Effective Communication in Interactive Media

Through Application of Gestalt Principles

Submitted by Cheryl R. Cicha

Disclosure

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Forward

The concept from which this thesis grew is the creation of an educational virtual environment through which the user can move at his or her leisure to discover factual information. Because I intended the application to be for users of varied ages and levels, I was required to fulfill the technical, intellectual and entertainment needs of an extremely varied group.

To solve this human communications problem, I applied principles traditionally used to enhance communication in printed media. This thesis is an exploration of how these principles apply to all aspects of interactive media including two and three dimensional design, animation and sound.

The objective of this thesis is to examine alternatives in the communication of educational material. It is grounded in the hypothesis that people are more interested in learning when information is presented in an organized, entertaining manner and that the use of traditional design theories enhances communication and thus accelerates learning.

To achieve these goals the physical application consists of a virtual museum through which the user moves in a non-linear fashion to discover more information about the display which is titled "Animals in Ancient Egypt." The atmosphere, music and humorous surprises take the place of the traditional data base supplied by most applications of this type.

An important aspect of this project is the accessibility of educational information to the student in an exploration of a virtual space instead of an exploration of a database. As is supported by studies in cognitive, behavioral and gestalt psychology, this type of learning can be very beneficial to the student in terms of the speed and accuracy by which they learn.

As a result of this project, I hope to contribute to the field of digital design more effective design guidelines for interactive applications through the use of gestalt theories. Benefits of this exploration will support computer graphic designers in their quest to present information clearly and to promote the creation of effective educational materials. The importance of this thesis is a response to the ongoing human desire for intellectual stimulation.

Contents

Introduction

An explanation of how human beings visually perceive and process information as well as an exploration of gestalt theory and its application to successful communication in design.

The impact of interactive media on the education of our society is currently an important issue. Instructional applications may be targeted toward students of any age and may be used under any circumstances from pre-school education to corporate training. Regardless of how it is applied, this new media lacks solid guidelines for effective communication through design.

The problems of communication are a challenge for both the innovative technologist and the designer. Like the educational process, communication concepts are interdisciplinary and involve the complete cognitive system of the audience. As designers, we must understand universal human factors in order to be successful at communicating effectively.

The model that is the cornerstone for human communications supports multimedia. However, successful multimedia applications do more than get images, text and sound from point a to point b and beyond. They strive to optimize the human communications process and effective design is at the root of this.

The use of design principles simplifies tasks for the developer as well as the user. These guidelines aid in quickly and effectively organizing information for accelerated and enhanced communication (table 1.). Following basic design principles frees the designer from recreating poor design solutions that do not meet user needs and may require time-consuming alterations later in the process. This could mean complete redesign of the project. These principles also allow the user to quickly process and retain information more effectively. Because the exchange of information is being handled more efficiently, the value of interactive media as an effective informational tool is enhanced. The principles and value will be discussed in more detail later in the chapter.

Many of the interface and design problems we deal with are the result, not only of cultural differences, but of the distinct nuances that make each of us individuals with independent thoughts. It is these differences that create user interface problems that seem nearly impossible to solve. There is a complete field of study called semiotics that focuses on the evolution, meaning and function of signs and symbols and how these systems serve the user and fulfill new needs. Its findings are extremely helpful in targeting the needs of specific audiences. Larger corporations such as Xerox and AT&T sometimes employ full-time anthropologists to assist them in

table 1.
Design Principles:
- *effectively organize information*
- *simplify use*
- *accelerate learning*
- *enhance communication*
- *respond to human needs*

creating universally acceptable interfaces. They have found, in many cases, that entirely different interfaces must be created for different regions of the world which magnifies the scope of our design dilemmas. (1) The division can be attributed to cultural differences, past experiences and thought patterns such as left/right brain analysis of information.

How then are designers to overcome these differences to create the most universally understandable interfaces? Although we live in a culturally diverse world, humans do share a common physiology. There is strong evidence to suggest that the physiology of perception may help us, as designers, to overcome some of these cultural differences and communicate effectively to a universal audience.

Perceptual Systems:
Perception is a pattern-selecting and pattern-making function. It is inherent in the physical structure of the nervous system.(2) As we see by fractals, physical matter organizes into coherent patterns of arrangements of molecules. Even the molecules themselves are patterned. These patterns are what allow us to identify, remember and classify information for future access. It has been gained from Robert Lucky's dialogue, in his book Silicon Dreams, that "vector quantization" represents the model of the three dimensions by or through which humans see. These vectors supply the human ability to recognize patterns or clusters in overall spatial relationships. Take Lucky's example of darts on a dart board. Perceptual patterns allow you to discriminate the dart board from the wall, the darts from the dart board and one dart from another. It is these patterns that also allow you to identify the items, or at the least, to recall past incidence of similar items with which to make a comparison. Incidentally, this process is relatively distinct to human beings. Animals have have been found to display varying levels of perception and recall. (3)

The circle shown in figure 1 is an example of a test that aids in understanding how people perceive images. This image was flashed to a test group who was asked to draw what they "saw." Results showed that people drew complete circles instead of circles with a break in them. This is because a circle is an element of a pattern that they are used to seeing (circles are very common shapes in our world) and this is the single most likely alternative from a limited set of possibilities. You see, the raw information taken in by the retina is immense. There are about 100 million photoreceptive cells, each of which can
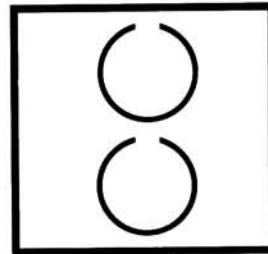
figure1.
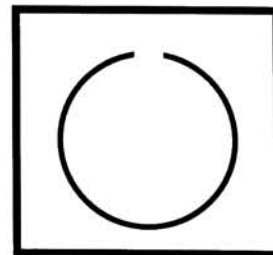
fire at a rate of about 1,000 Hz, for a possible total information rate of about 100 billion bits per second.(4) The human brain cannot process the information overload. Therefore, filtering of information begins in the retina and ends with the perceptual functions of the human brain.

The study group was also flashed the image in figure 2. The resulting drawings revealed exaggerated openings in both circles. The results of test B are due to the fact that the location of the breaks are the discerning factors between the 2 circles. The breaks are now a factor because 2 circles create a subset from which we compare one to the other. This pattern recognition is what allows us to discriminate and identify. These are often called "inferred sets" because we derive the fastest conclusion from a subset of possibilities.(5) These inferred sets provide physiological support for an area of psychology which examines the characteristics of patterns as they relate to perception. This field of study is gestalt psychology. The research and findings of gestalt psychology provide important physiological evidence indicating how the eye organizes visual experiences according to psychological laws.

Gestalt psychology originated in Germany prior to WWI. The word "gestalt" or "gestaltung" means organization, arrangement or structure. The man considered to be the founder of gestalt was Fredrick S. Perls. The principal researcher of visual perception was Max Werheimer who was offered research space at the Institute of Psychology in Germany in 1910. This is where the gestalt principles of design began their development.(6)

The research addressed the question, "what characteristics of patterns make some features appear to belong together while others seem to fall apart?" The results of Werheimer's experiments contain the basic ideas for his writings on unit-forming factors which are the essence of the construction and interpretation of organized patterns in visual design.(7) His results can be classified into what he terms the "principles of perceptual organization". This is the same as unit-forming factors. It is these factors which are the scientific perceptual basis for visual esthetic design. The five principles I chose to focus on in this thesis include figure/ground, isomorphic correspondence, closure, continuation and similarity. They are defined on the following page.

figure 2.

Figure/Ground is the fundamental law of perception which allows us to discern an image. The figure is the positive element defined by spatial relationships. It is often the visual subject. Ground is the background, field, white space or negative space which supports the visual subject.(8) Figure and ground are made possible by contrast. Can you think of a situation in which figure/ground does not exist? Probably the most noted example is camouflage. Of course the idea of camouflage is to make something unidentifiable. This is achieved by creating a figure that is identical to the ground. In figure 3 the figure is the black circle, the ground is the white space supporting it.

Isomorphic Correspondence deals with the relationship between structural characteristics of visual form and similar characteristics of human behavior. Experiences of people, both physical and psychological, are recalled and triggered by specific visual images.(8) For example, an advertisement for soda might make you thirsty, an illustration of a roller coaster may recall the way your stomach felt at the time of the experience, or the image of a face can make you feel happy or sad depending on the expression. (figure 4.)

Closure is a phenomenon of perception often created by the human mind to fulfill our natural tendency toward incomplete or unfinished forms.(8) This was demonstrated in the circle experiment and explains why many drew a complete circle although the correct information was physiologically input by the eye. This causes us to imagine closure in objects such as a series of dots whose relationships to each other causes us to see a circle as in figure 5.

Continuation is the organization in perception that leads the eye to continue along and beyond a straight line or curve.(8) An arrow points the eye in an intended direction as a navigational arrow might. Animation motion such as a character walking or ball bouncing into and then out of the frame is made believable because of continuation.(figure 6.)

Similarity is the grouping together of like shapes, sizes, colors or directions in order to define groups.(8) The brain's use of inferred sets is key to this principle. Similarity also aides in identifying separate groups. For example, in a herd of brown horses, we are able to differentiate and identify the one gray horse. The groups in figure 7 are separated by the size of the elements as well as the placement.
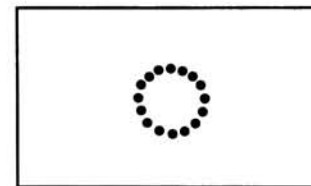
figure 3.
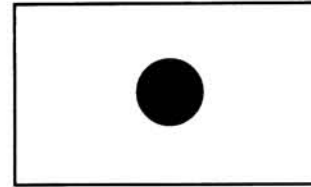
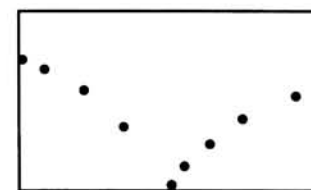Figure/Ground

figure 4.
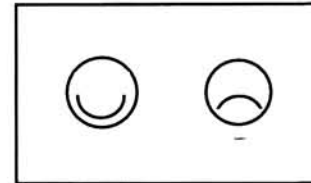
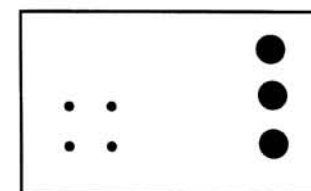Isomorphic Correspondence

figure 5.

Closure

figure 6.

Continuation

figure 7.

Similarity

As you can see, the principles rely on different characteristics of patterns. Gestalt is based on the structural aspect of relationships in patterns which states that the whole is greater than the sum of its parts. Let's take a 12 note melody. If we were to study the isolated notes we would be unable to determine the melody. It is the same idea as examining the letters "p","t","o" and "s" one at a time. It is impossible to foretell what the whole effect of the combinations might be. "It could be *pots* or *tops* or *stop* or *post* or whatever one *opts* for!"(9) The point is that the "whole effect" of the melody or word cannot be determined by studying isolated parts.

A melody played in 2 different keys is recognizable as the same melody yet they may not contain any of the same notes. The nature of the wholes is not in their parts but rather in how they are composed. The gestalt is the 13th ghostlike structural aspect or set of relationships that can survive a change of parts. (10) This applies directly to interactivity screens and each of the elements that exist therein. Later, in the "Process" chapter I will discuss specific screen designs and the application of gestalt.

Perceptual laws constitute a visual frame of reference that could provide the designer with a reliable psychological basis for the spatial organization of graphic information. All of the so-called laws cited can be described in graphic form. The knowledge gained from the original perceptual experiments is applicable to the visual solutions of contemporary graphic problems.

The research and findings of the school of gestalt perceptual psychology have laid the foundation for today's advanced knowledge of visual facts. These visual facts, when understood, can serve as design elements within a common language of visual communication and as a psychological basis for the spatial organization of graphic materials.

Although cultural and individual differences can create infinite sets of factors by which to design, the physiology and psychology of perception do give the designer some basic universal human factors by which to begin. As interactive media designers, we are usually presented with a target audience which will contain its own subset of factors, providing even further guidelines to adhere to. When these factors are considered vital to a successful user interface, redesign after testing is minimized. However, designers of any medium can become so proficient with their own product that they no longer perceive factors which may cause difficulties for the user. Even when the designers become users, they operate

almost entirely from their past experiences with similar products (11). Too easily the designer becomes unable to predict the problems, misinterpretations and errors that users at other levels will make. By utilizing perceptual principles that are universally acquired, the designer is better able to anticipate and, therefore, minimize the occurrence and ramifications of user errors.

