Definition

As indicated by the name, computer art is simply artwork that makes use of computer technology. As such, this encompasses a wide variety of art production processes and resulting artifacts, each of which makes use of technology to varying degrees and in vastly different ways. In its tamest incarnations, computers are used to produce images that can be output to two-dimensional surfaces like paper, film, videotapes, or monitors. In more interesting applications, computer technology can be harnessed for the creation of mixed media constructions, cybernetic sculptures, telecommunication events, virtual environments, generative videos, and interactive and collaborative artworks.

This expansive list of applications can largely be subdivided into the broad subcategories of computer-assisted art and computer-generated art. Computer-assisted artists use computer technology primarily as a design or fabrication tool, almost exclusively via off-the-shelf commercial software (e.g. Adobe Photoshop, Autodesk Maya, etc). In most of these instances, the computer offers advantages in speed, cost, efficiency, or flexibility over traditional art production processes while achieving similar results. Although computer-assisted art was developed in an attempt to replicate or mimic traditional art processes (e.g. painting, photography, and animation), it has subsequently evolved its own related, but distinct, styles and domain dominances. In particular, production intensive and time sensitive fields like animation, video production, graphic design, and architecture now use computer tools almost exclusively for design, visualization, and artistic rendering tasks.

In contrast to computer-assisted artwork, computer-generated artwork requires that the computer itself shoulders the vast majority of the work in producing the final perceptible art product. Before a machine can produce anything, however, it must be given instructions and guidelines. As a result, computer-generated artwork requires that the artist is capable of effectively communicating these instructions and guidelines to the computer via computer programming. In these cases, the creative effort of the artist is concentrated in the design and implementation of the computer software driving the artwork, rather than the final physical manifestation. As a result, once the software design is complete, the computer can repeatedly execute the program to produce one or more artifacts. Perhaps the most significant advantage of this approach to computer art production, however, is the potential to incorporate real-time interactivity with the audience. This interactive component shifts the artist-audience interaction from a single passive one-to-many presentation to multiple active one-to-one discussions (Nadin 1989).

Impact on Contemporary Art

As one would expect, the impact of computer art on the fine art community has in many ways been regulated by the development of its underlying technology. Early computer research (prior to the mid 1970s) was dominated by military concerns, thus access to computer equipment was primarily limited to military and university scientists. Even with access, it was impossible to work with computers without knowing how to program them. Several artist-programmer collaborations were attempted, but they often failed due to the vast differences in vocabulary, communication style, and research priority that exist between

these two fields. Consequently, hybrid artists, those with interest or training in both fields, became the key figures in early computer art.

The aesthetically rudimentary nature of early computers also imposed major limitations on early computer artists. Computer display screens were not developed until the mid 1960s and even then were only capable of displaying black and white images comprised of lines and simple curves. Prior to that, artists were forced to work blind and were limited to programming instructions for computer driven pen plotters that could only draw straight lines. Naturally, the most common output at the time was algorithmically-varied compositions of simple geometric shapes.

Two key computer artists of this early period were Manfred Mohr and Charles Csuri. In 1971, Mohr had the first museum based solo exhibition of computer graphic art (Digital Art Museum 2008). His work focused on abstract, linear, black and white compositions of cubes. Though he had pursued the same imagery before being exposed to computers, he “discovered that his aesthetic interest in multidimensional spaces could not be efficiently supported without [this new tool]” (Nadin 1989). In contrast, Csuri focused on largely representational images that he plotted out by hand and then varied or distorted using computers. His work also includes significant early experiments in computer animation (1967’s *Chaos to Order*) and computer assisted sculpture.

As is commonplace in the fine art community, “new forms of art emerge in a context of conflict with established art” (Nadin 1989), and, at this early stage of development, the larger fine art community actively resisted the efforts of computer artists. In 1963, the first computer art competition was sponsored, not by an art gallery, but instead by “Computers and Automation,” a technical trade publication (Digital Art Museum 2008). Though several

art exhibitions were held in the late 1960s, they never displayed computer art alongside traditional artwork. The consensus among art critics was that computer art focused on the formal approach to image making, without addressing any issues of concern to the art world. Also undermining the perceived legitimacy of the discipline was its continuing ties to the military, the corporate origins of its technology, and the fact that it did not look much like most established fine art.

In the 1970s and 80s the advancement of computer technology, particularly the development of personal computers, shifted the field in a much more beneficial direction for artists. In 1973, Xerox developed the Alto computer with the goal of creating an office machine that non-scientists could use. The Alto included a number of groundbreaking developments that were significant for artists, including a raster graphics display, a mouse driven graphical user interface, and off-the-shelf paint software. The trend toward more artist-friendly computing was continued with the release of the Macintosh computer, the creation of full color Photoshop software, and the development of photographic scanning technology. This rapid period of development was matched by a sharp decline in cost, resulting in significantly more people using computers for non-scientific purposes. Schools and small companies could now afford computers and artists could work without technical collaborators. Computer graphics quickly spread to all areas of design and architecture.

During this period of unparalleled expansion, the evolution of computer art split into two separate tracks. Hybrid computer artists maintained the belief that it was important for artists to program their own tools, while the newly enabled interactive graphic artists eagerly incorporated off-the-shelf graphics software into their repertoire. Two key computer artists of this period who embody these two tracks include Harold Cohen and Joan Truckenbrod.

Cohen, a hybrid artist, is most noted for programming an artificially intelligent computer, AARON, which could, in some sense, create its own abstract paintings. In 1983, AARON's work was displayed at the Tate Gallery in London (Digital Art Museum 2008). Truckenbrod, an interactive graphic artist, is well known for successfully incorporating expanding technology into her evolving art production process. She began by producing algorithmic computer prints on fabric, moved on to innovative photo manipulation and montage work, and has since progressed to multimedia installation.

The artwork of computer artists this period was much better received by the established fine art community. Advances in printing technologies allowed for computer work to be displayed in a fashion more typically associated with drawing, painting, and photography. The advent of photo scanning technologies allowed artists to deal more readily with content that mattered to the art world and more engaging forms of montage work quickly emerged. Established traditional artists even began to experiment with computers in limited capacities. David Hockney, for example, used a computer to produce photo collages and Andy Warhol used computers to experiment with color combinations for his silk screens.

In many ways, much of the computer art of the 1970s and 1980s attempted to use computer technology to imitate traditional art practices and artifacts. In contrast, the most recent period of computer art, starting in the 1990s and continuing to today, is marked by exploration of the inherent advantages of computers over traditional media. As Mihai Nadin said, "It is in the realm of what was not before possible that one can see the assets of this artistic involvement with technology" (Nadin 1989). Accordingly, recent developments have focused on 3D computer graphics, multimedia, and interactivity.

Interactive artwork like Myron Kruger's *Videoplace* allows audience members to engage with artwork mentally and physically, actively altering the computer graphic display by manipulating their own bodies. Virtual reality artwork like Char Davies' *Osmose* presents visually rich immersive environments in which the audience can interact with virtual spaces and their inhabitants. The introduction of the internet enables unmatched social and collaborative artworks like Rafael Lozano-Hemmer's *Vectorial Elevation, Relational Architecture #4*, in which anyone in the world can control and manipulate a large scale public art installation using a simple web site (Ars Electronica 2007).

These, and countless other examples, represent artwork in which the computer is an integral and unavoidable contributor to the final art product, works that could not or would not have been created without their use¹. When considered with the pervasive use of computers as tools within the established traditional art contexts of photography, print making, graphic design, film, and architecture, their impact is undeniable. Consequently, computer art, in its many forms, has attained a firm stance in the fine arts community as a legitimate art form and its artifacts now sit alongside traditional artwork in most contemporary exhibitions.

¹ A discussion of the evolution of interactive computer art, as seen through the artists and artifacts of the Prix Ars Electronica, the world's preeminent cyber arts competition, can be found in Appendix A.

INSPIRATION

Some would consider it ridiculous to claim that tribal and computer art have much in common. After all, tribal art consists of mankind's oldest forms of visual expression and computer art the newest. They exist on opposite ends of both the art historical and technological spectrums. When considered more carefully, however, it becomes apparent that tribal and computer art are significantly more related than they appear at first glance. In fact, I would argue that they have more in common with one another than either do with much of the artistic canon that interposes them. The similarities between these genres span all characteristics that are of importance to the fine art community, including their respective formal properties, conceptual content, and underlying socio-cultural context. More specifically, key similarities include extensive use of generative pattern, exploitation of the incorporeal, prominent use of multimedia expression, and an emphasis on interaction and collaboration.

Generative Pattern

A key component of tribal art that appears almost universal is the preponderance of abstraction. Whereas naturalistic artwork seeks to reproduce a physical reality, "non-naturalistic or abstract art seeks to express a 'conceptual reality,' not what the artist can see, but what he conceives as an idea" (Segy 1958). It is this tendency to represent the world symbolically that dominates tribal artwork.

In many tribal cultures, this abstraction takes the form of pattern. The Maori of New Zealand developed a highly homogenous, geometrically detailed aesthetic style consisting of

motifs based upon abstractions of fragments of the human figure (Chipp 1960). Maori artworks tend to use a relatively small set of these abstract organic motifs repeatedly in various combinations and orientations to produce larger, more complex motifs or entire compositions. In this, the Maori are not unique; the tendency to use additive motifs is also common to the tattoo traditions of several other Polynesian cultures.

Pattern recurrence is also prevalent in African art. In particular, the geometric property of self-similarity, in which the same pattern appears at different scales in a composition, is common in African textile, sculpture, and architecture. As seen in aerial photographs, the village of Logone-Birni in Cameroon grows in a self-similar pattern of rectangles within rectangles, creating a spiral path through its palace. Mangbetu sculpture displays recursive use of all four geometric transforms (reflection, rotation, translation, and scaling) (Eglash 2004) and Ethiopian crosses are generated using iterative line replacement with a simple core geometric shape. In fact, Ron Eglash has traced the development of the digital computer back to the generative processes used in another African art, Bamana sand divination. This process of predicting the future via sand drawing uses complex recursive algorithms that were initially adopted by the European alchemical community, before serving as the mathematical inspiration for the Boolean algebra and binary language that ultimately enabled the creation of the first digital computer (Eglash 2007).

More likely than not, when tribal mystics developed their generative patterns, they were simply responding to the patterns evident in their natural surroundings. After all, it is not difficult to find naturally occurring self-similar structures. Prominent examples exist worldwide in plant structures, including leaf veins, fern tendrils, and tree branches. Perhaps it is telling that many of the names for traditional Maori patterns come from similar natural

phenomena, such as waves and foliage (Chipp 1960). Regardless, the spiritual use of recurrent patterns common in tribal art may reflect a desire to discover and replicate the directing forces of the natural world.

Like tribal art, computer art makes use of a great deal of abstraction. Early computer art was dominated by simple geometric forms due to the technological limitations of the tools utilized. Artists like Manfred Mohr, Vera Molnar, and Edward Zajec primarily used repeated combinations of these simple elements to form larger abstract compositions.

As technological advances were made, computer research extended to the creation and study of naturalistic pattern. In the 1960s, mathematician Benoit Mandelbrot noticed that although many natural patterns appear fractured or irregular at first glance, a more detailed examination reveals a subtle form of repeating order (Taylor 2003). In 1975 he coined the term “fractal” to denote these self-similar forms and, in so doing, explicitly defined the complex patterning that tribal artists had been seeing around them and incorporating into their artwork for millennia. Mandelbrot illustrated these concepts with elaborate computer-generated visualizations, and fractal computer models were subsequently incorporated into the work of many prominent early computer artists, including Jean-Pierre Hebert and Edward Zajec.

The self-similar programming techniques used by Mandelbrot to create his computer-generated images have found continued relevance in the wider field of generative computer art. Generative computer art refers to art production systems that have been created in a procedural way using computers. Typically, the artist defines a system of rules, formulas, or limits and then allows the computer to execute a random or semi-random art creation process within those constraints. Some generative art is capable of evolving in real-time by

incorporating interactive artist or audience feedback into its iterative processes. Perhaps the best known instance of generative computer art is Harold Cohen's *AARON*, an artificially intelligent computer system that creates its own artwork.

Even though these generative systems are based on discrete, well-defined cause and effect relationships, their resulting behaviors are rich, complex, and unpredictable. One could argue that the continuous dynamic processes used in generative art reflect the methods of pattern generation found in nature more accurately than tribal pattern or fractal art does. As mathematician Richard Taylor states, "Nature doesn't prepare and think about its patterns – they are determined by the interaction with the environment at the specific moment in time that the patterns are being created." Generative artwork "doesn't reproduce Nature; it is Nature" (Taylor 2003). Thus, while their motives, rationalizations, and techniques may differ, an overriding affinity for generative pattern and process creates strong formal connections between tribal and computer art².

The Incorporeal

In most cases, tribal art had ritual and spiritual significance, and consequently aspects of the incorporeal permeated their content and function. "Art objects differ from society to society, but they tend to be concerned with making visible the supernatural and the intangible" (Errington 1994). African carvings, for example, are functional artifacts that serve as a habitat for ancestor or nature spirits. These objects are created specifically so that something significant, but intangible, can take up residence there. Artifacts such as these

² An extended discussion of generative pattern in tribal and computer art can be found in Appendix B.

provide a conduit through which tribal societies seek to understand and influence or manipulate the unseen forces that control the world around them.

In many cases, ritual objects are “activated by the presence within or among the objects themselves of the shaman” (Errington 1994). In this context, the objects are not inherently functional. Ritual use is required for them to attain their transcendent function, which is primarily to extend the shaman’s spiritual capabilities. Ultimately, “the importance of tribal art lies in its utility as a magical technology” (Dutton 1998).

As one would expect, in light of this spiritual content, aspects of the ephemeral were incorporated into the form of tribal objects. Relatively few tribal artifacts were composed entirely of durable materials. They incorporated natural, perishable resources like leaves, flowers, fruits, and feathers that would quickly rot or blow away. The Navajo “made intricate designs in the sand, which, in the course of the curing ceremony, were sat upon and stepped on, hence erased” (Errington 1994). Australian aborigines paint ancestral designs on their bodies, draw them in the sand, and incise them on tree bark. Many tribal works were considered incomplete until activated by the addition of evanescent components, such as ritual or performance.

Historically, “masks and all the rest of these objects slough off their evanescent... contexts on the way to New York, retaining only the durable part that can be set aside in a frame or on a pedestal” (Errington 1994). Thus, their intended form never makes it to the gallery. In some sense, these works can only be properly experienced within their original ritual or performance context. Their artistry lies beyond the mere physical artifacts that are left behind.

Computer art does not suffer from the same type of historical dislocation from context that much tribal art does; however, it does create similar confusion as to the relationship between its incorporeal content and its physical artifacts. Although computer art is usually presented through some physical object (e.g. paper, monitor, sculpture, etc), “computer artists create art that in nascent form originates in a computer as conceptual information” (Humphries 2003).

In the case of digital imagery, the exact same conceptual information can take the form of many different artifacts. An animation can be exhibited on a monitor or projected onto a wall. Its dimensions can be molded and manipulated to fit different spaces. It can be distributed via DVD or streaming video on a web site. Individual frames can be printed on paper for exhibition or sale. All of these artifacts are possible and, although they impact the audience’s experience of the work, they do not alter the identity of the work “because it is a concept, not an object” (Humphries 2003).

In the case of interactive or generative computer art, such as Harold Cohen’s *AARON*, “the expression is not the result of the hardware, but of an analytic effort.” Although *AARON* produces artifacts that are commonly associated with fine art, in the form of paintings, they aren’t the primary expression; “The program is the work of art” (Nadin 1989).

Like African sculpture, the computer is an artifact that serves as habitat for functional ephemeral content in the form of virtual objects, abstract concepts, data, and software. “The computer...can be harnessed to extend aspects of the artist’s [physical] and mental capabilities” (Humphries 2003). Likewise, through its use, we attempt to understand, mathematically and scientifically, the directing forces of the natural world, so that we may influence or manipulate them.

