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Overview of Movie Group Software

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Generally speaking the software is in source form on disk and tape with rough draft documentation.

The movie making process consists of two steps: First, the artist/programmer defines the objects in the movie and the motions of the objects. Second, he gives this information to TRANEW, which computes the movie frames and either displays the result or records the output on film. Most of the work involves going through this process repeatedly, revising the input until the movie looks right.

TRANEW

TRANEW is the movie making program. There is an operating manual for TRANEW that explains each command with about a paragraph of text. The manual also explains the format of the input files that define objects and motions. This manual is probably sufficient for a moderately skilled person to learn to use the program and then to teach it to someone else. The manual might be adequate for a highly motivated person with no previous TRANEW experience.

The input to TRANEW is disk files and/or typed commands. The disk files describe objects, from something as simple as a cube to as complex as an X-wing fighter. An object description is based on a list of polygons, but may also include color, reflectivity, texture, transparency, and shape information for bicubic patches (lumpy polygons). Other disk files specify the lighting, eyepoint (camera position), movement of objects, and movement of the camera. Commands tell TRANEW the output format and picture resolution. The output from TRANEW may go directly to the color monitor, to magnetic tape, or to disk. When making movies, the output is a series of disk files that describe how much red (and green and blue) to put at a particular place on the film. We don't have any document that describes the format of the output files from TRANEW.

Language and Portability Considerations

TRANEW is written in FORTRAN, with a substantial amount of PDP10 assembly code for speed. The internal data formats depend on a 36 bit word length, because of the designers desire to cram as much data as possible into memory. If the program is to be moved to another machine, some work will be needed on these machine dependent aspects. The other PDP10 programs are written in FORTRAN, MACRO (assembly), SAIL, and LISP.

Another consideration is that TRANEW is slow on complex objects (the interesting, useful ones). The program was developed on the KA10 processor, but runs very slowly. It is probably acceptable on a KL10, which is half as fast as Foonly. If the program is converted to run on a faster, number crunching machine, this shouldn't be a problem. The PDP10 memory space is probably inadequate to run TRANEW in real applications; The programmers needed the extra MMM memory to do complex pictures. There are several schemes for extending the PDP10 architecture to address additional memory. Since the places where TRANEW uses extra address space are already marked in the code, it should be easy to convert to any extended memory scheme. TRANEW did some work before Foonly was operating, so some level of animation is possible with an ordinary PDP10.

SHADER

A I1115 computer controls the exposing of film. The I1115 program is called SHADER. The source files for SHADER are fine. The operating instructions for SHADER need to be expanded. Its behavior is controlled by patches made when the program is loaded.

ASAS

ASAS is the director's language. It is used to describe the motions of the objects. ASAS is written in MACLISP (the MIT dialect of LISP). The documentation is reasonable. A thesis is included to explain the point of it all. A file of update notes describes the evolution of the program in recent years. The program had reached the capacity of the KA10 in terms of scene complexity; LISP was running out of space. LISP is semi-portable: Many machines have a LISP, but no two dialects agree. We have good documentation (a manual) for LISP.

3D2 and TUBES

Most objects are defined with the encoding station, an equipment group including the big data tablet and several displays, controlled by the III15 in the southeast corner of the Foonly room. The state of the encoding station needs further examination. The programs are available but the operating instructions are fragmentary. The encoding station programs are written in CASTLE language, which is implemented in III15 code. The utilities are written in CASTLE, and III15 assembly. There is a manual for CASTLE. If we sell the encoding station, the III15 should go with it to support the displays and the software. The output of the encoding station is a tape, which is read into Foonly and converted into PDP10 format.

GEOMED

Some object creation was done directly on the PDP10 using Baumgart's GEOMED. This program works best with the Leahy display. The program originally was written for the Stanford display system, which is very similar to one we have in house. I have seen a version of it work with the TEKTRONIX terminal, but I'm not sure if it was ever used that way for production. We have good documentation (a manual) for GEOMED.

TWEAK

There are several utility programs for editing objects; the workhorse programs are documented with cheat sheets. These should be usable with some experimentation. There is a collection of utilities for fixing specific database problems; these typically have a paragraph of documentation. The utilities for manipulating the object data bases are mostly written in SAIL, a language specific to the PDP10 (written at the Stanford AI Lab). We have a SAIL manual.

Other Utilities

There is a collection of test programs for the DFP. These utilities were also used to initialize it for shooting film. There are programs to produce color calibration wedges on different output media. We have tests for KBOX and for the STC disk.

Miscellaneous Notes

The programmers occasionally used picture input from a scanner as an ingredient. I think this was used for texture files. I didn't locate any specific information about textures or fractal surfaces. Both of these effects have been used in movie output.

In examining the disk data, I noticed source files for many programs. It seems likely that source files for all programs are present. We don't have instructions for compiling the programs, but we can probably work them out.



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DIGITAL SCENE SIMULATION SYSTEM FACT SHEET

Foonly 1 Mainframe computer with 1 Megabyte memory.
Executes 10 times as fast as a DEC KA10.
Top speed 10 million instructions per second.
Pipelined architecture.

Instruction prefetch.
2K by 72 bit writable microcode.
Up to 8 terminals.
Printer 600/300 LPM.
2048 word memory cache.
Cached IO controller.
PDP-10 style IObus.
Disk and tape subsystem:
4 x 50 MByte drives.
800/1600 bpi tape drive, 110 ips.
Tektronix storage terminal with vectors.