2 Process

A discussion of the procedures by which this thesis was created from brainstorming to final product. This section also addresses the use of gestalt in the design process.

PROCESS

Review of the Literature

After gathering information about perception in design I began to look for positive and negative aspects of this in other applications. In order to determine a general direction for my first brainstorming sessions I reviewed approximately 30 interactive applications that are currently on the market. Without giving them each an independent review, I drew general conclusions about their common strengths and weaknesses. If you are interested in exploring what I consider to be "good examples", I have included the names of the applications which I felt best exemplified the quality in table 2.

As a result of this research I worked to include the positive concepts I compiled. Later in the chapter you will find more detailed information about how I approached the development of these areas using gestalt principles. The sections below identify some of the aspects considered most important to resolve in the early planning stage.

Hardware:

The hardware required to build the application was identified early. This included a Macintosh Quadra 800 with 32 MB of RAM and a 19" color monitor, a 300 MB LaCie Tsunami external hard drive, a 44 MB APS Technologie's syquest drive and a Microtek ScanMaker 600ZS color scanner. Storage was primarily on the 300 MB LaCie Tsunami external hard drive and Quadra with backup on 44 MB syquests. About three quarters of the way through the project I backed up the entire thesis including parts onto a multi-session CD-ROM.

Software:

Deciding on software was a fairly simple task relying primarily on those applications with which I had experience for time sake. Those I chose included Adobe Photoshop, Macromedia Director, Adobe Illustrator, Macromedia Freehand, Quark XPress, SoundEdit16 and Strata StudioPro.

Multimedia "musts":

Once the basic idea was decided upon and hardware and software requirements met, I compiled a list of miscellaneous items based on my previous research that I felt were extremely important to the success of the project. These are listed to the right in table 3. I kept this list in sight during the project creation in order to keep my objectives in mind and in use in the final application.

table 2.
Positive points:
- *animated or simple directions*
  BusyTown
- *short, informative introductions*
  Darkseed
- *variety of choices*
  Busy Town, Sitting on Farm
- *lots of small animations*
  Busy Town
- *excellent illustrations*
  Sitting on the Farm
- *excellent 3-D graphics*
  Iron Helix
- *excellent facial animation*
  Pax Imperia
- *fun surprises*
  Busy Town
- *effective icons*
  Oceans Below
- *good character development*
  Who Wants Arthur?
- *excellent data base*
  Ancient Egypt
- *nice typography*
  Microsoft Musical Instruments
- *nice layout*
  Microsoft Multimedia Mozart
- *interface appropriate to application*
  Journeyman

Negative points:
- *aliased graphics and text*
- *terrible typographic choices*
- *repetitive sound that wouldn't turn off*
- *very rough animations*
- *poor character mouth synchronization*
- *lengthy game play explanations*
- *vague or no directions*
- *repetitive actions*
- *boring action*
- *repetitive game themes*

table 3.
Multimedia Musts:
- *exciting the audience in first few minutes*
- *making everything within the application appropriate to the subject and audience*
- *educating*
- *entertaining*
- *rewarding the user*
- *simplifying navigation*
- *communicating*
- *not overwhelming people with technology*

Brainstorming:

In order to come up with an idea for my thesis I made 3 lists which you can see in table 4. One list of the skills that I would like to showcase, one list of the areas in design that I would like to explore further, and one list of subject matter that interested me.

The results of the three lists produced an idea that would showcase my skills through the application of gestalt principles while being utilized in an edutainment application. I narrowed down the subject matter to that which interested me the most and then began researching.

Although each presented its own challenges and excitement factors, I decided to try and include all the items in the "Skills" list as I wanted my thesis to include the culmination of my acquired knowledge as a graduate student in the Computer Graphics Design program. I used selected items from the "Exploration of Design" list based on their ability to work well together in an actual application as well as their pertinence to each other. From the "Subject Matter" list, I chose ancient Egypt because of its vast resources and interest to the general public, however, I also chose to include some of the other ideas listed here as secondary.

At this point I had successfully identified the elements that I wanted to include in my thesis. This included the "musts" that I felt should be in any project regardless of the subject, the skills I wanted to showcase, the design problems I wanted to address, the subject matter and the hardware and software it required to make it all come together.

table 4.

Skills LIst:
- ••*animation*
- ••*illustration*
- ••*2-D design*
- ••*3-D design*
- ••*story-telling*
- ••*character development*
- ••*sound*

Exploration of Design LIst:
- ••*gestalt*
- ••*human communication*
- •*networks*
- ••*humor*
- •*shifting of information*
- •*traditional printed information*
- ••*communicating faster*
- ••*educating for higher retention*
- ••*mood*
- ••*computer as a learning tool*

Subject Matter List:
- •*marine life*
- •*history of man and the horse*
- •*African wildlife*
- ••*children's story*
- ••*adult story*
- •*animated medical procedure*
- •*animated veterinary procedure*
- •*corporate training*
- •*Eastern religion*
- ••*children's educational guide to animals*
- •*guide to a city or cities*
- ••*just-for-fun 3-D animation/story*
- •*unbuilt work of Frank Lloyd Wright*
- ••*puzzle*
- •*ship wreck*
- •*rebuilding a ruin*
- •*ancient Greek architecture*
- •*ancient Roman architecture*
- ••*ancient Egyptian architecture*
- •*Irish castle*
- •*Parthenon*
- •*Pyramids*
- ••*culture with deep philosophical roots*
- ••*culture with deep storytelling roots*

•• denotes ideas used in this thesis

Organization:

Now it was time to start to brainstorm the subjects I wanted to pursue, and the amount of information I was collecting was growing fast. Because of this complexity, I decided early how I wanted to organize the information. I broke the research up into 3 distinct areas; gestalt principles, ancient Egypt and technical subjects to be sure that I could carry out my ideas.(table 5.) An outline was then made for the project with corresponding sections in a 3-ring binder to keep information organized.

Various approaches

The research on both the technical avenues and gestalt was progressing on its own but I began wondering where to start developing a solid basis in which to house the subject matter. While researching gestalt I came across a project development guideline. The idea for this set of questions was derived from the book Scriptwriting for Animation. I used some of them directly and applied others to the specific needs of the project.

Included below is my list of questions. This was extremely helpful in exploring the possibilities of the application and then defining them in order to apply them. Through this method I was able to develop some infant ideas into the final thesis. I also came up with ideas that were simply fleeting thoughts as well as things that I really wanted to include that never made it to the final application for various reasons.

Questions for developing ideas:

•How will I gain the audience's interest within the first few minutes?

•What is the Catalyst that gets the story going?

•What are the catalysts that get the rest of the story going?

•Are there a variety of catalysts?

•How will the audience recognize these key points?

•What is the main point?

•What are the various smaller points?

•What is the direction or end point?

•What will be the branching areas?

table 5.
Graphic Design/Gestalt:
- *definition of Graphic Design*
- *history of Gestalt*
- *psychological theories*
- *define the theories*
- *figure/ground*
- *isomorphic correspondence*
- *closure*
- *continuation*
- *similarity*
- *foundations for effective communication*
- *human factors*
- *organization*
- *communication*
- *entertainment*
- *other designers*
- *views related to theories*
- *how theories apply to interface design*
- *multimedia musts*

Egypt:
- *Bird*
- *map of Egypt*
- *camel*
- *Abu Simbel*
- *purpose-why it was built*
- *inside of tomb-schematic*
- *artifacts and their meaning*
- *construction*
- *Nefertari's monument*
- *Ramses II*
- *political accomplishments*
- *concubines*
- *children*
- *monuments*
- *building program*
- *general culture*
- *afterlife beliefs-view of life/death*
- *serenity of life-tied to wealth & politics*
- *influence of the Nile*
- *tribes of different cultures*
- *political hierarchy*
- *brief History Leading up to this Point*
- *previous rulers*
- *political state*

Technical Subjects:
- *animation*
- *3-D*
- *data screen development*
- *character development*
- *sketches for motion*

•Does each one hold a similar amount of information and interest?

•How many layers of branching?

•Do situations resolve to their most stable state? (i.e. crime occurs, everyone suspected, crime solved)

•Are there unexpected barriers to prevent early resolution and prevent boredom ?

•What other elements may be required to reach the end point?

•What kind of mood do I want to set and how?

As the project progressed I came back to ask these questions many times, sometimes resulting in completely different ideas. As these ideas were forming research continued on gestalt and ancient Egypt.

Final approach for each topic
The information I found on gestalt was abundant but there was little direct application to interactive media. Exploration of many different temples and pyramids in ancient Egypt finally yielded the Great Temple at Abu Simbel. This was decided upon for the rich history of Ramses II and the depiction of his life within the temple. It was also chosen for the physical qualities of a temple that was carved by hand out of the side of a cliff, as well as the lighting of the innermost depths by the sun.

From this point on, I organized the information and creation by very specific subjects. Therefore, the rest of this chapter will be organized so that you can more clearly see how each aspect of the project developed along the way. In order to stay "on track" and sane I created 4 phases of the project as listed to the right in table 6.

Finally, I made a (yes, another) list of all of the things that needed to be accomplished before the thesis was due and broke it down into monthly tasks organized on a grid by week. (figure 8.) The weekly tasks were then broken down into daily tasks in a day planner.

One of the problems I ran into was that I would start on one task and realize that I had to do something else first. Instead of going through reams of paper, I used 3 x 5 cards to write down tasks by subject. I then hung them on a bulletin board where they were in constant view. If I needed to reorga-

table 6.
Phase I:
   complete the minimum of the project I wanted to accomplish
Phase II:
   add some items that would be nice to have
Phase III:
   include more "bells and whistles"
Phase IV:
   develop the entire project into part of a series.

figure 8.

Monthly Planning Sheet

nize the tasks I simply rehung them on the bulletin board. Also, for the development part of the thesis I kept a small sketch book with me all the time to chronologically record ideas and processes such as recipes for effects that I wanted to use over again.

Starting to Design

At this point, basic concept in place, I broke my research into the following areas:

- icons
- development of data screens
- help
- character development:
- 3-D space creation
- navigating the space
- interactivity in the space (clickables)
- cursors

Regardless of my quest for organization and planning, things do not always go as planned. Later I will discuss why the information particular to Abu Simbel was not used. However, this research is complete and if you know anyone who would like to do another thesis on Abu Simbel, I have some great information! To the right is a list of the main points in the story that I decided to use in what was at that point the final thesis.

Two months into the project it was evident to me that the story needed to be revised. In calculating of the clickable objects for each room, I discovered that I had over 150 ancient Egyptian objects to research, draw and animate. I felt that all of my time was being spent on Egyptian history and not enough on the creation of the 2-D screens, 3-D images and animation and how gestalt applies to each. To resolve this, I elected to change the focus from reaching the goal to being about the journey. This concept is also fundamental to why I chose not to create a game. I wanted the user to be able to enjoy the journey and learn along the way instead of being focused on the fastest way to a winning situation.

The resolution, seen in table 7, included revising the first two phases. After I began working on the project, I discovered that there were items from both phase I and phase II that I thought were vital as well as items in each that were secondary. I changed the listings in the phases to include the vital items in phase I and the less important in phase II. The result was that the introduction and animation would be fully developed as well as the exterior, facade and interior of the Temple. The latter three

table 7.
Revision #1

Phase I:

Introduction::
•setting of the scene through narration, imagery and music
•zoom from space to Abu Simbel
•Horus continues introduction

Help:
•Horus gives narrated and animated help

The Exploration:
•360 degrees clickables
•after clicking, information comes in the form of animations, narration, text & sound
•clicking doorway allows user to through a 3-D fly-through animation
•user may click around in the temple
•animated "surprises"
•mood music

Phase II:

•more Horus appearances and interaction
•user may access one transverse chamber from the Great Pillared Hall
•Second Hall is completely done in 3-D
•Sanctuary is completely done in 3-D
•user flies through of rest of temple to the
•sanctuary where they witness lighting

Phase III:

•complete 360 degree access to all rooms
•rooms contain clickable and fully animated objects

Phase IV:

•make this only one section of a collection of "Temples of the Nile" series of CD's the user could collect

would be fully clickable and use animations to communicate information about the item clicked. The last three chambers of the temple would become developed as part of phase two as time permitted.