One could argue that all art forms have important incorporeal or conceptual elements; however, they are most often confined to the content of the work, never impacting its formal properties. In contrast, tribal and computer art elevate the incorporeal above nearly all other factors and uniquely integrate it into their very form.

Multimedia

As a side effect of their ritual use, tribal artifacts were often inherently mixed media or multimedia works. For example, the use of ritual motifs by the Plains Indians of North America was not confined to a singular media; instead the same motifs appeared many times over in different forms. “In order for the clan to retain the animal’s favor, the chief ordered representations of the bear painted on the house fronts, woven in the blankets, and carved on ritual objects.” Likewise, for the Maori of New Zealand, “almost every weapon, utensil, or other useful object was decorated with the traditional designs” (Chipp 1960). These examples of cross media and mixed media artifacts still focused primarily on a single sense of perception: sight.

Other ceremonial art engaged multiple senses, making them fundamentally multimedia art forms. “African masks are used as part of a complete costume and are danced to music before an audience that often interacts with the dancers” (Saltzstein 1998). These performances simultaneously incorporate many arts, including sculpture, costume, music, dance, and drama. As Dennis Dutton, a notable professor of philosophy and aesthetics, states, “The approach to tribal arts must necessarily involve ‘blurred genres’ and fused disciplines” (Dutton 1995).

Similarly, computer art has evolved into primarily mixed media and multimedia embodiments. Computer technology “affords interaction between and within mediums, which is physically impossible in traditional art” (Johnson 1996). In fact, computers are so adept at mixing and manipulating other media that they have taken up significant, though often invisible, residence in the production processes of such traditional fields as photography, film, architecture, graphic design, and sculpture.

The unique capacity of computers to combine imagery, sound, and movement has become so fundamental to computer art that they are largely taken for granted; however, without computer technology, immersive multimedia artworks like Char Davies’ virtual reality installation *Osmose* would never have been possible. These abilities have unquestioningly revolutionized film and given rise to previously unimagined forms of environmental, multimedia, virtual, and interactive art.

Interaction & Collaboration

Another side effect of the ritual use of tribal art is the incorporation of interaction and collaboration in both the creation and use of artifacts. Tribal artifacts were almost always functional, and functional art objects are all, in some sense, interactive art. The user must manipulate or engage with the artifact, both physically and mentally, for it to realize its purpose. The Maori consider these interactive functional characteristics so important that they hail their carving tools as “animate, intelligent beings and conscious collaborators in the act of creation” (Chipp 1960).

Collaboration is so intrinsic to tribal processes that authorship of artwork can be quite complicated, a fact that is evident in the masking arts of Africa. “Sculpture is but one of

many elements in a complex mask ensemble, a synthesis of the artistic sensibilities of many individuals – carvers, painters, weavers, embroiderers, tailors, and dancers.” Furthermore, this interaction and collaboration does not end after the initial creation or use of the artifact. “In Africa, it is not only the artist and patron who determine how an object will look, but also the caretakers and inheritors of art. The object is not untouchable, although it may be sacred. Rather, generations of people wash, rub, dress, decorate, paint, and oil it, in a sense personalizing art and in the process affecting its meanings, enhancing its evocative powers and its efficacy” (Drewal 1988).

This collaborative trend is mirrored in the content of tribal art, where meaning is ultimately derived from a combination of individual and communal influences. For instance, the tepees of the Plains Indians were commonly painted with images that had appeared in the dreams of the owner. The meanings associated with these dreams were greatly influenced by the interpretation of the shaman, which “was made in terms of the body of traditional tribal concepts”. Consequently, “the only dreams that were considered significant were those that fell into the pattern of the tribal culture; other dreams of a personal meaning were disregarded” (Chipp 1960). The artists of many tribal cultures were similarly constrained by the functional requirements of their rituals. Although individual artistic differences persisted, they were limited by “fear that any departure from the tribal style would prevent the [artifact] from ‘working’ properly and carrying out its ritual purpose” (Segy 1958).

It is interesting to note, however, that, in spite of the formally conservative nature of much tribal art, there is ample evidence that meaning itself is far from static. Perhaps in part due to the abstract nature of most tribal motifs, “meanings for the same motif [can] vary widely even among members of the same tribe,” and “important concepts that are shared by

many tribes may be represented by many different motifs.” There are even “American Indian examples in which the forms of religious art exerted a reverse influence and substantially altered religious concepts” (Chipp 1960). Clearly, neither the artist nor the audience experiences artwork in isolation. Tribal artifacts are ultimately social objects created through social processes and attributed social meanings.

While the last several hundred years of fine art practice has diverged from this social mode of art production, computer art has begun to reverse the trend. Computers enable unique forms of audience interaction that challenge the passive modes of art perception and appreciation that have been the norm in the fine art community. In so doing, the art experience shifts from that of passive spectatorship to active dialogue.

In many computer artworks, the audience plays an equal, if not larger, role in the creation of the imagery or experience than the artist does. The artist simply prepares an environment upon which others can act to “complete” the work. Indeed, some insist that the meaning of these technological installations does not even exist without interaction. “When combined with social and network technologies the artist becomes a facilitator of an experience...created and shared by many” (Polaine 2005).

The introduction of the internet enables unmatched social and collaborative artworks, such as Rafael Lozano-Hemmer’s *Vectorial Elevation, Relational Architecture #4*, in which anyone in the world can control and manipulate a large scale public art installation using a simple web site. As in tribal art production, collaborative computer works challenge conventional Western ideas of authorship and ownership, enabling new modes of social and communal art production. “The distinction between artist and public gradually disappears” (Nadin 1989).

INTENTION

Clearly, the deep similarities between tribal and computer art provide ample material to further investigate. *Dream of the Techno-Shaman* (Figure 9) is my attempt to highlight and explore many of the similarities that exist between these two genres, as well as their associated cultural impact, in the form of an immersive multimedia installation. This work merges contemporary computer and interactive art processes with those of a more ancient aesthetic. In so doing, it draws engaging connections between our modern culture and that of our ancestors.

Dream of the Techno-Shaman centers on a life-sized shaman sculpture in which steel rod, sheet metal, circuit boards, and electrical wire are contorted into abstract forms and patterns inspired by African and Oceanic tribal art (Figure 10). The back of the figure remains hollow, allowing the viewer to inhabit it. A set of virtual reality goggles is mounted inside so the viewer can look through the shaman's eyes and experience a computer-generated vision (Figure 11). This entire figure is surrounded by a ritual space comprised of multiple projection surfaces, each displaying a combination of hand drawn, computer-generated, and photographic imagery (Figure 12).

The animated projections that surround the shaman form a sort of cultural sensor system. Several screens display a sequence of photographic images representing various aspects of tribal and contemporary culture. Fragments of those cultural indicators are continuously extracted and dropped into a swirling vortex below. This vortex pulls all of these photographic bits towards the centralized shaman figure. The shaman must analyze all

of these seemingly disjointed samples and come to some sort of cohesive conclusion about them.

The scale and arrangement of the projected space around the shaman forces the viewer to walk a spiral path toward its hollow back. This ritualistic circumambulation provides time for the viewer to examine and absorb the imagery swirling around them, perhaps drawing some of their own conclusions about the connections inherent there. The projected imagery is overlaid throughout with complex interlocking tribal patterns, indicating the natural order and interconnection that exists between all of these seemingly incompatible elements.

The shaman figure sits at the end of the path, collecting its data. The figure is constructed of decidedly technological materials, but reflects abstracted natural forms (Figure 13). It grows from the ground like mangrove roots, emphasizing the natural origins of our modern technological constructions.

Similarly, this technologically driven shaman establishes a substantial parallel with the tribal shaman. In many cultures, shamans served as mediators between the public and the incorporeal spiritual world, as they were the protectors and purveyors of knowledge and meaning. Contemporary science has in many ways supplanted the spiritual in our search for knowledge and truth, and as a result, the computer has been deified and ritualized. It serves as the new mediator between the public and the incorporeal by acting as the conduit through which we probe the invisible forces that control the world around us and engage the virtual, conceptual, and social spheres. This technologically driven shaman merges the traditional shamanic role, as the distiller of knowledge and mediator of meaning, with that of the contemporary digital “shaman”, which provides access to expansive knowledge but does not

necessarily delineate meaning. By inhabiting the hollow form of the figure, the viewer completes the piece by embodying the spirit of the shaman and engaging the dream (Figure 14). The computer-generated imagery that is presented through the eyes of the shaman conveys the complex web of connection that exists between the entire spectrum of tribal and contemporary cultural artifacts and practices (e.g. How do petroglyphs, neon signs, billboards, corporate logos, and graffiti relate to one another? What connects tribal dance to raves, religious services, and political rallies?) (Figures 15-16). It is then up to the viewer to distill the information presented and infer meaning from these connections. As a consequence, the dream stimulates just as many questions as it answers; but, after all, each of us has a role to play in shaping our own cultural experiences.

PROCESS

Dream of the Techno-Shaman is by far the largest and most ambitious artwork I have ever attempted. Its large scale and heavy use of both physical and virtual multimedia elements necessitated a wide range of traditional and digital production processes. The project was more or less developed in the reverse of the order in which it is ultimately experienced. The initial concept was to create a multimedia animation comparing tribal and contemporary art practices that could be viewed using a set of virtual reality goggles. It was clear that the VR headset should be housed in some sort of physical shell that was both easy for viewers to physically engage with and had a strong relationship to the virtual content.

The shaman figure was designed by drawing tribal patterns, inspired by Polynesian tattoo motifs, over photographs of natural elements, most notably a mangrove tree. After several sketches, a three-dimensional computer mockup of the central skeleton of the figure was created and further refined. The mockup was used as a guide for the creation of the physical skeleton, which was welded together from hand-bent steel rod. The skeleton's proportions were modified as needed to ensure that it could be approached and entered as naturally and comfortably as possible.

When the skeleton was complete, the tribal patterns of the shaman were altered to fit the modified design and printed out onto cardboard to ensure that they fit the complex shapes accurately. After a few revisions, the patterns were photographed and redrawn in AutoCAD so they could be laser cut out of sheet metal. The sheet metal patterns were then attached to the skeleton and further modified using a welder and other hand tools. This construction

required an interesting mix of manual and digital production processes that I found quite productive and satisfying.

After the design of the shaman sculpture was more or less complete and in the midst of construction, my thoughts turned to its final presentation. To emphasize the ritual importance of the shaman, I felt it needed to be presented in a ritual context. Many tribal and religious rituals require the circumambulation of an important object or structure, so the environment was designed to force the viewer to walk around the shaman along a spiral path. This allows the viewer to take some time to view the sculpture from all sides, finally ending up at the hollow back side of the figure.

Though I had initially considered exhibiting the sculpture in a natural environment, amongst the trees of a local park, I ultimately decided to present it in a gallery setting where I had more complete control over its environment. The structure of the projection environment surrounding the shaman was constructed out of steel tubing, fabric, and multiple LCD projectors. The projected imagery was selected to engage the audience and lead them conceptually and visually to the shaman.

Several flat vertical screens contain imagery gathered from various sources, including royalty-free stock photography collections. These images were digitally combined with hand drawn tribal patterns and abstract particle-based animations to create a cohesive, dynamic multimedia environment. An additional horizontal spiral shaped screen receives bits of the above imagery and combines it with additional tribal patterns and a particle-based vortex animation. Most of this digital image work was completed using a combination of commercially available computer software systems, including Adobe Photoshop, Adobe Premiere, Adobe After Effects, and Autodesk Maya. Some of the image processing and

generation work was augmented and expedited by programming custom animation scripts in Maya's MEL programming language³.

The animated imagery is projected onto the various screens via multiple ceiling mounted LCD projectors, each with an attached computer. All of these computers are attached to a small local network so that their presentations can be synchronized throughout the entire space. The immersive environment is completed by an audio system that, similar to the vertical projection screens, plays a seemingly random selection of tribal, contemporary, social, and electronic sounds.

The viewer's experience of *Dream of the Techno-Shaman* culminates with the dream sequence viewed from within the shaman itself. Although the idea for this multimedia installation began with the dream concept, the development and production of the rest of the installation, as well as the research for this written thesis, significantly changed my approach to the material. Ultimately, the dream sequence was the last piece of the installation to be completed. Most simply put, the dream sequence is comprised of almost the same material as is projected throughout the surrounding environment, but the imagery is presented in a much more structured way. Instead of being gathered and thrown together in a seemingly random fashion, the dream imagery has clearly undergone some more cohesive organization leading to a more concrete web of connection which emerges from the abstract, virtual environment. As with the projected imagery, this material was created using a combination of commercial software packages and custom animation scripts. The shaman's dream is

³A selection of custom Maya MEL scripts, used in the creation of *Dream of the Techno-Shaman*, can be found in Appendix C.

presented via a modified i-glasses head mounted display, which fully immerses the viewer in the virtual web environment by presenting it in stereoscopic 3D.

CONCLUSION

Overall, the design and production of *Dream of the Techno-Shaman* was the most exhausting, but satisfying, experience of my artistic life. It allowed me to discover significant commonalities between two of my fundamental artistic interests, tribal and computer art, and to unite them in a conceptually cohesive and aesthetically engaging way. It also exposed me to a multifaceted art production process that I hope to further explore in subsequent works.

In many ways, the shared facets of tribal and computer art represent a circle of artistic development. The modern era of fine art largely abandoned the social, interactive, and collaborative modes of art production, use, and appraisal that have been the norm worldwide for millennia and are still reflected in tribal art. Contemporary computer art practices can be used to eschew the individualistic trends of the modern era for a more socially responsible and engaging one, reuniting us with the arts of our ancestors. In spite of the inherent size and scale of our contemporary urban populations, modern technology has the potential to facilitate communication, interaction, and collaboration in previously unimaginable ways. Even if the cultural, social, and artistic norms of our society differ from those of our tribal ancestors and neighbors, we can exploit some tribal practices and perspectives to produce a more engaged, socially and environmentally conscious populace.

Tribal art production and use was inseparable from daily life in ways that the modern art scene largely abandoned; it was not “art-for-art’s-sake”. It contained mythical, ritual, and, above all, deeply social meaning and function. The ever expanding ubiquity of computer technology provides fertile groundwork for similarly entwined ritual and social

use. In recent years, many contemporary computer artists have revisited immersive, social, and collaborative modes of art production in an attempt to rediscover the social and communal roots of art and, in the process, bring new meaning and social significance to their own.

I believe *Dream of the Techno-Shaman* was a largely successful exploration of many of these concepts. The installation incorporates many of the shared properties of tribal and computer art in an attempt to emphasize the social and cultural connections we still bear with our tribal ancestors. Both the imagery and physical material presented include extensive use of multimedia processes and generative pattern. The viewer is also encouraged to physically interact with the work in order to activate its incorporeal content. In the future, I plan to further exploit the unique potential of computer technology to reengage with tribal processes through the creation of immersive, interactive, and collaborative multimedia art installations.

