Using Computers As A Tool In Architectural Applications

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USING COMPUTERS
AS A TOOL IN
ARCHITECTURAL APPLICATIONS

by

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CHAPTER 1

What benefits do computers offer to the Architect?

Increase in complexity is one of the many problems facing the Architect. Many aspects of the profession have now become more complicated and require other specialists who are qualified in their own fields as the architect himself. The fact that the principal architect does not now deal with the detailed aspects of design has meant that there are increasing problems of communication and coordination. The architect, as the key generator of design information, has the responsibility not only of communicating this information accurately to other members of his design team, but also ensuring that the many different aspects of his designs are ultimately integrated in such a way that the end product can be regarded as "architecture".

The human mind, brilliant as it is in many ways, is somewhat limited in its capability in memorizing large quantities of information and being able to retrieve it quickly at the right time. One of the great attractions of computers is their ability to store vast quantities of information, process, sort, analyze and retrieve them almost instantaneously any time they are needed.

The complexity and scale of many buildings today places the architect under great pressure to complete the design work in the least possible time. The overall period of time, from inception of the design to completion of the construction work, is tending to result in buildings which, if not obsolete are often obsolescent as soon as they are put into commission. The architect is therefore under pressure, not only to speed up the design and construction processes, but also to ensure that the standard of design meets the increasing sophistication demanded by the society as a whole.

Unfamiliarity with computers and their capabilities in general means that the architectural profession shall not be in a position to give much thought to the possibilities in this field. It is helpful to look at some of the tasks which computers can already undertake for the architect, and follow these with some ideas of the possible patterns of future use.

The rapid technology development in the last few years pushes the computer capabilities beyond the limits that we could imagine only a short time ago. The computer today is not only a useful machine for the architect but also an essential tool for him. This tool is not only a design tool, but also an evaluation and optimization tool for any design, no matter whether the design is for a huge project or a small residence. By the help of the computer the architect can explore his design, study the masses, walk through the building, apply different materials and colors, and even choose the right locations for interior lights to emphasize his idea. With the computer, designs break free from the paper plane, a project becomes a collection of symbols in the computer memory. The computer can manipulate these symbols automatically, at incomprehensible speed, to help produce ideas that we could not think of by ourselves. When tools are new (as the computer still is) they often seem strange and are understood in contrast to their predecessor. The automobile was first seen as a horseless carriage, the radio as a wireless telegraph, and the designer 's computer as a non manual drafting device. But with time, as use becomes commonplace and more mature understanding develops, the old wording sound increasingly quaint and eventually are discarded. The technology becomes transparent. Today's motorists have long forgotten that they are engaged in horseless travel, and today's architects would smile at the idea of pencil-assisted design. Chroniclers of our era may one day ask, "What is computer-aided design?" To them, it will just be design.

Part of the material in this chapter has been adapted from "Computers in architectural design" and "Digital Design Media"

CHAPTER 2
What is "Multimedia"?

2.1. Definition

Multimedia means using several communication sources such as sound, video and animation simultaneously through the computer in ways that involve the human senses especially sight and hearing - and give users the sense of interactive control over the computer.

Multimedia is not a revolution - it is an evolution in bringing together a wide variety of hardware and software tools with a common goal. Multimedia could be a simple "HyperCard" presentation using a humble Macintosh Plus or it could use sophisticated equipment to get a video production.

Multimedia could be defined also as the ability to use the computer to combine multiple media, text, graphics, sound, still images, animation and video. Text, graphics, and animation are usually computer-based; sound may be digitized (synthesized); still images may be made from slides or photographs and scanned into the computer, and video is generally a videodisk on a VCR that can be controlled by the computer or digitized into the computer.

These various media may be seen as the building blocks of a Multimedia presentation. The key for these components is the computer in an interactive operation.

2.2. Multimedia and video

Adding video capability to the computer system can revolutionize the presentation. The cost won't necessarily be very expensive. A NuBus board that provides output to a VCR can cost as little as $600. But the investment can easily rise above $10,000 for the high end equipment. Such equipment won't replace what is found in video production studios. But the Macintosh and its peripherals can process recordable video signals with an acceptable quality. With a powerful Mac system a lot can be done with video. Still-video frames can be captured in standard file formats. Those captured images can be integrated with a presentation, used with Mac graphics or applied (mapped) on 3D surfaces to have photo-realistic effects . A live video from an external source can be displayed as stand alone images, in a combination with Mac graphics or in an interactive presentation. Graphics created by the Mac can be recorded on an inexpensive video tape or on an expensive laser disc - the first copy will cost $2000 but the additional copies are only $10 each.

Overlaying graphics on real-time video signals is possible. Video equipment can be controlled from the Mac to produce an interactive presentation using graphics from the Mac and live video from a VCR avoiding the large storage area the images would need on the computer. In the near future, the Mac will be able to provide storage and playback of full-motion, full-screen, real-time video. This make it possible to build a full presentation with no external video source but still provide the user with a random access to any part.

Full-motion video requires large storage area and high speed. The minimum requirement is a MacII and for many applications IIci , IIfx, or even the new top of the line Quadra 900. At minimum of 2 megabytes of RAM is required but 8 megabytes or more is recommended. An 80-megabytes hard-disk drive is adequate, but it will not be too much if a 300-megabyte unit is required for complex digitized images.

2.2.1. Video quality

There are different factors that define the difference in image quality, but there are two major factors that measure the difference between classes. Those two factors are horizontal resolution in line per inch and S:N (signal to noise) ratio in decibels (electronic noise produces obvious video degradation at about 40 decibel level).

There are three levels for video quality, broadcast quality(400-600 lines S:N ratio

50-55), industrial quality(300-400 lines S:N ratio 50-55) and home video quality (400 lines S:N ratio 45).

2.2.2. Analog Versus Digital

There are two major problems in transferring the images between video and the computer. First, importing video into the Mac environment means converting from analog to digital (A-to-D or A/d converting). On the other hand recording or displaying Mac images on standard video equipment means converting from digital to analog (D-to-A or D/A converting).

The second problem is the scanning system used to create the display. Standard Mac color displays scan sequentially, one line at a time, from top to bottom; this is called "NON INTERLACED". NTSC, video scans each image in two passes. Of the 525 lines that constitute one full NTSC frame, the odd numbered lines 1,3,5,7,.........,523,525 are scanned to create the first "field", Then the even numbered lines are scanned in between to create the second "field". The field-scan rate is 60 times a second. The frame-scan rate is about 30 fps (frames per second).

2.2.3. Composite, S-Video, and Macs

There are three forms of the video signals (the first two types are used by consumers and semiprofessionals): composite video which combines brightness and color information in one signal, and S-video (Y/C video) sends brightness and color in two separate signals.

Component video is a third type often used for Commercial broadcast equipment. This type has three channels, one for brightness and two for color.

2.2.4. Converting between systems

The RGB format is usually used for computer color displays. The RGB format transmits signals in red, green, and blue. Converting a composite or S-video to RGB (A/D) is known as decoding; the reverse (D/A) is called encoding. Two major factors constrain what the Mac can do with the video.

The first factor is the data density. A standard NTSC broadcast-video frame has 483.5 active scan lines and a 4:3 aspect ratio (width to height). A 24-bit color and 640X480 resolution will display a Sony Trinitron-quality on a computer screen, so that 60 megabyte hard-disk can store 65 frames. That means it take slightly more than two seconds (at the roughly 30-frame-per-second rate of NTSC video). Digitizing resolution can reach 1,024X512 pixels but 640X480 is the most common acceptable resolution. It is also close to the broadcast standard. Anything beyond 483 vertical lines is wasted, because of the fixed number of lines in the NTSC system. The 640 horizontal pixel resolution exceeds what any current system can deliver to the screen. PAL and SECAM systems employ higher data densities than NTSC requires.

The second factor is digitizing speed. The problem is the Mac's NuBus-slot architecture can't transfer data faster than approximately 13 megabytes per second. To overcome this problem, the overlay board coverts the Mac graphics to analog form, overlays them, and sends the video signal back to a recorder. The speed problem can be handled by using the "one frame at a time" technique (Fig-1).

2.2.5. Image compression

At roughly 30 megabytes of data per second represented by the video, a full hour would require a 108 gigabytes hard-disk drive excluding the storage space needed for the sound. So, until a major advancement is made in mass-storage technology, efficient video-signal compression is necessary. JPEG (Joint Photographic Expert Group) and MPEG (Moving Picture Expert Group) are defining methods of image compression and decompression to make real-time video recording and playback practical. Discrete cosine transform (DCT) and huffman coding methods, were explored by the above two expert groups. The major advantage of these two methods is that images compress and decompress at the same speed works symmetrically.

All major hardware producers are working on developing compression technology.

It seems that compression of 100:1 or more will be available by 1992-1993. That means, one hour of video could be compressed to fit in one gigabyte hard-disk for a quality video in real-time.

The "Colorsqueez" program offered by Eastman Kodak can compress/ decompress the 24-bit PICT and TIFF files by 14:1, and it take 40 seconds on Mac IIcx to compress a 768K, 24-bit, 512X512-pixel file.

There is software such as "PicturePress" from storm technology (offers 2:1 compression), "PicturePress Accelerator" (combining the previous software with a NuBus card to offer 100:1), "CL-550 Processor chip" which offers from 8:1 to 200:1. Ratios of 20:1 and 35:1 appear to provide images that look as good as originals after the compressed files have been decompressed.

2.2.6. Digitizers and frame grabbers

The PICT2 format is the most popular, followed by TIFF for digitized video images. There are two major problems in digitizing from a still-frame video. First the "noise bar" at the top or bottom of the frame that exists when using some VCR models may cause problems for digitizers. Second the VCR must have a full-frame-buffer feature for digital effects or the still-frame will hold only one of the two fields of video needed to form an interlaced image. This cuts the vertical resolution in half from 525 lines to 262.5 lines.

Different types of digitizing cards are available. Digitizing could be in 8-bit-gray-scale or full 24-bit-color. It could be in a low-speed that takes more than 20 seconds to digitize a 640x480 -pixel image, or in a speed of 1/30 second, this depends on the hardware. A real-time -video also could be displayed on the Mac screen.

2.2.7. Recording Mac Images on Video

The image size in a NTSC monitor is 576x430 pixels, so for the computer image 640x480, the right 64 and bottom 50 pixels will fall off the edges of the screen. It is important to keep in mind those two different sizes when creating graphics. There also will be a narrow black band at the top and/or the bottom of the screen. When designing graphics for use in a video, allow for a loss of 10 to 15 percent of the image, especially at the sides. The "safe title" area is the central 85 percent of the picture.

2.2.8. Flicker and Anti-Aliasing

Flicker can be a major problem when Mac graphics are converted into NTSC (or any other system like PAL and SECAM). This occurs because of the crisp, clean non-interlaced display on the Mac's monitor versus the interlaced NTSC display. This problem occurs for the fine horizontal lines. Hardware solutions can reduce the problem, but carefully designing graphics can help greatly.

Anti-aliasing which is a blending of adjacent colors to provide a smooth transition for jaggy diagonal lines can help in a cleaner conversion to NTSC. It also reduces the flicker and jaggies in diagonal lines and fonts.

2.2.9. Future Video (HDTV)

High-definition TV (HDTV) will replace for NTSC in the near future. It is clearer and has a wider-screen video standard. The resolution will be doubled and the aspect ratio will change from 4:3 to 16:9. This will double the storage problem for the Video-to-Mac conversion. A full HDTV signal will take two to six times the space needed for NTSC.

2.2.10. Device Control by the Mac

Multimedia applications that use Mac to display live video from external sources require that the Mac be able to control the playback device (VCR or Laser disc). All professional videotapes and laser disc players can be controlled via a serial port "RS-422". The Mac modem port happens to be one. However the Mac must be able to index specific frames on a tape or videodisk. A "SMPT time code" for tapes and "index numbers" for videodisk is used for this function.

2.2.11. Video MASTER

This external device emulates the hand-held remote control for the video. Through this device we can record the protocol from the infrared remote to the Mac. Therefore, the Mac can control the VCR device through some programs such as HyperCard and MacroMind. This device could be used also for video editing, but accurate editing is difficult. The VCR must have flying erase heads which erase the existing video a frame at a time or the edits will not be clean.

2.2.12. Videotape

The problem of using Video tape for an interactive presentation has been the linear medium of the videotape. To access certain sections, a search around the tape must be done. Interactive applications require random access, which currently can be delivered only by videodisks. If the instantaneous response time is not as important, VCRs can be controlled by Mac's serial port, with a SMPTE time code for frame accuracy. The shuttle time on a T-120 tape is two-and-half-minutes.

2.2.13. Videodisk

This technology is similar the audio compact discs, and some players can handle both the digital and analog image-storage medium.

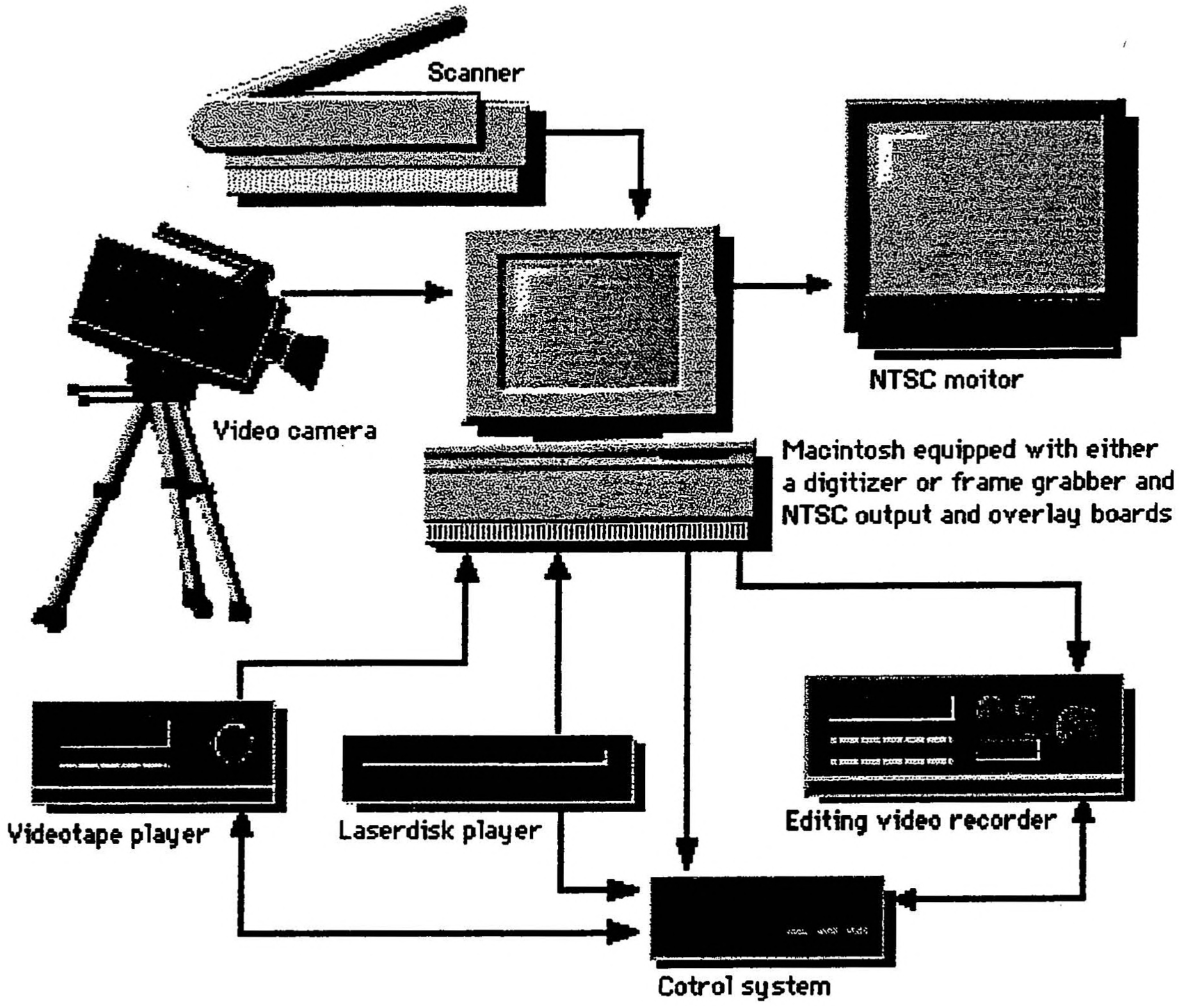
There are two types of laser discs:

CAV (constant angular velocity) and CLV (constant linear velocity). Both of these could be read by any videodisk player. The CAV discs store one frame per revolution, which facilitates still-frame and slow-motion effects and rapidly locating particular frames as interactive Multimedia applications generally require. However the CAV disc is limited to only a half an hour per side.

CLV records tracks of equal length contiguously, regardless of where they fall in the CLV's single spiral track. The latest machines contain frame buffers that provide for still-frame and slow-motion effects.

2.2.14. Display for Multimedia

Multimedia is ideal for presentations. Presentations are often given to large groups, that can



(Fig.-1) The Mac and different video input and out put devices
(Adapted from MacUser, Feb. 1991)

not cluster around a 13 inch display monitor. There are three common displays for group presentations; large-screen CRT monitors; video projectors, and LCD overhead-projection panels. The large-screen CRT monitor is suitable for use in permanent installations such as conference rooms. Video projectors use a projection bulb to produce a brightness level sufficient for medium sized images for use in small auditoriums and theaters. The LCD overhead-projection panels are suitable for small groups like classrooms and can easily be taken from place to place.

2.2.15. CD-ROM

The CD-ROM can be used as an input device for high quality images. There are some ready-made images available on laser disks.

2.2.16. Scanners

The scanner is used to digitize images from magazines and books or photographs for use in Multimedia presentation. Different types are available ranging from hand held to flatbed scanners and from gray-scale to full 24-bit color.

2.3. MULTIMEDIA AND AUDIO

Sound can be added to a Mac easily and cheaply. The Mac has a very good capability in sound. These are stereo-sound-output ports now with every Mac except the LC. The LC and the IIsi come with standard sound-input ports and microphones as well. With third-party products sound-input capability could be easily added (Fig-2).

Having so much standard sound capability on the Mac is encouraging vendors to develop more sophisticated sound products for the Mac. The variety of CD-ROM drives includes Audio-CD. The Macintosh has become the musician's instrument of choice for controlling MIDI (musical-instrument digital interface) devices. The Mac is able now to conduct virtual symphony orchestras. Because of all of that the Mac becomes the perfect computer for integrating sound into Multimedia applications.