Now that I had the priorities of the project laid out through assigning each portion a phase, I began to research 3-D software. I knew that I needed an application that met the following qualifications: the ability to texture map, animate or walk-thru, render shadows and reflections, be Macintosh-based, and be able to ultimately transfer to a PICT file even if through some series of importations. The list below depicts each software package I investigated. This information was collected prior to January, 1995 and may have changed since.

Virtus Walk-thru Pro: Runs slow but can be made a stand-alone which can be called from Macromedia Director. However, it is over $400.00. It also does not have raytracing so it would not produce shadows. The graphics were quite bitmapped compared to the results produced from Strata StudioPro for example. I attempted to Beta test for the company but I ran out of time waiting for a response.

Pixar's Renderman: No walk thru.

Lightwave 3-D: Not for Macintosh.

Strata virtual 3-D walk-thru: This is tied to StudioPro and cannot be run independently or be exported as PICTS or a Quicktime movie. Therefore, it cannot be accessed or used by Macromedia Director. I read that it has trouble handling the very complex files that StudioPro can produce. Strata virtual 3-D also runs at only 10 frames per second.

Autodesk's 3D Studio: Does an excellent rendering job but is made only for IBM machines.

*form*Z for Macintosh:* no animation ($1400.00!) Beautiful job on both exteriors and interiors.

Wavefront's Advanced Visualizer: This is for SGI workstations only but has all of the bells and whistles of Strata StudioPro (plus some) and also includes a "director" for project management and status which would be interesting to use in the face of large projects such as a thesis.

Ultimately I chose to work in Strata StudioPro because of its availability, my experience with it, the ability to raytrace and texture map and to be con-

verted to either Quicktime movies or PICT files. The biggest drawback was that there is no walk-thru function and therefore, any movement through space had to be achieved through the animation of separate PICT files in Director. This was preferable to creating a Quicktime movie which is memory intensive which was unnecessary for this project.

And then came a major obstacle...

After months of research, conceptualizing, organizing and sketching I began to build the temple at Abu Simbel in Strata StudioPro. It didn't take long for me to recognize that actually building the temple was a lot more than I bargained for. I believe the exact breaking point was constructing an ear. Being a medical illustrator I wasn't content on settling for something anatomically abstract especially when the original hand carving was so exact. It was clear to me that the challenge of building an entire temple in Strata could have been a thesis in itself. I came up with several solutions including the following:

• Using sand dunes to cover some of the facade
• Animating avalanches of sand or rock that would not allow you to enter another part of the temple.
• Animating snakes, insects or bats that would appear to scurry and not allow your entrance.
• Simply notifying the user that this section was not complete with an inventive message. For example, that they were being forced to turn back or that a sand storm was kicking up and they should hurry on their journey by following a suggested path.

The primary problem with all of these solutions was that the architecture of the temple was actually quite linear. This can be seen in an early screen test using a photograph of interior.(figure 9) The antechambers off to the sides were easily remedied but building the facade, second and third chambers that led you to the innermost lighted statues was still insurmountable. I took this dilemma to my thesis committee and we came up with several different ideas. My final decision was to take a giant step backward and change the subject matter of the space in order to save the integrity of the original idea. That idea was the concept of a user moving through a 3-D space utilizing 2-D screens, animation and sound in order to learn. The issues I wanted to address in the thesis were being compromised by the structure of the building. And so this led me to some serious soul- searching for the reconstruction of this thesis.

figure 9.
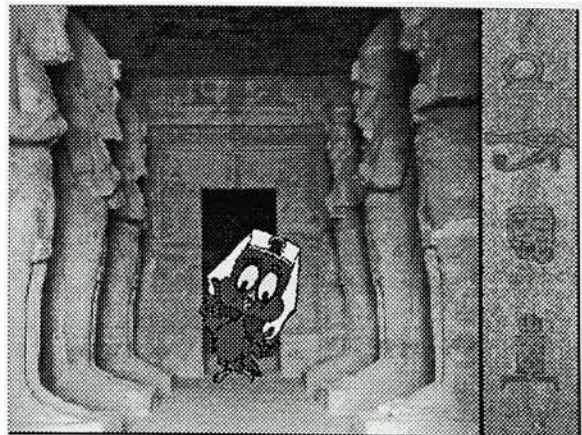
The following sections relate how I went about reconstructing the project. Although the research pertaining directly to the temple at Abu Simbel was being put aside, there were many other aspects of the project that could easily be incorporated into another architectural space. For each section I will discuss chronologically how my thoughts began to form through brainstorming and then how they developed into the final product that you see in the virtual museum application.

Redeveloping the Project:

In order to avoid completely starting from scratch I utilized the basic storyline that I had already developed. As time was beginning to close in, I decided that I did not have the luxury of completely researching another temple. I decided instead to use a fictional space containing factual information. The result was the virtual museum. I could easily conform the space to my own needs while at the same time using it to house the original concept.

I began redevelopment by using Netscape to access the WebMuseum network where I viewed approximately 20 on-line "virtual museums" of varying subject matter. From this point I began designing the architecture of the museum which I will discuss later and attempted to sort out that which I could use from my original research.

You may recognize the list in table 8 from earlier in the thesis when I was conceptualizing using Abu Simbel as the architectural subject. Fortunately, I discovered that the original concept was not dependent on the actual space. As you can see, the second revision employs many of the elements from the previous list.

One of the most important lessons I learned from this project is the importance of planning. Without records of my original ideas and lists of conceptual information this change in subject matter could have been a time-consuming nightmare. Instead, I was quickly able to reference and utilize many of my original ideas and in some cases pieces of work had already been started and could be used in their immediate state.

> *Failure to plan is a plan to failure ...think, focus, plan*
> *(author unknown)*

table 8.
Revision #2

Phase I

> Introduction:
> •*setting of the scene through narration, imagery and music*
> •*zoom from space to museum exterior*
> •*Horus continues introduction*
>
> Help:
> •*Horus gives narrated and animated help*
>
> The Exploration:
> •*360 degrees clickables*
> •*after clicking, information appears through animations, narration, text and sound*
> •*clicking doorway allows user to enter through a 3-D fly-through animation*
> •*user may click around in the museum*
> •*animated "surprises"*
> •*mood music*

Phase II

> •*more Horus appearances and interaction*
> •*artwork in museum wings made clickable*
> •*Debabelizer used to create custom pallets and increase speed*

Phase III

> •*more rooms added to the museum*
> •*all rooms contain clickable and fully animated objects*

Phase IV

> •*make this only one section of a collection of series of CD's*

The remainder of this chapter is divided into sub-headings consisting of the major aspects of creating the project. The development of each section is related chronologically. It explains how the idea developed from brainstorm to solution and how gestalt aided much of this problem-solving process.

Screen Design

When I began to experiment with the screen design and the issue of how to incorporate navigation, I started out with a traditional navigation bar. Through several experiments I came to the conclusion that to create a believable environment I needed to make moving around in it as close to real life as I could achieve through a mouse click.

Much of the research I did on interactive design indicated that users prefer navigation to be on the bottom or to the right of the screen. These are preferred positions because of lack of interference with program menu bars if they show. Being on the right allows easy access for a majority of right-handed users, which eliminates crossing the screen continuously. This, however, is a questionable assumption for many left-handed users who are still faced with the problem of crossing over the screen.

From the onset I wanted the navigation bar to be fairly inconspicuous especially because it is simple and redundantly appears on every screen. I tried to achieve this by making it very thin and using text as the clickable object.(figure 10.) It was evident that this was not working for many reasons: one of which was the harshness of the sleek black bar which produced a very strong figure/ground relationship in contrast to the organic colors and shapes appearing in most of the test screens. This caused the navigation bar to visually attract more attention than I wanted it to have.

To resolve this I turned to the principle of similarity. I made a word list of surfaces and objects that related to ancient Egypt. I finally chose sand from this list of materials. It was used as a background because of its similarity to the subject, yet it had material properties that allowed me to be able to differentiate it from the background of the temple without camouflaging it. The effect was achieved by using a sand texture and manipulating it in Photoshop with the Emboss filter. An example of the experiment can be found in figure 11.
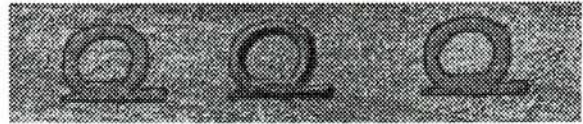
figure 10
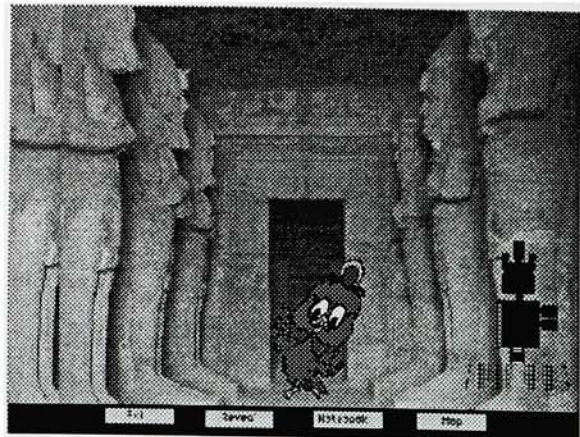
Early Navigation

It was extremely important to me that the users actually feltl like they were in a museum. At first I avoided placing the navigation on the bottom of the screen to intensify the feeling that the users were standing on the floor of the museum and so placed the navigation along the side.(figure 12.) But the navigation still appeared to interfere with actually feeling like they were in the environment. In order to solve this I turned to the principle of isomorphic correspondence. I asked myself what types of things we might see in museums and obviously a navigation bar is not one of them. I finally attempted to avoid using a navigation bar altogether.(figure 13.)

To create this I used "hot spots" at the edges of the screen and on doorways to change the cursor to a hand pointing in the direction that the users could turn or move. For example, when the users moved the cursor to the left edge of the room, the cursor changed to a hand pointing left. This was an indicator that the users could click to turn left if they wished (see the custom cursor recipe for more information). I also experimented with the idea that the users would automatically turn when they rolled over the hot spot. This produced a faster action museum than I wanted and this was particularly confusing to the less experienced users. The result was a clean design with continuity but not the redundancy caused by a navigation bar being constantly visible even when not in use.

I had hoped to use the same principle for "Help" and "Quit". This was originally to be achieved through the isomorphic correspondence principles that I had come up with on my list of things we see in museums. This was to be accomplished simply by making the museum door the "Exit" and using an information desk as the "Help" section. However, I had to keep the inexperienced user in mind. This method would require them to have to *find* the exit or the information desk, not always an easy task for a timid user. Instead, I elected to simply put the words "Help" and "Quit" on the screen where they would always be available.

I designed several different icons; however, they actually took up more space than the words. They also produced too strong of a figure/ground relationship in contrast to the images of the museum and, therefore, made the icons too obvious. For this reason I also changed the original blue of the text to the same green present in the plants in the museum and exterior to minimize the figure/ground relationship and, therefore, the attention that was

figure 11.

Test for Navigation Bar Effects

figure 12.

Verticle Navigation

figure 13.

"Hot Spot" Navigation

drawn to them. I placed them at the bottom of the screen where the floor of the rooms appeared. This meant that the user would not be continually looking at the words or crossing over them.

The result was an interface that appeared to be almost no interface at all. The user's movements through the museum were prompted from movements similar to those they would make in the actual space instead of clicking on a button. The navigation that did appear on the screen was minimized by its color and placement so as to make it less noticeable yet understandable and convenient to use.(figure 14.)

Icons

As I mentioned earlier, I had originally decided to use text to indicate navigation. Changing the qualities of the navigation bar allowed me more room to use for each clickable object. In considering the use of icons, I again used the principle of similarity and decided to use Egyptian hieroglyphics. In researching this ancient written form of communication, I discovered that they used an alphabet as well as pictographs. The alphabet is so far removed from the letter forms that we are familiar with that we would be unable to relate or correspond them to something that we are familiar with. Instead of using the letters or pictographs in their literal Egyptian form the principle of isomorphic correspondence was used to create a relationship between an Egyptian symbol and a contemporary symbol most users would recognize. For example, the "Eye of Horus". Because an eye often depicts looking at something or revealing something it became the icon to reveal the data for the artwork as well as the slider, seen in figure 15, to reveal further resources within the data screen.