FIGURES

Figure 1: *ID* © 2005
Computer Graphics

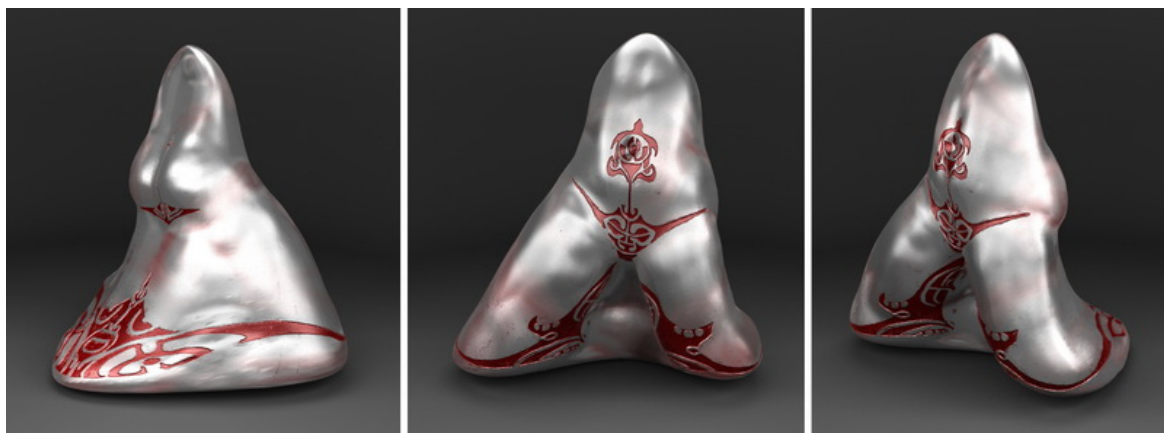


Figure 2: *Blood Rites* © 2005
Computer Graphics



Figure 3: *Flow* © 2006
Wood



Figure 4: *Maori Bust* © 2005
Computer Graphics



Figure 5: *Raven* © 2006
Computer Graphics



Figure 6: *Cave Scratchings* © 2005
Computer Manipulated Photography



Figure 7: *BabySitter* © 2006
Interactive Installation

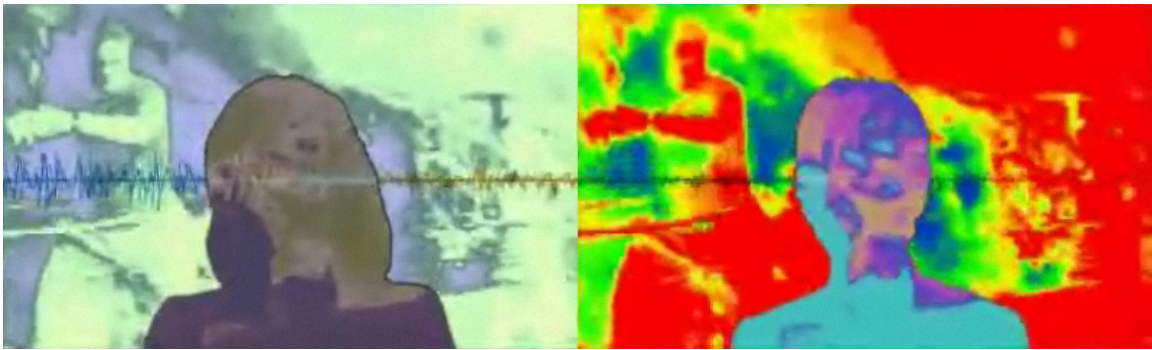


Figure 8: *Subconscious Debate* © 2007
Multimedia Installation

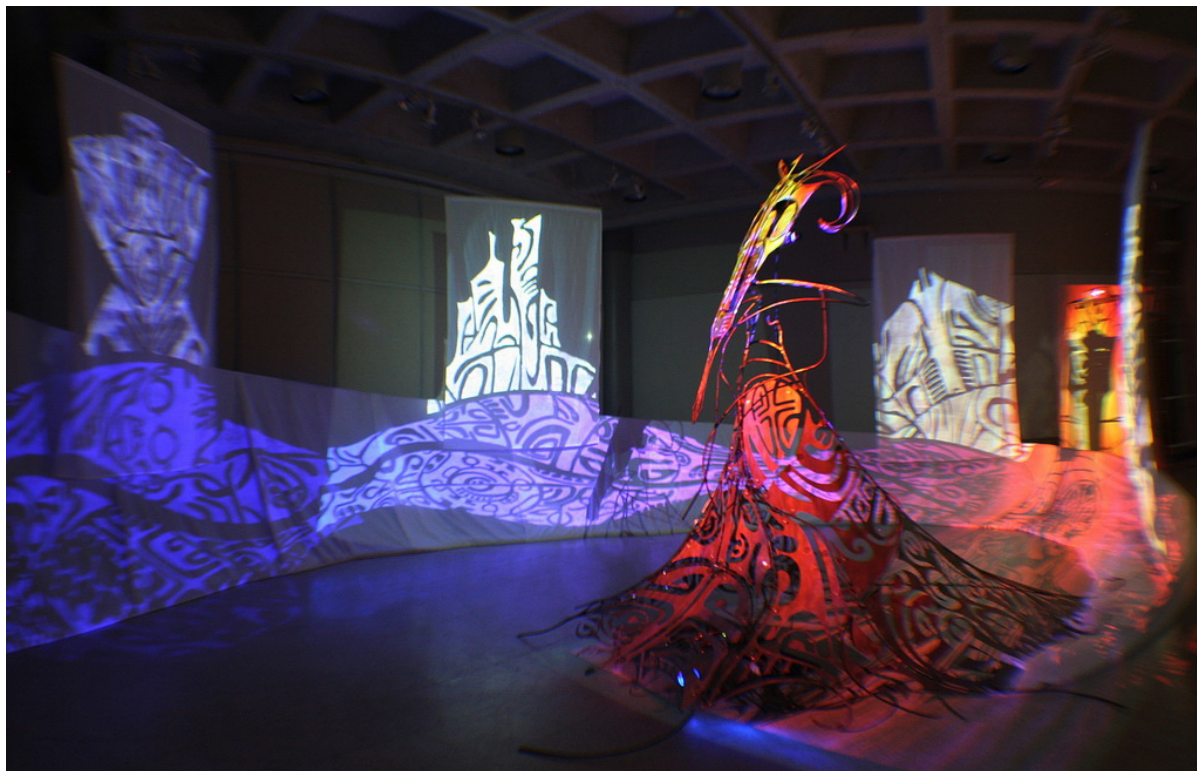


Figure 9: *Dream of the Techno-Shaman* © 2008
Multimedia Installation



Figure 10: *Dream of the Techno-Shaman* © 2008
Multimedia Installation
(Shaman figure)

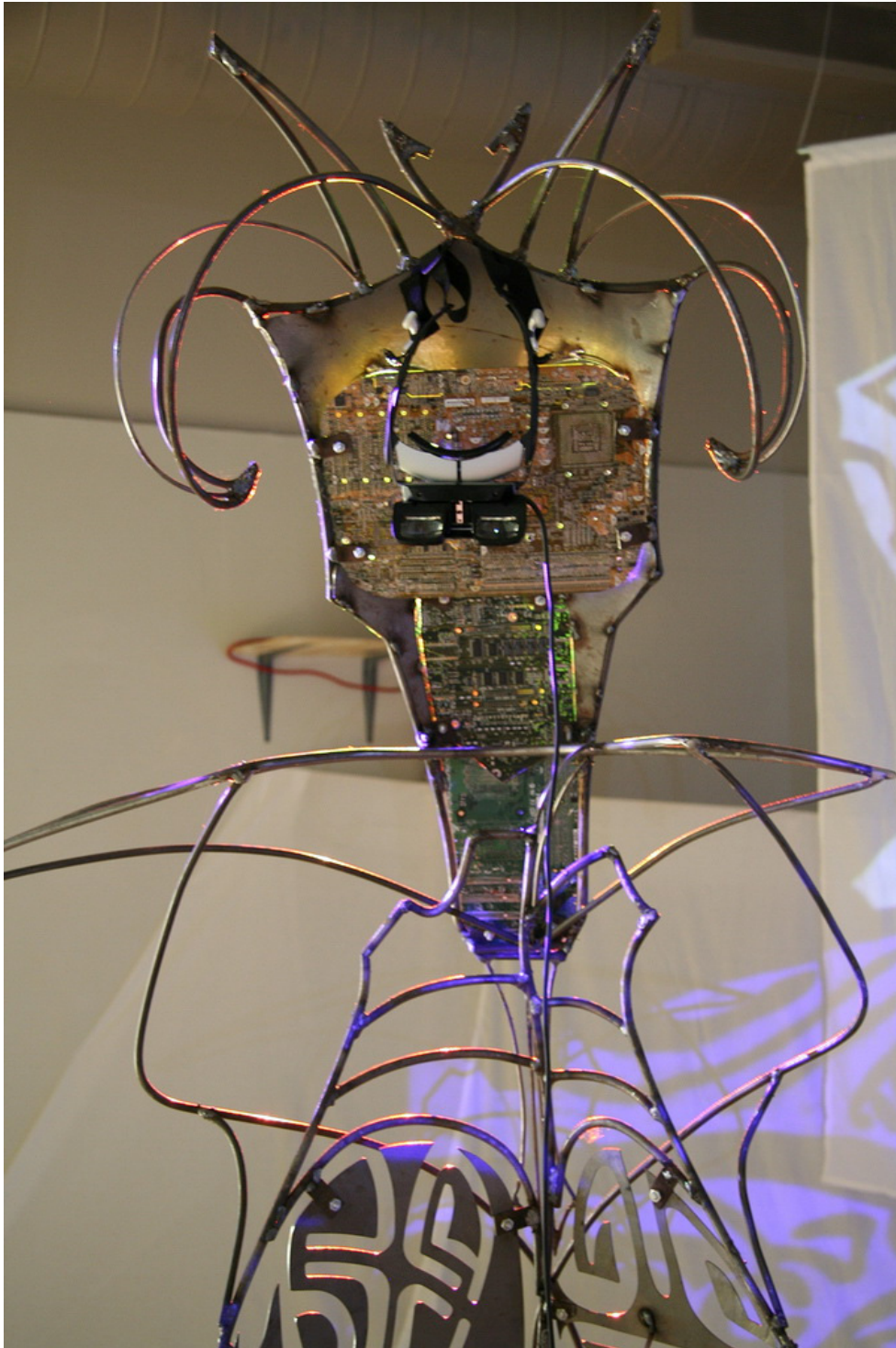


Figure 11: *Dream of the Techno-Shaman* © 2008
Multimedia Installation
(Rear detail with virtual reality goggles)