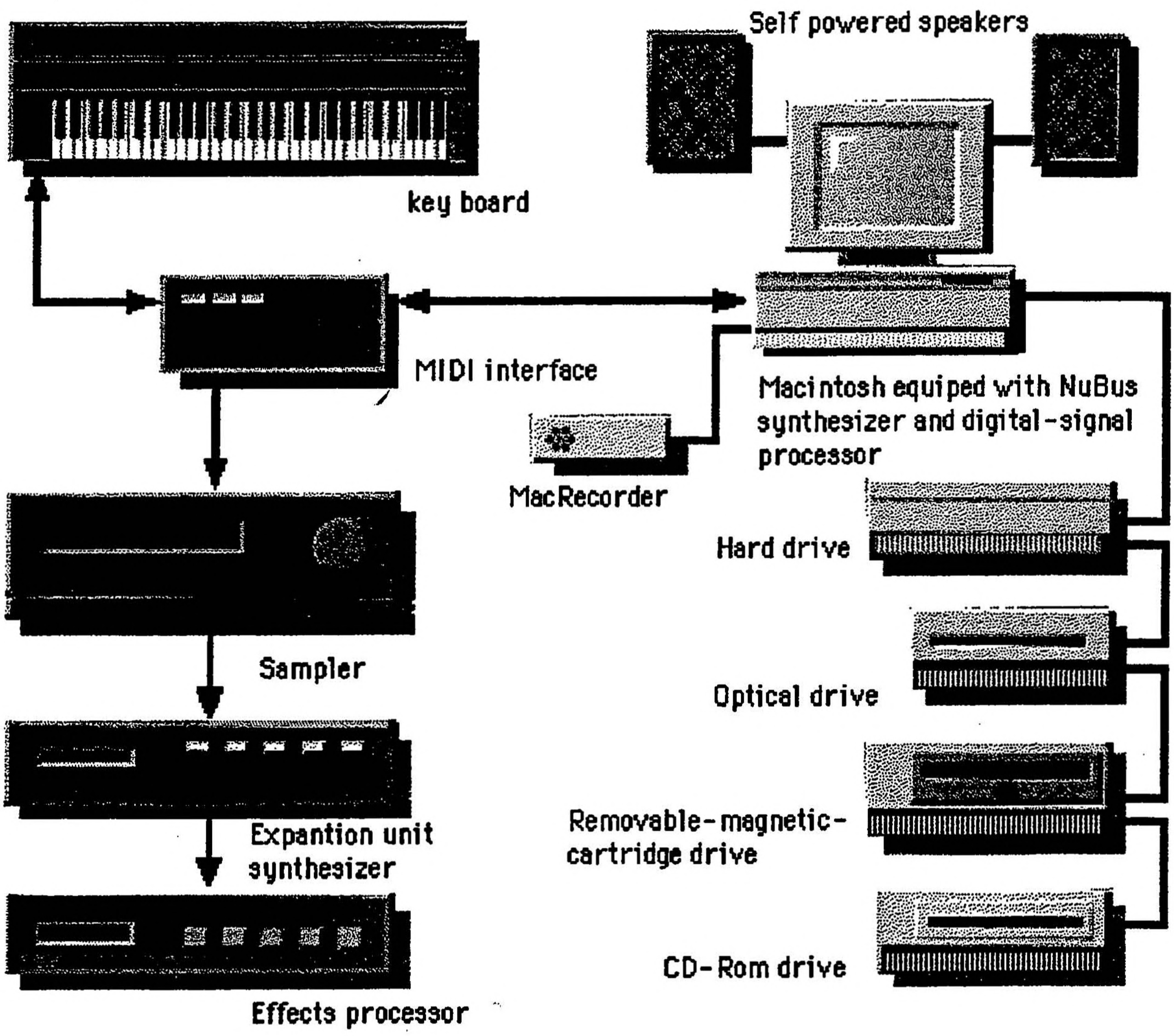
2.3.1. MIDI

To make music with a Mac via MIDI is a local-area-network protocol for sound. It provides communications paths among instruments, synthesizers, computers, and playback equipment. When the synthesizer became a digitally controllable device MIDI became possible. There are between 16 and 32 channels of communication among MIDI devices using the modem and printer ports.

2.3.2. Recording Sound in the Mac

The following will give an idea how a Mac records (digitize) sound using the MacRecorder:

- The MacRecorder filters the analog sound to eliminate frequencies over 11 KHz and captures the sound in evenly spaced intervals that are approximately 1/22,000 second apart, and creates samples.
- Each of these samples is assigned an integer value between 0 and 255 that reflects the sample's amplitude. SoundEdit software stores this sequence of values in memory to use it later to construct a wave form.



(Fig.-2) The Mac and different audio input and out put devices
(Adapted from MacUser, Feb. 1991)

2.3.3. Sampling

Sampling is the digitization of analog music by sampling the source at frequent enough intervals to fool the human ear. The sample rate and number of bits stored per sample are two important factors which determine the quality of the digitized sound. The MacRecorder for example has a 22 KHz sampling rate with an eight-bit resolution. In comparison the Audio-CD works at the same way by sampling the analog signal at approximately 44,000 (44 KHz) or so times a second with 16-bit resolution. A one second sampled at 22 KHz requires approximately 22k of disk space.

2.3.4. Synthesizers and Samplers

Before sampling technology synthesizers had to create sounds by using oscillators, filters and amplifiers. The quality was not the same. Today synthesizers create sound via sampling. This gives a better quality and opportunity to alter the sound up and down the scale. Synthesizing a sound takes a less memory than sampling, so low-cost synthesizers use a combination of sampled and synthesized sounds.

2.3.5. Multimedia Interfacing

Different types of soft ware and hardware could be used to integrate sound with the Multimedia application. HyperCard, SuperCard, and MacroMind can playback SND resources, such as those created with the popular device from "Farallon" MacRecorder.
Using some other software and hardware for MIDI allows different instruments in different tracks to be recorded separately with the playback for all of them together.

2.3.6. Digital Audio Storage

The storage area needed for the digitized sound varies according to the frequency. Digitized sound in 22 KHZ for 45 seconds needs one megabyte on the hard-disk. That means a removable-hard-drive or an erasable CD-ROM is an alternative solution for the hard-disk limitation.

The sound could be also integrated in the Multimedia application without recording it on the hard-disk. Using some of the Multimedia programs, the CD-ROM for example could be triggered at a appropriate time to start playing a chosen sound when it is needed during the presentation.

2.4. AUTHORING, MODELING, AND ANIMATION

These are two common approaches to create a Multimedia presentation. The first one uses the authoring system as its base - such as HyperCard, SuperCard or Plus. It is ideal for specific relationships among segments or user-controlled events. The second one uses an animation package as its starting point. Usually different programs are used to get the desired result. MacroMind Director for example has evolved from animation-creation programs to become the control center of true Multimedia presentations. On the other hand, authoring applications such as HyperCard can call up Director routines. Although HyperCard 2.0 is an authoring package, a lot of animation is now done in it, Thanks to its XCMD facilities. Today with the help of a Mac and Multimedia tools, a real interaction could be built without the necessity of drawing every frame. But assembling everything together is still an important Job, and that's where authoring software is used (Fig-3).

2.4.1. Authoring Versus Animation

Authoring software is used to combine and control the different media elements used to create a Multimedia application. The most widespread is HyperCard, and the high-end is MacroMind Director. Some authoring packages are animation packages and vise versa.

2.4.2. Persistence of Vision

Animation is a succession of still images that the human mind interprets as motion because of what is called persistence of vision. If the succession of images is less than 16 to 18 fps (frame per second) this phenomenon breaks down. Then a flicker will start to be noticed. A traditional movie runs at 24 fps, while video runs at 30 fps. On the other hand the computer monitor (RGB) runs at 66 fps. But in the Mac the capacity problem appears: A full-color, 24 bit, 640x480 image represents nearly 1 megabyte of data, which is to much data to be transferred quickly through the memory bus, and storage media.

2.4.3. Real-Time Animation

Slowing down the animation under the flicker level and treating the presentation as a slide show could be a simple technique to run presentation on the Mac. The other way, is to use a permanent background in a separate layer and on the other layer use the animated foreground presentation, that would conserve the Mac resources.

These foreground elements are called sprites and they exist independently of the background. Although the size an number for these sprites are limited, this kind of real-time animation could be successfully produced on a Mac.

2.4.4. Special Effects

The software available for Multimedia can create a special effects such as wipes, dissolves......etc. to have a sensational presentation effect.

2.4.5. Mac display Versus Videotape

There are two common output formats for Mac-based Multimedia displays these are the Mac itself, and a VHS-cassette videotape. Some limitations exist in each output. The Mac is constrained by image quality and movement, but offers an excellent interactive control. The videotape gives a highly sophisticated image, because each frame is created and recorded individually. The time required for this is increased significantly. On the other hand the interactive way is difficult because the tape is a sequential-access. Also the VCR must have a serial port to be controlled by the Mac, and a single-frame accuracy to find the segments it needs.

2.4.6. Professional-Quality Output

The level of quality required for real-time animation is defined by the purpose for which the Mac is being used. There are high-level applications in which the Mac's limited real-time capabilities work well such as the standard TV-news weather report that uses a local map with animated temperature and clouds.

2.4.7. Interactive Presentations

To control the paths through and around various segments in an interactive presentation is an ideal use for real-time animation on the Mac. Architects can use a 3-D animation to create a presentation, allowing the client to move from room to room in the building.

2.4.8. Frame Tearing

A Large number of animated sprites cause frame tearing. The Mac can't redraw an element in its new position fast enough for it to be finished before the next frame needs to be displayed. Frame tearing is an effect similar to seeing a truck through heat waves on a highway, except that the waviness is sharp-edged. The Mac IIfx will not solve the problem because it is a Nu-Bus problem. The Nu-Bus delays the data transferring.

2.4.9. Video Anomalies

To have a Multimedia presentation on a videotape, some precautions must be taken in consideration. Avoid horizontal lines with an odd number of pixels. Avoid sudden transitions between primary colors, especially bright reds. For better results use software that gives anti-aliasing (blending of colors to smooth transitions) for graphics and text. Anti-aliasing sometimes delivers blurring when the same image is viewed directly on a Mac. Fully saturated colors tend to smear on an NTSC monitor. Some software has a special palette for video colors which is limited to 75% saturation.

2.4.10. 3-D Modeling

The first step in creating animation is 3-D modeling. It simply means creating individual elements in a mathematical description that the software then draws on the screen, so they could be moved, linked and rendered. Once the 3-D elements are defined the program can display them in a variety of forms. The forms range from a wireframe to a fully rendered image with controllable light sources.

2.4.11. Rendering

Rendering is the process of transforming an object from a mathematical description into a realistic-looking image. This process can be approached in different ways and techniques including mapping, shading, and raytracing.........etc.

2.4.12. Mapping

This means taking a two-dimensional graphics file that describes a surface texture -wood grain, marble,.....etc.- and projecting it onto an object. Bump mapping is a more sophisticated level of mapping which includes not only an image but a texture as well.

2.4.13. Shading

Shading gives objects dimensions and depth by controlling different types and locations of different light sources. Smooth transitions, casting shadows, and other effects could be provided by more sophisticated techniques.

2.4.14. Ray Tracing

This is a computation-intensive technique that plots a view for each pixel taking into account location from the camera lens, quality and strength of all light sources, along with surface characteristics.

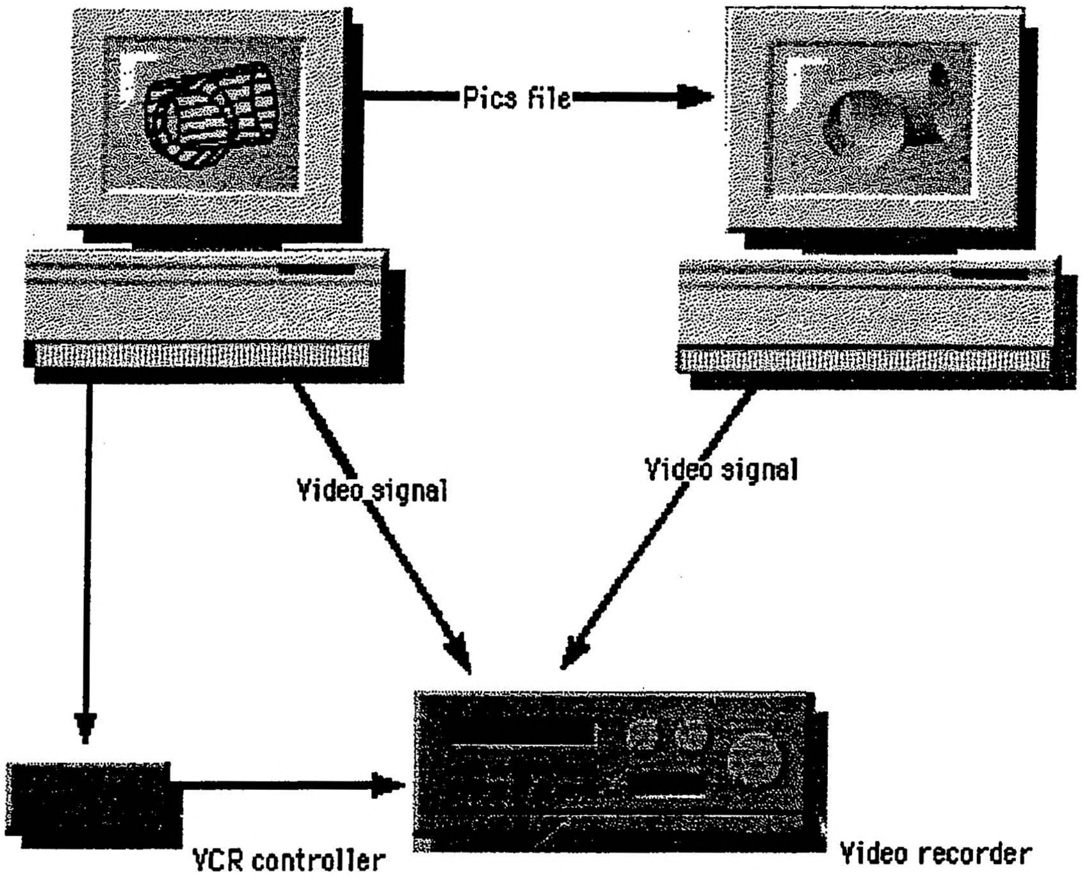
2.4.15. Tweening

This is slang taken from the animator's term *in-betweening* , in which the position of an object and/or camera, an ending position, a path to follow, and the number of frames is specified. Then the program automatically creates the movement.

2.5. The use of "Multimedia"

Drawing on paper was the only way available for the architect to express his imagination. Using several techniques to illustrate his creation in plans, elevations, and perspectives. Using black and white or colors, different techniques such as watercolor or air brush was used to make impressive presentations. Even so for the non professional it was difficult to understand and relate these drawings to each other to get a good idea about the design.

Today the giant step in computer technology software and hardware allows the electronic image to have the photo-realistic images and also to animate them to simulate



(Fig.-3) The Mac and the animation
(Adapted from MacUser, Feb. 1991)

reality. This makes it easy for the non-professional to visualize the design, walk-through it or fly over it as if it was real.

Multimedia can make an impressive presentation, but also with its help it becomes easy to study the design by visualizing the relation between the different parts or scanning (digitizing) the real finishing materials and applying them on the surfaces, so that the appropriate changes can be made before starting construction.

2.6. QuickTime

Apple tackled the problem of managing time-based information. It has defined a standard protocol that it calls QuickTime. The new protocol is a media-integration architecture. It provides a system-level standard for manipulation and synchronizing full-motion images and sound and creates a unique level of functionality for the Macintosh.

One of the things that makes using the Macintosh so easy an intuitive is the transparent data type. A transparent data type is a class of information that Macintosh operating system recognize as an integral, standardized element. Text is a transparent data type. Through QuickDraw, graphics are transparent data type. Being transparent means that cut, past, copy and save data can be done with any application. QuickTime has a new transparent data type, calls dynamic data, for multimedia information. The new data type means that cut, paste, copy, and save digital video with full-motion images and sound as easily as cut, copy, paste and save text and graphics.

Equally important, QuickTime provides a method of synchronizing the video and sound, so that the sound track for a video segment stays in sync with the visual image and is saved in the same file as the images. The synchronization works within the Macintosh and between the Macintosh and the video and audio sources. QuickTime is not apparent at the user level but its impact on audiovisual products and applications is enormous.

QuickTime is essentially a media-integration architecture with provisions for video, audio, animation, and device control. It acts as a transparent interpreter between applications, special drivers called codecs (short for compression / decompression manager), and other applications and equipment. In addition computers in general are not timing oriented. They simply process as much data as they can as quickly as they can. Audio and video, on the other hand, are very dependent on split-second timing and synchronization. QuickTime provides the time-based framework for recording, playback, and synchronization that is needed for converting video successfully.

Part of the material in this chapter has been adapted from "MacUser" Feb, 91 and "VideoSpigot" user's manual.

CHAPTER 3
Computers and their Peripheral Equipment

3.1 Types of computers

There are two major computer platform available in the market. The IBM which uses the Intel processor (8088, 8086, 80286, 80386, 80486), and the Macintosh which uses the Motorola processor (68000, 68020, 68030, 68040). Both have the same basic structure. Of course there are some difference in the detailed design, but recently they became very close to each other. Below a brief explanation for the Macintosh parts and devices.

3.2 CPU (Central Processing Unit)

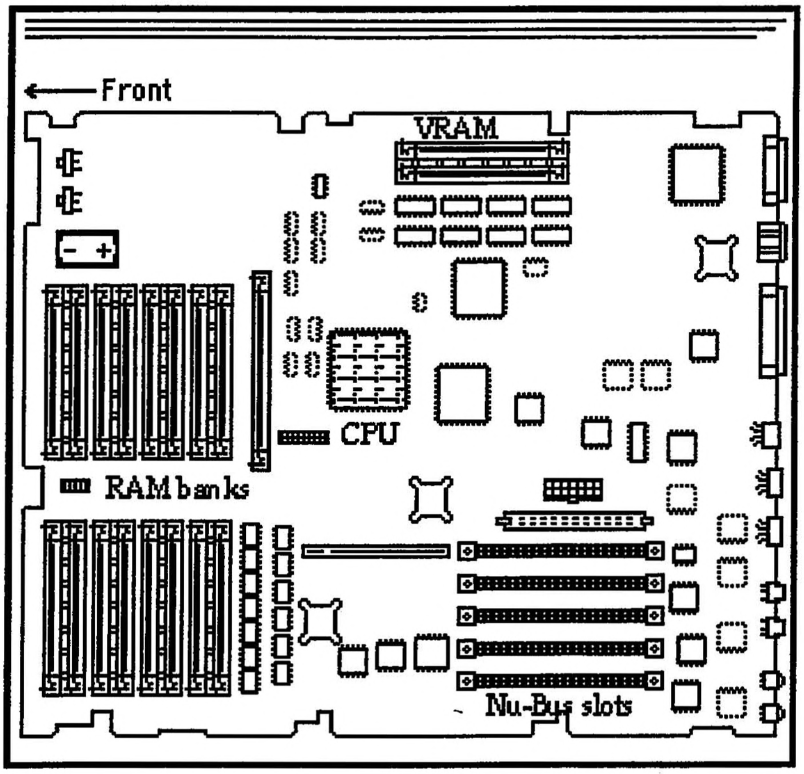
The CPU is the box that contains a board full of integrated circuits, chips, connectors, jumpers, expansion slots, different ports, ...etc. This is named the Motherboard (Fig-4). The CPU box contains also the storage drives (floppy disk drive, and hard disk drive), and power supply. Sometimes the microprocessor itself is called the CPU.

3.2.1 Microprocessor

The processor is the computer's heart. All the operations pass through this chip. The speed for this chip also refers to the computer speed as a whole. The Macintosh computer uses Motorola 680XX (xx refers to 00, 20, 30, ...etc.). The bigger the xx number the more advanced and faster is the chip. The available speeds are 8MHz, 16MHz, 25MHz, 40MHz. It is a separate chip in 68030 and lower chips. But it is built in the 68040 an higher chips(Fig-5).

3.2.2 Mathcoprocessor and PMMU

As it seems from the name this chip is working as a helper to speed up the mathematical operation and of course the speed for the machine as a whole. The existence of this chip is a must for some programs such as the CAD programs and the high-end rendering applications. Its different versions usually known from each other by its version number (68881,68882,..). The PMMU is the paged memory management unit that makes virtual memory possible on the Mac. Called the 688851, it's part of the 68030 an higher chips and can be added to the 68020 (Fig-5).