Character Development

The idea of having a "tour guide" was born out of a personal experience with virtual reality. At the 1994 SIGGRAPH Exposition I worked for Walt Disney Inc. demonstrating a virtual reality application in which I flew on a magic carpet through the village scene from the movie "Aladdin." When I first started out it was obvious from the way I seemed to hoover that this was going to be easily disorienting. Disney used a character that appeared and explained the scene. The character was used to make the user feel more comfortable in this strange environment. He also served to entertainingly explain a situation that would otherwise have to be read or narrated by a voice unrelated to the scene.

figure 14.

Help Exit

Final Navigation

figure 15.
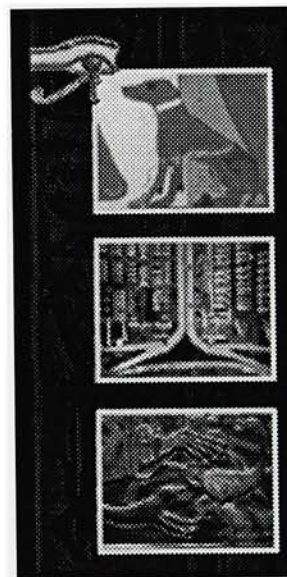
"Eye of Horus" Slider

25

This concept of a tour guide and why it is successful is directly related to isomorphic correspondence. In looking at an animated tour guide, the observer will usually respond with physiological feelings congruent to those experiences with a similar object such as a human guide. Perceiving and identifying the meaning of an object implies an actual incorporation of the object into the sensibilities of the viewer. For example, in this case, the automatic sensibilities might be that there is "someone" in this space that is knowledgeable about the space and can be trusted to guide them safely through the space. Of course not everyone has the same experiences, and for those who may have had negative experiences with tour guides, Horus is given a friendly, helpful personality that is introduced almost immediately.

I chose a bird for this part primarily because of the time required to move limbs. To my delight, in my subsequent research I discovered the importance of birds to Egyptian culture, and in particular of Horus the sky-god, hence the name Horus.

To decide the look and personality of Horus I made a word list of all of the characteristics that I wanted him to possess and why. The words ranged from his sense of humor to his age to the size of his head. The importance of this list was that it shaped Horus into an archetype or a particular personality that most users would be able to identify with through the use of isomorphic correspondence. If Horus contained personality traits that were contradictory such as having angry facial expressions and a cute, happy voice, the users would be unable to relate to the character. Instead of being an amusing source of information he would be an annoying nuisance.

The final personality decided on was modeled after a young boy. The primary reason for this choice was that he could still have child-like features that help in animating expression such as rounder cheeks, large eyes and simple noses.(figure 16.) It also gave Horus the ability to be active and appear often in different places popping out here and there. This gave him the qualities of being mature enough to give thorough explanations while at the same time explaining them simply. He also has a sense of fun and adventure.

Horus had many different "looks" before the last was decided upon. The most difficult task was to keep the qualities from my word list while making him simple enough to animate. For most of the sketches, the only representation of his Egyptian

figure 16.
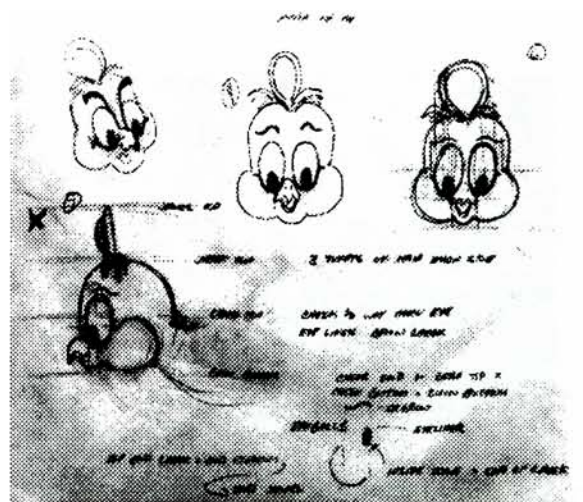
Early Horus Sketches

heritage was the paint under his eyes and the jewel on the top of his head that was taken from original depictions of Horus the sky-god in ancient pieces of jewelry. The addition of an Egyptian hat made him look truly Egyptian. Many different types of hats were tried (figure 17) but when asking testers for opinions, most of them related to the headdress of the pharaoh. This common symbol of ancient Egypt is the element of isomorphic correspondence that allows users to see him clearly as an Egyptian bird. It took over 40 different major changes to create the final character.

Horus Animation

The final changes to Horus developed while I was animating him. The most important change was that his beak became larger.(figure 18.) This aided in making his voice synchronize with the movement of his mouth and being a believable combination. The final change was playing with his color. I actually used a color I had tried in a very early test that seemed to work well against all of the backgrounds. The deep burgundy set up a clear figure/ground relationship with the greens of the exterior environment as well as the beiges of the interior of the museum. This was necessary in order to prevent Horus from blending in with his background. The chosen color was also more in staying with the traditional colors of a hawk.

In testing, Horus was often perceived as an owl. This resulted in collecting more images of live hawks and studying their expressions as well as physiology. This resulted not only in the color decision but also in creating his eyes as more rounded than oval and moving them further to the edges of his head. The final Horus can be seen in figure 19. The process by which he was finally created can be found in the "Recipes" chapter under the recipe card titled "Animation-from storyboard to Director".

In order to animate the character I created I first sketched the motion as a box with wings and legs to gain the proper perspective as well as to avoid time-consuming detailed drawings.(figure 20.) I used a box of film held at the desired angle as a referece I then scanned the sketches and brought them into Director, separating them here as different cast-members.(figure 21.) I could then see, by playing the movie, where the animation needed work or perhaps did not need as many drawings. Once the individual "boxes" with legs worked as an animation, I went back to the drawing table and made the boxes into the character. These drawings were then
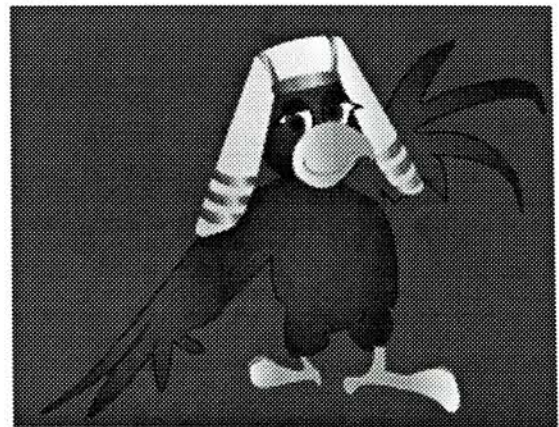
figure 17.
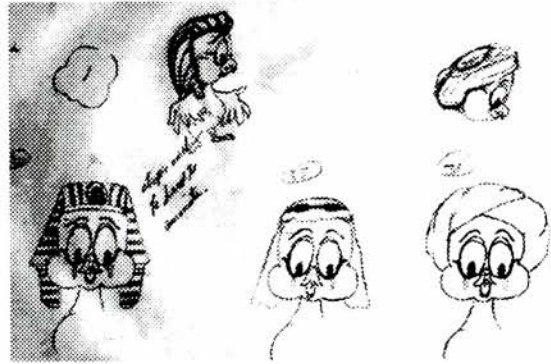
Horus's Hats

Refining Horus

figure 19.

Final Horus

scanned and taken through the same process as the rest of the character drawings to color them and import them into Macromedia Director.(figure 22.) At this point I could create Horus confidently knowing that each image was a necessary and correct part of the animation.

3-D

Preliminary tests were done in Strata StudioPro to try and foresee and, therefore, to avoid future problems. This was done using a texture similar to that of the final wall and using straight walls without the statues to determine how the temple interior needed to be lit. The result showed that some very creative lighting would be required for the interior rooms. Cameras were placed facing each wall and were named for the wall they point to. This allowed me to select the cameras from a dialogue box and know exactly what they would be looking at. I had to select the cameras in this manner because with the floor, ceiling and 4 walls, they were nearly impossible to click on without "hiding" an object that needed to be in the picture for the render.

With this preliminary test already completed, much of the basic idea concerning how I would create the museum in 3-D was done. Designing the museum itself was actually a fairly simple task. Through my research on ancient Egypt I had been observing many different types of Egyptian architecture and was actually taking some of my research from publications dedicated directly to Egyptian architecture. At the time I was also studying architecture and employed some concepts from Frank Lloyd Wright's designs as well as Louis I. Kahn. The shape of the floorplan and the look of the facade are actually a combination of similar facades by Kahn, simplified and combined with the basic structure of some Egyptian facades.

In researching walk-thru programs I discovered that the user is often restricted visually to one room at a time. This is more for technical reasons than user comfort as it cuts down on rendering time and makes the application easier to animate as the user paths are more clearly defined. To me, this layout felt restricted and suppressed. Instead, I created the entire museum as one file to produce an open and contemporary floorplan. With over 9,000 objects in one file this was not the simplest way to create the space but it was the most beneficial for the user. Strata's ability to hide and show objects was extremely important to managing the information.

figure 20.
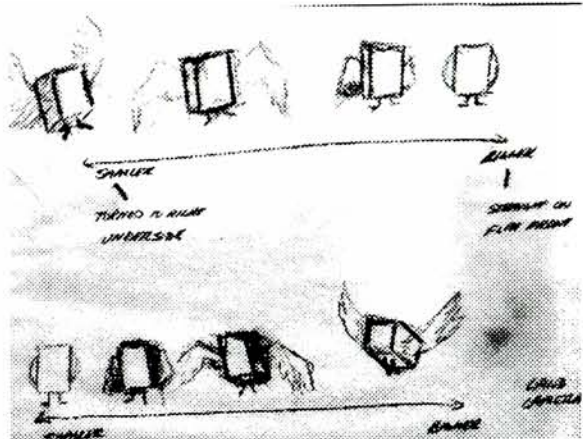
Sketch of Animated Boxes

figure 21.
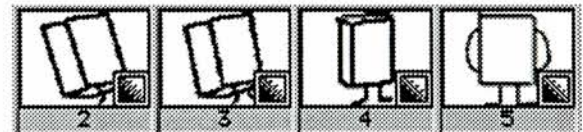
Boxes Imported Into Director's Cast

figure 22.
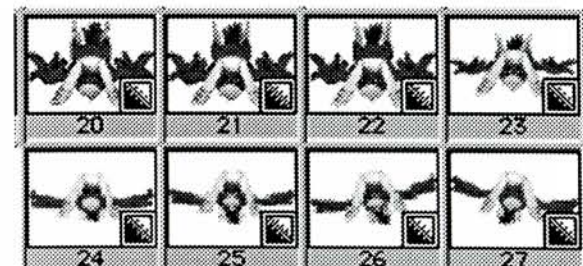
Final Castmembers for Animation

The concept of an open space is seated in the principle of continuation. In order for users to feel comfortable in a virtual space, they must have a fairly clear idea of their position relative to the rest of the space.(figure 23.) This is particularly true for the beginner users who were part of my target group. The influence of Wright was used in making the interior feel inviting. Kahn's interiors tend to be slightly harsh with concrete as surface and cool color schemes. The openness of Wright's interiors coupled with their relationship between the interior and exterior were used to create a warm, comfortable space in which the user was not visually restricted to one room or even to the interior of the museum in most cases. The use of skylights and the wall of windows (influenced by Kahn) also opened up the space in this way. Including plants aided in creating a continuation not only from room to room but from exterior to interior. (figure 24.) The openness of the plan also provided a further focal point from which to reference. For example, the users may be able to see objects on the opposite side of the museum and visually put together a mental map of the space.

3-D Floorplan

I began by taking my sketch of the museum and simply recreating the floorplan. Each wall was a separate object so that I could accommodate the 3 separate levels including the entrance, the second level up where the two wings appear and the final level up containing the wall of windows and clickable art. Creating the walls as separate units also gave me the flexibility to hide them individually as needed. The skylights as well as the wall of windows were intentional design inclusions to avoid placing dozens of artificial lights and also to aide in reducing the number of odd shadows cast by lights that the user really couldn't see.