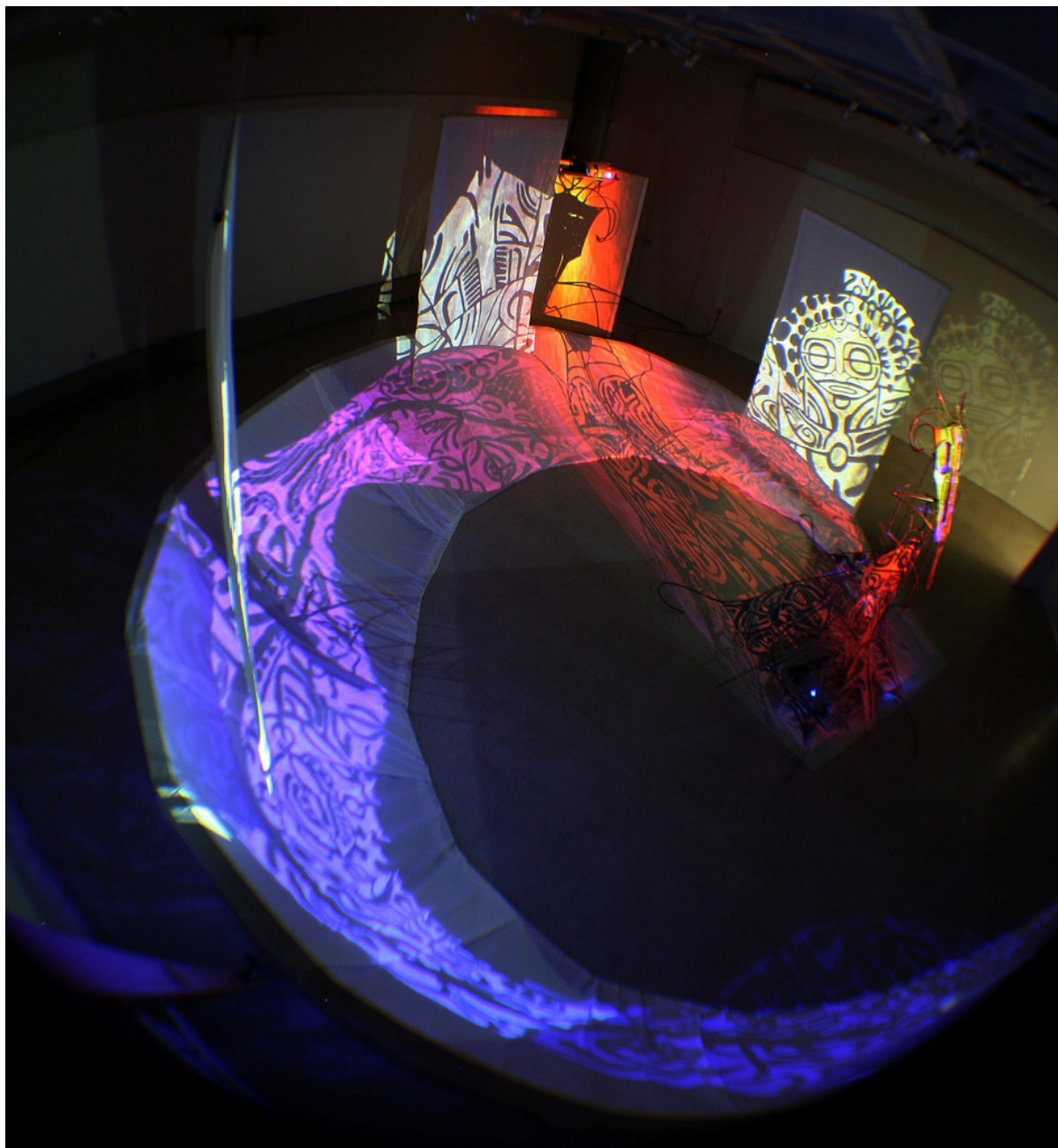


Figure 12: *Dream of the Techno-Shaman* © 2008
Multimedia Installation

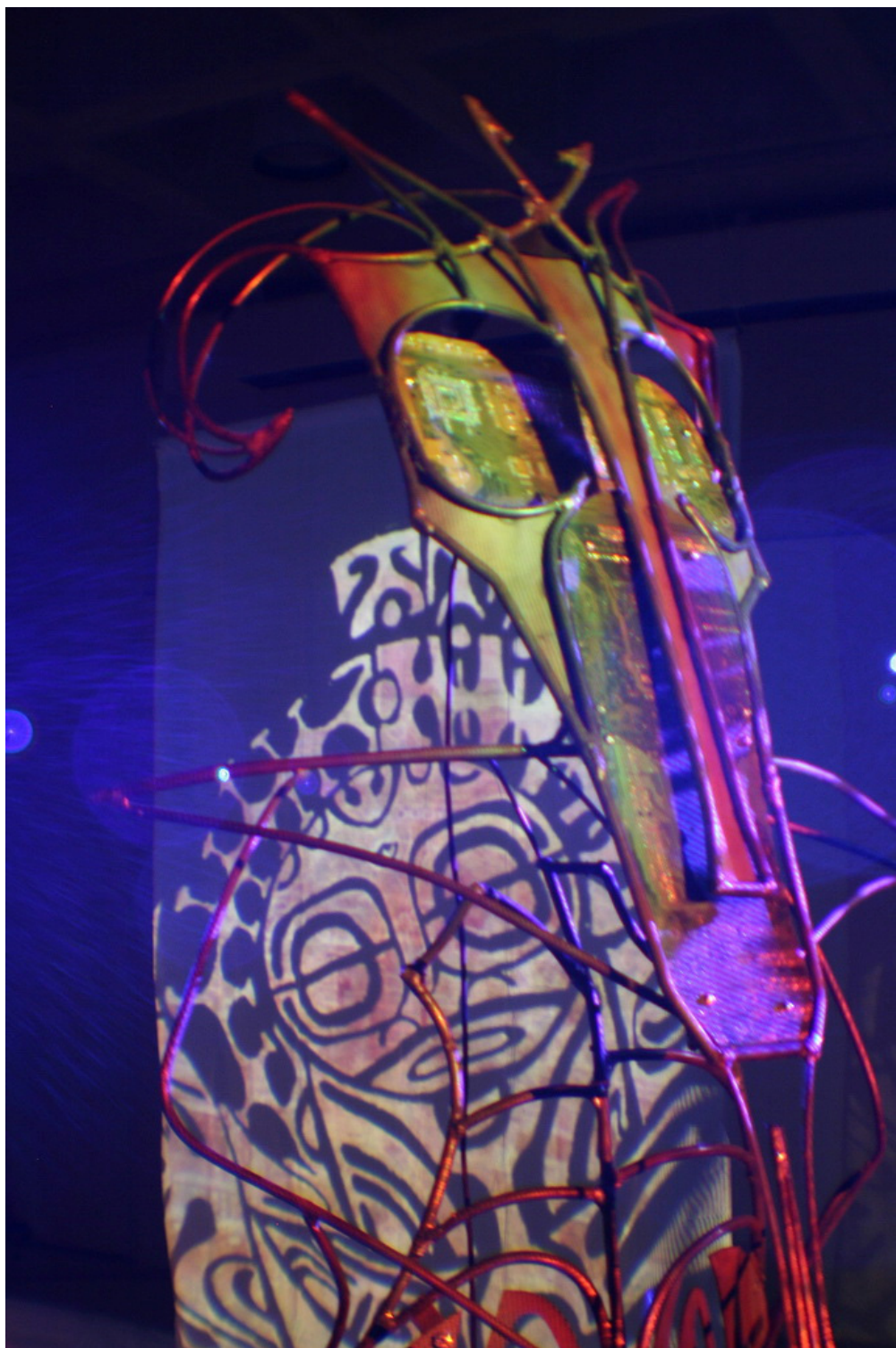


Figure 13: *Dream of the Techno-Shaman* © 2008
Multimedia Installation

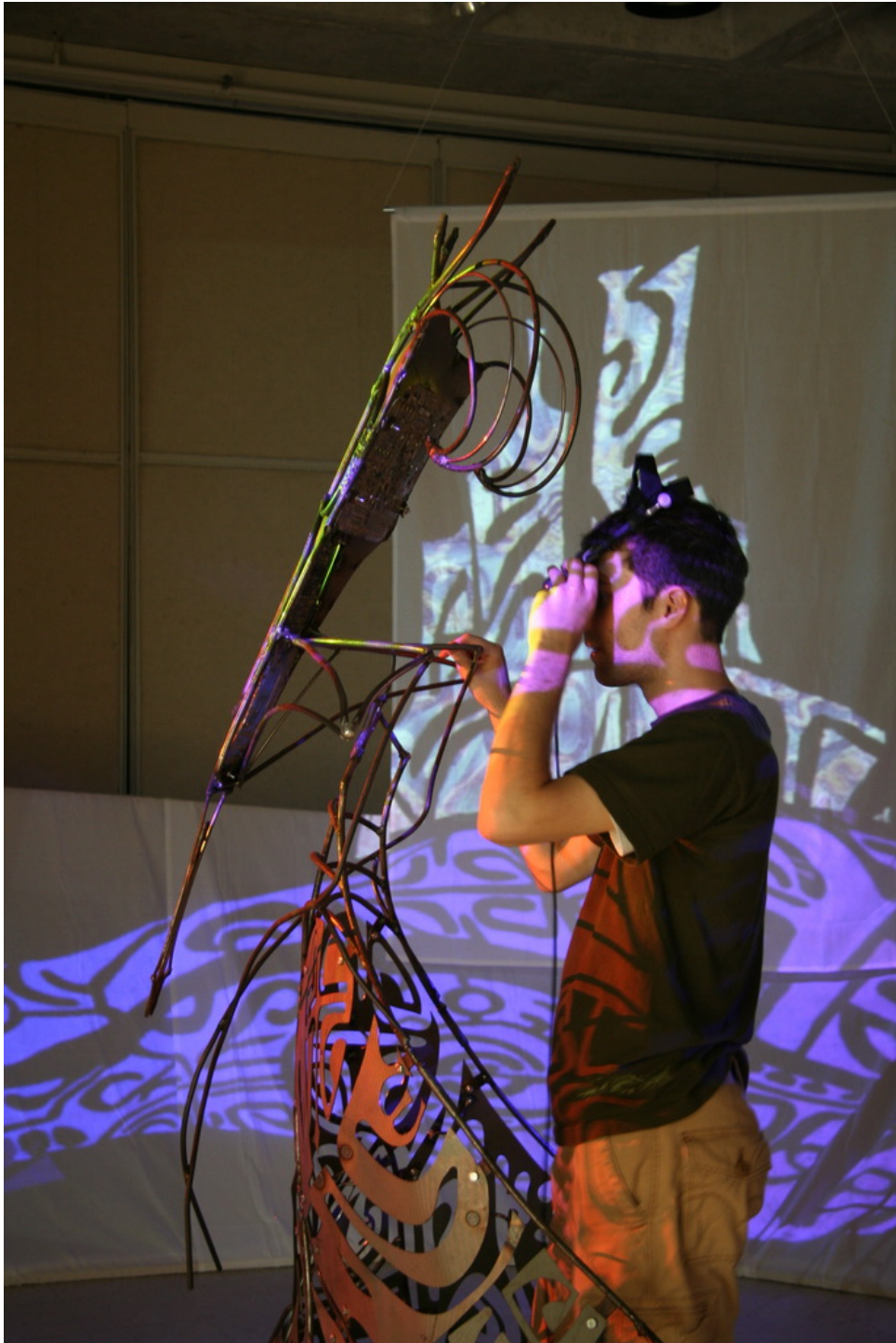


Figure 14: *Dream of the Techno-Shaman* © 2008
Multimedia Installation



Figure 15: *Dream of the Techno-Shaman* © 2008
Multimedia Installation
(Dream detail – full color)

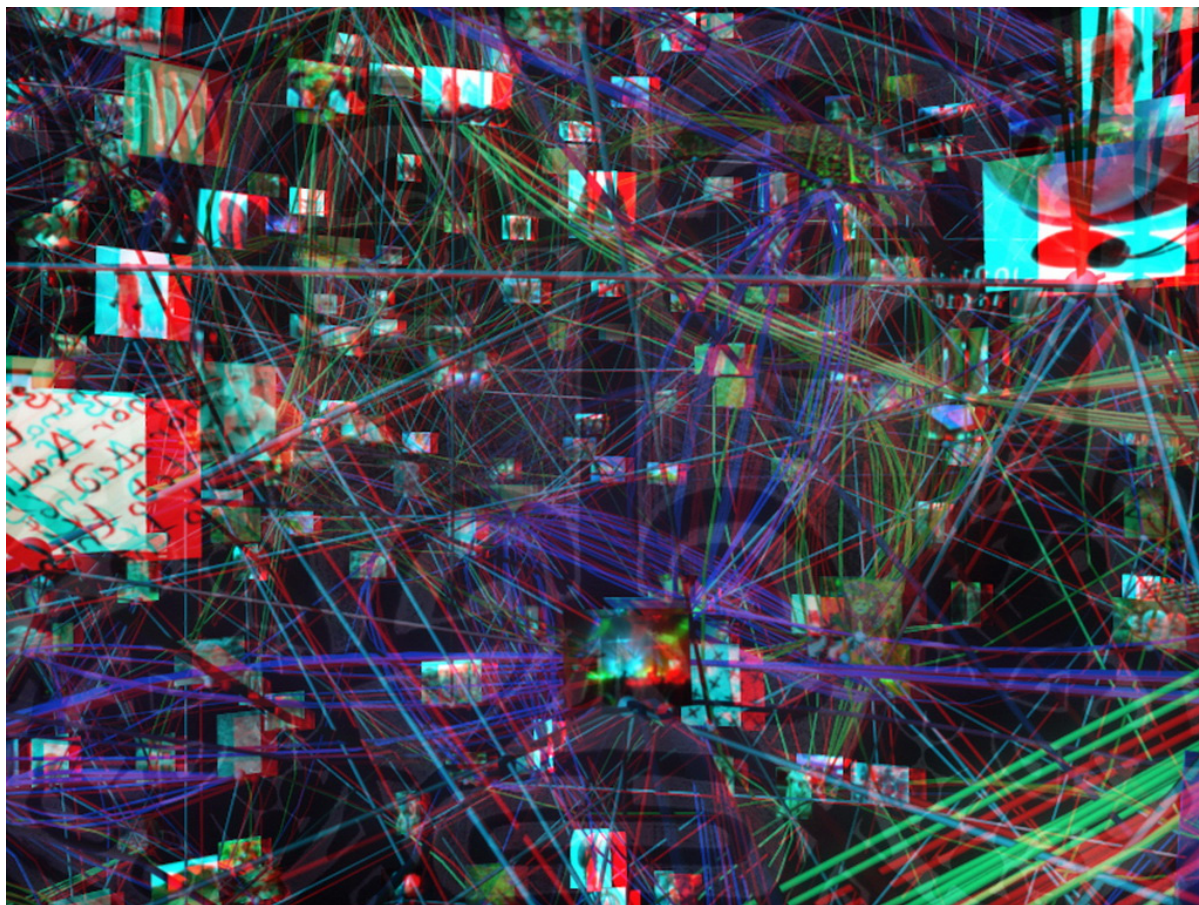


Figure 16: *Dream of the Techno-Shaman* © 2008
Multimedia Installation
(Dream detail - 3D anaglyph)

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APPENDIX A

ARS ELECTRONICA: TOWARDS THE INTEGRATION OF ART, TECHNOLOGY, AND SOCIETY

In the past few decades, new technology has fundamentally altered our daily lives on a larger scale and at a faster pace than ever before. Computer technology has forever changed the way people interact and communicate on both a personal and global level. It makes perfect sense that art, as an expressive and communicative medium, would, and should, expand to incorporate the expressive and communicative potential of emerging technologies. Likewise, art has had a significant role to play in our recent technological development and, as a result, strong essential relationships have emerged between art, technology, and human society.

This is a rather complex subject to explore, but, luckily, an excellent historical and contemporary resource already exists for us to take advantage of. The events and exhibitions of Ars Electronica have provided a unique platform for exploring, discussing, tracking, and analyzing the interrelation between art, technology, and society throughout a time of unparalleled technological change. The organizers of this festival, along with its associated events and forums, have been uniquely consistent, progressive, and open in the arena of new media and technological art for nearly 30 years. Within the extensive Ars Electronica library of publications, both in print and online, we find a compelling snapshot of codependent technological and artistic development with expansive and lasting social and cultural impact.

[1979] Ars Electronica

The Ars Electronica Festival is an annual event that has been held in Linz, Austria since 1979 (Ars Electronica 2007B). It focuses on interdisciplinary discussion and collaboration between international experts from both the arts and sciences. Various symposia are held that cater mostly to art and science community insiders, along with exhibitions, performances, and open air events designed to include and engage the general public.

The founders of Ars Electronica recognized that the computer was changing our work, our economy, our thinking, and our culture more than almost any other technology before. Both artists and scientists need to recognize, discuss, and ultimately confront the social and cultural phenomena that are the inevitable consequences of rampant technological change. The singular goal was to foster a universally beneficial integration of technology, art, and society, with a constant eye to the future. These concepts are definitely not in line with the Modernist view of “art for art’s sake.”

[1987] The Prix Ars Electronica

In Ars Electronica’s early years, most of the artwork consisted of commissioned performances and digital music. Though the festival was widely successful, drawing attention from artists and scientists the world over, the creation of an international cyberarts competition, called the Prix Ars Electronica, in 1987 (Ars Electronica 2007D) was a significant event in the history of digital art. The Prix quickly became the world’s premier cyberarts competition and, as such, is often credited with introducing media art to the world.

The competition provided heretofore rare global networking opportunities for experimental digital artists and has since been consistently regarded as a bellwether for the world of technological and media art. Its coveted Golden Nica award is the Oscar of digital art. It's through the winners of the Prix Ars Electronica that we'll trace the evolution of digital art.

[1987] Computer Animation

The inaugural Prix Ars Electronica offered awards in the categories of Computer Animation, Computer Graphics, and Computer Music (Ars Electronica 2007A). It's worth noting that all of these categories reflect passive or traditional approaches to art. At this stage, the digital art community is still trying to figure out how to replicate or approximate traditional artistic practices using computers as tools. The question remained: Can human beings produce engaging art, particularly visual art, with computers?

The resounding yes came at the hands of animator John Lasseter and the software development team of Pixar. Their computer generated short film *Luxo Jr.* (Figure 1) was the first to successfully use a computer to communicate emotion and engaging storytelling using wholly digital techniques (Ars Electronica 2007A). Pixar's success was a direct result of the types of interactions that Ars Electronica was designed to elicit. Artists and scientists worked together in close interaction, ultimately producing something that neither group could have accomplished alone.

Pixar's successes didn't stop there. Subsequent short films won additional awards, including the first Oscar for a computer animated short film. In 1995, Pixar released *Toy Story*, the first computer generated feature length film. Hollywood hasn't been the same

since. Computer generated entertainment is now a clear mainstay of our contemporary culture.

This early computer graphics work demonstrates an often ignored relationship between art and technological development. Technology clearly impacts society, but it is often overlooked how integral of a role artists play in that impact. Technological innovations occur in corporate, academic, and private settings every day, but they usually fail to make significant societal impact until they have been presented to the public in the right way. It's increasingly in the hands of artists and designers to alter, mold, package, or meld new technology into intuitive, elegant solutions to social problems. Only then does new technology thrive and propagate throughout the general population.

[1990] Interactive Art

By 1990, the passive mediums of television and film have been replaced by the active medium of the computer for the more progressive of media artists. Consequently, an Interactive Art category was added to the Prix Ars Electronica. The first winner was *Videoplace* (Figure 2), by computer scientist and artist Myron Krueger.

When interacting with *Videoplace*, participants' silhouettes are captured and tracked in real-time by a video camera. A series of hand-made, specialized computers then performed various image analyses, allowing these "shadowpeople" to interact with objects provided by the computer system in a multitude of different ways (Ars Electronica 2007A).

Though aesthetically crude, *Videoplace's* art lies less in its visual content than in the methods of interaction it fosters between the piece and its participants. Krueger understood that many of the technological developments that had made multimedia so important for

social communication since the late 1980s lay in artistic solutions to problems. In this case, he presented an artistic solution to the problem of human computer interaction. Instead of requiring participants to engage with his digital work through the conventional tools of keyboard and mouse, he allowed them to interact in a more intuitive, physical way. The participant's entire body is engaged by the work.

Given the limited technological capabilities of the time period, the creation of *Videoplace* required a great deal of specialized knowledge and experimentation. One of the defining features of the emerging technological and media arts is this experimental quality, which quickly brings its artists and proponents into a close association with engineers and researchers. Interactive media artists were suddenly being counted amongst the inventors and developers of emerging technologies.

[1991] Mass Media Backlash

In 1991, interactive art lost some of its playfulness. The Gulf War emerged as the first totally electronic war. The military made extensive use of electronic command and decision systems and the first laser controlled bomb met its target. The war on the battlefield was paralleled by the war for people's hearts and minds, waged via worldwide mass media networks. It's in this environment that artists began to employ digital media and information technologies not only as their tools and materials, but also as subject matter.

An exemplary instance of this is found in that year's Golden Nica winner in Interactive Art. *Think about the people now* (Figure 3), by Paul Sermon, is an interactive hypermedia environment about a man who set himself on fire in public protest. Sermon was surprised by the triviality and scarcity of media coverage that followed this event, so he

performed extensive research of his own and organized the image, text, and video data into a network of interlinked files that could be browsed via a computer. The data is organized geographically and temporally to simulate an environmental narrative in which the users can perform their own research. The participant uses a joystick to “travel” through Whitehall via animated scenes and video footage. As a result of the user’s navigational decisions, he/she can end up in one of 64 situations, including setting fire to him/herself (Ars Electronica 2007A).

Think about the people now clearly deals with the question of truth in a culture of mass media. How can the conflicting perceptions of events be recognized and accounted for by news media? How can concepts like truth and objectivity be successfully applied under these conditions? What role does mass media play in the presentation or creation of truth? How can we guard our perceptions against these inconsistencies?