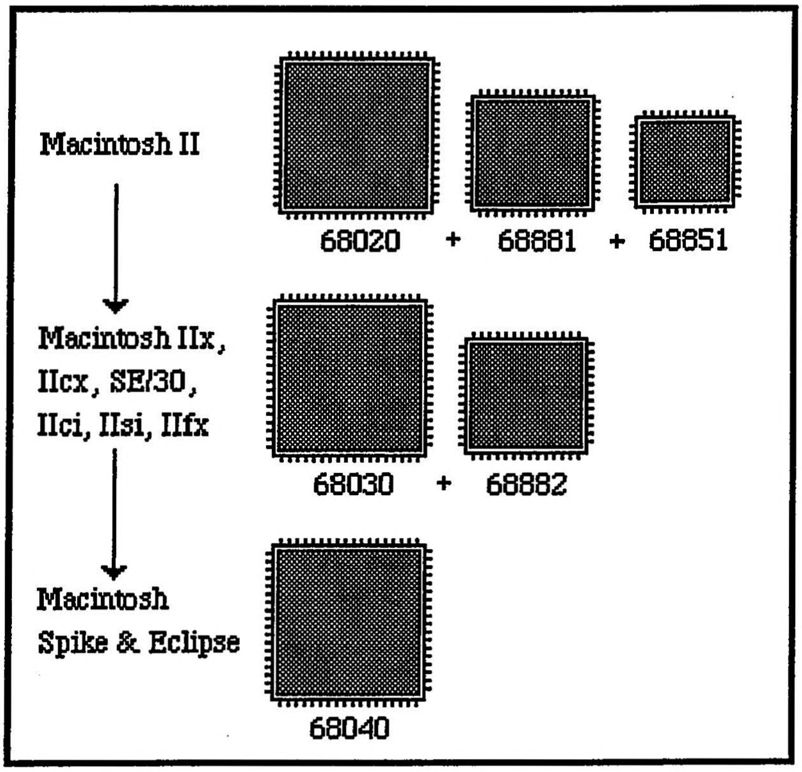


(Fig.-4) The Macintosh Quadra 900 Motherboard
(Adapted from Apple Hypercard stack, 1991)

3.2.3 Ram

RAM means random access memory. It is the place that handles all the information that the computer is working with. RAM chips have different capacities and speed. They could be

256k, 1MB, 2MB, 4MB, or 16MB. The MacII family have a number of slots for this chip and most of them can be upgraded to 32MB. With the arrival of system 7.0 these computers can be upgraded to 128Mb. By using this system also a virtual memory can be addressed up to 1 gigabyte. Of course the virtual memory is much more slower than the RAM itself. The RAM speed ranges from 150 Nanosecond to 70 Nanosecond (the small number refers to a higher speed).



(Fig.-5) The different versions of the CPU in the MAC
(Adapted from Apple HyperCard stack, 1991)

3.3 MONITORS & DISPLAY CARDS

The Display card is the card that produces the display signal and passes it through its port to the monitor to display the image. There are different types and levels. The display color depth can be 2-bit(black & white), 4-bit (gray), 8-bit (256 color), 16-bit(32,000 color), or 24-bit & 32-bit (16,000,000 color). The bigger the number of bits the bigger the information that must be stored to define this image. Some of these cards have a capability to capture images from any video resource, others have video capturing capabilities beside video output signals in different formats (NTSC, PAL, and SECAM) directly or through an encoder.

3.3.1 APPLE CONVOLUTION

The Apple 8•24 Display Card introduced in 1990 addressed the problem of screen flicker by implementing a new way of pixel averaging called Convolution. It runs every pixel through a formula that averages the pixel with its individual neighboring pixels above and below, and it is part of the function of the CLUT/DAC chip on the Display Card 8•24, 8•24 GC and the built on the mother board Quadra's display chips.

Convolution causes a blurring effect between scan lines so that a horizontal line includes at least a portion of the scan line above and below its own scan line. A portion of the horizontal line remains visible during display of the both the odd and even fields so flicker is avoided. The convolution formula follows a 1:2:1 ratio where the current pixel value is given twice the weight of its neighbors above and below.

3.4 STORAGE MEDIA & DEVICES

There are different categories of storage devices using different storage media, starting from the floppy disk drive to the CD-ROM.

3.4.1 Floppy diskette

This is a magnetic media. It comes in a 3.5" size with two capacities 720KB, and 1.44MB. This type of storage media is the most popular one. A floppy disk drive is used to read and write the data to this media. It is slow and easily to be damaged. But it is handy and easy to carry anywhere.

3.4.2 Hard disk

This is the second most popular device. It is a magnetic media. It has two sizes 3.5", and 4.25". Speed varies from one to one but usually it falls between 15-28 millisecond. Different capacities are available from 20MB to 1 gigabyte (1000MB). It could be internal or external.

3.4.3 Portable & Removable HD

Portable hard-disks are very useful for moving data from place to place. They have the same specification as the normal hard disks except that they are shock protected. Removable HD usually refers to the storage device that has a removable cartridge as a removable storage media. It comes in two capacities 40MB , and 80MB.

3.4.4 CD-ROM

This is a new technology and its market is still limited. There are two types read-only, and read- and-write. The second type is much more expensive, but it is a promising device because it has a big capacity (650MB).

3.4.5 Optical Storage

This type of storage media can hold up to 128 megabytes in a 3.5 inch optical disk. In my opinion this type will replace the ordinary 3.5 floppy disks.

3.5 INTERFACES(PORTS) & ADD-IN CARDS

3.5.1 Scsi

This interface is available in the MacII family to connect different devices such as removable HD, portable HD, scanner, and CD-ROM. These devices can be connected serially in a maximum of 7 devices.

3.5.2 NuBus

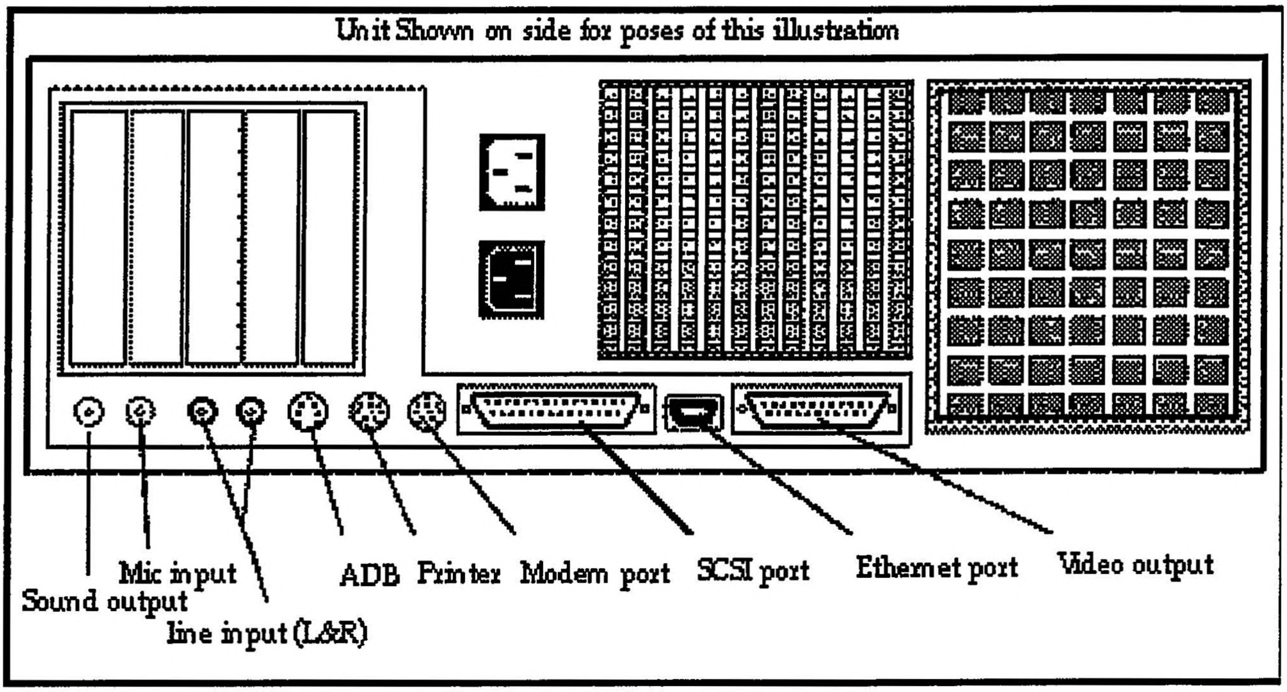
This is the type of connection the MacII family offers for expansion slots. Concerning the Multimedia it represents the bottleneck for the data transmission.

3.5.3 ADB Port

This is a low-speed, input-only serial bus. Into this port different devices can be connected. The apple mouse is one of them.

3.5.4 Printer & Modem Port

This port is used to connect printers with different types. Modems are also connected to the modem port to transfer the data between different computers through the telephone line. A MacRecorder also could be connected to record any sound into the Mac (Fig-6).



(fig.-6) The Macnitosh Quadra 900 rear shows the different ports
(Adapted from Apple HyperCard stack, 1991)

3.5.5 Accelerator

This comes as a separate NuBus card or attached(or built-in) to the display card. It speeds the QuikDraw drawing process and helps in redrawing and windows scrolling.

3.5.6 Cash Ram Card

This card has its own memory to speed-up the computer by storing the frequently used commands and passing it quickly to the processor so that the processor will not go to the hard disk to read it.

3.6 The Ideal System

The ideal system to create complete animation and authoring is a Macintosh Qaudra 900 with a 400MB hard-disk drive, optical-disc drive for backup and archival copy, multisync monitor, 24-bit-color display card, a frame grabber card, video sources - VCR, laser disc player, and video camera.

Part of the material in this chapter has been adapted from "The Macintosh Bible" and Apple's documentation about the Quadra model.

CHAPTER 4
Available software and its capabilities

4.1. MODELING

4.1.1. CAD Software

In the last few years CAD applications have been developed significantly. There are common capabilities that can be found in most of them, but each one has its own way to build a 3D model. The CAD application can be used also as a modeling application beside its 2D capabilities. Brief information in the following paragraphs will discuss some of the CAD programs and their features (Table-1).

ArchiCad: One of the most powerful programs available for the Macintosh. This application has a very good approach in modeling buildings. The elements used to create any building are familiar to the Architect. It uses walls, slabs, roofs,....etc. The program has 3D modeling in different levels including full rendering with the Phong method and an accurate position for the sun at a certain location in a certain day and hour. Finally the walk-through and fly-over features add a very important part to this splendid application. The program also has different types of popular file formats to exchange with other programs such as DXF, PICT, PICS, and RIB.

Architrion: This program has good features but the complex way it uses them lessens its power. This application uses a single unit (BLOCK) to generate all the building elements and this block is limited to has 6 faces which is painful in shaping any irregular shape. The Lack of true DXF and PICT formats are another disadvantages. It takes double the effort to create the same model in this application.

AutoCad: The most popular program for the IBM. The Mac version has the same capabilities. It is a general program, and can be used for mechanical or electrical drawings. To create an architectural element several steps must be achieved to get this element versus one or two steps in the other programs. It hasn't any rendering capabilities unless the "AutoShade" program is added.

4.1.2. 3D modeling software

The 3D modeling program is an easy and fast way for an Architect to visualize his idea in masses. Of course details could be made by this program. But it is not the right place for full Architectural design. Some of these applications will be discussed in brief.

DynaPrespective: 3D conceptual design program for multimedia presentation. Masses can be built quickly with different properties. The created model can be animated. This program can export/import DXF, export PICT, and PICS.

Swivel 3D: Three-Dimensional modeling and photo realistic application. This is an easy program to create a 3D model and render it. It has some other features like mapping, and eight independent light sources. It has good animation capabilities. PICS, DXF, and RIB are the file formats available.

StrataVision: This has very good capabilities in modeling. It is very easy to use and very fast to get a good result. Mainly it is a rendering application and for animation. DXF format is available beside PICT, and PICS.

ModelShop: Ideal for a modeling presentation in 3D. Different features are available such as bezier walls, object of revolution, linked walls, and punched holes. Rendering includes unlimited colored light sources, heliodonic cast shadows and animation (tween) is also available. DXF, PICT, and ClarisCAD are available.

4.2. RENDERING

4.2.1. Using painting software

A limited rendering can be achieved also by using painting programs. The result depends on the user sense and the program capabilities. These programs produce bit-map formats.

PixelPaint: One of the best programs in painting capabilities. It has different tools that make it easy to create a painted image in a short time.

Canvas: A highly rated program among the other painting programs. The ability to create different layers adds more power to this sophisticated application.

UltraPaint: From the same company that creates Canvas. It has good features and is easy to learn. Three different layers are available. Other standard tools also exist.

AdobePhotoShop: Photoshop is a powerful tool for image retouching. Contrast, brightness and color values are some of what can be controlled. Special effects are also available for a high quality professional final product.

4.2.2. Using rendering software

This type of application gives a photo-realistic image. Different materials can be specified, and different light sources. Mapping also is a very useful feature.

ArchiCad: Although this is mainly a CAD program, it has good rendering capabilities. There is a list of materials in the program's library. New materials can be specified also. In the expert mode a detailed and precise material's characteristics can be specified to get an accurate result. The light here is global, imitating the sun's effect. Different other settings are available, but of course it is somehow limited in the rendering compared with the stand alone rendering applications.

StrataVision 3D: One of the good programs in rendering. It has powerful capabilities in defining the material characteristics. Different light sources with different shapes and positions can be added. Mapping is also available to add more realism.

MacRenderMan: This is the standard to the other programs in photo-realistic rendering. This program has everything that anyone would need to get a professional photo realistic image. PIXAR the software house that creates this sophisticated program won the Academy Award in creating a film (Tin Toy) using this program.

ShowPlace: This program can build a 3D scene by importing and arranging Clip Objects or RIB models. It gives Objects realistic appearance. A variety of lights can be placed in the scene with full control over color, direction and intensity. Cameras can be moved to view an object or the entire scene from many different perspectives. Wrapping an object with any TIFF or PICT color graphics is available. It is another good product from PIXAR.

4.3. ANIMATION

Animation is creating a sequence of images, and putting them together to create movement vision illusion . The accuracy of the animation depends upon the number of frames (usually 24 per second). Some of the programs that create animation will be described in brief.

StrataVision 3D: This is the a part of the StrataVision 3D. This part accepts different shots created in the StrataVision. The program can create any number of frames between those shots (key frames). The camera movement can also be adjusted to have a smooth movement. PICT and PICS files can be exported.

DynaPerspective: This Program can animate the 3D model in a simple way. It creates simple rendered frames between the shots.

ArchiCad: Using this application a fly-over and a walk-through can be created in a good rendered images. Images can be exported as PICT or PICS. The animation can be also a wireframe or just a simple rendering.

Swivel 3D: Objects can be constrained in their range of motion and rotation in order to build hinges, wheels or sliding panels. This feature is not available in the other animation packages. It also includes different key frames, smooth 3D path (Bezier function), fast preview, and it can use an object as a camera. PICS and PICT formats are available.

DynaPerspective: This program has a capability to generate a sequence of frames between the key frames and animate them (tween).

Vitrus Walk through: This lets architects create conceptual designs of buildings then move through and around them on screen. It is an ideal tool for a pre-CAD, visualization phase and a quick demonstration.

4.4. MULTIMEDIA

MacroMind: This is the standard for Multimedia programs. MacroMind's powerful tools give a good environment for Multimedia creation. External equipment can be controlled from the program. Sound, animation, digitized images,....etc. can be merged together for an impressive Multimedia presentation. Script language (lingo) is available to create an interactive presentation it also links between different Multimedia segments.

FilmMaker: This program seems to have a good capabilities such as real-time control over position, scale and rotation of animated objects, as well as full-screen anti-aliasing.

Adobe Permiere: It works with Apple QuickTime software, and it has the capability to create and play movies from video, recorded sound animation, photographs, drawings, text, and other material. It has special effects to be applied on the movie to create smooth transition between different segments. Three sound channels are also available for sound mixing.

	3-D Modeling	Redering	Animation	Multimedia	Paint & Retouch
Adobe PhotoShop					●
AdobePremiere				●	
ArchiCAD	●	●	●		
Architrion	●		●		
AutoCAD	●				
Canvas					●
DynaPrespective	●	●	●		
FilmMaker				●	
MacrenderMan		●			
MacroMind Director				●	●
ModelShop II	●	●	●		
PixelPaint					●
StrataVision 3D	●	●	●		
Swivel 3D	●	●	●		
SuperPaint					●
ShowPlace		●			
UltraPaint					●
Virtus Walk-Through	●		●		

(Table-1) Table shows some of the software and its use.

CHAPTER 5
Standard file formats

A file format is the structure of the data used to record an image onto a disk. The same data structure can be used to record more than one type of graphics, and a given type of graphic can be stored in several data structures. For instance, the PICT file format can contain both bit-mapped an object-oriented graphics, and a bit-mapped image can be stored in a Paint, PICT, TIFF or EPS format. Each combination of file format and graphic type have advantage and disadvantage.

5.1. Bit-Mapped Image

One of the two basic types of graphics is the bit-map. It is made from tiny colored elements called pixels. Lines are rows of adjoining pixels, and all shapes are outlined and filled with pixels. Achieve the illusion of unavailable colors or grays (in 8-bit mode) can be done by "dithering", or mixing pixels of available colors or gray shades.

Black-and-white bit maps need only 1 data bit to describe each pixel. Gray-scale and color images created by painting programs or by image-editing applications look and act essentially like bit maps. However, a single data bit per pixel doesn't provide enough information to specify a particular color or shade of gray. Images containing 256 grays or colors require 8 bits per pixel, and photographic-quality. Full color images require as many as 24 bits per pixel to specify 1 of the 16.8 million values. Thus depending partly on their resolution, color and gray-scale files can occupy a vast amount of disk space.

The nature of a bit-map can produce undesirable results when an area of the image is moved, enlarged, or rotated. Getting a jagged edges is a one of the common problems. Although bit-maps have inherent limitations, the are still the perfect medium for many needs. Photo-retouching programs perform their magic on bit-maps, which are the default graphic type for scanned images.

5.2. Object-Oriented Art

Object-oriented graphics which typically produced by drawing programs avoid the limitation of bit-maps in several ways. First, the images are composed of mathematically described objects and paths, sometimes called "vectors". In the Object-oriented applications objects can be enlarged, reduced, moved individually as if each item were drawn on a separate, transparent sheet. They can be stacked and partially hidden by other objects without being permanently erased.

The advantages of object-oriented art extended to the printing phase as well. Instead of dictating to the printer where each image spot should be, the program mathematically describe the shape of the object and lets the printer render the image at the highest resolution possible. Thus unlike bit-mapped images, object-oriented graphics are resolution-independent. The higher the printer resolution is the better the result.

Object-oriented graphics are excellent choices for technical illustrations, highly detailed work, and when the size of finished work is unknown or variable, because they scale, rotate, and print without unpleasant side effects.

5.3. Paint (simple bit-maps)

Named after Mac's first graphics program. It holds only black-and-white bit-maps, at 72 dpi. It also limits document dimensions to exactly 8x10 inches in a vertical orientation. Graphics saved in Paint format are stripped of most attributes, flexibility, gray-scale, values, and color. If the original graphic is wider than 8 inches its right side is cropped off.

5.4. PICT (limited-color bit-maps and objects)

It can hold any mixture of bit-maps and resolution-independent objects, which are encoded in QuickDraw language. PICT objects and bit-maps can be any of eight colors: white, black, cyan, magenta, yellow, red, green, or blue. It can hold resolution greater than 72 dpi.

The PICT format allows applications to add comments about image components to the file data such as curve-smoothing information or Post-Script description of the PICT image. When graphics are cut or copied to the Clipboard for pasting into another application, they are normally converted to PICT.

5.5. PICT2 (full-color bit- maps and objects)

PICT2, an extension of the PICT format, has two subtypes: a 16.8 million-color version, commonly called 24-bit PICT2, and the 8-bit PICT2, which holds only 256 colors. It stores drawing information for black and white, gray scale and color images of various bit depth. When drawn on screen, these images are converted through a process known as "rasterization" into image elements called "pixels" that look like dots on the screen. The collection of these pixels form a "bit-map" representation of the image displayed. With 8-bit, a custom 256-color palette can be saved along with the image data, otherwise a color shift will occur. PICT2 is an excellent choice for presentation and animation work in which final image is viewed on-screen or on slide. But it is not the best format for use in desktop publishing. Some application offer a PICT save option, but the images are actually saved as PICT2.