3-D Lighting

The ceiling was created using a grid of beams in Kahn's manner. The beams are narrow but deep so that the amount of sky actually visible from any one viewpoint is reduced. For me this prevented too much attention being drawn to the ceiling while still allowing a maximum amount of light in. Spotlights were still used at equidistant spaces but diffused so as to prevent harsh shadows.
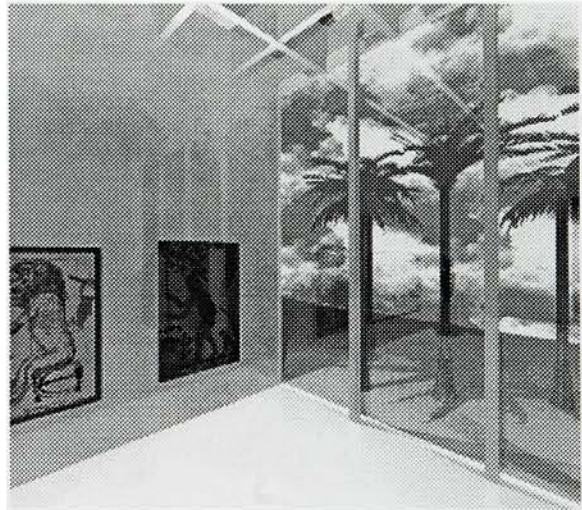
3-D Cameras

In order to stay sane, I named the cameras for the room they were in and avoided moving them

figure 23.

Open Floorplan

figure 24.

Wall of Windows

except to spin. To move along a linear path such as entering the museum, I created separate cameras and named them for the path they reflected.(figure 25.) To name the cameras I followed the same naming principles as I used for the room navigation in the Macromedia director map. For example, "L2" is the wall to the left of the user in the Director application. "L2" would also be the name of the camera in Strata StudioPro which points to that wall.

3-D Animation

Although I did several tests with Quicktime movies and PICTS files, I elected to use individual PICT files. It only took 5 to 7 individual images to simulate a turn as opposed to the many more frames and higher memory requirements that a Quicktime movie maintains. This is a case in which the laws of continuation are too much for the human eye to comprehend. In other words, the extra frames of the Quicktime movie were not necessary because the user perceived the same amount of information for less time, space and memory.

3-D Texture Mapping

In considering how to "hang" the art on the wall, two choices appealed to me. First, the creation of a grid in Strata which could be used to place the art on the walls in the correct perspective and maintain the quality of the image which is sometimes sacrificed when Strata renders. Secondly, and what became my ultimate choice, was to texture map the art directly onto the walls. After testing each method this was definitely faster. There were only a few images I touched up in Photoshop and only one that I completely replaced using Photoshop because it rendered too dark. This, however, was made simple by using the original mapped piece as a template for perspective and placement. With the exception of the cat mummy whose texture was imported from a photograph of the original, the remainder of the textures were created using the Strata palette of textures provided with the software.(figure 26.)

3D Exterior

The plants, bushes and grass were created entirely in Strata. Using photographic references for the plant life I first created the stem or trunk. Then the branches and individual leaves which after creating a varied set could be flipped, resized, recolored and regrouped to add even more variety. The most important objectives to creating a realistic look are
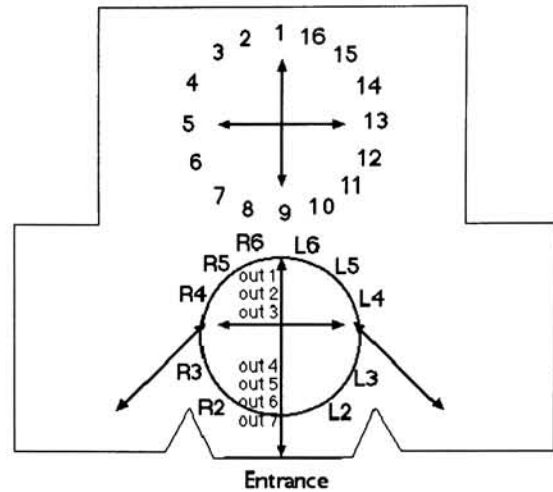
figure 25.

Entrance

figure 26.

Artwork Mapped onto Walls

variety to the pattern to avoid pattern recognition and rotation of the individual branches and leaves so that the flatness of their actual two dimensionality are avoided.(figure 27.) This is a great project to tackle when your brain power is low and you have some time on your hands. Patience in this endeavor is definitely a virtue.

Information Screens
When researching other virtual museums I was amazed at the amount of text the user was required to read off the screen. Reading paragraphs of text off a computer monitor is much more stressful to the eyes than reading from a printed page and is often ignored. The approach to the information screens that the user arrived at after clicking on the art was, therefore, to employ more visual than textual information. The combination of a small paragraph of text, visual image, animation and, in some cases sound, allowed me to utilize the design principles I discussed earlier. In this manner, I effectively communicated what only text and sometimes images had previously done. This included allowing me to effectively organize the information, which simplified use, enhanced communication, responded to human needs and, therefore, accelerated learning.

Designing the information screens was probably the most complex design problem I dealt with in the project. To begin solving this problem a made a list of objectives that I wanted the screens to incorporate. These are listed in table 9.

With all of these objectives in place I needed to come up with a system to accomplish them. Because of the complexity of the problems I relied heavily on the gestalt principles as guidelines. To accomplish the first objective I gathered as much information as I could that was related to the artwork. Although this involved a lot of research time it allowed me the flexibility to choose from many elements. This included images and factual information from the resources listed in the bibliography including books, videos and even other interactive pieces. It also allowed me to translate textual information into visual animations or sound that encompassed the ideas related in the text. Gathering a wealth of resources gave me the flexibility to include the information that was most interesting as well as to let the users reference more images and information on the subject if they wished.

figure 27.

3-D Plants

table 9.
Screen Design "Musts":

- *contain pertinent, important information*
- *contain as little text as possible*
- *research and write to make the information as interesting as possible*
- *give the user other resources to reference pertaining to that area*
- *be entertaining*
- *re-confirm in some way, what they clicked on to get to the screen*
- *give the screens a similar look*
- *subtitle the areas for organization*
- *include necessary navigation to return to the museum*
- *include an avenue to get to "Help" or "Quit" from all of the screens*
- *be pleasant to look at*

The elements that make something entertaining to a wide variety of people can be a science in itself. I utilized a resource on the philosophy of humor which was somewhat helpful but being funny wasn't precisely what I was after. One thing that was very clear to me was that this couldn't be entertaining if the user was frustrated in any way. I felt this could be prevented through good design and effective user testing which is discussed later in this chapter. In my study of humor I discovered that the element of surprise or an unexpected relationship between ideas is often a source of entertainment. Through this concept the idea of animating the artwork or making it produce a related sound was born. This is usually not expected to be produced by a piece of artwork hanging in a museum or seen in a book. To expand the element of surprise I let the user discover how to make the artwork produce something fun instead of giving them specific directions.

I also utilized the principle of isomorphic correspondence to create entertaining elements. The structural characteristics of the artwork were manipulated in Photoshop to produce animations. I attempted to animate the scene so that it would remind the user of experiences similar to their own. For example, a curious human nature might make us wonder what is inside of a series of closed jars and for a moment, even recall the act of looking into a vessel. The fact that the canopic jars contained human organs may not have been what the user expected and the element of surprise added to the entertainment value.(figure 28.) Even if the user read the text which mentioned what was inside, every one of the users took a peek. I would think that the same psychological charge that attracts us to thriller movies and books is at work. It is something we can physically or psychologically relate to, but the twist that makes it different from each of our precise experiences is what provides the entertainment factor.

The last group of objectives is what gave the screens their actual design. The design was not approached until after all the data had been collected, organized and prioritized. Foremost, it was important to me that the users feel like they were not leaving the space they were standing in inside the museum. To achieve this I first attempted to relate information about the art in the same space as the museum. Because of the changing architecture in each scene, it was difficult to do so effectively and interfered with communicating all of the information that I felt was necessary. The idea of

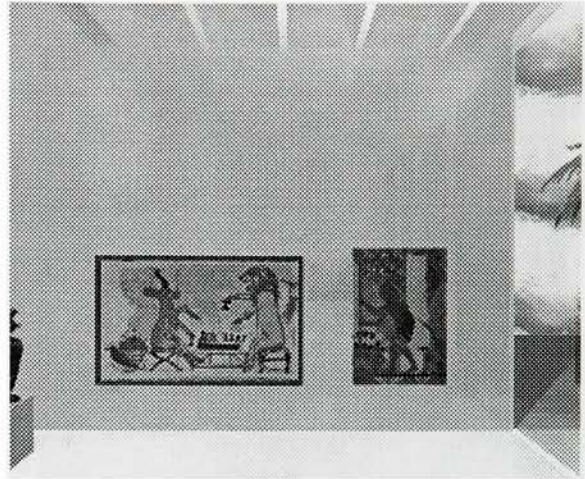figure 28.

Seeing into the Canopic Jars

going to a completely different data screen satisfied the communication requirements but failed to address the users having to leave the room. The concept of continuation was employed to solve the problem. By creating a data screen that would not take up the entire frame of the application I allowed the users to continue to see the room they were in.(figure 29.) The effect was that the users perceived that they had not moved but that the data was being presented to them within the room.(figure 30.) To intensify this feeling, the users could click on the room to get rid of the screen and view the room in full once again.

The second most important element of the data screens used continuation in its repetition of the artwork on the screen. This reinforced to the users that they were indeed seeing information about the art they clicked as well as giving them a closer view. The other principles used in reinforcing the artwork were similarity and figure/ground. It was important that the art be recognizable as the subject. Therefore, similarity was used in making the artwork larger than the other elements on screen, making it dissimilar enough to stand out. To make the subject stand out even further, the background was created almost as black with only a vague pattern to insure that none of the colors in the artwork, which varied greatly between pieces, would be camouflaged by the background.

Using the same background for all the screens aided in giving them a similar look and, therefore, by establishing a pattern, made them quickly recognizable as a data screen. The pattern on the background also helped to create part of the grid and supply a system by which to place an element. The similarity between each screen set up a recognizable pattern. Once the pattern was learned the users were quickly guided to the elements they needed. For example, the artwork always appeared on the left of the screen. Buttons to reference the subject further appeared consistently on the right in groups of threes. Although it may have taken some users a short amount of time to figure out what the buttons functioned as, once it was recognized and mentally established, there was rarely hesitation in clicking on these areas.
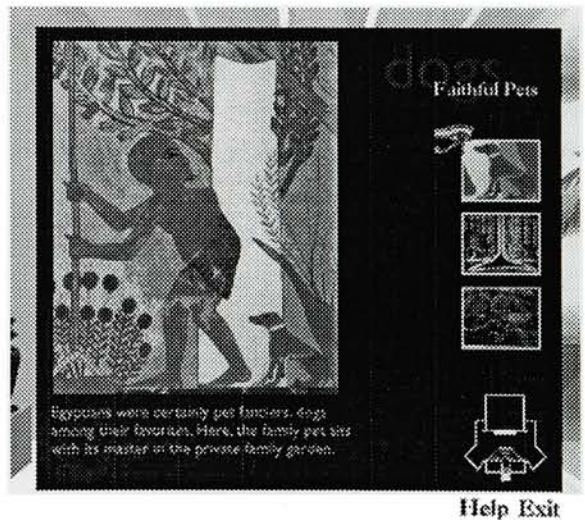
A subtitle also appeared on each screen. This aided in identifying the subject matter as well as indicating to the users what section of the whole application they were in. In creating these subtitles it was extremely important to be consistent and use the

figure 29.

Room Art Is Clicked From

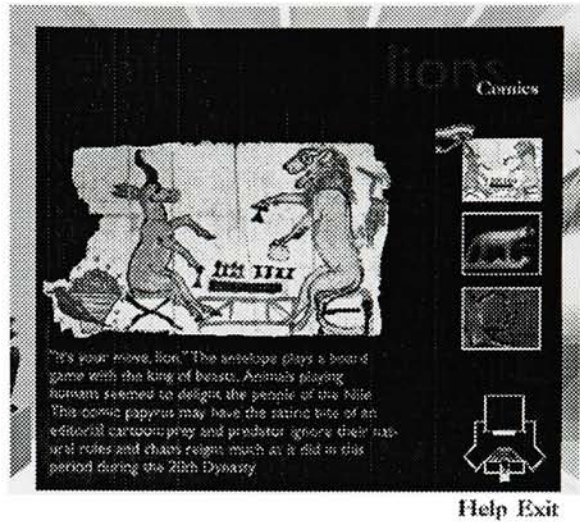figure 30.