[1993] The Internet

By 1993, the internet has established itself as a new forum for human communication that is growing faster than television, radio, or printed media ever did. With the propagation of the internet, the concept of a global mind or consciousness enters digital art. That year’s Golden Nica winner in Interactive Art, *Simulation Room – Mosaic of Mobile Data Sounds (SMDK)* (Figure 4), by Knowbotic Research, taps into that global mind for its source material.

SMDK’s creators sent out an international call for participation in the project through public message boards and forums throughout the internet. Volunteers were asked to send acoustic messages in the form of digital audio files across international computer networks.

They received a wide variety of personal statements, attitudes towards the world, human voices, and music. The sounds were then analyzed according to their audio properties, represented as geometric shapes, and collected into a self-organizing databank, or “sound room” (Ars Electronica 2007A).

Within an empty physical room, participants could use a hand sensor and eye monitor to view and interact with the virtual sound room. The collected sounds could be played back by touching their corresponding floating geometric objects. In this way, the databank forms a virtual instrument that can be navigated and played via physical interaction. This method of interaction stresses the importance of physicality in an age in which the physical is being lost to the mentality of the virtual. As has become the norm, in this interdisciplinary, participatory project, art serves as an intermediary or interface between technology and society.

[1996] The Ars Electronica Center and FutureLab

In 1996, the Ars Electronica Foundation took another step beyond the Prix Ars Electronica in its mission to foster exploration of the integration of art, technology, and society with the opening of the Ars Electronica Center and FutureLab.

The Ars Electronica Center provides a permanent home base for the Ars Electronica Foundation’s efforts and contains a prototype Museum of the Future. The Museum of the Future is designed to use interactive forms of media to facilitate the general public’s encounter with the state of the art (virtual reality, digital networks, and modern media) (Leopoldseder 2004). The museum’s focus is on media art, new technologies, and their

related social developments. Unlike conventional museums, the Museum of the Future does not take stock of the past. It is oriented to the developments of tomorrow.

The FutureLab is a media art laboratory in which artistic and technological innovations can nurture one another through mutual and reciprocal inspiration, interdisciplinary environments, and international networking. The FutureLab also serves as Ars Electronica's gateway to the corporate and scientific worlds. The artists and scientists working here design and engineer exhibitions, create art installations, and pursue collaborative research with universities and joint ventures with private sector associates. FutureLab has since become an internationally regarded study facility for art, research, and industry (Leopoldseder 2004).

[1999] Cyberspace

By 1999, traditional media and computer art is on its way to becoming cyberart. There exists a new abstract and virtual space for art to exist in called cyberspace. The Golden Nica winner for that year's Interactive Art competition, *Difference Engine #3* (Figure 5), by Lynn Hershman, takes full advantage of this new ephemeral arena.

Difference Engine #3 is an interactive, multi-user sculpture about surveillance, voyeurism, digital absorption, and spiritual transformation of the body. The work uses the architecture of a physical museum as a 3D template for a corresponding virtual museum and uses its visitors as an interface. When entering the physical museum, the visitor approaches a Bi-Directional Browsing Unit (BBU) and their image is captured. An avatar representing the visitor is created within the virtual museum and assigned a number. The avatar then takes a short journey through the virtual museum, before entering a Purgatorial site where it cycles

continuously with other avatars. Eventually the avatar is archived permanently on the internet, where the image can be recalled via the ID number (Ars Electronica 2007A).

Online visitors can choose a generic avatar to take the same journey, capture images from the physical museum space, or use a dedicated chat line to communicate with those in the physical space. In this way, the BBU serves as a mirror that reflects from the internet into the physical space, and from the physical space into cyberspace. Interactions are possible beyond the borders of physical space, virtual space, physical presence, and telepresence.

[2000] Global Egalitarianism

In 2000, powerful enablers of direct communication have begun to emerge through peer-to-peer networking technologies, like *Napster*, mobile computing advances, and cell phone based internet access. The individual now enjoys a degree of independence from time and space. One can now participate in nearly every area of life (business, entertainment, leisure, culture, etc) no matter where he/she is. This sort of direct communication opened up new possibilities for digital artists.

The 2000 Golden Nica winner in Interactive Art, *Vectorial Elevation, Relational Architecture #4* (Figure 6), by Rafael Lozano-Hemmer, took advantage of this mobile, space independent participation in a large scale public art piece. The work consisted of an installation of robotic searchlights in Mexico City's historic center. The searchlights could be controlled over the internet via a sophisticated, but simple, user interface. Via the internet interface, web site visitors could create their own light sculptures over Mexico City that could be seen from a 10 mile radius. The designs were sequentially rendered as they arrived

over the internet. Every 6 seconds the lights would move to form the next design, 3 webcams would document it, and an archive web page would be created for it that housed miscellaneous information, comments, and photos (Ars Electronica 2007A).

This work was viewed as a highly successful collaborative work. Free web terminals were set up in public libraries and museums across Mexico. Ultimately the piece garnered participants from more than 50 countries and from all regions of Mexico.

This work also makes novel appropriations of traditionally authoritarian and military technologies in a celebration of egalitarian access to public artistic expression. Searchlights are associated with fascist lighting schemes and anti aircraft surveillance. The internet itself is a legacy of a military desire for distributed operations control. *Vectorial Elevation, Relational Architecture #4* establishes new creative relationships between control technologies, urban landscapes, and the local and remote public. Technological control is making its way out of the hands of elite academic, corporate, and government entities and into those of the general public.

[2002] Artificial Life

By 2002, computer technology has brought about revolutions in biological fields that spawn new ethical dilemmas. The advent of genetic engineering and nanotechnology place the future of evolution into human hands in a very literal way. In this setting, *n-cha(n)t* (Figure 7), by David Rokeby, won the Golden Nica for Interactive Art.

n-cha(n)t is comprised of seven computers that perform voice recognition, free association, and language generation. The computers use microphones and speakers to listen to the words and phrases spoken by those nearby and speak their own stream of word

association. Their text and speech is improvised based on an English language knowledgebase and grammar rules. As a result, their grammatical slips, unconventional word choices, and awkward sentence structure creates an unusual, but consistent, dialect of English.

Together, the seven computers form a social group, a community of computers speaking together. When left alone, they intercommunicate, eventually synchronizing their states of mind, resulting in a collective chant. When a participant speaks to one of the computers, distracting it from the chant, its state of mind changes and it listens. Afterwards, the computer relays its new info to its neighbors, disrupting the chant into chaos, until the community can incorporate the new info and work its way back to a synchronous chant (Ars Electronica 2007A).

Rokeby has created a community of lifelike organisms through the use of simple technological tools. He's given them the ability to manipulate language, but not to understand it. They are nothing but slaves to his code. This prompts expansive questions about the role humans play in the creation or manipulation of artificial or scientifically constructed life.

[2004] Digital Community

The overarching goals of the Prix Ars Electronica are not limited to individual artistic achievement. Its focus is instead on the interrelation between art, technology, and society. As a result, it's not uncommon for awards to go to researchers or organizations that are doing innovative work in one of the competition categories. This trend became evident along with the introduction of some new award categories within the last 5 years.

In 2004, the Digital Communities category was added to the Prix Ars Electronica. In the face of rampant economic and cultural globalization, the predominant challenge in both artistic and technological circles was the challenge to build a better world. The Digital Communities award was created to encourage projects that utilize technology as a means for channeling social, political, and cultural commitment (Ars Electronica 2007A).

The first winner of this new award was *Wikipedia*, an online collaborative encyclopedia project, managed and operated by the nonprofit Wikimedia Foundation. *Wikipedia* represents one of many efforts to create a freely available, global library or knowledge repository. It contains standard encyclopedic knowledge, the knowledge often associated with almanacs and gazetteers, as well as current events. *Wikipedia's* novelty lies in the fact that its content is created entirely by users, it has no owner, and it is never finished. Its content can be freely used, edited, copied, and redistributed.

Wikipedia's core value lies in its expansive social and cultural purpose and its unique methods of interaction and engagement with a global audience. *Wikipedia's* editing process, or lack thereof, urges questions of collective human ethics. Can we really trust humanity to keep this knowledgebase accurate and objective? Will the intellectual vandalism of a disingenuous minority derail the sincere efforts of thousands?

[2005] Technological Enablers

Though internet related works have been represented at Prix Ars Electronica in various award categories since 1995, it's worth calling attention to the 2005 winner of the Net Vision category, *Processing*. *Processing* is not itself a digital artwork. Instead, it is a

toolset created specifically for the electronic arts community and thereby deserves recognition as a facilitating technological development.

Processing is a programming language and environment used by students, artists, designers, architects, and researchers for learning, prototyping, and artistic production. The system teaches the fundamentals of computer programming within a visual context and allows users to create Java applets that can be simply uploaded to the internet and shared. It has been extensively used for creating academic exercises, information visualization, art installations, posters, video games, animation, and music videos (Ars Electronica 2007A).

These types of facilitating technologies represent a developing trend towards a blurring of interdisciplinarity. In the past, artists and scientists worked together on technological and artistic developments, but were usually constrained in their spheres of influence. The projects were broken up into their component tasks. Then the scientist performed the scientific tasks and the artist performed the artistic tasks. *Processing* is an effort to blur those distinctions of task and role. The artist can now learn to perform technical tasks from an artistic state of mind, and vice versa. The artistic and scientific communities are becoming more interested in encouraging all of us to use our entire brain, rather than just its dominant half.

[2006] Subversion

The Prix Ars Electronica of 2006 also granted Interactive Art distinction to a social art group, rather than to a particular artwork. The Graffiti Research Lab is a moderately subversive technological art group dedicated to outfitting graffiti writers, artists, and protestors with open source technology for urban communication. Their goal is to

technologically empower individuals to creatively alter and reclaim their surroundings from corporate visual culture in a time of aggressive, paramilitary policing tactics. A secondary goal of GRL is to bring graffiti to a broader public audience, demonstrate its intent, highlight its positive aspects, and start a critical discussion regarding its criminality, culture, and context (Ars Electronica 2007A).

To that end, the GRL has integrated software, electronics, digital fabrication, materials research, and the Do-It-Yourself community into traditional street art practices. Their work has resulted in the development of several new street art technologies including LED throwies, graffiti writing capture software, mobile urban projection, the Electro-graf, circuit stickers, and Etch tech. All of these technologies are researched and developed with input from practicing street artists and writers and field demonstrated in the streets of New York City and Washington DC. Video documentation and instructions are published on various online forums.

The Graffiti Research Lab's efforts display an interesting reversal in the use of technological art. A previously prohibitively expensive art, funded through alliances with academic, corporate, and government agencies, has been subverted. The tools and technologies of these often conformist entities have been modified and deployed for individualized, nonconformist expression.

[2007] Hybrid Art

In 2007, another new category was added to the Prix Ars Electronica schedule. The Hybrid Art category focuses on transdisciplinary projects that fuse different media into new forms of artistic expression or transcend existing boundaries between art, technology, and

society (Ars Electronica 2007D). In short, any work that doesn't fit nicely into one of the competitions long standing categories can qualify here.

The first Hybrid Art winner was SymbioticA: the Art and Science Collaborative Research Laboratory at the University of Western Australia's School of Anatomy and Biology. This is an artistic laboratory, devoted to the research, learning, and critique of the life sciences. Here artists can engage in wet biology lab practices within a biological sciences department. Likewise, researchers can pursue curiosity-based art explorations free of the demands and constraints associated with the culture of scientific research.

An example of the work produced at this facility is *Victimless Leather* (Figure 8), by the Tissue Culture & Art Project. This work consists of a stitch-free jacket of cultured human tissue. The growth of a skin garment provokes questions about our constantly evolving relationships with natural and manipulated living systems. The Hybrid Art category sets a precedent for previously unimagined new media, tools, and subject matter to emerge.

Evolution

It's clear that art, technology, and human society are interrelated and codependent in significant, complex, and ever evolving ways. The many arms of Ars Electronica represent a comprehensive forum for encounters with and discussions of techno-cultural phenomena. In spite of all the techno-imagery and machinery, the human being must still occupy the center of attention here. Human beings are the artists, scientists, and consumers. We are also the beneficiaries, victims, and, above all, creators and appliers of new technology. Hopefully, Ars Electronica will be able to maintain its ongoing quest for innovation and expansion so

that we can all benefit from and further involve ourselves in the integration of art, technology, and society.

Figures



Figure 1: *Luxo Jr.*, by John Lasseter
(Pixar 2004)

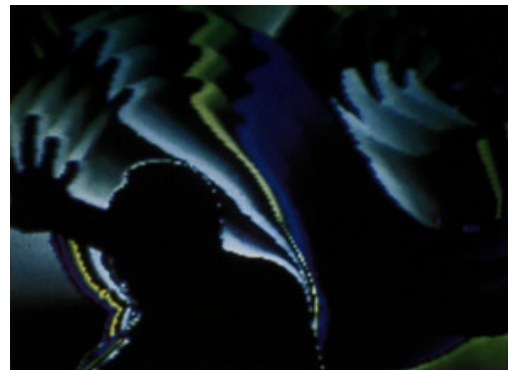


Figure 2: *Videoplace*, by Myron Krueger
(Vajpeyi 2001)



Figure 3: *Think about the people now*, by Paul Sermon
(Sermon 2000)



Figure 4: *Simulation Room – Mosaic of Mobile Data Sounds*, by Knowbotic
Research (Knowbotic Research 2007)



Figure 5: *Difference Engine #3*, by Lynn Hershman (Hershman 2001)

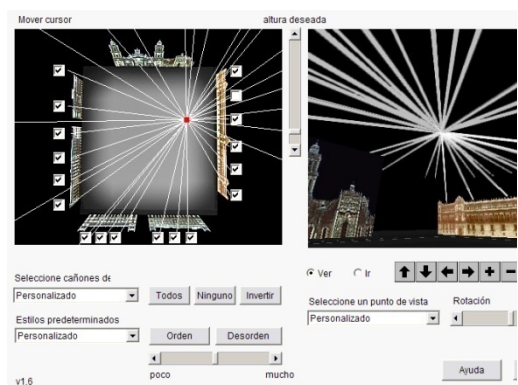


Figure 6: *Vectorial Elevation, Relational Architecture #4*, by Rafael Lozano-Hemmer (Lozano-Hemmer 2005)



Figure 7: *n-cha(n)t*, by David Rokeby
(Rokeby 2007)

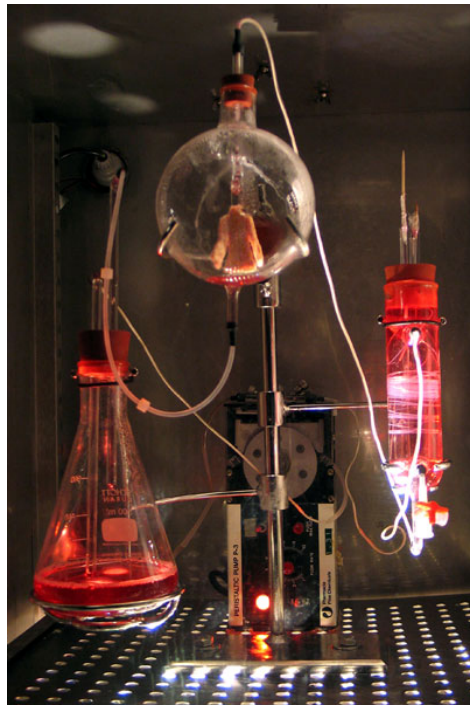


Figure 8: *Victimless Leather*, by the Tissue Culture & Art Project
(Tissue Culture & Art Project 2007)

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APPENDIX B

GENERATIVE PATTERN IN TRIBAL AND COMPUTER ART

Pattern in Tribal Art

A key component of tribal art that appears almost universal is the preponderance of abstraction. Naturalistic artwork seeks to reproduce visual reality, while “non-naturalistic or abstract art seeks to express a ‘conceptual reality,’ not what the artist can see, but what he conceives as an idea” (Segy 1958). This tendency to represent the world symbolically dominates tribal artwork.