1000 x 1000 color monitor, 60 Hz refresh, interlaced.
Driven from 2 Megabyte frame buffer.
Frame buffer may also be used as extra memory for Foonly processor.

Programmable 35mm color film reader/recorder system
800 bpi tape drive, 9MByte disk drive.

Stand-alone input system with:
Talos data tablet 48" x 60", two cursors.
High performance color film scanner.
4 high speed vector displays.
800 bpi tape drive, 9MByte disk drive.

Operator aids:
Comprehensive operator aids and data-base verification programs
for creating 3D descriptions of objects and scenes.

Available proprietary software:
Written in FORTRAN, interloops provided in PDP-10 assembly language,
input/output data structures optimized at 36-bit wordlength,
instantly useful on PDP-10 or PDP-10 lookalike system and can
be readily converted to operate on other large mainframes. Major
contributions to the software came from 20 man years of development.
License agreement will vary with intended use.

Sample programs:
TRANEW Scene simulation program
ASAS Scene choreography language
GEOMED Object preparation
TWEAK Object editor



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CAMERA CONFIGURATION FOR DIGITAL SCENE SIMULATION SYSTEM

The system contains two modified programmable Film Reader/Recorder systems similar in configuration and function to the standard III FR-80 microfilm recorder. One unit can be used for scanning or recording while the other is for recording only. They may be connected via disk interface to perform a simultaneous scan and record operation.

There are 3 camera subsystems interchangeable at a universal mechanical camera mount interface. The 3 cameras are;

1. Standard Model 8029/A 35mm camera pin registered camera with dedicated color filter subsystem.
2. Prototype 35mm camera body with dedicated color filter subsystem and integrated photomultiplier light measurement unit for use as a film scanner. The camera contains a pin registered single frame Acme movement with an academy aperture. This camera may be used for recording as well as scanning.
3. Special purpose 4 x 5 aperture camera fitted with a standard Graflex plate holder and dedicated color filter subsystem.

INFORMATION INTERNATIONAL'S MOTION PICTURE PROJECT

Digital simulation for motion picture applications is a major activity in Information International's continuing development of advanced capabilities in computer graphics. Information International established the standard for high-quality graphics recording on microfilm with its 1968 introduction of the FR 80 Precision Graphics Recorder.

With the introduction in 1972 of the COMp 80 Microform Composition System, FR 80 capabilities were extended to include the recording of color vector graphics and high-quality graphic arts typefaces, and the inclusion of line art in both still and moving graphics. Early credits included *Matrix III* and *Arabesque*, produced by John Whitney, Sr. for the museum and art film circuit. Through joint efforts with John Whitney, Jr., feature film work included FR 80 recordings of major scenes in the 1973 feature film, *Westworld*, and the 1976 feature film, *Futureworld*.

Information International's existing facility for color graphics recording is based on the company's GRAFIX I image processing system, including two PFR-3 programmable film readers, an FR 80 film recorder, and a PDP-10 control computer supported by an auxiliary, high-speed, 36-bit computer with performance ten times in excess of PDP-10 speed, and with software compatibility. This, together with auxiliary equipment such as two cursor data tablets, display monitors and frame buffers, provides approximately a \$3 million facility to support this ongoing development.

Project goals are aimed at achieving high-quality, smooth-shaded motion pictures for the scientific and entertainment markets. The challenges involve an improved human/computer interface to enhance the director's ability to control scene action. Considerable effort is directed at increased computational capacity to permit greater scene enrichment at realistic frame rates. Information International's capabilities in event simulation represent the most advanced work in computer-generated shaded imagery worldwide. The process now in use for feature film and television commercial simulation includes the following phases:

1. Design
2. Data entry
3. Director's language
4. Filming

Design

This initial phase involves storyboard creation based on client consultation, research, design and approval of idea.

Data Entry

Data entry can be accomplished by one of three methods:

1. Encoding by hand
2. Algorithmic description
3. Picture scanning

Encoding by hand. The majority of data is encoded by hand. Two precise views, front and side, are drawn onto drafting paper, then XY and Z cursors are used to encode the points which represent the three-dimensional space coordinates.

Algorithmic description. This method, using algorithms, or mathematical descriptions, is used to describe an object which is very regular.

Picture scanning. Unlike hand encoding and algorithmic description, which are both three-dimensional, the picture scanning method of data entry creates two-dimensional data bases. The scanning method is used for adding texture to three-dimensional surfaces of data bases.

Director's Language

The actual size, color and orientation of the objects, as well as lighting, reflections and textures, are determined with the aid of Information International's proprietary Director's Language. This interactive language specifically asks for all of the characteristics of a scene that a studio production company would require on the set. This allows for subtle variations of shading, direction, and quality of lighting.

All of the variables visible in nature are carefully considered and then automatically added by the Information International GRAFIX I Image Processing System and the Information International FR 80 Computer Output Microfilm Recording System.

Filming

During the filming process, a high-resolution electronic imaging/motion picture camera system is used with the FR 80 color recorder. Eastman #5247 is used for film recording, and Vericolor II and Ektachrome 64 are used for 4 x 5 negative and transparency output.

Information International's computer-generated graphics are used in the entertainment and advertising industries. Recent projects include a 12-second logo for Pyramid Films and a station identification for KCET, a public television broadcasting station in Los Angeles. Current work includes special effects for several feature films.

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