5.6. TIFF (versatile bit-maps)

TIFF (Tagged Image File Format) is the most flexible scheme for storing bit-mapped image with various resolutions, numbers of grays, and colors. But it cannot store object-oriented images. It is the most reliable format used to save the scanned images and exporting them to other programs. It is usually used in desk-top publishing. Because there have been attempts to improve it in different ways, the TIFF standard is no longer the standard. But it has three subtypes, which are distinguished by the number of colors or gray shades they contain. Monochrome TIFF (1-bit images), Gray-scale TIFF (256 grays), and Color TIFF (16.8 million colors) are these three types.

5.7. JPEG (highly compressed bit-maps)

It is "Joint Photographic Experts Group" compression method. It is a sophisticated technique for reducing the amount of data needed to describe a full-color bit-map. JEPG compression can reduce 24-bit images to about 1/20 of their original file size. The process selectively discards relatively unimportant image data and then compress the rest. At compression ratios of 20:1, images look visually identical to their originals; at higher compression ratios, image degradation starts to become obvious.

5.8. EPS (PostScript objects and bit-maps)

Encapsulated PostScript is a popular format for storing object-oriented artwork. It can also store bit-maps, but it is not suitable for that because of the file size. It has two subtypes, ASCII (text-base), and binary (hexadecimal). An EPS file in ASCII format contains two versions of the graphic. The main image is a resolution-independent PostScript (text) description for printing on PostScript device. The second, optional image is s low resolution, bit-mapped PICT preview that can be quickly displayed on-screen without PostScript interpretation. Binary format is more compact. It contains both a PICT preview image and the actual graphic.

5.9. PostScript

A PostScript file is a purely text-based description of an image, Without the displayable PICT image that EPS offers. A PostScript can be opened by any word processor and modified. The advantage of the PostScript is that it doesn't need the original application to be printed. With PostScript download utility, the file can be fed directly to a PostScript printer.

5.10. PICS (animated bit-maps)

In the same way that Apple once defined the PICT format, several developers of graphics products, led by MacroMind, decided to establish a file format that would enable various applications supporting animation to share data. The result of this was a very simple file format, known as PICS. It is basically a succession of PICT files grouped into a single file.

5.11. DXF

DXF (Drawing Interchange File) feature is a standardized method of representing a CAD drawing. It has been adopted by most CAD packages as an industry Standard of drawing-information exchange. The DXF format consists of an ASCII file containing coded text information about a drawing. This file could be 2D or 3D drawing.

5.12. RIB

MacRenderMan format (RenderMan Interface Bytestream). Most of the new versions from different vendors in modeling an rendering support this format. It is an ASCII format containing coded text information about the 3D elements in the scene and its shaders for rendering.

5.13. SND

It is an abbreviation of Sound resource. A file format supported by the Macintosh system software. Apple defines two types: Format 1 and Format 2. Format 2 is used by HyperCard; all other file types use Format1.

5.14. Movie

A new arrival with the first addition to system 7 which is the QuickTime. This file format refers to all dynamic data, such as a presentation slide show or dynamic graph. It is a container for this time-based data.

Part of the material in this chapter has been adapted from "The Macintosh Bible", "The MacRecorder" user's manual, and "MacUser".

CHAPTER 6
Advanced Techniques in the Photo-Realistic-Image

The advanced rendering programs usually provide the opportunity for either simple settings or complex settings (expert modes) for each object and source light in the scene.

There are three main aspects we must deal with to control the final rendered image. These three aspects are "Materials' Attributes", "Light Source Characteristics" and "Rendering Algorithm". Any change in any one of these elements will affect the material rendering on the screen.

6.1. Materials Attributes

This part controls how the material responds to the light. It could be controlled through different factors as follows:

6.1.1. Transparency

This factor describes the amount of light that passes through the surface. A transparent surface transmits light without scattering so that the surface behind it is partially visible. Transmittance indicates the percentage of light that penetrate the material. Transparency could be expressed as a real value between 0%-100% (or 0-1). A value of zero means that the surface is opaque and 100% or 1 means it is fully transparent.

Some programs give an additional factor for transparency adjustment to control how fast transmittance diminishes as the object's surface becomes less perpendicular to the viewing direction. This is called "attenuation".

6.1.2. Refraction

Whenever light travels through one medium to another (i.e. from air through glass through water an back again to air) it bends. This phenomenon is called refraction. Refractivity can be used to model (simulate) curved or optical transparent surfaces such as lenses, gems, crystal......etc. If the index of refraction is equal to one that will represent the air.

6.1.3. Reflectivity

The level of mirror-like reflections a surface can be controlled in this attribute. In this calculation the program takes care of the amount of the reflected light, the directionality of the surface and the view point position. The value could be represented in percentages (0%-100%), or a value (0-1) in which zero describes a fully diffused surface.

Any surface reflects light, otherwise there would be no image. Reflectivity could be described as the ability of a curved surface to reflect directional light from a point-like source (sun, flashlight,...etc.) in a more or less Focused fashion. The more focused the reflector the more shiny the surface appears. Highlights will be confined to a small area if the reflectivity is set to 100% (or 1) while a low value will result in a wider highlight area. The reflected light has two components "Specular" and "Diffuse".

6.1.3.1. Specular

This determines how much total light is reflected from a surface. It is a directional reflection carrying the color of the incident light rather than that of the material; an extremely smooth and saturated hard surface will produce strong specular light (close to 100%), while a soft and light material will produce hardly any specular light (close to 0%). The concentration of specular highlights depends on the smoothness of an object's surface. Objects with high specularity reflect pinpoint highlights, on the other hand objects with low specularity create more softened highlights.

6.1.3.2. Diffuse

With diffuse reflection the surface quality of the material can be defined. An uneven or rough surface will reflect incident directional light in a non-directional (diffused) way close to 100%. Diffuse reflection caries the color of the material rather than the color of the light because diffused reflection is light that scatters in all directions.

6.1.4. Glowing (Emission)

This is the amount of luminescence a surface emits without reflecting light from an outside source. It does not illuminate other nearby surfaces. Glowing color is the same as surface color not the color of the light falling on the object's surface. If the glowing (emissivity) is full it will override other surface reflectivity and diffuse characteristics. An object with this effect will take a neon-like appearance.

6.1.5. Mapping

This is the process of using two-dimensional bit-mapped images to alter the surface properties of objects; by wrapping the object with those images. There are different fields that control the mapping appearance in the final rendering. The following will explain each field.

6.1.5.1. Surface Maps (Bump)

The object's surface normals will be changed by using this field based on the bit-mapped image used to reflect light in different directions in a way as close as possible to the light affected by an actual textured surface represented in that bit-mapped image. Based on the Image's gray scale the light area in the surface where the bit-mapped image is used to give that effect will appear depressed, and the dark area will appear raised.

6.1.5.2. Surface Maps (Specular Color)

These two fields apply the color values of the image to form a graphic image on the surface. This technique can be used to give an object the look of brick, wood, marble...etc.

6.1.5.3. Surface Maps (Secular, Glow, Transparency & Reflectivity)

This uses the bump technique to alter the surface based on the image's gray scale and rate of change between the adjacent areas of the image. White is full on, black is full off. Values of gray fall within the two extremes. These fields cannot exceed the ceiling value set in the material surface properties.

6.1.6. Surface Color (Diffuse and Specular)

These two fields are to set the color of the specular and diffuse reflection. The specular color will affect the color of specular or "hot" highlights. This is particularly important in the rendering of metals. By linking those colors to the maps metals are simulated in the right way because metals produce the same color diffuse and specular reflections.

6.2. Light characteristics

Usually there are three common light sources available in most rendering programs, Global light, Projector light and Point light. Different settings could be applied to source as well as other reflected light. Those settings will be discussed below.

6.2.1. Ambient lighting

Ambient lighting is used to simulate the effect of the light that exists all around and does not come directly from the source but comes from bouncing off of the surrounding objects. Ambient light is a non-source / non-directional illumination.

6.2.2. Mapping

Bit-images could be mapped around the light source. These maps are then projected in the same way that a projector projects an image. An effect of a light coming from a window with a specific shape could be simulated by mapping the window image around the light source.

6.2.3. Light overflow handling

Using these settings determines how excess lighting intensity is resolved during the rendering. Different reasons may cause the over-illuminated areas in the final image. These reasons are:

1- By directing multiple light sources to a certain object.

2- By setting the ambient lighting brightness too high.

3- By giving objects high reflectivity attributes.

The result is similar to what happens to overexposed photographs. There might be different ways to over come this problem. Different programs offer different settings to overcome this. Below are some of the controls used in StrataVision 3D.

6.2.3.1. Clipped

The clipped control ignores all lighting intensity over 100%. It is not the optimum solution if exact color is critical because it will affect each of the color components (red, green and blue) differently resulting in a color shift.

6.2.3.2. Scaled

This control will scale total lighting back so that the highest intensity is equal to 100%. If none of the different areas exceed 100% this method does not scale back lighting.

6.2.3.3. Hybrid

In this field a diffuse percentage must be adjusted. Then if the total lighting intensity exceeds 100% in a specific area, the light hitting the object surface will be divided into its two components specular and diffuse. The diffuse light will be scaled back based on the diffuse % that has been adjusted as mentioned. Then the scaled light will be recombined in a recalculated light level.

6.2.3.4. Debug

By choosing the debug color the overflow areas (exceeds 100% intensity) will show in that color then a manual adjustment must be done to reduce the overflow.

6.3. Rendering Methods

When a building or other object has been modeled as a collection of plane or curved surfaces in space, it can be rendered realistically in line, tone, or color. This is a three step process.

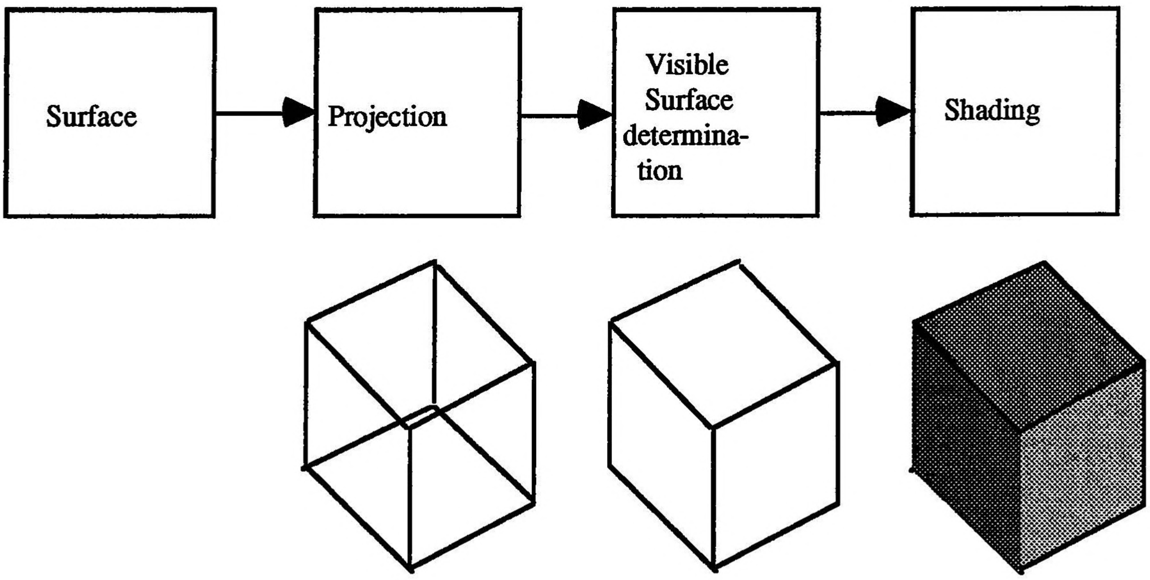
Rendering software must first generate a perspective or other projection. Next, the visible surfaces must be determined. Finally, some surface computations must be executed to determine how the visible surface will look (Fig-8). There are different rendering algorithms and methods that give different rendering level (Table-2 & 3). These rendering algorithms and method options are:

6.3.1. Wireframe

This is the simplest rendering method. It will generate a line representation of the 3D model. In this method no surfaces are calculated or implied. The opaque polygons and hollow polygons are displayed the same.

6.3.2. Hidden Line Removed

In this way the hidden lines will be removed from the wirefarme. Surfaces will be recognized, but without any illumination or materials.



(Fig-8) The rendering pipeline
(Adapted from Digital design Media)

6.3.3. Quick Shading

This way will calculate actual surface orientation for each polygon. It calculates illumination intensity polygon by polygon.

6.3.4. Flat Shading (Constant Shading)

This rendering algorithm calculates a single color for each planar polygon. The surface orientation in relationship with light sources is taken in consideration. The rendering is obviously faceted in appearance because it uses one normal per polygon. Normal is a vector perpendicular to each polygon which indicates the orientation of the surface. It is a very fast method but it is poor in presenting the model. It is usually used for preview and animation development.

6.3.4. Gouraud Shading

This method is named after "Henry Gouraud" at the University of Utah. It mainly uses a linear interpolation which is the numerical version of grading a wash or smearing charcoal. It is an intensity interpolation renderer. The algorithm calculates the shading of a polygon by interpolating color intensity from the vertics of shared polygons, then it averages the shading across the surface of each polygon. The result is a smooth shaded image, but it could have artifacts at the polygon boundaries. The artifacts are most noticeable in areas around specular highlights on the object surface. The Gouraud method uses the normals at each vertex (if available). Only surfaces constructed as a triangulated mesh, in which vertics are shared by adjacent polygons, have the requisite vertex normal. If no normals are available at the vertex point, the renderer cannot perform a smooth shading interpolation. However, Gouraud-shaded objects never sparkle. They always look as if they are made of some dull, matte material. This follows from the fundamental assumption, made in Gouraud shading, that light is reflected equally in all directions. But most real surfaces reflect light somewhat unequally in different directions, with the result that specular highlights -more or less definite reflections of the light source- appear. These highlights move and change as the viewpoint changes.

6.3.5. Phong Shading

This algorithm is named for the person who developed this shading technique, Phong Bui Toung. It is a normal vector interpolation shader. Phong is a popular method for shading shiny curved objects. It evaluates the position of the vertices, with their associated normals, and interpolates a complete new set of normals across the entire surface of the object. These normals are then used to calculate an intensity for each pixel in the rendered image. The ability to calculate each pixel allows Phong to include surface mapping, environment mapping, and shadow mapping. Phong is more complex than Gouraud and it is difficult to compile into silicon.

Blinn shading procedures, and other more recent refinements of the idea, provide better results in some contexts. With the Phong-shading system an architect can conduct parametric studies of potential building appearance by systematically varying diffuse and specular reflectivities (to approximate effects of different materials and finishes) and lighting parameters.

6.3.6. Ray tracing

Raytracing was first applied to perspective rendering of architectural scenes by "Arthur Apple" in the late 1960s. During the 1970s and the 1980s the technique was much elaborated, but production of Raytraced images was regarded as a super computer application, and there was little practical application in design. By beginning of the 1990s, through, it was becoming increasingly feasible on inexpensive personal computers. This renderer traces rays of light backward through a model to determine how the image should appear from the chosen viewing position. If the light ray comes from a surface, the renderer then calculates where the light reflected off that surface originated. It is possible to trace the light rays through multiple reflections until the source. Ray tracing is more computationally intensive than previous algorithms to bring true reflection, refraction, transparency, shadows and mapping.

6.3.7. Radiosity

For a designer interested in a close study of the effects of light and surface, Radiosity renderer (particularly when calibrated carefully to produce accurate results) is an exceptionally powerful simulation tool and a necessary complement to a raytracer. For example a raytracer can be used to produce studies of a building's exterior in crisp sunlight, while a radiosity renderer is used to study interior spaces with diffuse artificial light, windows areas that function as light sources, and light-colored walls and ceilings that produce extensive diffuse inter-reflection. A Radiosity renderer is slower than Raytracing. Below comparison tables of the different algorithms.

Wireframe	Solid	Quick Shaded	Flat shaded	Gouraud	Phong	Raytracing
•Draw PICT •Anti-aliasing •Glowing surfaces	•Draw PICT •Anti-aliasing •Glowing surfaces	•Draw PICT •Anti-aliasing •Glowing surfaces	•Anti-aliasing •Glowing surfaces •Fog	•Anti-aliasing •Glowing surfaces •Fog •Smooth shading	•Anti-aliasing •Glowing surfaces •Fog •Smooth shading •Surface mapping •Reflectivity transparency •Shadows	•Anti-aliasing •Glowing surfaces •Fog •Smooth shading •Surface mapping •Reflectivity Transparency •Shadows •Refraction

(Table-2) Different rendering algorithms and its capabilities
(Adapted from StrataVision 3d User manual, 1992)

	Wireframe	Solid	Quick Shade	Flat Shaded	Gouraud	Phong	Raytracing
Anti-Aliasing	●	●	●	●	●	●	●
Draw-type PICTs	●	●	●				
Fog Effect				●	●	●	●
Glowing Surface			●	●	●	●	●
Pixel-type PICTs	●	●	●	●	●	●	●
Reflectivity						●	●
Refraction							●
Shadows						●	●
Smooth Shading					●	●	●
Surface Mapping						●	●
Transparency					●	●	●

(Table-3)Comparison of effects supported by each renderer
(Adapted from StrataVision 3D User manual, 1992)

Part of the material in this chapter has been adapted from "StrataVision 3D" user's manual and "Digital media design".

CHAPTER 7
Presentation concepts and ideas

Technical representation such as plans and sections, while enormously informative to experienced professionals, are often poorly understood by clients and prospective users. Some designers regard this comprehension gap as an advantage - a way of establishing uniqueness and of maintaining a privileged professional position. It leaves many clients and users with little option but to let the designer make all decisions. Other designers, however, want to establish close collaborative relationships with clients and users and will find it worthwhile to invest in computer tools that increase the level of comprehension about what is being considered and proposed. Certainly, clients and users do not like to be mystified and will usually consider more comprehensible presentation a significant value added to design services. Since the conventions of photographic presentation are universally familiar and well understood, realistically shaded perspective images and animation sequences are very effective for communication with client and users. Together with a plan, an aerial perspective, sectional perspective and interior views rendered as a photo-realistic-image can be shown. If the rendering process is fast enough, the designer can respond immediately to a client's request to see a proposal from another viewpoint or under different lighting conditions or as it would be experienced by walking along specific path. There are some interesting ways to structure presentations and discussions. Particularly where a proposal is complex or unusual in form or where the conditions of project demand an unusual number of presentations, the computer presentation has an overwhelming advantage. Increasingly, client presentations are packaged as videotapes, and interactive multimedia production rather than traditional way. In future, clients may take home virtual reality presentations to explore at their convenience. Different ways of Multimedia presentation are available. Each one of these ways has its most suitable situation for use. In brief some of these ways will be discussed.

7.1. Static multimedia presentation (slide show)

In this type of presentation the computer could be used as the slide projector except that the powerful tools available in the computer make it capable of a more advanced presentation. It can also be used for an interactive slide show to put the audience in action with the information displayed. A combination of different media could be in each slide such as scanned images sound and graphics.

7.2. Dynamic multimedia presentation

Animation is a very powerful way to demonstrate architectural ideas to nonprofessional people. The animated object stimulates the real and makes a good illustration for complex ideas. Any path through a certain part of the design can be defined, then a sequence of images can be generated to simulate in real time a walk through. This type of presentation needs a powerful and fast computer. It also needs a large storage media.

Adding sound to the animation pushes the Multimedia presentation to take several steps ahead. It makes it easy to give more description about the subject. It could also be used also to make the audience pay attention to a certain segments of the presentation.

By adding the captured and scanned images, the capability to demonstrate and imitate the real becomes possible. For example the building can be superimposed on a site captured image of the site where it will be erected.

Adding the interactivity to the presentation makes it very impressive. It gives the flexibility to go back and forth to manipulate the whole presentation and make the audience more active.

7.3. Possible presentation application

Multimedia presentation can be constructed in different ways as mentioned above. It mainly depends on the group that the presentation will be prepared for. Below some of the different audience type.

7.3.1. Professional

Multimedia presentation for a professional audience does not have to be complicated, it must be straight forward but it might contain details, flexibility to go back and forth, and well described ideas.