Data Screen with Room Behind

same context for each area. For example, a few of the sections were labeled as follows: *dogs, cats, cattle.* If the labels appeared as *dogs, cats, cow* (two plurals and one singular form) it would probably be understood by most of us but would break the pattern that allows the quickest and most effective comprehension. As the subject matter was not complex I chose to use a more subtle figure/ground relationship for the subtitles. By making the text a slightly lighter value than the background, the subtitles provided information without shouting it and becoming a primary focal point.

The text for the information was placed by using the length of the artwork below which it appeared. Similarity was used in its placement, color, font and size to make it recognizable as the data. However, the line length was varied to form a more continuous relationship with the art that it pertained to. The size and placement of the art caused the eye to be lead from the subject to the textual information about it.

The approach to the design of the text was based on developing a strong figure/ground relationship. Because the background was dark, I chose a light color for the type. Some text was eliminated in favor of using a larger type size for readability. The typeface was chosen from a group selected for easy readability including Palatino, Garamond, Century and Gil Sans. Palatino and Garamond contain delicate Roman serifs, while Century displays more squared Egyptian serifs. Gil Sans, a sans serif typeface, was finally chosen for its small amount of contrast as well as the high x-height which make the letterforms easier to discern and identify. The process by which I created the text is listed in the recipes in chapter 3. The ways in which the concepts discussed pertain to the data screens are illustrated in figures 30 and 31.

Much of the development and final problem-solving for each section of the thesis was based on user feedback. Two formal testing forms are included at the end of this chapter but there was much informal testing as well. In almost every case of change, I found that I could resolve the problem by returning to the basic principles of human perception. First, I asked myself what the goal was of the item that was causing the problem, then brainstormed different ways in which I could meet the user's needs.

figure 30.

Example of Data Screen

figure 31.

Example of Data Screen

For example, I wanted the user to be able to access further links within the subcategories. Using buttons that were similar but lacked intriguing elements were not likely to get clicked on. I ran into the same problem when trying to use text as buttons. The goal was to entice the user to click on the button in order to expand the learning process of moving through the museum. Moving through each of the principles I asked how I could make the buttons stand out using figure/ground, how I could make them more interesting by appealing to the user's past experiences using isomorphic correspondence, how I could induce them to click the buttons through continuation of something they had already seen and so on.

Often, having a methodology to solve problems aides in overcoming the panic that arises with tight deadlines. This is not to imply that this is a rigid and regulated process. It simply offers guidelines from which to begin a new starting point. Brainstorming within this process is half the fun! Using this method it was possible to recognize and overcome weak points through redesign. It aided in predicting the actions of the user interacting with navigation, screen design, animation, virtual space and almost every other aspect of the project. These results support my theory that the use of perceptual principles can increase the success of interactive media as an educational tool.

Testing Session #1 of Application of Gestalt...

Thank you for taking the time to review my thesis. Simply circle the number that best describes your impressions. Additional comments are welcome. Relax and enjoy!

Overall reactions to the concept of applying gestalt to screen design:
Comments:

terrible   wonderful
1 2 3 4 5 6 7 8 9

unnecessary   useful
1 2 3 4 5 6 7 8 9

Overall reactions to the use of an Egyptian educational application to demonstrate the use of gestalt principles in 2 & 3D design and animation:
Comments:

unnecessary   helpful to understanding of gestalt
1 2 3 4 5 6 7 8 9

boring   interesting
1 2 3 4 5 6 7 8 9

Overall reactions to the introduction:
Comments:

timely   too long
1 2 3 4 5 6 7 8 9

informative   confusing
1 2 3 4 5 6 7 8 9

Overall reactions to the character Horus:
Comments:

dislikable   likeable
1 2 3 4 5 6 7 8 9

annoying   helpful
1 2 3 4 5 6 7 8 9

Overall reactions to the layout:
Comments:

unsuitable   suitable
1 2 3 4 5 6 7 8 9

Overall reactions to the look of the navigation:
Comments:

unsuitable   suitable
1 2 3 4 5 6 7 8 9

Overall reactions to the meaning of the icons:
Comments:

confusing   clear
1 2 3 4 5 6 7 8 9

Testing Session #2 of Virtual Museum

Thank you for taking the time to review my thesis. Simply circle the number that best describes your impressions. Additional comments are welcome. Relax and enjoy!

Introduction

Overall reactions to the introduction:
Comments:

entertaining   boring
1 2 3 4 5 6 7 8 9

timely   too long
1 2 3 4 5 6 7 8 9

informative   confusing
1 2 3 4 5 6 7 8 9

Overall reactions to the character Horus:
Comments:

likable   annoying
1 2 3 4 5 6 7 8 9

helpful   useless
1 2 3 4 5 6 7 8 9

The "help" section was:
Comments:

helpful   useless
1 2 3 4 5 6 7 8 9

O check here if you chose not to use the help section

Museum

Navigating through the museum was:
Comments:

easy   difficult
1 2 3 4 5 6 7 8 9

I felt lost in the museum:
Comments:

never   often
1 2 3 4 5 6 7 8 9

The museum map with arrow pointing to my location was
Comments:

helpful   useless

1 2 3 4 5 6 7 8 9

Information Screens

Overall reactions to the general layout and graphics:
Comments:

pleasing   disturbing
1 2 3 4 5 6 7 8 9

Reactions to using the navigation:
Comments:

easy   difficult
1   2   3   4   5   6   7   8   9

Using the slider to access other artwork was
Comments:

nice   confusing
1   2   3   4   5   6   7   8   9

O check here if you did not to use the slider

The use of animation, sound and games was a helpful addition to the images and text in aiding my understanding of the ideas behind the artwork:
Comments:

often   never
1   2   3   4   5   6   7   8   9

The animation, sound and games were:
Comments:

fun   boring
1   2   3   4   5   6   7   8   9

O check here if you chose not to play animations or games

Please feel free to make any additional or general comments below:

Once again, thanks for your time!

4 Recipes

These are the results of producing the technical portion of this thesis. They are a culmination of different combinations of techniques and software used to produce the effects in the Virtual Museum. Included are a few of the treasures I discovered, through trial and error, that will be used to enhance future productions. They are listed alphabetically for quick reference.

RECIPES

Animation-from storyboard to Director

Take your sketches and make them into smooth, full color characters ready for animation.
1. draw the character by hand using white paper or board and a soft pencil or medium tip marker
Note: if you keep the lines clean and use a soft lead, you can avoid having to retrace in ink to get a solid outline when you scan. If the outline is not solid, it may be difficult to color, select or fill.
2. organize as many images on the page as possible categorized by action (ie. flying Horus).
This keeps your files organized and the images are more quickly traced,colored and imported.
3. scan images
4. you may want to play with brightness and contrast in photoshop to give lines more clarity
5. save file in Photoshop as EPS
6. place into Adobe Illustrator
7. lock image in background
8. on another layer use the pen tool to trace the images
9. color, shrink, change etc. anything you want at this time
10. create a large rectangle the color of the background to which you will be antialiasing
11. place the rectangle behind the images.
12. save as "Illustrator 5" format
13. place in Photoshop
14. use the magic wand to select the background color then inverse selection
15. copy and paste selection into a cast window in Macromedia Director
16. you may then cut and paste each image as a separate castmember

Animation-receding into space

Making a character recede into space is one of the most difficult things to animate traditionally and is the reason why most cartoon characters walk *across* the stage. The computer makes this easy.

1. open your Illustrator 5 file (created in the recipe "Animation-from storyboard to Director")
2. select the image you want to recede into space
3.double click the scale tool
4. click "uniform"
5. type in the percentage you want to reduce the image
6. click "copy" and Illustrator creates another image your percentage smaller
7. create the percentages based on the rate at which the image recedes. For example, if you want the character to move back in space at an even pace, you may reduce in increments of 10 or 20 percent. If you want an ease-in or ease-out effect, the increments may increase or decrease relatively.
8. follow from step 12 in the "Animation-from storyboard to Director" recipe

Calling a Movie Script

This script is useful if you need to call a movie that is in another folder. This may be required particularly if you are using a shared cast.

```
on exitFrame
   put the pathname into t
   set the itemdelimiter = ":"
   delete the last char of t
   delete the last item of t
   set the itemdelimiter = ""
   put ":x" after t
   --x is the name of the movie you are calling
   go frame "V.M" of movie t
end
```

I would like to give credit to Dave Seah for helping to write this script.

CD Preparation

Keep these things in mind when you are initially planning your project to save time in the end.

1. break up Director movies into files no larger that 5 MB
2. create a separate startup projector that sets the color depth and sound level, contains FinderHider and calls the first movie
3. make sure that all the Quicktime movies, shared cast and any other files you call from Director are in the appropriate folders or have path names scripted to find them
4. clear any unnecessary files off your hard drive in order to make a large chunk of room to store the files you will be toasting

Custom Cursors

To create a custom cursor you need a data fork in the Director application. An audio resource will automatically create one. If the application does not have a resource fork, create one using ResEdit. Make a copy of the Director application before adding a data fork in RedEdit as it can sometimes corrupt the application. The following are 2 different ways to create custom cursors:

1. Black and White cursor called with a script in Director:
      1. open Director file in ResEdit (this opens a resource fork)
      2. copy a freeware cursor from "101 Cursors" supplied with ResEdit
      3. paste into cursor resource of Director application
      4. name the cursor a number different from Director cursor numbers (listed in the manual)
      Note: This is a resource, not a castmember and must be called with a frame script
      —cursor (9)

2. Black and White cursor as a castmember:
      1. in Director's paint window draw the cursor 16 x 16 pixels
      2. under the "cast" pulldown menu, change it to a 1 bit castmember
      Note: the number of the cursor is the same as the number of the castmember
      the first number being the cursor, the second the cursor mask
      —cursor [25],38

Custom Cursor Script

This script uses built in cursors as well as castmember cursors. The scrpit causes Director to default to a built-in cross cursor (3) when the mouse location is over a wall. When the mouse location is over sprite 21 it changes to a hand pointing left, over sprite 22 it changes to a hand pointing right.

```
On CursorChange

  --sprite 1 = wall
  --sprite 2 = left
  --sprite 22 = right

--this declares the name of the cursor which is the same as its cast number
cursor [5]
  --right
cursor [7]
  --left

  set the cursor of sprite 1 to 3
  set the cursor of sprite 21 to [23,24]
  set the cursor of sprite 22 to [21,22]
end
```

Data Screen Layout

1. before you design anything make sure that you have all the data
2. create sketches of several layout possibilities based on the amount of data, how you want to organize it and include other factors that may appear on each screen such as a navigation bar
3. the exercise above should produce a grid (see bibliography for references if you need)
4. if your grid is measurable you can recreate it in Photoshop or you can use a screen already in Director to lay the grid on as another castmember
5. bring your grid into Director as a castmember if it is not already there (this is something you may want to use as a shared castmember)
6. place the grid in one of the last channels, drag it through the frames that require it and turn it on and off on the score palette as needed
7. delete the grid from Director after your screens are in place to save memory but keep a file somewhere in case you need the grid again or the project requires additional data screens

FinderHider-custom color

1. open ResEdit
2. open FinderHider XOBJ from ResEdit (found in the FinderHider application folder)
3. open a *copy* of your Director movie from ResEdit (in case the resource fork becomes corrupted)
4. copy and paste the XOBJ into the Director resource
5. open your Director movie
6. In frame 1 put the following script

> *on exitframe*
> *global fh*
> *set fh= FinderHider (mNew)*
> *fh (mShowBorder, 1)*
> *fh (mSetColorRGB, #,#,#)*
> *fh (mUpdateBorder)*
> *end*

To get the color you want, from FinderHider go into the Window menu to the color palette, double click the color and adjust as needed. Write down the numbers for R, G and B then cancel and put the numbers into your script

Note: don't forget to drag your movie to the FinderHider application to imbed it.

Music-background

1. choose or create music that does not have any distinctive changes to avoid it noticeably repeating
Note: a good length to prevent obvious repeating is 45 seconds to a minute
2. set the loopback in SoundEdit (setting sound as a loop in Director alone is not sufficient)
3. test your music at this point with several listeners to make sure that it is not annoying or obviously repeating in a loop
Note: Always provide the user with a sound level control in case they do want to turn the music off
4. I prefer to save the sound as an audio AIFF file so that I don't have to worry about keeping track of resources. However, if file size is an issue you may want to make it a resource
5. import the sound into director
6. check the loop box of your sound castmember
7. you may now call your sound from a script or place it in one of the sound channels
Note: if you set a puppetsound in a script it will override any sound you have in channel I

Premiere Tidbits

Although I did not use Premiere in the final thesis I did do several tests with it. Along the way I found some interesting tidbits.