For the Plains Indians of North America, motifs are strictly limited, often confined to simple arrangements of lines, circles, and geometric figures. These can form stylizations of natural forms like men, animals, and mountains, or be used purely as decorative geometric patterns without naturalistic reference. In this culture, symbolism was tightly regulated and form was dictated primarily by historical or cultural precedent. For example, “the first ritual painting of the bear was a sacred image, and became the accepted model for succeeding representations.” The relative naturalism of that sacred image was completely irrelevant. “Craftsmanship was necessary only to the point where it produced forms that adequately suggested or symbolized the all-important meaning” (Chipp 1960).

Similarly, the Maori of New Zealand developed a highly homogenous, though more geometrically detailed, aesthetic style. Most of their motifs are based upon abstractions of the human figure and various fragments derived from it. Maori artworks tend to use a relatively small set of these abstract organic motifs repeatedly in various combinations and orientations to produce larger, more complex motifs or entire compositions (Figure 1).

Though the majority of their work is abstract, they do use naturalistic representations in limited instances. For example, a “chief is generally portrayed with the face in a fairly realistic style, although conforming to typical rather than individual facial features. The other, non-distinctive parts of the body are treated in the traditional stylized manner with the surface covered with spiral motifs.” However, most Maori depictions are of less literal intent and therefore use more abstract imagery. An ancestor figure, being of the spirit world, is depicted with traditional stylized head and figure forms, covered with subsidiary abstract motifs (Chipp 1960).

The Maori tendency to use small, simple, geometric motifs to construct more complex compositions is also notable in several other Polynesian cultures. The earliest examples of Polynesian tattoo motifs include simple forms like crosses, parallel lines, and elliptical patterns, largely because of the technological constraints imposed by Polynesian tattoo combs, which were best suited to linear designs. However, Polynesian tattooists quickly began to use these simple rectilinear motifs in complex interlocking patterns to create abstract masks, plants, and animal forms. These detailed forms are often repeated to form compositions that filled the entire surface of the body (Figure 2). Though the Maori style is distinctly more curvilinear, it also maintains a close structural relationship between the motifs applied and the objects or forms on which they are carved (Chipp 1960). One could argue that Polynesian patterns are iteratively generated by repeatedly applying and rescaling or reorienting a small set of motifs based upon the geometric constraints imposed by their final composition.

Similar pattern recurrence is prevalent in African art. In particular, the geometric property of self-similarity, in which the same pattern appears at different scales in a

composition, is common in African textile, sculpture, and architecture. These conscious patterns can be seen in aerial photographs of African villages. The village of Logone-Birni in Cameroon grows in a self-similar pattern of rectangles within rectangles, creating a spiral path through its palace. As one follows the spiral path towards its center, the rules of etiquette become more stringent, creating an interesting social pattern that corresponds to the geometric one. These self-similar properties apply to other African cultures in similar but distinct ways. The Ba-ila village in southern Zambia unfolds as an iterative ring of rings, in which a small spirit house is enclosed by the family house, which is enclosed by relatives' enclosures, which are enclosed by the rest of the village (Figure 3). The chief's set of enclosures sits at the center of the village (Egash 2007). Self-similarity is also evident in the architecture of Hindu temples, in which recurrent patterns of small architectural modules accumulate to form a larger, similar structure (Situnkir 2005), and in the textile patterns of Indonesian batik (Situnkir 2008).

Perhaps one reason for the predominance of generative pattern in tribal art is that extensive use of abstract imagery requires some means of maintaining consistency among the motifs, and their associated meanings, within their individual cultural contexts. As such, "tribal arts are governed by systems of rules as complex as those that govern Western art forms" (Dutton 1998). One means of emphasizing or protecting these culturally significant visual symbols within non-literate societies is to regiment them. By developing simple, easy to learn, procedures that are capable of generating complex, aesthetically sophisticated imagery, one can efficiently propagate these symbols while maintaining aesthetic cohesion with the established motifs.

When consistency over time is of utmost importance, mathematical patterns or procedures perform much better than arbitrary ones. Potential evidence for this view can be found in several African arts that rely on sophisticated mathematical algorithms. Mangbetu art displays recursive use of all four geometric transforms (reflection, rotation, translation, scaling) (Eglash 2004) and Ethiopian crosses are generated using iterative line replacement with a simple core geometric shape (Figure 4). The sona, or sand drawing system, of the Chokwe people of Angola makes use of recursive Eulerian paths (never lift the stylus and never trace the same line twice) to create complex geometric designs. The drawing process is paired with the relation of a myth that is associated with the design. As students get older, they learn more complex drawing algorithms, along with more complex mythic knowledge (Eglash 2007).

Perhaps the most influential use of mathematical pattern in Africa is found in Bamana sand divination, a system of sand drawing for predicting the future. Though the algorithms were long protected by a religious class, they have recently come to the attention of mathematicians and computer scientists. As the session begins, symbols are drawn randomly in the form of lines in the sand. After this initial stage, a recursive process is used to generate the remaining symbols necessary for telling the future. Each symbol takes the form of a four bit binary word and the self-propagating process unfolds much like the pseudo-random number generators used in modern computers (Eglash 2007).

In fact, Ron Eglash argues that, in light of this process, every digital circuit in the world started in Africa. Bamana sand divination was brought into Spain by Islamic mystics in the 12th century where it was adopted by the alchemy community and redubbed geomancy. In the 17th century, Gottfried Leibniz converted its system of odd and even lines into the

binary code of zeros and ones. In the 19th century, Georges Boole used the binary code to create Boolean algebra. Finally, in the 20th century, John von Neumann used Boolean algebra to create the digital computer (Egash 2007).

Pattern in Computer Art

Like tribal art, computer art makes use of a great deal of abstraction. As with Polynesian tattoo motifs, early computer art was dominated by simple geometric forms due to the technological limitations of the tools utilized. Similarly, artists like Manfred Mohr, Vera Molnar, and Edward Zajec primarily used repeated combinations of these simple elements to form larger abstract compositions (Figure 5).

Of course, there are two evident problems with this line of comparison to tribal art. The first is that as computer technology advanced, many computer artists eschewed the abstract for more representational imagery. The second is that it could be argued that this abstract tendency isn't necessarily specifically tied to computer art. Much of the early computer imagery could be created similarly using more traditional art practices. Strong repudiating examples can be found in the geometric tessellations of M.C. Escher (Situngkir 2005), completed entirely without the aid of computer technology. These are both valid points. However, even though computer art ultimately developed in multiple directions, a certain segment of the computer art community stayed true to these tribal roots. As such, an extension of tribal generative pattern can be found in the computer art subgenres of fractal and algorithmic art.

I doubt tribal mystics had anything like modern computers in mind when they developed their generative algorithms. More likely than not, they were simply responding to

the patterns evident in their natural surroundings. It is not difficult to find naturally occurring self-similar structures. Prominent examples exist worldwide in plant structures, including leaf veins, fern tendrils, and tree branches. Logarithmic spirals can be found in various sea shells, including ammonite fossils and the nautilus, and in the horns of a variety of mammals, including the African kudu antelope. Dynamic examples can be found in the vortices and waves of rivers (Pickover 1988). Perhaps it's telling that many of the names for traditional Maori patterns come from similar natural phenomena, such as waves and foliage (Chipp 1960). In fact, one of their most important and often used motifs, the koru, is based upon the shape of an uncurling fern frond.

What's most interesting is that African artists were not content to just mimic the patterns of nature. They clearly took steps to analyze and systematize what they saw. In the 20th century, this challenge was taken up again by mathematicians and computer scientists. Famous mathematically generated self-similar geometry, including the Cantor set, the Koch snowflake, and the Sierpinski Triangle, were introduced to academic literature. However, the study of self-similarity shifted in a new direction when Benoit Mandelbrot began studying it in the 1960s.

Mandelbrot noticed that though many natural patterns appear fractured or irregular at first glance, a more detailed examination reveals a subtle form of repeating order (Taylor 2003). In 1975 he coined the term "fractal" to denote a fairly specific variety of these self-similar forms. In the simplest of terms, a fractal is an image that represents the behavior of a certain set of mathematical equations. More specifically, fractal formulas describe geometric patterns that can be repeated at any scale to produce self-similar shapes that can't be represented by classical geometry. Mandelbrot had explicitly defined the complex patterning

that tribal artists had been seeing around them and incorporating into their artwork for millennia. Fractals even leave room for some random variation at different scales. Though a cursory inspection of some fractals give the impression of precise self-similarity, a more rigorous examination can reveal unique qualities throughout. These nearly self-similar and nearly symmetrical properties are much more routinely found in tribal art than their more precise counterparts.

Mandelbrot illustrated his fractal concepts with elaborate computer-generated visualizations that garnered a great deal of public attention (Figure 6). Since fractal patterns recur at finer and finer magnifications, computers could use basic geometric primitives to build up shapes of immense complexity. Computers have since become almost the singular tool used to generate and study fractal imagery because they excel at the iterative numerical processes that underlie self-symmetry.

This study has led to the development of procedural models for the visual representation of complicated physical and mathematical structures and phenomena, including computer-generated natural structures like plants and trees. Efficient data structures have even been developed that allow these computer-generated plants to grow and flower over time (Alvy Ray 1984). With computers, it is possible to use simple fractal formulas to create imagery with an infinite diversity of form, detail, color, and light.

Fractal computer models were incorporated into the work of many prominent early computer artists, including Jean-Pierre Hebert (Figure 7) and Edward Zajec, in part because decidedly intricate imagery could be generated with little human effort. The associated procedures “function as the artist’s helper, quickly taking care of much of the repetitive and sometimes tedious detail” (Pickover 1988).

Over the subsequent years of continued computer art development, fractal art appeared less often in the fine art context, but maintained a healthy esteem in the context of the popular arts. Fractals still serve as the basis for a wide range of still image, animation, and music production. Several sophisticated interactive software systems, like Apophysis, have been developed for generating and manipulating fractal imagery.

Fractals are even combined with human-assisted evolutionary algorithms that allow users to control the underlying mathematical systems by iteratively selecting attractive or aesthetically interesting features. The Electric Sheep project uses the internet and distributed computing technologies to generate fractal imagery that can be rated by users worldwide. Those user ratings in turn influence subsequent fractal generation schemes, encouraging aesthetically desirable traits, while filtering out the undesirable, ultimately producing a massive computer-generated, community-created artwork.

Though the use of fractal art has diminished in fine art, its underlying methodologies have found continued relevance in the wider field of generative computer art. The self-similar programming technique referred to as recursion that was used by Mandelbrot to create his computer-generated fractal images became the basis for a much less specific set of generative procedures.

In its broadest sense, generative computer art refers to art production systems that have been created in an algorithmic or procedural way using computer hardware and software. To meet this criterion, the system must be self-contained and capable of generating artwork with some degree of autonomy. Usually the artist defines a system of rules, formulas, or limits and then allows the computer to execute a random or semi-random art creation process within those constraints. Some generative art is capable of evolving in real-

time by incorporating interactive artist or audience feedback into its iterative processes.

Works of this type will never be experienced in the same way twice.

Even though these generative systems are based on discrete, well defined cause and effect relationships, their resulting behaviors are rich, complex, and unpredictable. One could argue that generative art's continuous dynamic process reflects nature's methods of pattern generation more accurately than fractal art does. As Richard Taylor states, "Nature doesn't prepare and think about its patterns – they are determined by the interaction with the environment at the specific moment in time that the patterns are being created." Unlike fractal artwork, "it doesn't reproduce Nature; it is Nature" (Taylor 2003).

Perhaps the best known instance of generative computer art is AARON, by Harold Cohen (Figure 8). AARON is an artificially intelligent computer system that Cohen has been continually developing to create its own artwork since 1973. In 1983, AARON's work was displayed at the Tate Gallery in London. Another notable example is n-cha(n)t, by David Rokeby, which uses voice recognition, free association, and language generation algorithms to create a small community of artificially intelligent, socially responsive computers. Digital artist and art theoretician Joseph Nechvatal creates computer-assisted paintings and animations using custom programmed computer viruses.

Even though their motives, rationalizations, and techniques may differ, an overriding affinity for generative pattern and process creates strong formal connections between tribal and computer art.

Figures



Figure 1: Carved wood window head, New Zealand
(Educational Technology Clearinghouse 2006)

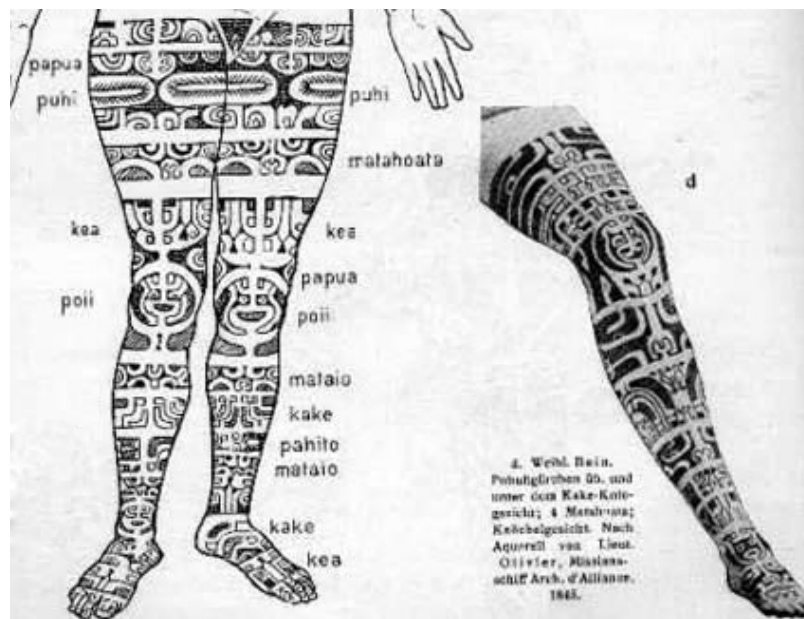


Figure 2: Marquesan tattoos
(Vanishing Tattoo 2008)

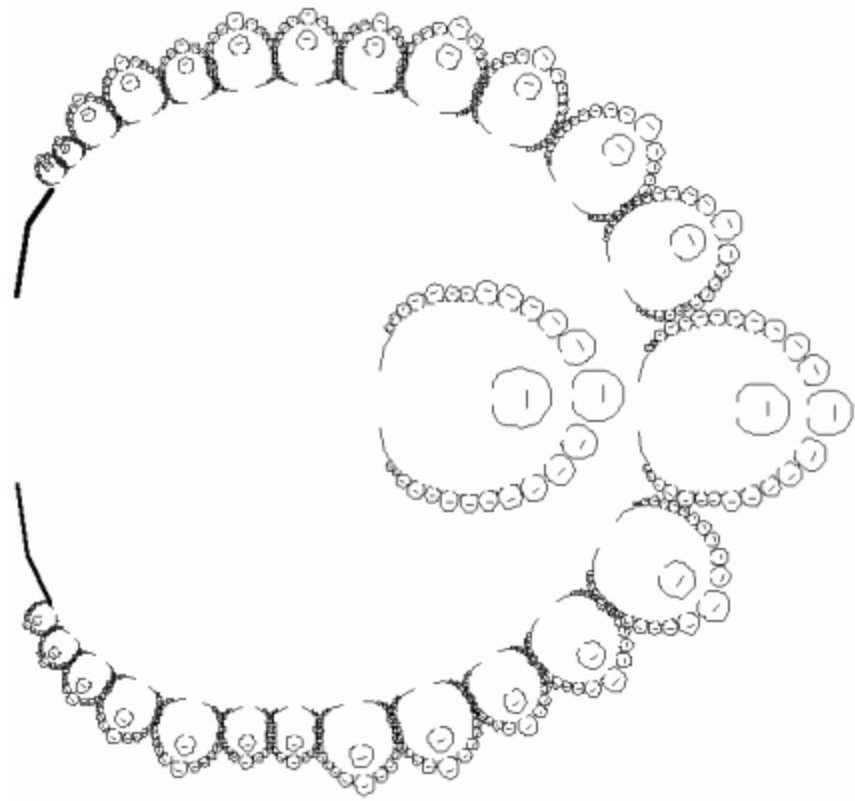


Figure 3: Fractal pattern in Ba-ila settlement
(Devaney 2008)