7.3.2. Exhibition & museums

This type of Multimedia presentation must be showy, impressive, and attractive. Animation sound and scanned images will do the job. It must simplify the information needed to describe the subject.

7.3.3. Client

For a client a clear illustration must be made to create an understanding of the full idea and a sharing of the architect's imagination. It is also recommended to include different media in a way that makes the presentation self illustrative. It might be also suitable to record the presentation on a videotape and give it to the client so that he can watch it in his convenience.

7.3.4. Conference

For a conference the brief demonstration with flexibility to go back and forth through the demonstration will provide the chance to answer questions in an effective way. Like the presentation for the professional audience it has to be straight forward, clear, and containing new ideas.

Part of the material in this chapter has been adapted from "Digital Design Media".

CHAPTER 8
Where and how can Computers serve better

8.1. Design & Drafting

Using computer as a tool for designing and drafting takes those two processes to a higher level. The Architect can use these powerful tools for his benefit. As a designing tool, the computer can help the architect to study his preliminary design as a 3D from unlimited angles, taking into consideration the relationship between the different masses, and the vertical and horizontal circulation. In a very short time a major change can be done and viewed again in 2D and 3D. Computers are considered to be time saving in studying different solutions with minimal effort. In the advanced stages of the design process the architect can study carefully and verify the shading devices (the fins and the over-hangs) all over the year in a few hours. The finishing materials for the interior as well as the exterior can be studied in a very effective way by applying different materials and colors to the same space. In the same way the internal light distribution can be studied. Even the surroundings and how they will affect the building can be studied by digitizing the site's image into the computer and superimposing the building on its real site. When it comes to drafting the computer can beat any competition. As a drafting tool it is a perfect tool. The capability of edit, copy, rotate makes the computer a very powerful tool. A job that would have taken several days using conventional methods can be done in a few hours by using the computer. Of course for a certain systematic or modular type of design (i.e. contains repeated, symmetrical, and mirrored components) the computer is incomparable.

8.2. Team-work design (Architectural, Electrical, Mechanical, ... etc.)

The design process is a team-work controlled by the architect. Different types of jobs must be organized together to minimize the site problems. Computers make it easy to achieve this organization. By studying the different mechanical and electrical networks beside the structural elements in the building as a 3D, any conflict between them will be easily located and solved.

8.3. Quantity surveying & cost estimating

Computers as number crunching machine are perfect for this job. Even some software like ArchiCAD keeps track of each element drawn and adds it to the database to be ready any time it should be needed. If the unit price is inserted from the beginning, a detailed cost estimation can be available any time. This job will take days to be finished without the computer.

8.4. Archive

The amount of data that can be stored in any computer storage media is huge in comparison with that can be stored in any other conventional media. A complete project can be saved on a few floppy disks which take a few square inches to be stored. Of course this is incomparable with the space needed to store the drawings on paper for the same project.

8.5. Presentation

Presentation is an important part for the architect to present his work and communicate with others to explain his ideas. Multimedia is a perfect way to achieve this. It is possible today to have an impressive presentation using multimedia. Putting digitized video, images, sound, and animation isn't any more an impossible job to be done. Now the architect can create a video tape explaining every thing in his design in a high quality computer graphics. These graphics can be recorded in a video tape to be ready for the client to take it home and explore his future home on video.

CHAPTER 9
Case study

9.1. Case study #1 (The 3D Model)

In the first case study there will be an explanation on how the 3D model used as a computer presentation along with this documentation has been prepared and rendered. The model as shown has been designed by "John Pat Guthrie". I chose this design because of its simplicity.

The workstation that has been used to create the 3D is a Mac IIci with 80 MB hard disk, 8MB RAM, Apple 8•24 display card, and Apple high resolution 13" monitor.

The software programs that has been used in this process are ArchiCAD 4.0.3, AutoCAD 10, and StrataVision 2.0. The following steps shows the full process.

-The 3D model has been created in ArchiCAD using its powerful tools and library.

-The full version of the building has been saved as DXF file in the 3D mode. The ArchiCad DXF file does not contain the layer's definition in order to facilitate giving each object the material's attribute in the redering program.

- To overcome this problem the DXF has been imported in AutoCAD using DXFIN command.

-The 3D model translated as grouped 3D lines, and 3D faces in three separate layers 3D lines, 3D faces, and 3D objects. In order to separate each group of objects with the same material's attributes in a separate layer, the translated 3D has to be exploded.

-After exploding the model, new layers have been created. The 3D lines can be deleted since the 3D faces is sufficient for defining each object. Deleting the 3D lines will also reduce the final file's size.

-Each group of objects that has the same material's attribute have been inserted into its layer.

-Pline with different width in AutoCAD will give only lines without any width in StrataVision. The lines that have been created using Trace command will not appear at all in StrataVision. Objects created by Solid command will appear like a bow tie in StrataVision. Any object that has been created in a different UCS will appear in a strange positions in StrataVision.

-The whole file has been saved as a new DXF file using DXFOUT command.

-The DXF file has been imported in the StrataVision program using Open As command.

-Now the file with the new layers is ready and each layer can be viewed separately under Edit Object command.

-Scanned images have been used to prepare the suitable materials plus the available built-in materials.

-Different light sources have been placed in the desired Locations.

-The suitable renderer has been chosen to render the scene.

9.2. Case study #2 (The Animation)

This study shows how the architect can study and explain his ideas and design by walking through the building. It also shows the different amount of information that can be gained by applying different type of rendering to the animation and choose the suitable one for the his presentation (Fig-9).

The configuration of the workstation that has been used as follows. Macintosh Quadra 900, 200 MB hard disk, 36 MB RAM, 24 bit display card, and NEC 4FG 15" monitor. The software programs that has been used in this process are ArchiCAD 4.0.3, QuickTime movie converter, and player. The following steps shows the full process.

-The whole model has been created using ArchiCAD 4.0.3.

-By using the 3D mode capability in the program 12 key-frames has been inserted in order to define the path.

-The analog for the whole path has been set to 96 frame.

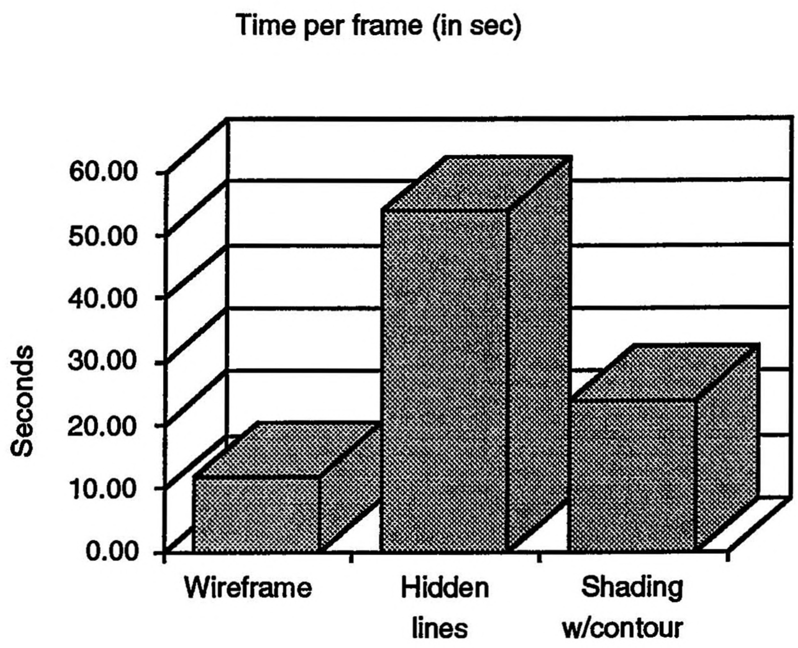
-By using 3 rendering methods the animation has been created.

-The wireframe animation took 12 sec. per image in a total of 19:12 min.

-The hidden lines animation took 54 sec. per frame in a total of 86:24 min.

-The shading with contour took 24 sec. per frame in a total of 38:24 min.

- The chart below shows the time difference in time between the 3 methods.



(Fig-9) Time consumed by 3 different 3d presentation using ArchiCad

9.3. Case study #3 (Rendering The Interiors)

This study shows how the architect can study interior finishing materials. It also shows how the human feeling in the interior can be changed by applying different type materials and light sources to the same space.

The configuration of the workstation that has been used as follows. Macintosh Quadra 900, 210 MB hard disk, 36 MB RAM, 24 bit display card, NEC 4FG 15" monitor, and a Microteck 300ZS scanner.

The software programs that has been used in this process are StrataVision 3d 2.5, Adobe PhotoShop 2.0.1, and Jag 1.0. The following steps describes the full process.

-After preparing the 3D model in the other software mentioned above in case study 1, StrataVision 3d primitive has been used to replace some furniture pieces to speed up the rendering because the objects created in the program usually compiled faster than the imported one.

-Different material images have been scanned to create new materials' images.

Adobe PhotoShop has been used to retouch those images and prepare them to be transmitted to StrataVision to create new materials.

-By using bump and mapping technique a new materials have been created and applied to the different building's parts.

-The study has been made on the living room, the dinning and the kitchen.

-The automatic rendering option has been chosen but by checking the different rendering characteristics which is reflectivity, refraction, mapping,..... etc. except the anti-aliasing and the fog effects, the program forced to use the raytracing.

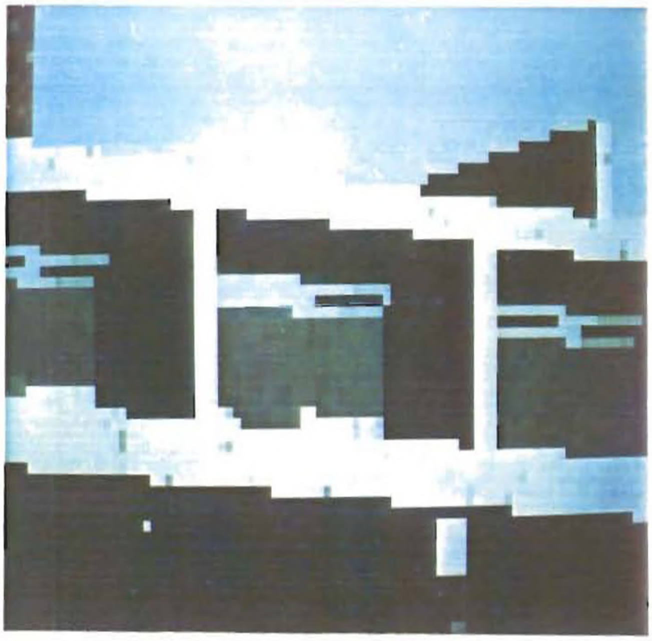
-Anti-aliasing has not been checked to reduce the time the program needs to render the model (see case studies below).

- From the environment options the suitable background has been chosen.

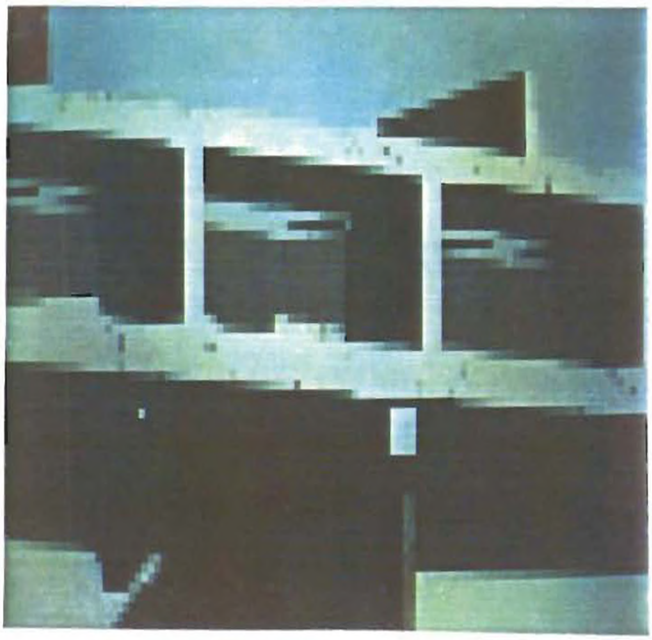
-The first model has been experimented on the Workstation mentioned in case study 1 above with StratVision 2.0 and it took 9 hours per image. However the same image took on the work station mentioned in this case study and it took 2:30 hours. By upgrading the program to version 2.5 the time consumed for the same image was about 48 minutes.

-Each image has been rendered in the size of 512X384 pixels, and with view angle of 110. The light options was set to clipped.

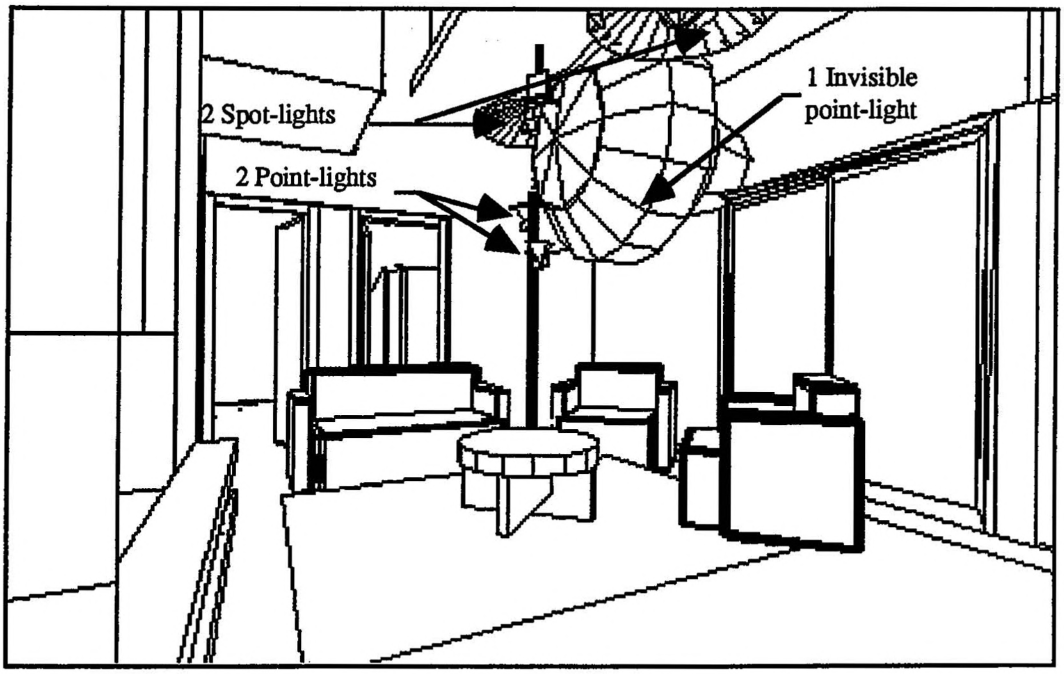
-JAG program has been used Later on to anti-aliase the rendered image. This program anti-aliase the whole image in about 10 seconds (Fig-10 & 11). In the other hand trying to do that in the rendering process will slow down the rendering time.



(Fig-10)The rendered image before using the Anti-aliase



(Fig-12)The rendered image after using the Anti-aliase



(Fig 13) A wireframe shows Living-room different light sources

-The wireframe image above (Fig-13) shows the living room scene including the different light sources. Notice that the invisible light source is visible in the image here before rendering. As soon as the image has been rendered this light will disappear, but its effect will show. There is two point lights in the stand lamp (indirect light) and 2 spot lights (ceiling light).

-The two images below show the same image before and after using JAG program to apply the anti-aliase effect.

-The following tables and images show the different settings for each image (Table-4) to (Table-12) and (Fig-14) to (Fig-22).

Living room-1 (Objects and light sources Setting)

Name	Material	Mapping (Horz. & Vert.)	Color (Hue, Sat., Bright.)	Light Intensity
Fireplace	Brick,red (scanned)	0.3	none	—
Ext. wall	Plastic	none	5545, 12926, 60000	—
Int. wall	Plastic	none	5545, 12926, 65535	—
Int. floor	Oak, floor	1	none	—
Ext. floor	Stone (marble)	2	none	—
Ceiling	Rough, plaster (scanned)	1	7000, 4000, 65535	—
Sun light	none	none	white	110%
Invisible point light	none	none	white	20%
2 point light	none	none	white	off
2 Spot lights	none	none	white	2X 40%
Ambient	none	none	0, 0, 34000	—

(Table-4) The different setting for living room-1 in StrataVision 3D

Living room-1B (Objects and light sources Setting)

Name	Material	Mapping (Horz. & Vert.)	Color (Hue, Sat., Bright.)	Light Intensity
Fireplace	Brick, red (scanned)	0.3	none	—
Ext. wall	Plastic	none	5545, 12926, 60000	—
Int. wall	Plastic	none	5545, 12926, 65535	—
Int. floor	Oak, floor	1	none	—
Ext. floor	Stone (marble)	2	none	—
Ceiling	Rough, plaster (scanned)	1	7000, 4000, 65535	—
Sun light	none	none	white	off
Invisible point light	none	none	white	off
2 point light	none	none	white	2X 60%
2 Spot lights	none	none	white	off
Ambient	none	none	0, 0, 5107	—

(Table-5) The different setting for living room-1B in StrataVision 3D

Living room-1C (Objects and light sources Setting)

Name	Material	Mapping (Horz. & Vert.)	Color (Hue, Sat., Bright.)	Light Intensity
Fireplace	Brick, red (scanned)	0.3	none	_
Ext. wall	Plastic	none	5545, 12926, 60000	_
Int. wall	Plastic	none	5545, 12926, 65535	_
Int. floor	Oak, floor	1	none	_
Ext. floor	Stone (marble)	2	none	_
Ceiling	Rough, plaster (scanned)	1	7000, 4000, 65535	_
Sun light	none	none	white	off
Invisible point light	none	none	white	off
2 point light	none	none	white	off
2 Spot lights	none	none	white	2X 60%
Ambient	none	none	0, 0, 5107	_

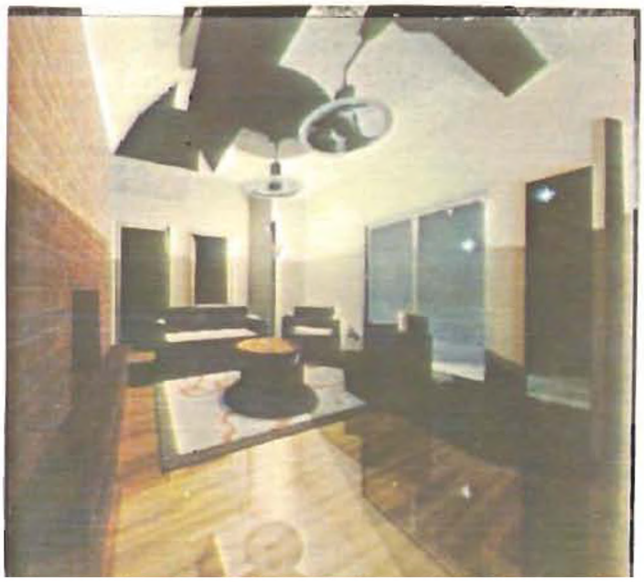
(Table-6) The different setting for living room-1C in StrataVision 3D

Living room-1D (Objects and light sources Setting)

Name	Material	Mapping (Horz. & Vert.)	Color (Hue, Sat., Bright.)	Light Intensity
Fireplace	Brick, red (scanned)	0.3	none	_
Ext. wall	Plastic	none	5545, 12926, 60000	_
Int. wall	Plastic	none	5545, 12926, 65535	_
Int. floor	Oak, floor (scanned)	1	none	_
Ext. floor	Stone (marble)	2	none	_
Ceiling	Rough, plaster (scanned)	1	7000, 4000, 65535	_
Sun light	none	none	white	off
point light	none	none	white	off
2 point light	none	none	white	2X 60%
2 Spot lights	none	none	white	2X 60%
Ambient	none	none	0, 0, 5107	_