When you make a movie in Premiere it requires the Premiere program to play it. In other words, if you open a file from Director, it opens Premiere in order to play it. Solution:
1. open Movie Player
2. open Premiere movie
3. re-save the file and make sure the box is checked to make the movie self contained

When creating a Quicktime movie to import into Director, make it about 1/8" bigger all the way around in order for it to completely cover the stage. Even if you measure to the pixel, I found that for some reason it imports slightly smaller.

Reformatting a System

There are many reasons for reformatting a system. The most common problems appear as corrupted files, extensions that won't work properly or a series of system error messages. When these problems occur it is a good idea to run Norton Utilities first to attempt and isolate the problem. An excellent way to prevent having to reformat your system is to optimize often, be familiar with everything loaded on your computer and use a good reference to find out exactly what those error messages mean. I recommend Mac Secrets.

1. from the system CD copy the minimum system for your machine and SCSI Probe onto a floppy disk
2. copy the complete system onto a Syquest
3. re-start with the floppy
4. open SCSI Probe and mount the Syquest
5. replace the system on the hard drive with the system on the Syquest
6. restart
If the system is still not working try the following:
7. take out of your system folder: ATM, control panels, preferences, fonts, and extensions
8. drag them onto the hard drive and reinstall one into the new system folder
9. restart
10. repeat steps 8 and 9 until you find the corrupted software and replace it by reloading a new one

Reloading a System

I am including reloading because when *all* fails, the sad Mac appears and you're crunched for time you will have to take the time to do this. To save you some grief, here are quick instructions to get you going again in no time.

1. locate the "Tools" disk that came with your system
2. load this disk to get your hard drive icon back
3. install your system software as per normal (or follow steps 1-6 in the recipe "Reformatting a System")
4. reload your application software which is the most time consuming part of the process. If you're in a time crunch, load what you require to complete the immediate project and load the rest later

Rendering

As rendering can be a lengthy process depending on the complexity of your file, plan your time so that you can use your own downtime to render. To help in cutting your render time even further, use the recipe below:

1. hide any objects not seen by the camera shooting the image to be rendered
2. use the "default" background for renders not using the environment (ie. an interior shot with no windows)
3. under the Render menu, turn off any effects that your camera view does not use
4. utilize "Extension Manager" (which can be downloaded) to turn off unused extensions
 Note: extensions to commonly leave on are Quicktime and SCSI Probe
5. avoid using Virtual Memory unless you have to, it will slow the render time down
6. if you have to use Virtual Memory, look at Memory to see how much RAM is available
7. set Virtual Memory 20 MB below what is available so that Strata has room to save your file
8. set the remaining memory as Strata's allocation. (ie. if RAM is 78 MB, set Virtual to 58 MB, and allocate all 58 MB to Strata)
9. Always remember to reset Virtual and restart before you begin working on your Strata files again

Score-color coding

The colors that Director provides can be used in many ways as a great organization tool. I utilized them so that I could quickly recognize puppetsprites called by scripts that shouldn't be moved. The colors also aided in more quickly selecting an objet on the stage from the score instead of clicking directly on that object which can sometimes be frustrating with a hierarchy of availability.

Pink = puppetsprites
Teal = text
Green = navigation
Yellow = invisible buttons
Red = any important objects clicked on with regularity

Slider Script-vertical

```
on mouseDown
        puppetsprite 48,true
        repeat while the stilldown
        set the locH of sprite 48 to the mouseH
        set the locV of sprite 48 to the mouseV
        set the constraint of sprite 48 to 47
        if the top of sprite 48 > the top of sprit 47 then
            if the bottom of sprite 48 < th top of sprite 47 + 75 then
                go "1"
            else
                if the bottom of sprite 48 > the bottom of sprite 47 - 45 then
                    go "3"
                else
                    go "2"
                end if
            end if
        end if
updatestage
end repeat
```

Sound Level Script

The following script goes in the button which turns the sound level down:
```
on mouseUp
    global gOldSound
    set the soundLevel to gOldSound - 1
    put the soundlevel onto gOldSound
end
```

The following script goes in the button which turns the sound level up:
```
on mouseUp
    global gOldSound
    set the soundLevel to gOldSound + 1
    put the soundlevel onto gOldSound
end
```

Shadows

Shadows aid in giving objects in your application depth. The gray of the shadow can also help to make the object more noticeable by increasing the figure/ground relationship between the object and the background

1. in Photoshop put the object casting the shadow on a layer
2. duplicate this layer
3. select lower layer and select all
4. move 1 pixel with any arrow key, this selects the object
5. select inverse (the background) and fill with black
6. select inverse (the object) and fill with black
7. under the Select menu feather 5 pixels
8. select inverse (the background) and delete
9. use the arrow keys to nudge the shadow into place until you get the desired effect

Text Creation-antialiased

1. open your word processing document and copy the desired section of text
2. paste into Director in the area provided by your grid
3. choose the font and size
4. make sure this is exactly (line for line) how you want your text to appear, this gives you a line length
5. copy and paste into a text box in Quark XPress
6. choose the font and size
Note: this may seem like an extra step but I found that the actual text size in Director was not the same as in Quark and Photoshop which can make your line lengths very "off".
7. kern as needed
8. from the View menu Show Invisibles and check for extra spaces and returns at the end of each line
9. select all and copy
10. save the Quark file for later changes
11. paste into Photoshop
Note: the lines do not appear as they did in Quark in the Photoshop text box until you click "OK"
12. choose your foreground (text) color (make sure you record colors for future text)
13. choose a background color close to your Director background color for antialiasing
14. set the magic wand tolerance to 3 and make sure the box for antialiasing is NOT checked
(continued...)

Text Creation-antialiased continued

15. select background with the magic wand
16. select inverse
17. copy and paste into the Director cast to replace the old text castmember

I know this sounds like a lengthy process but you can get a system going quickly by planning to do all your text at once. This way the required applications are open and colors and tools are set as you need them. The results are definitely worth it, your text will look beautiful and will be error free which beats redoing it!

Note: If your line length is still not quite right just go back to your Quark document which should still be open and change what you need to, take it back through the process in Photoshop and then paste into Director again.

Note: for some reason hyphens don't paste from Quark to Photoshop and you may need to manually add them in the Photoshop text window.

Text Creation-not antialiased

Although text looks 100% better when it is antialiased, if you do choose not to do so I highly recommend that you use FontDA mover. This application may be downloaded and allows you to imbed your font as a resource so that if your application plays on a machine without your font, your text will not appear as heinous depictions of your letterforms. This is how it works:

1. make sure your Director file contains a resource fork, if not, make a copy and add one in ResEdit (just open it from ResEdit, save and close)
2. open FontDA Mover and locate the desired font on your computer
3. open the Director file in which you wish to embed the font (press the Option key if your file isn't listed)
4. copy the font as directed by FontDA
5. test to be sure your font is embedded by taking the file to a computer without your font or simply by re-starting your machine while holding the shift key to disable the extensions and your screen fonts

Voice-creation for a Character

Finding just the right person to do a voice is not always easy even with SoundEdit. Before choosing a volunteer be sure that they understand how much time it may take and that it will probably take more than one session. Make it convenient for that person by volunteering to go to their house or office if they have an appropriate machine and a quiet environment. You can always bring along a microphone, software and storage device.

1. use a high quality microphone like a Lavalier if one is available to you
2. ask your "voice" person to stand up while they are recording and even to act out the scene if they're so inclined, this helps to increase inflection
3. provide the "voice" person with a typed script broken up into as many short lines as possible.
4. record 5 or 6 takes of each line and sort them out later, this prevents you wasting your volunteer's time and you may even choose to use some of those different lines in another way.
6. know where you want the inflection to be and say it that way for the "voice" so they understand what you want. (ie. *Hi*, I'm Horus, or Hi, *I'm* Horus or Hi, I'm *Horus*)
7. when you have all of your recordings, sift through them and put the best in a separate folder, as I said , you may be surprised at what you can go back and put together in SoundEdit without having to ask you "voice" for more of their time.
8. if you alter the voice in a sound program be sure to write down the formula so that your voice is consistent and believable
8. save your original files in case testing proves that your voice alterations are not successful

Voice-syncing sound to animation

1. make each mouth movement a separate castmember in Director
2. import your sound into a channel (do not script it to play) and change the tempo or number of frames in which each individual mouth movement appears to synchronize the sound properly

Note: sync your sound using the same machine as speed will vary between computers. It is critical to the believability of your character that your mouth movements correspond with the voice. To be sure that it is synchronized on any computer you will make the sound and animation into its own Quicktime movie. This works best for short phrases. If you are brave enough to sync long paragraphs I suggest you break them into smaller sections so that the Quicktime doesn't get large enough to drop frames on a slow machine.

3. select the channel containing the mouth castmember over the range of frames that make up the phrase
4. under File, export your selection as a Quicktime movie
5. check which sound channel you have your voice in and be sure to include it in your movie
6. re-import the movie into the cast and drag it onto the stage where the mouth should be
7. remove the original animated sequence you used to create the movie and you may delete the original castmembers and sound from the score if they are not used anywhere else
8. click "wait for Quicktime movie" in the tempo channel of the frame the movie is in
9. Quicktime movies are resources, make sure you keep them in the same folder with your Director file
Now your character's voice will by synchronized on any computer

4 Summary

A summary of the relationship between human perception and effective design. Includes examples of gestalt principles and how they may be applied to interactive media to increase effective communication.

SUMMARY

The following is a summary of gestalt principles and some ways in which they can be applied to interactive media. These ideas greatly helped to organize the project as well as produce effective results by avoiding extreme surprises when user-testing and the subsequent time consuming redesign of the project. These concepts were also used as guides in solving instances when the application failed at clear communication as discovered through user testing.

Figure/Ground:

This explores the importance of the role that ground or background plays in providing contrast to support the subject or figure to the extent that the subject requires recognition by the user.

- identifies the subject matter
- provides a visual hierarchy
- aides in preventing redundancy of repetitive images such as navigation
- helps aid in separating navigation from subject matter

Isomorphic Correspondence:

This allows faster relationships to be formed and often a clearer understanding of an idea by providing visual forms that trigger or recall images from the past experiences of the user.

- makes icons, navigation or conceptual metaphors more effective
- provides relationships by which the user forms deeper understanding of the subject
- makes virtual space believable
- makes animated characters believable

Closure:

This is used to take advantage of people's natural tendency to finish incomplete forms.

- allows a character to exit the screen, return at a different perspective and give the feeling of movement
- causes us to recognize vague or incomplete forms that blend with the background or ground
- allows comprehension of space as a whole when viewing only a part of that space at any one time; this is useful in making virtual reality believable

Continuation:

This simply leads the eye along a given path.

- creates motion in animation
- gives the feeling of walking around in

a virtual space
•gives the feeling that the user is not
leaving a space
•is employed by background music that
continually plays, tying the entire application together.

Similarity:

This groups like-objects in order to make them more easily identifiable to the user.

•helps the user identify navigation
•identifies subject matter
•aides in quickly locating navigational
 elements on different screens

Most things in our world exhibit a considerable amount of complexity. The designer is intrigued and challenged by the balance of opposites. At one extreme, camouflage depends on disorder; it distracts and hides. Yet an environment which leaves nothing to the imagination produces disinterest, boredom and lack of involvement.

Our feelings and comprehension of things are intensified by participation. We will give attention to, and hold in our memory longer, that which is a potential problem, one that we are compelled to solve. As designers and as communicators, we are required to find the delicate balance between supplying the public with information that is neither unclear and ambiguous or so very clear that it leaves nothing to the imagination.

The variety of sensory stimulation provided by multimedia certainly leaves room for imagination. However, as designers we must remember that we are also communicators. The challenge of balancing innovation and communication is aided by the results of cognitive research and findings. These findings have resulted in the evolvement of design principles that simplify the task of communicating for the designer. Following these basic principles frees designers from re-creating poor solutions that do not meet the user's needs.