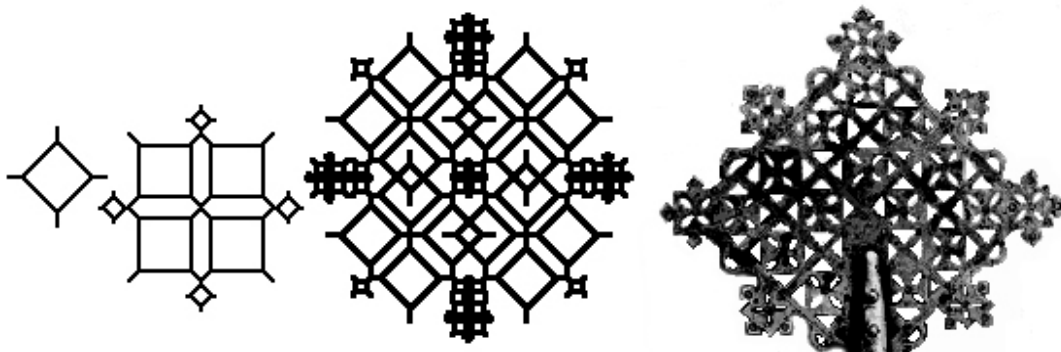


Figure 4: Iterative generation of Ethiopian cross
(Eglash 2008)

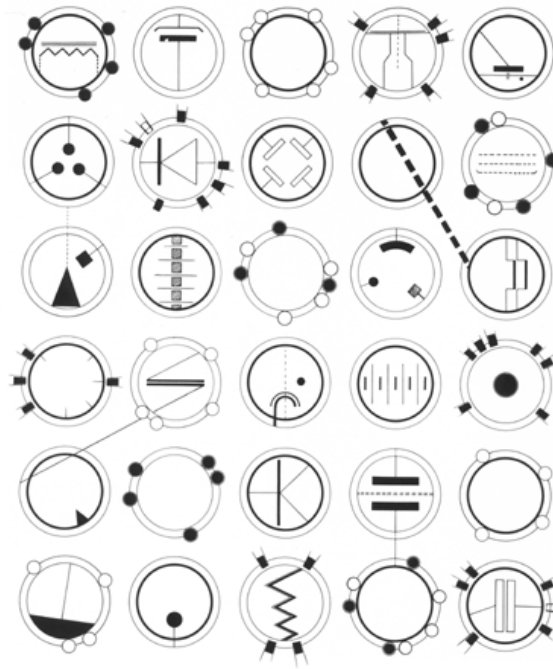


Figure 5: *Zeichnung A*, by Manfred Mohr
(Mohr 2007)

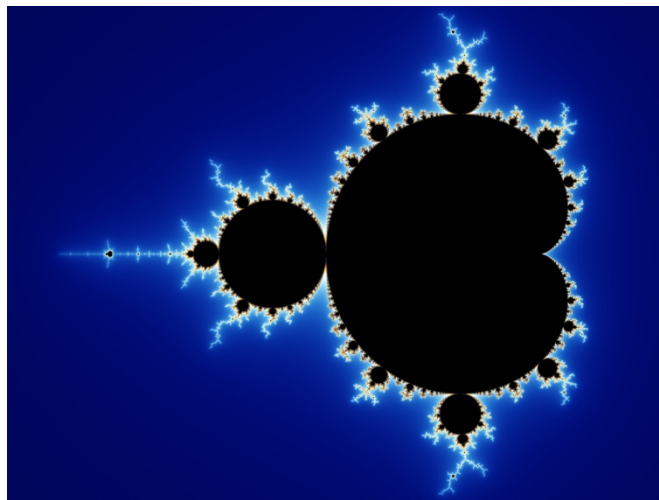


Figure 6: Mandelbrot Set
(Wikipedia 2008)

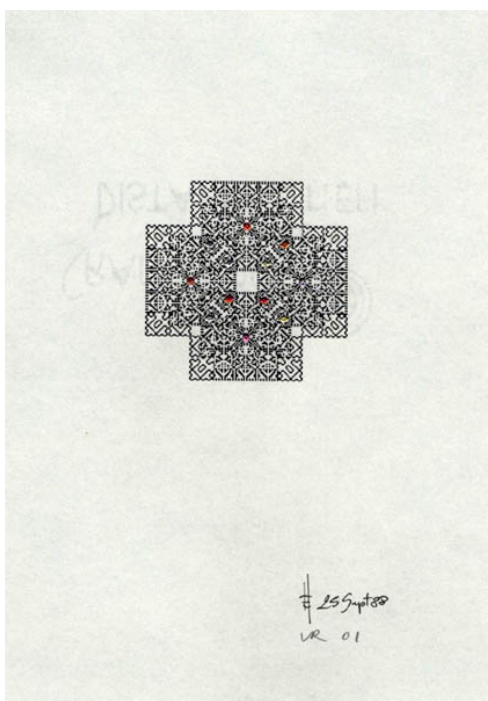


Figure 7: *Untitled*, by Jean-Pierre Hebert
(Digital Art Museum 2008)

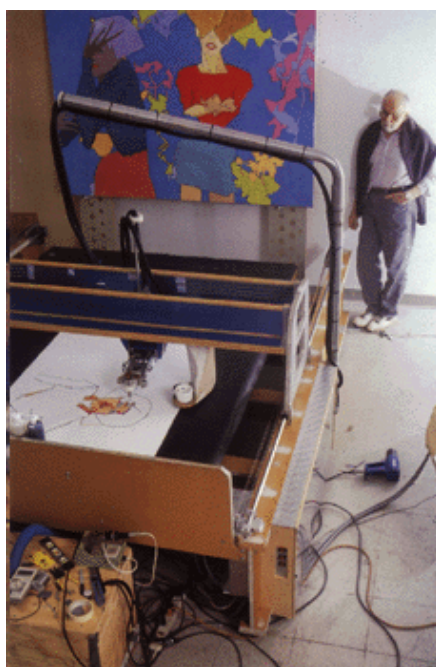


Figure 8: *AARON*, by Harold Cohen
(Cohen 2008)

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APPENDIX C

MAYA EMBEDDED LANGUAGE SCRIPTS

The following Maya Embedded Language (MEL) scripts were written and utilized in the creation and animation of the stereoscopic 3D vision sequence incorporated in *Dream of the Techno-Shaman*.

Sphere Emitter Max

This script creates a spherical particle emitter with the specified maximum number of particles and seed value.

```
global proc sphereEmitterMax(int $numParts, int $seedVal)
{
    // create spherical emitter with particle system
    string $newEmit[] = `emitter -pos 0 0 0 -type volume -r 24 -sro 0 -nuv 0 -cye none -cyi 1 -spd 1 -srn 0
        -nsp 1 -tsp 0 -mxd 0 -mnd 0 -dx 0 -dy 0 -dz 0 -sp 0 -vsh sphere -vof 0 0 0 -vsw 360 -tsr 0.5
        -afc 0 -afx 1 -arx 0 -alx 0 -rnd 0 -drs 0 -ssz 0`;
    string $newPart[] = `particle`;
    connectDynamic -em $newEmit[0] $newPart[0];

    // set the desired number of particles and random seed value
    setAttr ($newPart[0] + ".maxCount") $numParts;
    setAttr ($newPart[0] + ".seed[0]") $seedVal;
}
```

Import Image Planes

This script loads each image file found in a selected directory, creates a Maya surface shader that displays it, and applies that shader to a new polygonal plane within the Maya scene.

```
global proc importImagePlanes()
{
    fileBrowserDialog -m 4 -an "Import Directory" -fc "importAllImages";
}

global proc int importAllImages(string $filename, string $fileType)
{
    // build image list
    string $imExts[] = {"iff", "tga", "tif", "tiff", "gif", "jpg", "png", "bmp"};
    string $imFiles[];
    for ($i = 0; $i < size($imExts); $i++)
        $imFiles = stringArrayCatenate($imFiles, `searchFiles ($filename + "/" +
            ("*" + $imExts[$i]))`);

    // import all the files and assign them to shaders and planes
    for ($i = 0; $i < size($imFiles); $i++)
    {
        // create the surface shader
        string $newShader = `shadingNode -asShader surfaceShader`;
        string $fileTexture = `shadingNode -asTexture file`;
        setAttr -type "string" ($fileTexture + ".fileTextureName") $imFiles[$i];
        connectAttr -f ($fileTexture + ".outColor") ($newShader + ".outColor");

        // Create the plane with proper image proportions
        float $sizeFactor = 0.01;
        float $imageSize[2] = `getAttr ($fileTexture + ".outSize")`;
        float $planeWidth = $imageSize[0] * $sizeFactor;
        float $planeHeight = $imageSize[1] * $sizeFactor;
        string $plane[] = `polyPlane -w $planeWidth -h $planeHeight -sx 1 -sy 1 -n
            (substring(basename($imFiles[$i]), "", 1, (size($imFiles[$i]) - 4))) -ch 0`;

        // assign the shader to the plane
        select $plane[0];
        hyperShade -assign $newShader;

        // move the plane's bottom center to the origin
        move -a 0 0 (- $planeHeight / 2) $plane[0];
        move -a 0 0 0 ($plane[0] + ".scalePivot") ($plane[0] + ".rotatePivot");

        // create an anchor sphere
        string $curSphere[] = `polySphere -r 0.35`;

        // group the image plane and sphere together
        select $curSphere[0] $plane[0];
        string $curGroup = `group`;
        move -a 0 0 0 ($curGroup + ".scalePivot") ($curGroup + ".rotatePivot");
    }
}
```



```
    }  
  
    return 1;  
}  
  
global proc string[] searchFiles(string $dir, string $fileType)  
{  
    // grab all the files in the directory  
    string $files[] = `getFileList -fld $dir -fs $fileType`;   
    for ($i = 0; $i < size($files); $i++)  
        $files[$i] = ($dir + $files[$i]);  
    return $files;  
}
```

Web Parts

This script creates a web of cylinders that joins all of the particles in the specified particle system by iteratively searching for and adding the nearest particle to the existing web.

```
global proc webParts(string $partName, float $stickRad)
{
    // grab the particle positions
    int $numParts = `particle -q -ct $partName`;
    float $partPos[] = `getParticleAttr -at worldPosition -array true $partName`;

    // calculate the distances between all particle pairs
    float $dists[];
    float $maxDist = 0;
    for ($i = 0; $i < $numParts; $i++)
    {
        float $curX1 = $partPos[$i * 3];
        float $curY1 = $partPos[$i * 3 + 1];
        float $curZ1 = $partPos[$i * 3 + 2];
        int $arrOffset = $i * $numParts;

        for ($j = 0; $j < $numParts; $j++)
        {
            float $curX2 = $partPos[$j * 3];
            float $curY2 = $partPos[$j * 3 + 1];
            float $curZ2 = $partPos[$j * 3 + 2];

            float $distSq = ($curX1 - $curX2) * ($curX1 - $curX2)
                + ($curY1 - $curY2) * ($curY1 - $curY2)
                + ($curZ1 - $curZ2) * ($curZ1 - $curZ2);
            $dists[( $arrOffset + $j)] = $distSq;

            if ($distSq > $maxDist)
                $maxDist = $distSq;
        }
    }
    $maxDist = $maxDist + 1;

    // make sure we never link a particle to itself
    for ($i = 0; $i < $numParts; $i++)
        $dists[( $i * $numParts + $i)] = $maxDist;

    // keep track of linked particles
    int $linked[];
    for ($i = 0; $i < $numParts; $i++)
        $linked[$i] = 0;

    // find the closest two particles for starters
    float $bestDist = $maxDist;
    int $ind1 = 0;
    int $ind2 = 0;
}
```

```

for ($i = 0; $i < $numParts; $i++)
{
    int $arrOffset = $i * $numParts;
    for ($j = 0; $j < $numParts; $j++)
    {
        if ($dists[$arrOffset + $j] < $bestDist)
        {
            $bestDist = $dists[$arrOffset + $j];
            $ind1 = $i;
            $ind2 = $j;
        }
    }
}

// link them
string $links[];
$links[size($links)] = ($ind1 + "." + $ind2);
$linkeds[$ind1] = 1;
$linkeds[$ind2] = 1;

// link in the remaining particles
for ($k = 0; $k < ($numParts - 2); $k++)
{
    // find the closest remaining particle to the existing web
    $bestDist = $maxDist;
    $ind1 = 0;
    $ind2 = 0;
    for ($i = 0; $i < $numParts; $i++)
    {
        if ($linkeds[$i] == 1)
        {
            int $arrOffset = $i * $numParts;
            for ($j = 0; $j < $numParts; $j++)
            {
                if ($linkeds[$j] == 0)
                {
                    if ($dists[$arrOffset + $j] < $bestDist)
                    {
                        $bestDist = $dists[$arrOffset + $j];
                        $ind1 = $i;
                        $ind2 = $j;
                    }
                }
            }
        }
    }

    // link them
    $links[size($links)] = ($ind1 + "." + $ind2);
    $linkeds[$ind2] = 1;
}

// draw the web based on the found links
string $lines[];

```

```

for ($i = 0; $i < size($links); $i++)
{
    // grab the position data for this link
    string $linkData = $links[$i];
    string $tokens[];
    tokenize $linkData ":" $tokens;
    $ind1 = $tokens[0];
    $ind2 = $tokens[1];

    float $curX1 = $partPos[$ind1 * 3];
    float $curY1 = $partPos[$ind1 * 3 + 1];
    float $curZ1 = $partPos[$ind1 * 3 + 2];

    float $curX2 = $partPos[$ind2 * 3];
    float $curY2 = $partPos[$ind2 * 3 + 1];
    float $curZ2 = $partPos[$ind2 * 3 + 2];

    // draw in the link
    if ($stickRad == 0)
    {
        string $newCurve[] = `curve -p $curX1 $curY1 $curZ1 -p $curX2 $curY2 $curZ2`;
        $lines[size($lines)] = $newCurve[0];
    }
    else
    {
        float $axis[];
        $axis[0] = $curX2 - $curX1;
        $axis[1] = $curY2 - $curY1;
        $axis[2] = $curZ2 - $curZ1;
        float $height = sqrt($dists[$ind1 * $numParts + $ind2]);
        string $newCyl[] = `polyCylinder -ax $axis[0] $axis[1] $axis[2] -r $stickRad
            -h $height -sx 5 -n stick`;
        $lines[size($lines)] = $newCyl[0];

        float $middle[];
        $middle[0] = ($curX1 + $curX2) / 2;
        $middle[1] = ($curY1 + $curY2) / 2;
        $middle[2] = ($curZ1 + $curZ2) / 2;
        move -a $middle[0] $middle[1] $middle[2] $newCyl[0];
    }
}
group $lines;
}