(Table-7) The different setting for living room-1B in StrataVision 3D

(Fig-14) Living room-1 rendered



(Fig-15) Living room-1B rendered

(Fig-16) Living room-1C rendered

(Fig-17) Living room-1D rendered

Living room-2 (Objects and light sources Setting)

Name	Material	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Fireplace	Stacco	none	5544, 12926, 55000	—
Ext. wall	Plastic	none	5545, 12926, 60000	—
Int. wall	Plastic	none	5545, 12926, 65535	—
Int. floor	Carpet, tiles (scanned)	0.2	none	—
Ext. floor	Stone (marble)	2	none	—
Ceiling	Rough, plaster (scanned)	1	7000, 4000, 65535	—
Sun light	none	none	white	110%
Invisible point light	none	none	white	20%
2 point light	none	none	white	off
2 Spot lights	none	none	white	2X 40%
Ambient	none	none	0, 0, 34000	—

(Table-8) The different setting for living room-2 in StrataVision 3D

Living room-3 (Objects and light sources Setting)

Name	Material	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Fireplace	Stacco	none	5544, 12926, 55000	—
Ext. wall	Brick, red (scanned)	0.3	none	—
Int. wall	Plastic	none	5545, 12926, 65535	—
Int. floor	Ceramic, tiles	0.2	none	—
Ext. floor	Stone (marble)	2	none	—
Ceiling	Rough, plaster (scanned)	1	7000, 4000, 65535	—
Sun light	none	none	white	110%
Invisible point light	none	none	white	20%
2 point light	none	none	white	off
2 Spot lights	none	none	white	2X 40%
Ambient	none	none	0, 0, 34000	—

(Table-9) The different setting for living room-3 in StrataVision 3D

(Fig-18) Living room-2 rendered

(Fig-19) Living room-3 rendered

Living room-4 (Objects and light sources Setting)

Name	Material	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Fireplace	Stone (scanned)	0.25	none	_
Ext. wall	Wall paper (scanned)	1	none	_
Int. wall	Wall paper (scanned)	0.8	none	_
Int. floor	Tiles-1 (scanned)	0.2	none	_
Ext. floor	Stone (marble)	2	none	_
Ceiling	Wood (scanned)	0.5	none	_
Sun light	none	none	white	110%
Invisible point light	none	none	white	20%
2 point light	none	none	white	off
2 Spot lights	none	none	white	2X 40%
Ambient	none	none	0, 0, 34000	_

(Table-10) The different setting for living room-4 in StrataVision 3D

Living room-5 (Objects and light sources Setting)

Name	Material	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Fireplace	Plastic	none	5545, 12926, 65535	_
Ext. wall	Wood solid	none	none	_
Int. wall	Wood solid	none	none	_
Int. floor	Stone (marble)	1	none	_
Ext. floor	Stone (marble)	2	none	_
Ceiling	Rough, plaster (scanned)	0.25	7000, 4000, 65535	_
Sun light	none	none	white	110%
point light	none	none	white	20%
2 point light	none	none	white	off
2 Spot lights	none	none	white	2X 40%
Ambient	none	none	0, 0, 34000	_

(Table-11) The different setting for living room-5 in StrataVision 3D

(Fig-20) Living room-4 rendered

(Fig-21) Living room-5 rendered

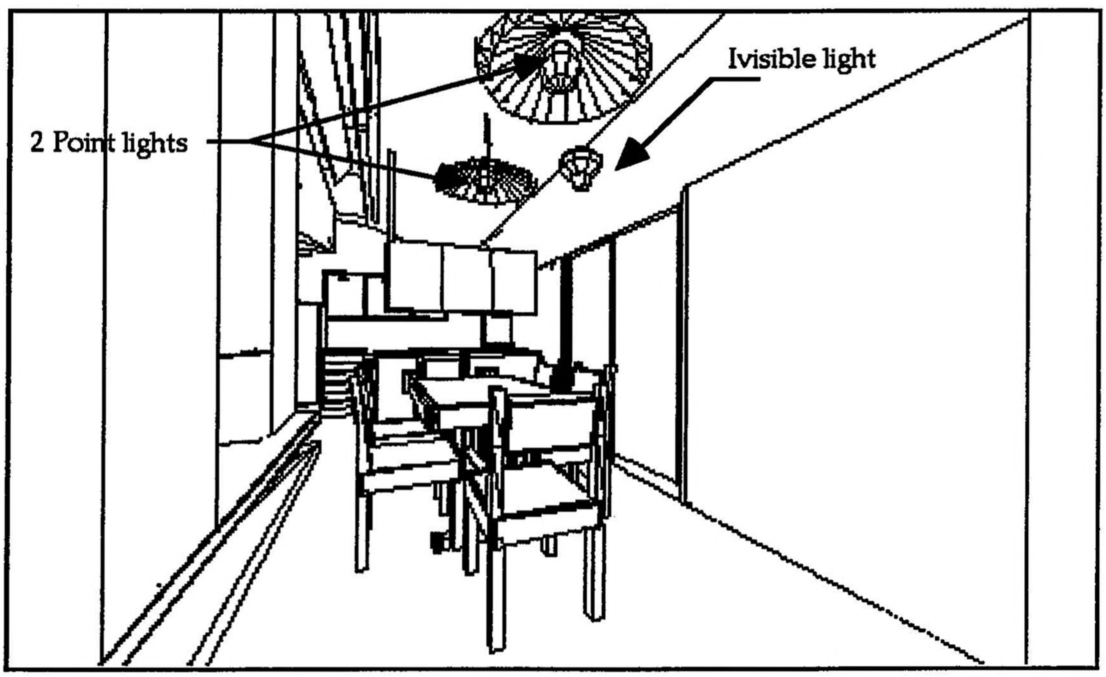
Living room-6 (Objects and light sources Setting)

Name	Material	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Fireplace	Plastic	none	5545, 12926, 65535	—
Ext. wall	Stone (scanned)	0.25	none	—
Int. wall	Wall paper (scanned)	0.8	none	—
Int. floor	Granite, red (scanned)	1	none	—
Ext. floor	Stone (marble)	2	none	—
Ceiling	Plastic	none	5545, 12926, 65535	—
Sun light	none	none	white	110%
Invisible point light	none	none	white	20%
2 point light	none	none	white	off
2 Spot lights	none	none	white	2X 40%
Ambient	none	none	0, 0, 34000	—

(Table-12) The different setting for living room-6 in StrataVision 3D

(Fig-22) Living room-6 rendered

-The wireframe image below (Fig-23) shows the dinning room scene including the different light sources. Notice that the invisible light source is visible in the image here before rendering. As soon as the image has been rendered this light will disappear, but its effect will show. There is 2 point lights in the ceiling light.



(Fig-23)A wireframe shows Dinning room different light sources

-The following tables and images shows the different settings for each image(Table-13) to (Table-16) and (Fig-24) to (Fig-27).

Dinning room-1 (Objects and light sources Setting)

Name	Material	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Fireplace	Brick, red (scanned)	0.3	none	—
Ext. wall	Plastic	none	5545, 12926, 60000	—
Int. wall	Plastic	none	5545, 12926, 65535	—
Int. floor	Hardwood	1	none	—
Ext. floor	Stone (marble)	2	none	—
Ceiling	Rough, plaster (scanned)	1	7000, 4000, 65535	—
Sun light	none	none	white	110%
Invisible point light1	none	none	white	10%
Invisible point light2	none	none	white	10%
2 point light	none	none	white	off
Ambient	none	none	0, 0, 34000	—

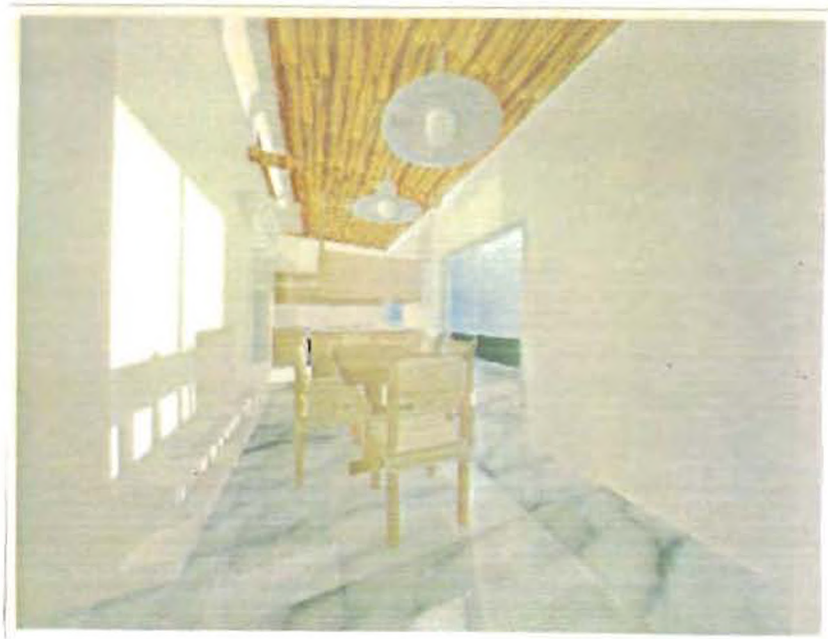
(Table-13) The different setting for dining room-1 in StrataVision 3D

Dinning room-2 (Objects and light sources Setting)

Name	Material	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Fireplace	Plastic	none	5545, 12926, 60000	—
Ext. wall	Plastic	none	5545, 12926, 60000	—
Int. wall	Plastic	none	5545, 12926, 65535	—
Int. floor	Stone (marble)	2	none	—
Ext. floor	Stone (marble)	2	none	—
Ceiling	Wood (scanned)	0.5	none	—
Sun light	none	none	white	110%
Invisible point light1	none	none	white	10%
Invisible point light2	none	none	white	10%
2 point light	none	none	white	off
Ambient	none	none	0, 0, 34000	—

(Table-14) The different setting for dining room-2 in StrataVision 3D

(Fig-24) Dining room-1 rendered



(Fig-25) Dining room-1B rendered

Dinning room-3 (Objects and light sources Setting)

Name	Material	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Fireplace	Plastic	none	5545, 12926, 60000	_
Ext. wall	Stone (scanned)	0.25	none	_
Int. wall	Plastic	none	5545, 12926, 65535	_
Int. floor	Stone (marble)	2	none	_
Ext. floor	Tiles-3 (scanned)	0.2	none	_
Ceiling	Plastic	none	5545, 12926, 65535	_
Sun light	none	none	white	110%
Invisible point light1	none	none	white	10%
Invisible point light2	none	none	white	10%
2 point light	none	none	white	off
Ambient	none	none	0, 0, 34000	_

(Table-15) The different setting for dining room-3 in StrataVision 3D

Dinning room-3B (Objects and light sources Setting)

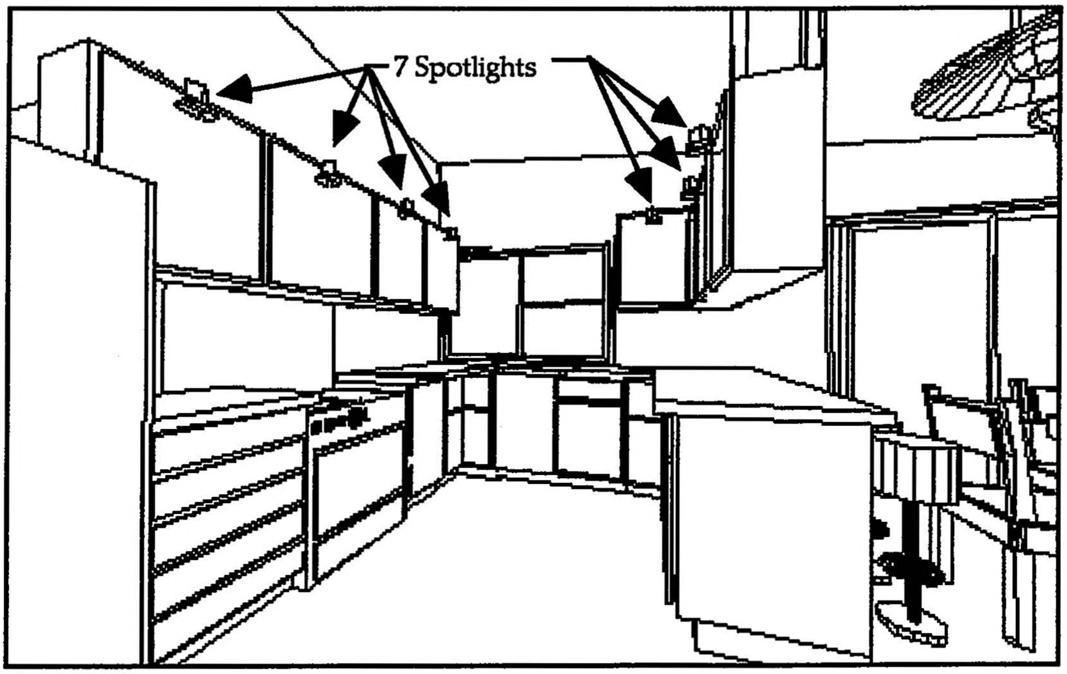
Name	Material	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Fireplace	Plastic	none	5545, 12926, 60000	_
Ext. wall	Stone (scanned)	0.25	none	_
Int. wall	Plastic	none	5545, 12926, 65535	_
Int. floor	Stone (marble)	2	none	_
Ext. floor	Tiles-3 (scanned)	0.2	none	_
Ceiling	Plastic	none	5545, 12926, 65535	_
Sun light	none	none	white	off
Invisible point light1	none	none	white	off
Invisible point light2	none	none	white	off
2 point light	none	none	white	2X 100%
Ambient	none	none	0, 0, 5107	_

(Table-16) The different setting for dining room-3B in StrataVision 3D

(Fig-26) Dining room-3 rendered

(Fig-27) Dinning room-3B rendered

-The wireframe image below (Fig-28) shows the kitchen scene including the different light sources. Notice that the invisible light source is placed beside the camera in the image here before rendering, so that it didn't show here. As soon as the image has been rendered this light will disappear, but its effect will show. There is seven spotlights in the top of each upper cabinet.



(Fig-28)A wireframe shows Kitchen's different light sources

-The following tables and images shows the different settings for each image (Table-17) to (Table-19) and (Fig-29) to (Fig-31).

Kitchen-1 (Objects and light sources Setting)

Name	Material	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Wall	Plastic	none	5545, 12926, 60000	—
Floor	Hardwood	1	none	—
Ceiling	Rough, plaster (scanned)	1	7000, 4000, 65535	—
Cabinets	Plastic	none	5910, 34179, 49151	
Cabinets' doors	Plastic	none	5910, 34179, 43115	
Sun light	none	none	white	110%
Invisible point light	none	none	white	10%
Cabinets' Spotlights	none	none	white	off
Ambient	none	none	0, 0, 34000	—

(Table-17) The different setting for kitchen-1 in StrataVision 3D

Kitchen-1B (Objects and light sources Setting)

Name	Material	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Wall	Plastic	none	5545, 12926, 60000	—
Floor	Hardwood	1	none	—
Ceiling	Rough, plaster (scanned)	1	7000, 4000, 65535	—
Cabinets	Plastic	none	5910, 34179, 49151	
Cabinets' doors	Plastic	none	5910, 34179, 43115	
Sun light	none	none	white	off
Invisible point light	none	none	white	off
Cabinets' Spotlights	none	none	white	7X 30%
Ambient	none	none	0, 0, 5107	—

(Table-18) The different setting for kitchen-1B in StrataVision 3D

(Fig-29) Kitchen-1 rendered

(Fig-30) Kitchen-1B rendered

Kitchen-2 (Objects and light sources Setting)

Name	Material	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Wall	Ceramic tiles	0.2	none	_
Floor	ceramic tiles	0.2	none	_
Ceiling	Rough, plaster (scanned)	1	7000, 4000, 65535	_
Cabinets	Wood surface	0.5	none	
Cabinets' doors	Wood surface	0.5	none	
Sun light	none	none	white	110%
Invisible point light	none	none	white	10%
Cabinets' Spotlights	none	none	white	off
Ambient	none	none	0, 0, 34000	_

(Table-19) The different setting for kitchen-2 in StrataVision 3D

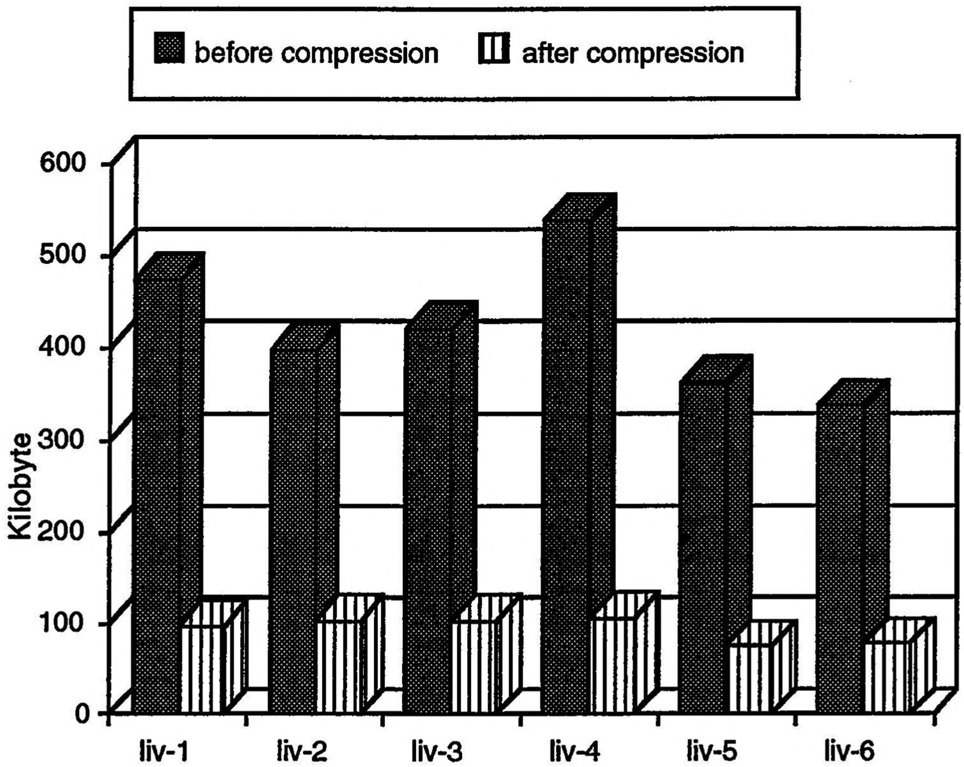
(Fig-31) Kitchen-2 rendered

-The previous living room rendered images has been saved first normally, then QuickTime compression method has been applied. The images' size has been reduced dramatically without any noticeable loss in quality (Table-20) & (Fig-32).

-The following table and chart show this difference.

	Before compression (KB)	After compression (KB)
liv-1	473	95
liv-2	396	102
liv-3	420	102
liv-4	539	105
liv-5	361	74
liv-6	336	77

(Table-20) The file size before and after compression using StrataVision 3D



(Fig-32) A graph shows the file size before and after compression 9.4.

Case study #4 (Rendering The Exteriors)

-The same steps mentioned above has been applied to render the exterior for the model.

-The first 3 images a blue sky scanned image has been used as a back ground. The rest of images different scanned scenes has been used to add more realistic, an to study the effect of the surroundings.

-Adobe Photoshop has been used later to retouch the rendered image. Some objects (such as trees) has been cut from the scanned background image and pasted in front of the building to add more realistic.

-The following tables and images shows the different settings and the result (Table-21) to (Table-26) and (Fig-33) to (Fig-38).