When information is supplied in an effective manner it results in an enhanced communication tool whose use allows the audience to more quickly assimilate and retain information. The knowledge we have of how the human brain uses perceptual systems to identify, remember and classify information provides the designer with a basis from which to approach effective communication in interactive media design.

The depth of research pertaining to perception that was provoked by this thesis may not be necessary for every designer to understand in order to produce effective design. However, awareness and understanding of some of the principles can make the process have a much more clearly motivated goal and result in a more effectively designed piece of work.

As an interactive media designer, it is easy to get caught up in the technology which barrels forward daily and over the last few years has continuously produced a flurry of new ways to create images and distribute information. Combining this with the principles that help us understand how the human mind processes information is clearly one way to provide innovative and effective communication.

Researching how we process information has opened my eyes, as an interactive media designer, to the wealth of ways in which I can enhance my work. By employing some of these basic principles to all aspects of my design I was more effectively able to produce a project that was educational, entertaining, and easy to understand. The principles aided in identifying user needs as well as achieving them in an optimal way. I avoided making extreme changes after user testing by using the principles to anticipate the way in which humans commonly perceive, comprehend and learn.

5 Endnotes and References

A list of resources that aided in the development of this project. Endnotes refer to the sources used in writing this paper. References pertain to sources used in the actual project or for general information. Sources are listed alphabetically under the subject headings to which they pertain.

ENDNOTES

Chapter 1

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5. Lucky, Robert W., Silicon Dreams, (New York: St. Martin's Press, 1989), 298

6. Behrens, Roy R., Design In The Visual Arts, (New Jersey: Prentice-Hall, 1984), 49

7. Behrens, Roy R., Design In The Visual Arts, (New Jersey: Prentice-Hall, 1984), 52

8. Berryman, Gregg, Notes on Graphic Design and Visual Communication, (Los Altos, California: W.Kaufman, 1980) 8,9

9. Behrens, Roy R., Design In The Visual Arts, (New Jersey: Prentice-Hall, 1984), 49

10 Keough, Bob, The Psychology of Everyday Things, Photocopy of typescript. Rochester Institute of Technology, 157

11. Behrens, Roy R., Design In The Visual Arts, (New Jersey: Prentice-Hall, 1984), 49

BIBLIOGRAPHY

The following list is a compilation of resources used for the project portion of this thesis or for general information not cited directly. A brief summary is listed below each source for future reference.

Graphic Design Concepts/Gestalt
Apple Computer, Inc., HyperCard Stack Design Guidelines, (Massachusetts: Addison-Wesley Publishing Company Inc.)
Source: C. Cicha private collection
Presents basic principles for screen design, particularly in reference to placement of elements. It is also useful as a tool for helping to organize projects.

Ajayi, A'isha, Human Factors and Issues with Multimedia, Photocopy of typescript. Rochester Institute of Technology.
Defines the components of interface. Also talks about trends in interactive media.

Behrens, Roy R., Design In The Visual Arts, (New Jersey: Prentice-Hall, 1984),
Source: RIT graphic design office (on loan)
Discusses the application of Gestalt principles to design in-depth.

Bubie, Walter, "Human Factors In Graphical User Interface Design." Lecture presented at Rochester Institute of Technology., Rochester, New York, November, 1985
Discussion of development of multimedia in industry. Brought up good ideas on designing universally understandable interfaces. Provoked thoughts on the use of anthropological studies to determine human factors for a product.

Cataldo, John W., Graphic Design and Visual Communication, (Pennsylvania: International Textbook Co., 1986)
Source: RIT graphic design office (On loan)
Provides a detailed explanation as well as examples of gestalt perceptual psychology.

Dawson, Jeff, "The Learning Revolution: Goals for the Year 2000," MacHome Journal, (October, 1994)
Information in this article was of use in developing ideas about the future of multimedia, particularly in the field of education.

Hurlburt, Allen, The Design Concept, (New York: Watson-Guptill Publications, 1981)
Source: RIT WML NC 997.H83 c.3

This book discusses basic design principles related to gestalt theory. It also provides view points of influential designers such as Paul Rand on their own design process.

Kubovy, Michael and James R. Pomerantz, Perceptual Organization, (New Jersey: Lawrence Erlbaum Assoc., 1981)
Source: RIT WML BF203 .P3
bar code #ROOO2524123
Provides an excellent scientific explanation of the laws of perception. This explains the gestalt approach in design and why it is valid to use gestalt principles in interface design as well as two dimensional media.

Lockhead, Gregory R. and James R. Pomerantz, The Perception of Structure, (Washington D.C.:American Psychological Assoc.., 1991)
Source: RIT WML BF202 .P47
bar code #ROOO4875910
Supplies excellent examples of how perception works in the human being, both physiologically and psychologically.

Lucky, Robert W., Silicon Dreams, (New York: St. Martin's Press, 1989)
Source: C. Cicha private collection
This source provides some interesting view points on the direction of electronic technology. It also provides the resource for information on "vector quantization" and other perceptual phenomena.

Schank, Roger C., "Active Learning Through Multimedia," IEEE Multimedia, (Spring 1994)
Provides support for higher levels of education and learning through doing or action. It explains the basic learning principles and how multimedia can take advantage of these natural tendencies to accelerate the learning process.

Turnbull, Arthur T., and Russell N. Baird, The Graphics of Communication, (New York: Holt, Rinehart and Winston, 1980)
Source: RIT graphic design office (On loan)
Discusses why and how we read in basic human information processing. Also discusses different aspects of graphic design such as the use of typography, the use of pictures combined with text and basic layout.

Van der Heijden, A.H.C, Selective Attention In Vision, (London: Routledge, 1992)
Source: RIT WML BF241 .H43

bar code #ROOO4938182
Provides detailed scientific data on human perception. This book is presently being used to verify facts from other resources. It may provide more scientific data if necessary later in the project.

Berryman, Gregg, Notes on Graphic Design and Visual Communication, (Los Altos, California: W.Kaufman, 1980) 8,9
Source: Lorrie Frear photocopy of typescript
Provides a explanations of the gestalt principles.

Animation
Blair, Preston, Animation, (California: Walter Foster Publishing Inc., 1980)
Source: C. Cicha private collection
This was used as a reference for animating "Horus" the hawk-like tour guide, especially for the movement of his wings as arms and hands.

Lasseter, John, "Principles of Traditional Animation Applied to 3D Computer Animation", SIGGRAPH Conference Proceedings, 1993.
Source: C. Cicha private collection
This is a wonderful reference to basic animation motion and the suggestions of momentum in subject movement.

Hayward, Stan, Scriptwriting for Animation, (New York: Hastings House, 1977
This is the source from which I derived many of the questions I constructed to help in beginning to define the entire project.

Muybridge, Eadweard, Animals In Motion, (New York: Dover Publications Inc., 1957)
Source: Tanya Weinberger
This was used to study the flight pattern and wing motions of different types of birds.

Thomas, Frank, and Ollie Johnston, Disney Animation: The Illusion of Life, (New York, Abbeville Press, 1981)
Source: Tanya Weinberger
This source was referenced when it came time to create backgrounds and mood. The colors depicted to create an environment were aided by this book. It may also be a reference for character expression.

Whitaker, Harold, and John Halas, Timing for Animation, (New York: Focal Press Ltd., 1981)
Source: Tanya Weinberger
This resource aids in animating and making movement look believable

White, Tony, The Animator's Workbook, (New York: Watson-Guptill Publications, 1988)
Source: Tanya Weinberger
Contains some good animated references for the movement of birds.

Humor
Morreall, John, The Philosophy of Laughter and Humor, (Albany: State University of New York Press, 1987)
Provides support and evidence for the benefits of humor on human learning and interaction.

Ancient Egypt
Badaway, Alexander, A History of Egyptian Architecture, (Berkely: University of California Press, 1968)
Source: RIT WML NA 215.B287
bar code R0004923006
Used as a source for creation of the floor plan of The Great Temple at Abu Simbel. Contains the only illustration of the temple depicting "life as it was". The scale of the temple in the drawing is greatly exaggerated but provides an interesting angle from which the introductory scene was to be developed. Contains a few common black and white photos of the temple.

Badaway, Alexander, Architecture in ancient Egypt and the NearEast, (Cambridge: M.I.T. Press, 1966)
pages 10, 41, 59, 68
Source: RIT WML 3rd floor NA310.M2
bar code # R0004923072
Contains several maps of ancient Egypt which are line drawings. If referenced, they would need to be verified as to accuracy by other sources. Contains, on page 41, a short but excellent architectural description of the temple. An appendix charts the architectural characteristics of this period in history. Speaks briefly about war and politics of the time.

Casson, Lionel, The Pharaohs, (Chicago: Stonehenge Press Inc. 1982)
Source: RIT WML Over DT 60.639
bar code # R0006045169
Reference for the Egyptian characteristics of "Horus" through a photograph of a necklace containing a jeweled hawk. Pages 140-162 contain information on Ramses II and beautiful color photographs of the temple. Pages 170-171 show the chronology of Egypt. Page 9 contains a very nicely rendered map.

De Cenival, Jean-Louis, Living Architecture: Egyptian,(New York: Grosset & Dunlap, 1964)
Source: RIT WML NA 215 .c353
barcode #R0006050206
Contains only a few black and white photos but they are very clear.

Drower, Margaret S. and Roger Wood, Egypt In Color, (New York: McGraw-Hill Book Company, 1964), 150
Source: RIT WML Over DT 47.W6.
bar code # R0000346105
Beautiful, oversize color photos. Page 148 contains a great reference as to the scale of the temple. It pictures the entire front of the temple and a single person near it. Page 150 reveals some of the environment and nature surrounding the temple. Page 153 shows the first hall and how the sun lights the interior. Nice details of wall reliefs as well.

Kusch, Eugen, Egypt in Pictures, (Nuremberg: Hans Carl, 1955)Source: RIT WML Over DT 63.M25
bar code # R0000346171
Contains very generalized black and white photos of mid-1950's Egyptian culture and general photos.

Lloyd, Seton, Hans wolfgang Muller and Roland Martin, Ancient Architecture: Mesopotamia, Egypt, Crete, Greece,(New York: Harry N. Abrams Inc., 1972)
Source: RIT WML NA 210.L58
bar code # R0002029034
Contains only a few paragraphs of text, but it is descriptive of the temple and helpful in verifying the correctness of the floor plan of the temple.

Macaulay, David (director unknown), "Pyramid, with David Macualay", Unicorn Projects Inc.,1988
Source: RIT Media Resource Center #VH 901
This video combines location photography with animation to tell the story of the planning, construction and cultural significance of the Great Pyramid at Giza.

Macaulay, David, Pyramid, (Boston: Houghton Mifflin Company, 1975)
Source: RIT Wallace Memorial Library
bar code #R0000346595
Used as a reference to aid in depicting life during the time period. Helpful in gaining knowledge about the building procedures of the time. This is one of the few contemporary illustrative works I can find on the subject.

MacQuitty, William, Abu Simbel, (New York: G.P.
Putnam's Sons, 1965)
Source: RIT WML NA 216.A17 M2
bar code #R0002028410
This book is extremely helpful visually and verbally
explaining the qualities of light within the temple. It
is also a useful source for general information sur-
rounding the existence of the temple.

Porter, Eliot and Wilma Stern, Monuments of Egypt,
(Albuquerque: University of New Mexico Press,
1990
Source: RIT WML Over DT 60.P67
bar code # R0004758859
Beautiful full color photographs of various aspects
of the temple, especially the exterior and front hall.

National Geographic Society, Ancient Egypt:
Discovering its Splendors, (Washington, D.C:
National Geographic Society, 1978
Source: RIT WML Over DT61.A6
bar code # R0002558651
Displays some interesting artistic styles in rendering
ancient Egyptian elements including architecture,
maps and schematics. On page 14 and 15, is an
interesting colored pencil illustration of what the
interior of a temple might have looked like. Page 38
reveals a very nicely rendered map of the Nile river.

Software Manuals and Resources Consulted:

Macromedia, Using Director, Using LIngo and Lingo
Dictionary, (San Francisco:Macromedia, Inc. and
Apple Computer Inc., 1994)

McClelland, Duke, Macworld Photoshop 3 Bible, 2nd
Edition, (California:IDG Books Worldwide Inc , 1994)

Help Exit

Loving Companions

Help Exit

Faithful Pets

Help Exit