```

Web Multi Part

This script creates a set of nurbs curves that join a sequence of particle systems such that all particle positions are included with as few redundancies as possible.

```
global proc webMultiPart1()
{
    // since MEL doesn't let me create data structures
    // we'll do this the hard way

    // get the relevant data from each particle system
    string $partName[] = {"particle1", "particle2", "particle3", "particle4", "particle5", "particle6",
        "particle7"};
    int $numSys = size($partName);
    int $numParts[];
    for ($i = 0; $i < $numSys; $i++)
        $numParts[$i] = `particle -q -ct $partName[$i]`;

    // find the nearest child particles
    int $child1[] = getNearPartIndexes($partName[0], $partName[1]);
    int $child2[] = getNearPartIndexes($partName[1], $partName[2]);
    int $child3[] = getNearPartIndexes($partName[2], $partName[3]);
    int $child4[] = getNearPartIndexes($partName[3], $partName[4]);
    int $child5[] = getNearPartIndexes($partName[4], $partName[5]);
    int $child6[] = getNearPartIndexes($partName[5], $partName[6]);

    // find the nearest parent particles
    int $parent2[] = getNearPartIndexes($partName[1], $partName[0]);
    int $parent3[] = getNearPartIndexes($partName[2], $partName[1]);
    int $parent4[] = getNearPartIndexes($partName[3], $partName[2]);
    int $parent5[] = getNearPartIndexes($partName[4], $partName[3]);
    int $parent6[] = getNearPartIndexes($partName[5], $partName[4]);
    int $parent7[] = getNearPartIndexes($partName[6], $partName[5]);

    // add curves until all particles have been used
    int $used2[] = initIntArray($numParts[1]);
    int $used3[] = initIntArray($numParts[2]);
    int $used4[] = initIntArray($numParts[3]);
    int $used5[] = initIntArray($numParts[4]);
    int $used6[] = initIntArray($numParts[5]);
    int $used7[] = initIntArray($numParts[6]);

    // make sure that each particle lies on a curve
    string $curves[];

    // particle1
    for ($i = 0; $i < $numParts[0]; $i++)
    {
        int $curveInds[];
        $curveInds[0] = $i;
    }
}
```

```

$curveInds[1] = $child1[$curveInds[0]];
$curveInds[2] = $child2[$curveInds[1]];
$curveInds[3] = $child3[$curveInds[2]];
$curveInds[4] = $child4[$curveInds[3]];
$curveInds[5] = $child5[$curveInds[4]];
$curveInds[6] = $child6[$curveInds[5]];

$used2[$curveInds[1]] = 1;
$used3[$curveInds[2]] = 1;
$used4[$curveInds[3]] = 1;
$used5[$curveInds[4]] = 1;
$used6[$curveInds[5]] = 1;
$used7[$curveInds[6]] = 1;

string $newCurve = "";
for ($j = 0; $j < size($curveInds); $j++)
    $newCurve += ($j + ":" + $curveInds[$j] + " ");
$curves[size($curves)] = $newCurve;
}

// particle2
for ($i = 0; $i < $numParts[1]; $i++)
{
    if ($used2[$i] == 0)
    {
        int $curveInds[];
        $curveInds[1] = $i;
        $curveInds[2] = $child2[$curveInds[1]];
        $curveInds[3] = $child3[$curveInds[2]];
        $curveInds[4] = $child4[$curveInds[3]];
        $curveInds[5] = $child5[$curveInds[4]];
        $curveInds[6] = $child6[$curveInds[5]];

        $curveInds[0] = $parent2[$curveInds[1]];

        $used3[$curveInds[2]] = 1;
        $used4[$curveInds[3]] = 1;
        $used5[$curveInds[4]] = 1;
        $used6[$curveInds[5]] = 1;
        $used7[$curveInds[6]] = 1;

        string $newCurve = "";
        for ($j = 0; $j < size($curveInds); $j++)
            $newCurve += ($j + ":" + $curveInds[$j] + " ");
        $curves[size($curves)] = $newCurve;
    }
}

// particle3
for ($i = 0; $i < $numParts[2]; $i++)
{
    if ($used3[$i] == 0)
    {
        int $curveInds[];

```

```

$curveInds[2] = $i;
$curveInds[3] = $child3[$curveInds[2]];
$curveInds[4] = $child4[$curveInds[3]];
$curveInds[5] = $child5[$curveInds[4]];
$curveInds[6] = $child6[$curveInds[5]];

$curveInds[1] = $parent3[$curveInds[2]];
$curveInds[0] = $parent2[$curveInds[1]];

$used4[$curveInds[3]] = 1;
$used5[$curveInds[4]] = 1;
$used6[$curveInds[5]] = 1;
$used7[$curveInds[6]] = 1;

string $newCurve = "";
for ($j = 0; $j < size($curveInds); $j++)
    $newCurve += ($j + ":" + $curveInds[$j] + " ");
$curves[size($curves)] = $newCurve;
}

}

// particle4
for ($i = 0; $i < $numParts[3]; $i++)
{
    if ($used4[$i] == 0)
    {
        int $curveInds[];
        $curveInds[3] = $i;
        $curveInds[4] = $child4[$curveInds[3]];
        $curveInds[5] = $child5[$curveInds[4]];
        $curveInds[6] = $child6[$curveInds[5]];

        $curveInds[2] = $parent4[$curveInds[3]];
        $curveInds[1] = $parent3[$curveInds[2]];
        $curveInds[0] = $parent2[$curveInds[1]];

        $used5[$curveInds[4]] = 1;
        $used6[$curveInds[5]] = 1;
        $used7[$curveInds[6]] = 1;

        string $newCurve = "";
        for ($j = 0; $j < size($curveInds); $j++)
            $newCurve += ($j + ":" + $curveInds[$j] + " ");
        $curves[size($curves)] = $newCurve;
    }
}

// particle5
for ($i = 0; $i < $numParts[4]; $i++)
{
    if ($used5[$i] == 0)
    {
        int $curveInds[];
        $curveInds[4] = $i;

```

```

$curveInds[5] = $child5[$curveInds[4]];
$curveInds[6] = $child6[$curveInds[5]];

$curveInds[3] = $parent5[$curveInds[4]];
$curveInds[2] = $parent4[$curveInds[3]];
$curveInds[1] = $parent3[$curveInds[2]];
$curveInds[0] = $parent2[$curveInds[1]];

$used6[$curveInds[5]] = 1;
$used7[$curveInds[6]] = 1;

string $newCurve = "";
for ($j = 0; $j < size($curveInds); $j++)
    $newCurve += ($j + ":" + $curveInds[$j] + " ");
$curves[size($curves)] = $newCurve;
}
}

// particle6
for ($i = 0; $i < $numParts[5]; $i++)
{
    if ($used6[$i] == 0)
    {
        int $curveInds[];
        $curveInds[5] = $i;
        $curveInds[6] = $child6[$curveInds[5]];

        $curveInds[4] = $parent6[$curveInds[5]];
        $curveInds[3] = $parent5[$curveInds[4]];
        $curveInds[2] = $parent4[$curveInds[3]];
        $curveInds[1] = $parent3[$curveInds[2]];
        $curveInds[0] = $parent2[$curveInds[1]];

        $used7[$curveInds[6]] = 1;

        string $newCurve = "";
        for ($j = 0; $j < size($curveInds); $j++)
            $newCurve += ($j + ":" + $curveInds[$j] + " ");
        $curves[size($curves)] = $newCurve;
    }
}

// particle7
for ($i = 0; $i < $numParts[6]; $i++)
{
    if ($used7[$i] == 0)
    {
        int $curveInds[];
        $curveInds[6] = $i;

        $curveInds[5] = $parent7[$curveInds[6]];
        $curveInds[4] = $parent6[$curveInds[5]];
        $curveInds[3] = $parent5[$curveInds[4]];
        $curveInds[2] = $parent4[$curveInds[3]];
    }
}

```



```

$curveInds[1] = $parent3[$curveInds[2]];
$curveInds[0] = $parent2[$curveInds[1]];

string $newCurve = "";
for ($j = 0; $j < size($curveInds); $j++)
    $newCurve += ($j + ":" + $curveInds[$j] + " ");
$curves[size($curves)] = $newCurve;
}

// draw in curves
for ($i = 0; $i < size($curves); $i++)
{
    string $verts[];
    int $numVerts = `tokenize $curves[$i] $verts`;
    string $curveCmd = "curve";
    for ($j = 0; $j < $numVerts; $j++)
    {
        string $inds[];
        tokenize $verts[$j] ":" $inds;
        int $whichPart = $inds[0];
        float $partPos[] = `getParticleAttr -at position ($partName[$whichPart] + ".pt("
            + $inds[1] + ")")`;
        $curveCmd += (" -ep " + $partPos[0] + " " + $partPos[1] + " " + $partPos[2]);
    }
    eval $curveCmd;
}

global proc int[] initIntArray(int $arraySize)
{
    int $curArr[];
    for ($i = 0; $i < $arraySize; $i++)
        $curArr[size($curArr)] = 0;
    return $curArr;
}

global proc buildPartCurve(string $partName)
{
    int $numParts = `particle -q -ct $partName`;
    float $partPos[] = `getParticleAttr -at position -array true $partName`;
    string $curveCmd = "curve";
    for ($i = 0; $i < $numParts; $i++)
        $curveCmd += (" -ep " + $partPos[$i * 3] + " " + $partPos[$i * 3 + 1] + " "
            + $partPos[$i * 3 + 2]);
    eval $curveCmd;
};

global proc buildPartCurve(string $partName)
{
    int $numParts = `particle -q -ct $partName`;
    float $partPos[] = `getParticleAttr -at position -array true $partName`;
    string $curveCmd = "curve";
    for ($i = 0; $i < $numParts; $i++)

```

```

        $curveCmd += (" -ep " + $partPos[$i * 3] + " " + $partPos[$i * 3 + 1] + " "
            + $partPos[$i * 3 + 2]);
    eval $curveCmd;
};

global proc float getPartDistSq(string $partName1, int $index1, string $partName2, int $index2)
{
    // get the particle positions
    float $partPos1[] = `getParticleAttr -at position ($partName1 + ".pt[" + $index1 + "]"`);
    float $partPos2[] = `getParticleAttr -at position ($partName2 + ".pt[" + $index2 + "]"`);

    // return the distance squared
    float $distSq = ($partPos1[0] - $partPos2[0]) * ($partPos1[0] - $partPos2[0])
        + ($partPos1[1] - $partPos2[1]) * ($partPos1[1] - $partPos2[1])
        + ($partPos1[2] - $partPos2[2]) * ($partPos1[2] - $partPos2[2]);
    return $distSq;
}

global proc float getPartDistSqB(string $partName, int $index, float $posX, float $posY, float $posZ)
{
    // get the particle positions
    float $partPos[] = `getParticleAttr -at position ($partName + ".pt[" + $index + "]"`);

    // return the distance squared
    float $distSq = ($partPos[0] - $posX) * ($partPos[0] - $posX)
        + ($partPos[1] - $posY) * ($partPos[1] - $posY)
        + ($partPos[2] - $posZ) * ($partPos[2] - $posZ);
    return $distSq;
}

global proc float[] getPartDistSqs(string $partName1, int $index, string $partName2)
{
    // get the position data
    float $partPos1[] = `getParticleAttr -at position ($partName1 + ".pt[" + $index + "]"`);
    int $numParts = `particle -q -ct $partName2`;
    float $partPos2[] = `getParticleAttr -at position -array true $partName2`;

    // calculate the distances
    float $dists[];
    for ($i = 0; $i < $numParts; $i++)
    {
        float $curX2 = $partPos2[$i * 3];
        float $curY2 = $partPos2[$i * 3 + 1];
        float $curZ2 = $partPos2[$i * 3 + 2];

        float $distSq = ($partPos1[0] - $curX2) * ($partPos1[0] - $curX2)
            + ($partPos1[1] - $curY2) * ($partPos1[1] - $curY2)
            + ($partPos1[2] - $curZ2) * ($partPos1[2] - $curZ2);
        $dists[size($dists)] = $distSq;
    }
    return $dists;
}

global proc int getNearPartIndex(string $partName1, int $index, string $partName2)

```

```

{
float $dists[] = getPartDistSqs($partName1, $index, $partName2);
float $minDist = $dists[0];
int $outIndex = 0;
for ($i = 1; $i < size($dists); $i++)
{
    if ($dists[$i] < $minDist)
    {
        $minDist = $dists[$i];
        $outIndex = $i;
    }
}
return $outIndex;
}

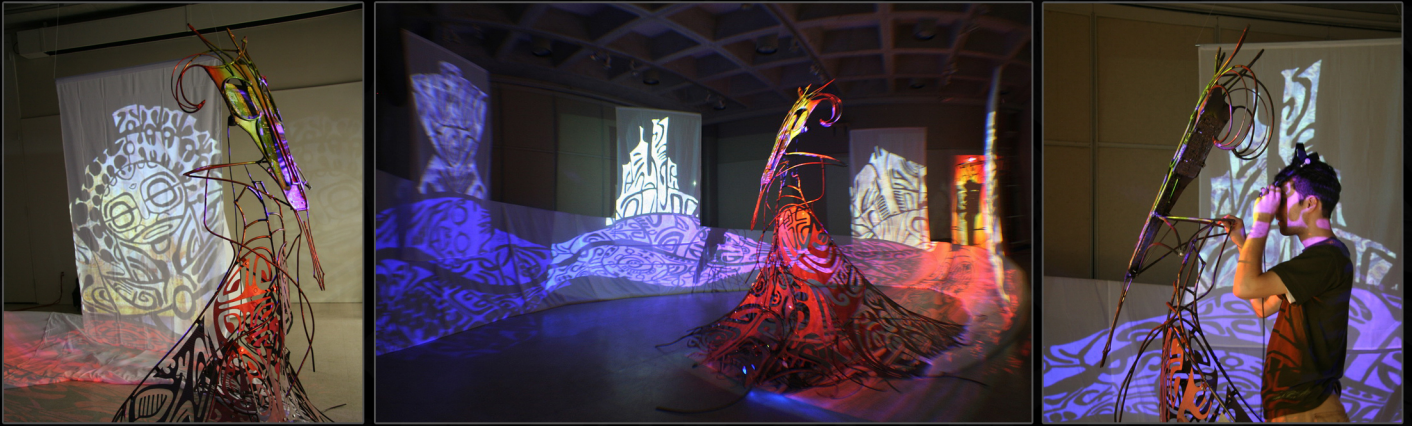
global proc int[] getNearPartIndexes(string $partName1, string $partName2)
{
int $numParts = `particle -q -ct $partName1`;
int $indexes[];
for ($i = 0; $i < $numParts; $i++)
    $indexes[size($indexes)] = getNearPartIndex($partName1, $i, $partName2);
return $indexes;
}

```

Join Path

This script creates a single nurbs curve that contains all points on the specified sequence of curves.

```
global proc joinPath()
{
  string $paths[] = {"path1A", "path2D", "path3B", "path4B", "path1B", "path2B", "path3A", "path4C",
                    "path1C", "path2C", "path3C", "path4A", "path1D", "path2A", "path3D", "path4D"};
  string $curveCmd = "curve";
  for ($i = 0; $i < size($paths); $i++)
  {
    float $curEps[] = `getAttr ($paths[$i] + ".ep[*]")`;
    int $numEps = size($curEps) / 6;
    for ($j = 0; $j < $numEps; $j++)
      $curveCmd += (" -ep " + $curEps[$j * 3] + " " + $curEps[$j * 3 + 1] + " "
                  + $curEps[$j * 3 + 2]);
  }
  float $curEps[] = `getAttr ($paths[0] + ".ep[0]")`;
  $curveCmd += (" -ep " + $curEps[0] + " " + $curEps[1] + " " + $curEps[2]);
  eval $curveCmd;
}
```



Dream of the Techno-Shaman was created in partial fulfillment of the degree requirements for the Master of Fine Arts degree in Integrated Visual Arts. This multimedia installation was completed and exhibited at the Design Center's Gallery 181, on the Iowa State University campus in Ames, IA, during July of 2008.

This text details my creation process in its entirety, from initial inspiration to final exhibition. This begins with a brief introduction to tribal and computer art, followed by discussion of the inspiration I found in the similarities between these seemingly disparate genres. These similarities span all characteristics of importance to the fine art community, including their formal properties, conceptual content, and underlying socio-cultural context. More specifically, key similarities include extensive use of generative pattern, exploitation of the incorporeal, prominent use of multimedia expression, and an emphasis on interaction and collaboration.

Dream of the Techno-Shaman is my attempt to highlight and explore many of the similarities between tribal and computer art, as well as their associated cultural impact, in the form of an immersive multimedia installation. Its large scale and heavy use of both physical and virtual components necessitated a wide range of traditional and digital production processes. Ultimately, this installation successfully exploits the unique potential of computer technology to reengage with tribal processes through interactive and immersive multimedia art.