Elevation-1 (Objects and light sources Setting)

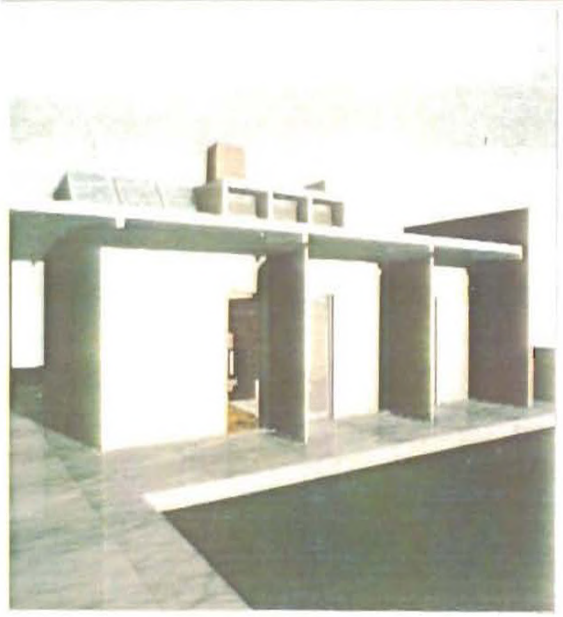
Name	Material (or image)	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Wall	Plastic	none	5545, 12926, 60000	—
Wall (side)	Brick, red (scanned)	0.3	none	—
Floor	Stone (marble)	1	none	—
Roof	Rough, plaster (scanned)	1	7000, 4000, 65535	—
Fins	Plastic	none	—	—
Sun light	none	none	white	110%
Background	Blue sky (scanned)	none	none	—

(Table-21) The different setting for elevation-1 in StrataVision 3D

Elevation-2 (Objects and light sources Setting)

Name	Material (or image)	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Wall	Stone (scanned)	0.25	none	—
Wall (side)	Plastic	none	5545, 12926, 60000	—
Floor	Tiles-3	0.2	none	—
Roof	Rough, plaster (scanned)	1	7000, 4000, 65535	—
Fins	Plastic	none	—	—
Sun light	none	none	white	110%
Background	Blue sky (scanned)	none	none	—

(Table-22) The different setting for elevation-2 in StrataVision 3D



(Fig-33) Elevation-1 rendered

(Fig-34) Elevation-2 rendered

Elevation-3 (Objects and light sources Setting)

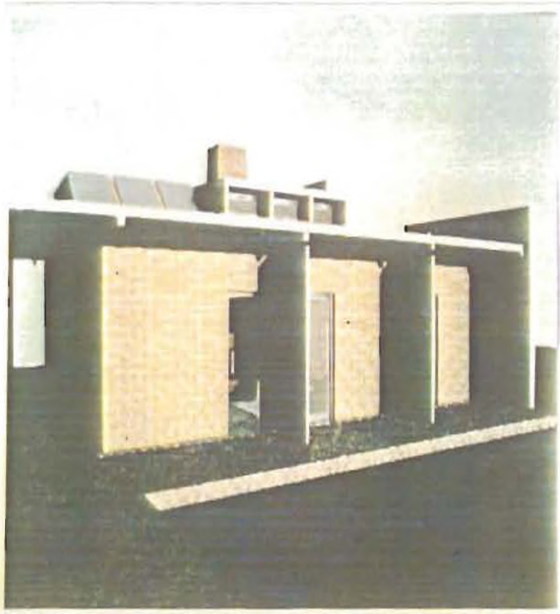
Name	Material (or image)	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Wall	Brick, red (scanned)	0.5	none	—
Wall (side)	Plastic	none	5545, 12926, 60000	—
Floor	Gravel (scanned)	1	none	—
Roof	Rough, plaster (scanned)	1	7000, 4000, 65535	—
Fins	Plastic	none	5545, 12926, 60000	—
Sun light	none	none	white	110%
Background	Blue sky (scanned)	none	none	—

(Table-23) The different setting for elevation-3 in StrataVision 3D

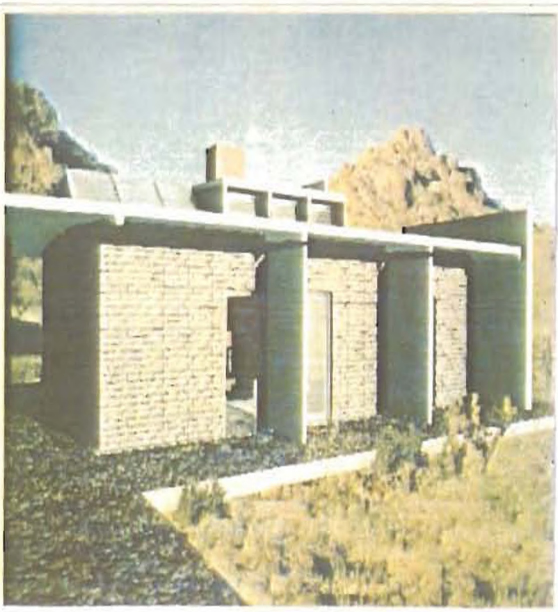
Elevation-4 (Objects and light sources Setting)

Name	Material (or image)	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Wall	Stone (scanned)	0.25	none	—
Wall (side)	Plastic	none	5545, 12926, 60000	—
Floor	Gravel (scanned)	1	none	—
Roof	Rough, plaster (scanned)	1	7000, 4000, 65535	—
Fins	Plastic	none	5545, 12926, 60000	—
Sun light	none	none	white	110%
Background	Desert (scanned)	none	none	—

(Table-24) The different setting for elevation-4 in StrataVision 3D



(Fig-35) Elevation-3 rendered



(Fig-36) Elevation-4 rendered

Elevation-5 (Objects and light sources Setting)

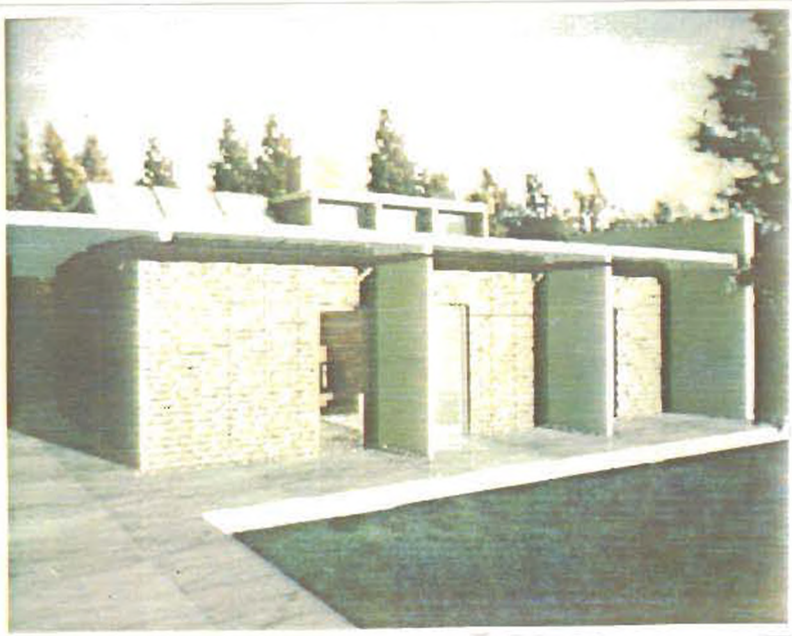
Name	Material (or image)	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Wall	Stone (scanned)	0.25	none	—
Wall (side)	Plastic	none	5545, 12926, 60000	—
Floor	Stone (marble)	1	none	—
Roof	Rough, plaster (scanned)	1	7000, 4000, 65535	—
Fins	Plastic	none	5545, 12926, 60000	—
Sun light	none	none	white	110%
Background	Forest (scanned)	none	none	—

(Table-25) The different setting for elevation-5 in StrataVision 3D

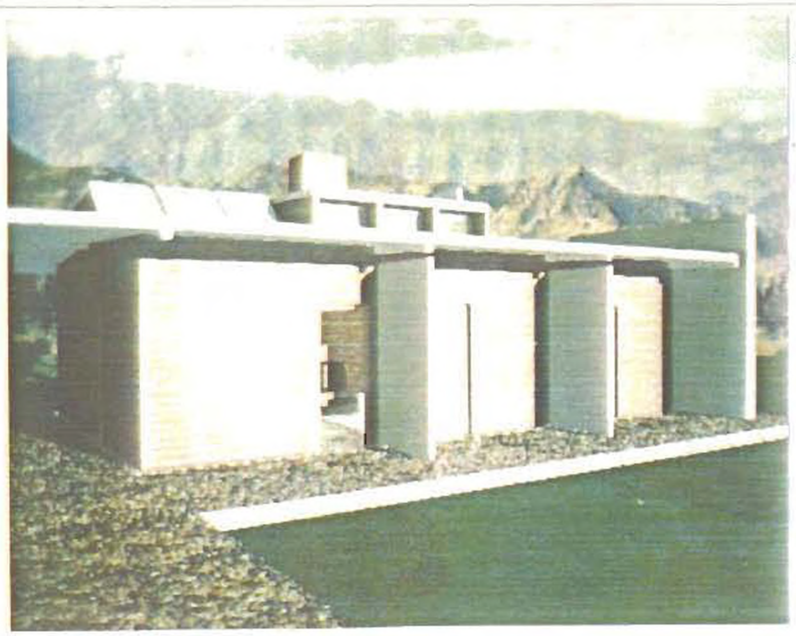
Elevation-6 (Objects and light sources Setting)

Name	Material (or image)	Mapping (H & V)	Color (Hue, Sat., Bright.)	Light Intensity
Wall	Brick (scanned)	0.5	none	—
Wall (side)	Plastic	none	5545, 12926, 60000	—
Floor	Gravel (scanned)	1	none	—
Roof	Rough, plaster (scanned)	1	7000, 4000, 65535	—
Fins	Plastic	none	5545, 12926, 60000	—
Sun light	none	none	white	110%
Background	Mountains (scanned)	none	none	—

(Table-26) The different setting for elevation-6 in StrataVision 3D



(Fig-37) Elevation-5 rendered



(Fig-38) Elevation-6 rendered

9.5. Case study #5 (Rendering Settings' Comparison in ArchiCAD)

-In this study a comparison has been done between the different settings in ArchiCAD rendering.

-ArchiCAD uses Phong algorithm to render the 3D model.

-There is two major settings has been taken in consideration into this comparison.

-Anti-aliasing is one of them. There is 4 different settings off, good, better, or best.

-Method of rendering is the second setting. It can be flat shading, better, final, or best. With "best" the program works in full, calculating the light attributes of each pixel. As the choices decrease in quality it will calculate individual values for every second or third pixel only. Flat shading means that each shape is roughly approximated by flat surfaces only, and special effects like transparency, smooth surfaces, highlights light decay will not be available.

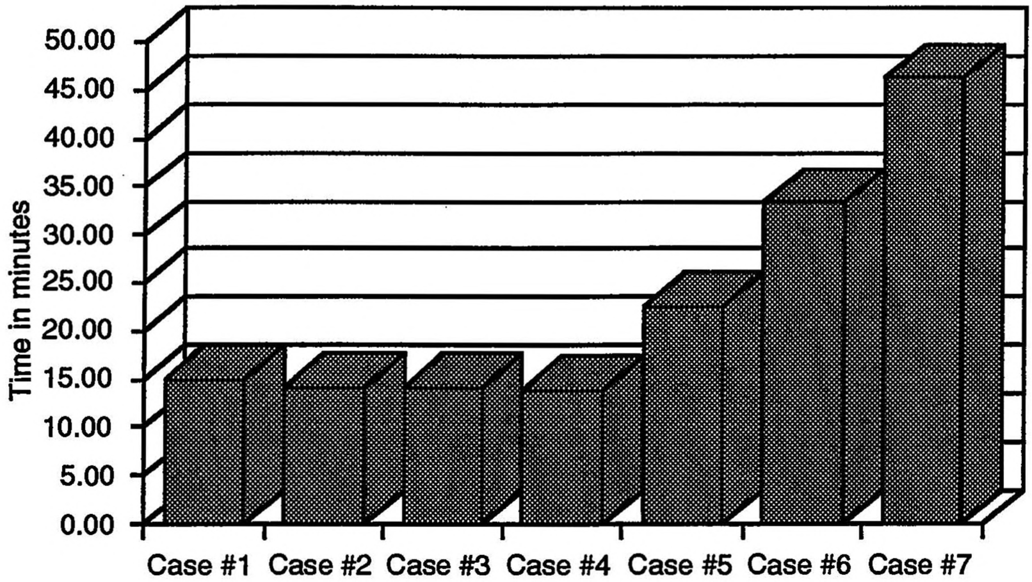
-The method of rendering didn't affect much the time consumed by the rendering.

-Anti-aliasing doubled the time needed for the rendering.

-By turning off the anti-aliasing and using any other program like the JAG program or the AdobePhotoshop to anti-alias the rendered image will speed up the process.

-Of course the time consumed to render any image depend on the image size, the larger the image the more time it takes.

-The following chart shows the time consumed, and PICT file size by each method (Fig-39) and (Table-27).



(Fig-39) The difference in minutes between different settings in ArchiCad

Case no.	Time (minutes)	Anti-aliasing	Method	Background	All effects	File size (kilobytes)
Case #1	15:00	off	best	yes	on	186
Case #2	14:09	off	final	yes	on	186
Case #3	14:03	off	better	yes	on	186
Case #4	13:52	off	flat shading	yes	on	182
Case #5	22:35	good	flat shading	yes	on	189
Case #6	33:24	better	flat shading	yes	on	193
Case #7	46:17	best	flat shading	yes	on	196

(Table-27) The different setting, time consumed, and file size using ArchiCad

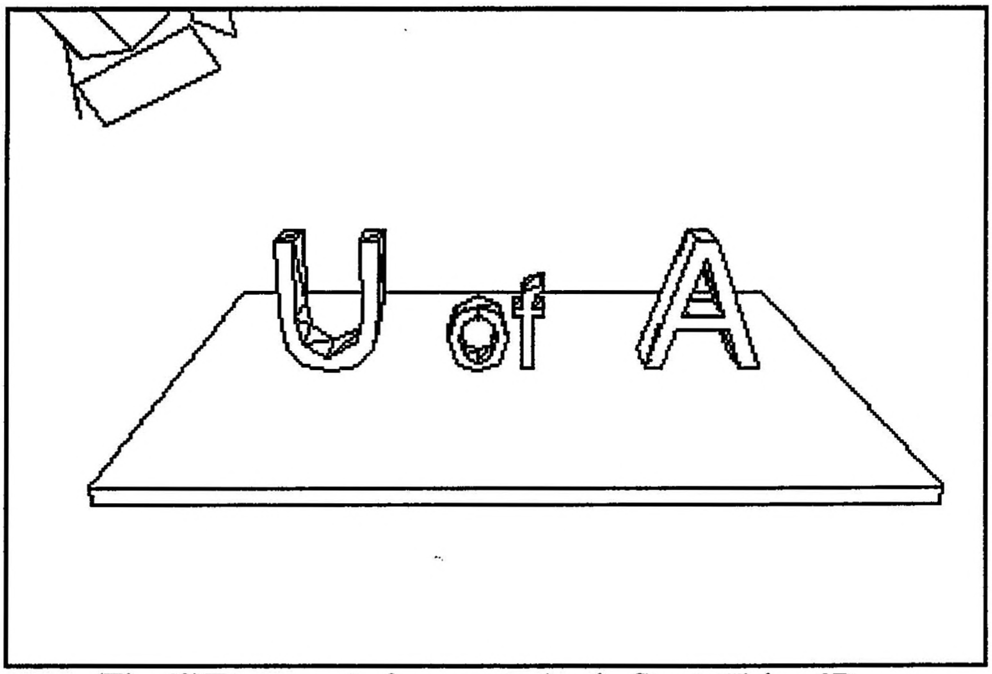
9.6. Case study #6 (Rendering Algorithms' Comparison in StrataVision)

-This case study is focusing on the time consumed by StrataVision's algorithms to render a 3D model.

-The model has been created completely by StrataVision 3d using its primitive shapes, text, and extrude command (Fig-40).

-The model consists of extruded text which is " U of A", and a base. The light source here is a spotlight.

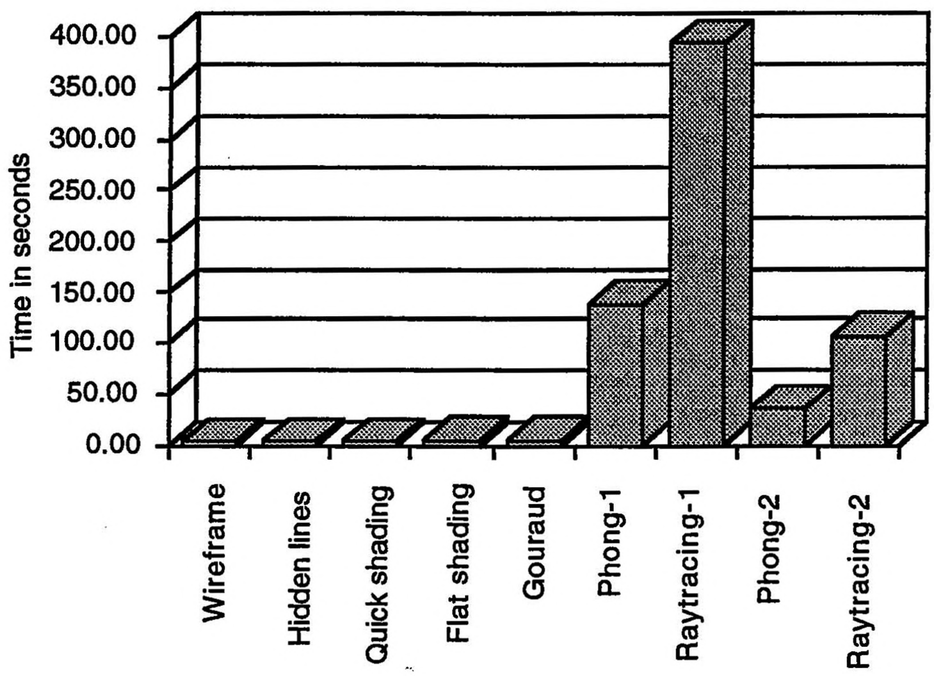
-The letter "U" has been set to be Shiny blue metal. The letter "A" has been set to be semitransparent red plastic. "Of" has been set to be transparent yellow. As for the base, it has been mapped with black and white shiny squares. The following table, Charts and Images shows the different renderers, the time, and the file size (Table-28) and (Fig-41) to (Fig-48).



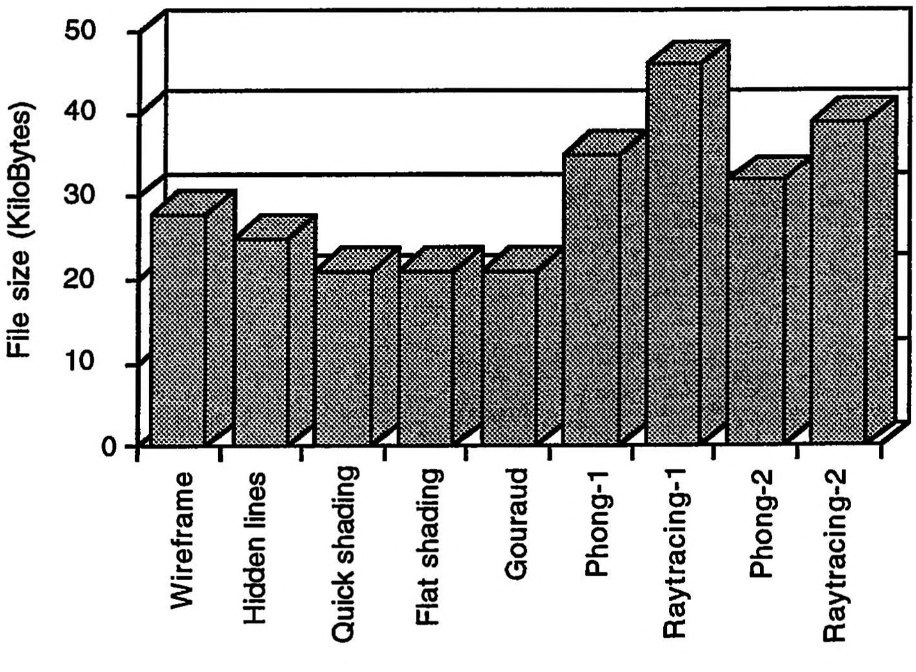
(Fig-40)The scene before rendering in StrataVision 3D

Renderer	Time (seconds)	File size KB	comments
Wireframe	3.35	28	all effects on
Hidden lines	3.53	25	all effects on
Quick shading	3.21	21	all effects on
Flat shading	4.71	21	all effects on
Gouraud	5.26	21	all effects on
Phong-1	137.71	35	all effects on
Raytracing-1	393.91	46	all effects on
Phong-2	35.53	32	antialiasing off
Raytracing-2	105.29	39	antialiasing off

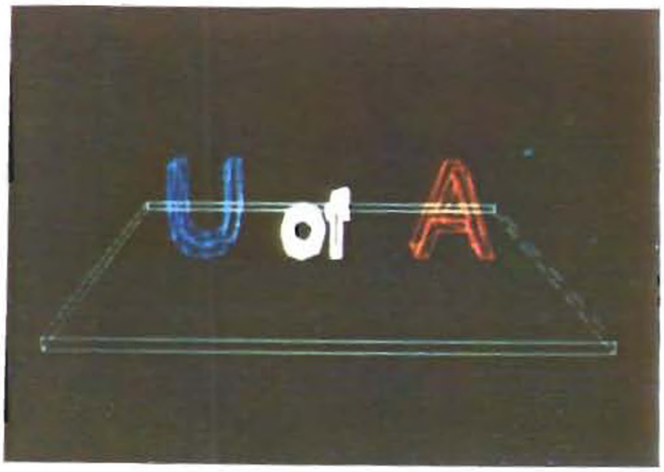
(Table-28) The different renderer and the time consumed using StrataVision 3D



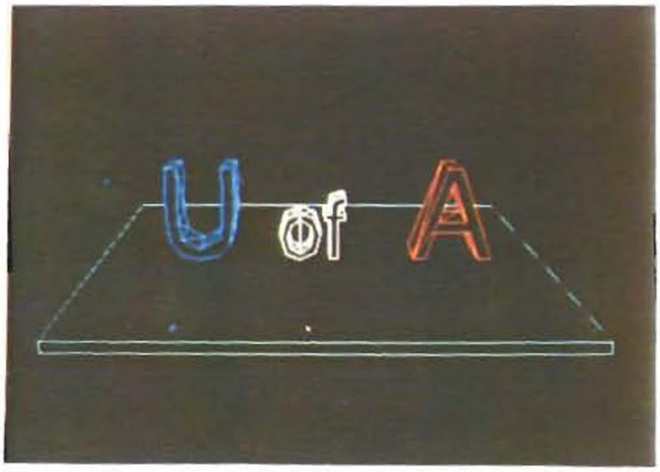
(Fig-41)Time consumed using StrataVision renderer



(Fig-42) Files' size for different rendered images

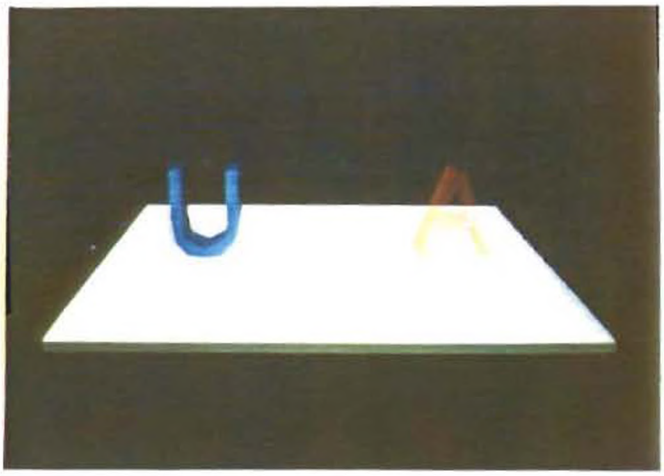


(Fig-43) The wireframe

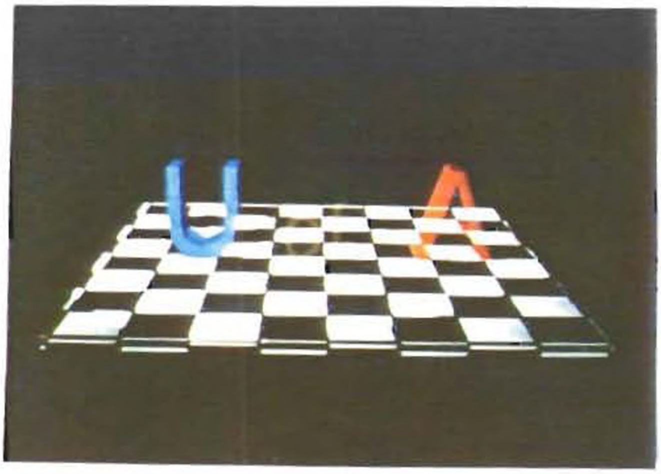


(Fig-44) The hidden lines

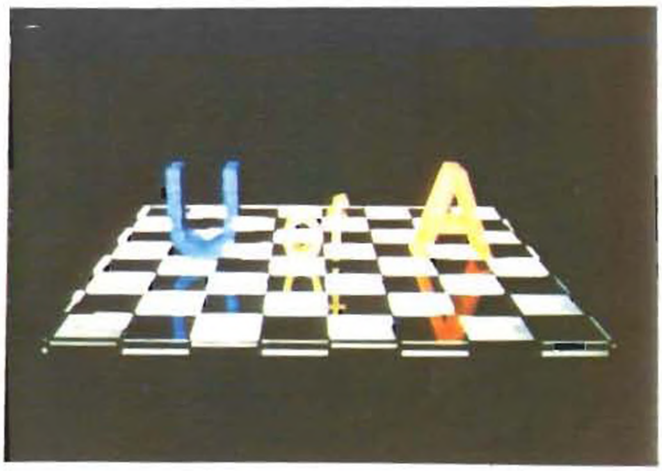
(Fig-45) The quick & flat shading



(Fig-46) The Gouraud



(Fig-47) The Phong



(Fig-48) The Raytrace

9.6. Case study #7 (context study)

-In this study ArchiCad 4.03 had been used to superimpose the building in different sites (Fig-49). The following steps describe the process:

-Microteck scanner had been used to scan some images to use them as a background to superimpose the building into that site.

-One block representing the building in a separate layer has been modeled.

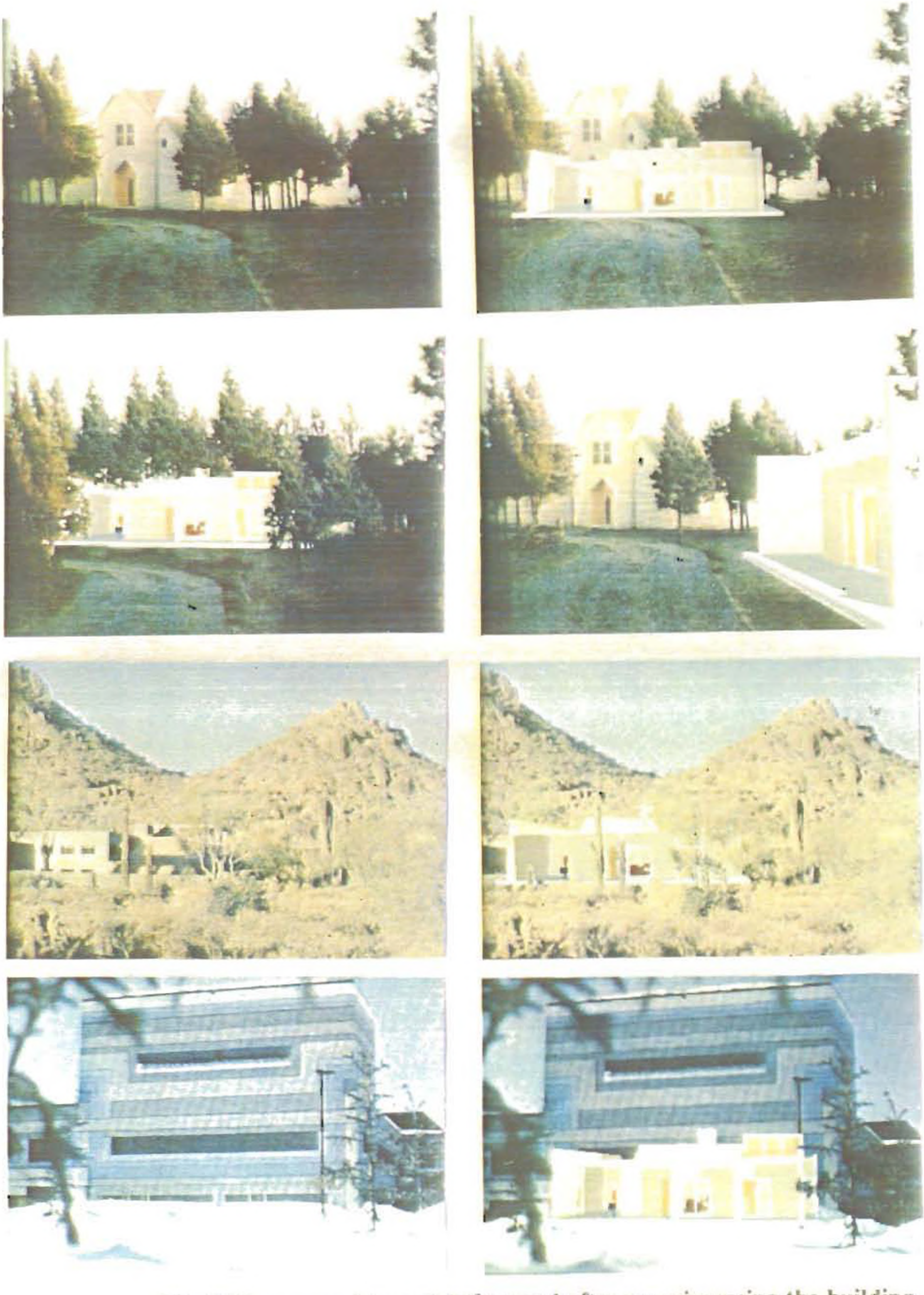
-The block was rendered along with the background while the other layers has been turned off.

-Adjustment has been done to make the block fit in the site (scanned image).

-As soon as the experimental block superimposed into the site, its layer has been turned off.

-After turning all the other layers on, the building has been rendered along with the background.

-Different scanned images has been used as seen in figure-49.



(Fig-49)the scanned images before and after superimposing the building

Appendix (A)
Multimedia Terminology

•**Audio Interchange File format(AIFF or audio IFF):** A standard audio file format supported by many applications.

•**Betacam:** Professional component video 1/2-inch recording format using a cassette resembling that of Betamax.

•**Betamax:** A 1/2-inch home-video format developed by Sony, later eclipsed by VHS despite Betamax's higher quality because of Betamax shorter record/play time and RCA's aggressive marketing of VHS.

•**Blanking:** Interval during which a CRT's electron beam blanks out while it traces back to the start of the next line (horizontal blanking) or while it traces from the bottom of the screen to the top of the next field or frame of video (vertical blanking).

•**Brightness:** The amount of white (as compared to the amount of red, green, and blue) in a color. On a monitor this translates into the amount of light)pure light, in addetive color, produces white). For light sources, the brightness component is also called luminance.

•**Codec:** A compression/decompression system extension used by QuickTime to save disk space. Different codecs use different image compression schemes.

•**Color Components:** The colors Red, Green, and Blue (RGB), which produce all colors on the display when combined in varying percentages.

•**Color Depth:** The number of bits used to define the color of each pixel on the screen. 1-bit is black and white. 4-bit is 16 colors. 8-bit allows 256 colors. 24-bit provides 16.7 million colors. Also called "Pixel Depth" and "Bit Depth".

•**Component video:** Video-signal-transmission system used in Betacam and MII professional videotape formats. It separates luminance and two chrominace channels to avoid the loss of quality caused by NTSC (or PAL) encoding. Resembles S-video in concept.

•**Composite video:** Video signal that combines luminance and chrominance signals through an encoding process (such as NTSC) into a single signal that includes both picture and sync information. Composite video is easier to transmit, but picture is degraded compared with component, S-video, or RGB signals.

•**Contrast:** The ratio between the maximum and minimum luminance (brightness) values of a display.

•**Digitize:** The process of converting an analog signal into digital signal. It can be a sound or an image from analog to digital format.

•Field: One half of the scan lines in an interlaced monitor. In interlaced display, scan lines divided into odd and even. One half (field) is drawn, then the other.

•**Frame:** A single video image, containing both even and odd fields. In NTSC, there are 30 frames per second. PAL has 25 frames per second.

•**FPS:** An acronym for frames per second. The rate at which images are displayed on the screen. Video images (NTSC) are displayed at 30 FPS.

•**Genlock:** The ability of device that handles video signals to synchronize itself to an external signal, as for overlaying graphics onto incoming signal.

•**Hi8 Video:** Higher quality extension of the Video 8 format with higher luminance resolution. It is to Video8 what S-VHS is to VHS.

•**Interlaced video:** The process of scanning frames in two passes. with each pass painting every other line of the frame onto the screen. NTSC's 525-line frame scans in two fields of 262.5 lines each that take 1/60 second to paint. Thus, each frame takes 1/30 second to paint.

•**MII:** Professional component-video 1/2-inch recording format, based on cassette similar to that of home VHS tape.

•**Movie:** In Macintosh terms, a file of dynamic data combining video and audio. The file in QuickTime format, the new Macintosh protocol for multimedia.

•**Non-interlaced:** The process of scanning complete video frames in one pass. This usually produces higher image quality than interlaced video produces.

•**NTSC:** National Television Standards Committee, which the 525-line, 30 frame per second TV standard currently used in U.S., Canada, Mexico, Japan, and a few other countries.

•**PAL:** Phase Alteration by line, the 625-line, 25 frame per second TV standard used in Western Europe, India, China, Australia, New Zealand, Argentina, and part of Africa.

•**Pixel:** A single dot displayed by a monitor. On the standard 13" Apple color monitor there are 640X480 pixels. each one of these pixels can be described in software by 1, 2, 4, 8, 16, 24, or 32 bits to produce 2, 4, 16, 256, 32000, or 16.7 million colors.

•**QuickTime:** Apple's new protocol; for real time multimedia. QuickTime integrates moving images and sound in a single, new data type called dynamic data. the new data type makes multimedia data as transparent as text and graphics, so that the data can be cut and pasted in all document as easily as text and graphics.

•**RGB:** Method of transmitting video signals that feeds the basic red, green, and blue channels over separate wires. This provides the highest quality video signal and is the native format for most computer equipment.

•Saturation: the amount of pure hue (red, green, and blue) in a color, relative to the amount of white it contains.

•**S-VHS:** Higher quality extension of the VHS format. It features higher luminance (but same chroma) resolution. It is to VHS what Hi8 to video 8.

•**S-Video:** Type of video signal used in the Hi8 and S-VHS videotape formats. It transmits luminance and color portions separately, using multiple wires, thus avoiding the NTSC encoding process and its inevitable loss of picture quality.

•**SECAM:** Stands for Système Electronique pour Couleur Avec Mémoire, the 625-line, 25 frame per second TV system used in France, Eastern Europe, the USSR, and parts of Africa.

•**SMPTE time code, or SMPTE:** Society of Motion Picture and Television Engineers' system of giving each frame of video a unique number to allow indexing and precise tape control. The SMPTE signal is recorded as a modulated audio signal on an audio channel, as a dedicated address track (called Longitudinal Time Code or LTC), or as a visible digital signal in the vertical-blanking interval above the active picture area (called Vertical Interval Time Code, or VITC). Frames are identified in an hours-minutes-seconds-frames format - 08:12:37:22, for example.

•**VHS:** A 1/2 inch video system developed by Matsushita that has become the predominate home format.

•**Video 8, 8mm Video:** The tape format based on the 8-millimeter videocassettes popularized by camcorders.

•**Sampling Rate:** The number of intervals per second used to capture a sound when it is digitized. Sampling rate affects sound quality; the higher the sampling rate, the higher the sound quality.

Appendix (B)
Rendering Terminology

•**Anti-aliasing:** The process of reducing the visibility of aliasing by using gradient pixel values to smooth the appearance of jagged edges. If this is done well, the eye creates smooth curved lines and diagonals.

•**Animation:** A series of still images which, when presented in rapid succession, create the illusion of motion.

•**Bump:** in the mapping it alters the object's normals based on the image to reflect light in different directions and approximate the way light is affected by an actual textured surface.

•**Diffuse reflection:** The light that scatters in all directions. It makes the materials appears matte or dull.

•**Extrude:** To push two dimensional objects through space to create new three dimensional objects.

•**Flat Shading:** Rendered the object with solid surfaces.

•**Glow Factor:** determines the amount of luminescence a surface emits, without reflecting light from an outside source (i.e. gives neon-like).

•**Gouraud:** Shading oriented rendering algorithm to refine the image specifically in how an object's surfaces are shaded.

•**Index of Refraction:** Light bent or changing of direction (available in ray tracing method).

•**Lathe:** To spin two and three dimensional objects around an axis to create new three dimensional version.

•**Mapping:** Using two dimensional bit-mapped images and treating them as if they were the surface of a two or three dimensional objects.

•**Phong:** It is a light oriented algorithm capable to handle transparent surfaces and perform image mapping.

•**Ray Tracing:** the most capable rendering mode. It calculates how rays of light react to the objects within the model before reaching the viewer's eye. It creates the most photo-realistic images.

•**Reflectivity:** It is the bouncing of light off a surface into the area around it and towards the viewpoint(available with ray tracing and phong).

•**Smooth Edges or Anti-Aliasing:** the stair-stepped appearance minimized with this effect.

•**Smooth Surfaces:** Adjusts how an object's curved surface are rendered, because of the polygon that create the curvature, a smoother appearance can be obtained by averaging the change across polygon surfaces.

•**Specular Fraction:** The first component of the reflected light determines how much of the total light reflected from a surface. It creates highlights on an object.

•**Transparency:** Describe the amount of light that passes through a surface.

Appendix (C)
Hardware and Software used

The software and the hardware that has been used to create the presentation accompanying this Master report are mentioned below.

•SOFTWARE

-ArchiCAD 4.03

-AutoCAD 10

-StrataVision 3d 2.5

-JAG 1.0

-AdobePhotoshop 2.0.1

-MacroMind Director 3.0

-Adobe premiere

Sound Edit 2.0.7

•HARDWARE

-MAC IIci, 8MB RAM, 80 MB HD, Apple 8•24 DisplayCard, 13" Apple monitor

-Macintosh Quadra 900, 36MB RAM, 210 MB HD, NEC 4FG monitor

-MacRecorder

-ComputerVision video encoder

-Sony CD player

-Peripheral Vision 44MB removable Syquest

-Microteck 300ZS scanner

Appendix (D)
Video output Optimization

Graphics created on a non-interlaced monitor (computer monitor) may lose quality when displayed on an interlaced monitor (TV monitor). The following precaution will optimize the quality of graphics that have been created on a non-interlaced monitor to be displayed on an interlaced monitor:

-Highly saturated colors often have fuzzy edges. Avoid highly saturated colors such as bright red. Some programs have special color palette for NTSC.

-High contrast between adjacent areas can increase the flickering and can create fuzzy edges. For example, black text is more clear to read on a colored background than on a pure white.

-For text a larger font (at least 18 point) will make text more readable. Anti-aliased text gives cleaner appearance.

-Horizontal lines must be at least two pixels. This will minimize flickers.

-During the creation of the project review it in its early stages on an interlaced monitor to make any required adjustments.

-Do not let your project to fill the entire computer monitor (the 13” monitor with 640x480). The right 64 pixel and the lower 50 pixel will not appear on the TV screen or when it is recorded on a VCR. Keep the project within the 85% of the total computer monitor area.

-To show the entire desktop on the interlaced monitor, set the display card to a smaller monitor.

Appendix (E)

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