

A COMPUTER AIDED VIDEO ILLUSTRATING SYSTEM

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ABSTRACT

A Computer Aided Video Illustrating System (CAVIS) has been developed by Digital Methods Ltd. This system, which allows a graphic artist to quickly and effectively prepare artwork, makes extensive use of interactive graphic procedures.

System features include not only the ability to create standard objects such as lines, arcs, circles, text, and rectangles, but also the ability to edit these objects, i.e., they may be moved, sized, copied, coloured, deleted, etc. Individual objects may be grouped in a hierarchical manner and then manipulated as a whole.

Support functions allow an artist to define his own character fonts and patterns. Standard chart types, such as pie charts, histograms and graphs are created via the entry of descriptive parameters at an alphanumeric terminal.

A prime consideration of the design has been to make the interactive operation as simple as possible, allowing a technically unsophisticated graphic artist to operate the system with a minimum of training. The artist interacts with the system via a graphic tablet and a joystick. Final artwork is either photographed from a colour TV monitor, or produced on paper by a four colour plotter.

SYSTÈME D'ILLUSTRATION GRAPHIQUE À BASE D'ORDINATEUR

RÉSUMÉ

Un système d'illustration graphique à base d'ordinateur (CAVIS) a été développé par Digital Methods Ltée. Ceci permet à l'utilisateur/artiste de construire des dessins sur un télécouleur avec rapidité et efficacité à l'aide de techniques interactives.

Le système peut non seulement créer des lignes, des cercles, du texte et des rectangles mais permet aussi de les déplacer, copier, colorier, effacer, agrandir ou rapetisser à volonté. Des objets individuels peuvent se voir groupés de façon hiérarchique et puis se faire manipuler en bloc.

À l'aide de fonctions de support, l'artiste peut définir l'ensemble de caractères de son choix. Certains diagrammes standards, tels que les histogrammes et tartes sectionnées sont créés par soumission de paramètres descriptifs au terminus alphanumérique.

Une considération majeure vis à vis la conception du système a été d'assurer simplicité d'opération, ce qui permet à un artiste de s'en servir avec un minimum d'entraînement - il dessine à l'aide d'une tablette graphique et d'un "joystick". Le dessin est affiché sur le télécouleur où on peut le photographier - on peut aussi se servir d'une traceuse à quatre couleurs pour en tirer une épreuve sur papier.

INTRODUCTION

The production of graphic artwork has traditionally been a labour intensive task requiring skilled personnel to produce quality results. Because of this high labour content, the cost of this service has been getting more and more expensive.

With the recent advent of low cost computer generated graphics, it has become feasible to provide computer assistance to the graphic artist in order that he may perform his work more efficiently.

The CAVIS system is designed for use by a graphic artist – that is, a person who is totally unfamiliar with computer technology. Using interactive graphic devices, the artist communicates with the system in a step by step manner to produce and edit a piece of artwork.

SYSTEM OVERVIEW

Figure 1 illustrates the major components within the CAVIS system. The artist operates from a work station consisting of a graphic tablet, a joystick, and a colour monitor. The tablet and joystick are used by the artist to communicate with the system, while the colour monitor provides an exact view of the image that the artist is currently processing. The processor is a DEC PDP 11 with 56Kb of memory running under the RT-11 operating system. Two RK-05 disc drives are available; one for the storage of operating system and work files, the other for the retention of artwork. An average of 500-1000 pictures may be stored on a single disc cartridge, thereby providing a very compact means of storage. The filming station consists of a high quality monitor and a standard 35 mm camera, which allows the artist to film his work as he completes it. Alternately, the work may be forwarded to the plotter for paper (or mylar) copy.

OPERATOR INTERFACE

The prime means of interaction between the artist and the system is via a graphic tablet. A tablet was chosen because it seems to provide the most natural interface to an artist – i.e., all his work is performed with a pen, either for the entry of specific functions and arguments or for entry of freehand drawings. The joystick is used both as a locating device and as a valuating device. As a locator, it moves a crosshair cursor on the screen, to be used not only for identification of positions for new objects, but also for identifying existing objects for manipulation. As a valuator, it provides input to various manipulative functions and specifies size, position, rotation angle, etc.

At all phases of interaction, the artist is provided with prompts specifying what his course of action should be. These prompts are displayed on the colour monitor in a normally unused area of the display. Any errors which the system detects in the artist's response cause a definitive error message to be displayed. The artist may then either correct his mistake or

abort the current function.

THE GRAPHIC STRUCTURE

Within the CAVIS system, there is a three level hierarchy which allows graphic data to be structured in a manner which is meaningful to the artist. The lowest level of detail is the item - consisting of one single indivisible object, e.g. point, line, arc, etc. Any number of these items may be combined to form a feature, and any number of features may be combined to form an entity.

The advantage of providing this hierarchy is that it allows the artist to operate on a group of objects with a single operation. It is important that the artist spend some time organizing his work in order that logically related items are combined into a single unit. For example, in a standard organization chart (Figure 2) each box with the associated text would be made into a feature to allow it to be moved or sized individually. Similarly, all lines should be made a single feature so that their attributes can be changed simultaneously, e.g. colour or weight.

MODES OF OPERATION

There are four basic modes of operation within the CAVIS system: Font, Pattern, Chart and Creative. Figure 3 illustrates the relationship between these modes.

FONT MODE - The font mode of operation allows the artist to define and update the definition of individual characters within a character font. Up to nine different character fonts may be resident within the system.

Each character may be defined using standard drawing items, e.g. lines, arcs, circles, and curves. Characters are originally created in a very large format (effective size is 240 pt.) so that detail may be correctly established. When the characters are used in an actual piece of artwork, they are scaled down to the required size. Characters may be defined either as 'stick' figures consisting of single strokes, or as 'closed' figures which may be shaded solid (or even filled with patterns).

PATTERN MODE - The pattern mode of operation allows the artist to define various geometric patterns which may be used to fill enclosed polygonal regions. These patterns are defined in terms of a dot matrix cell pattern consisting of up to 1024 dots. Up to three different colours may be used within a single pattern. This cell pattern is then applied repetitively to fill the specified object. Up to 99 different pattern types may be on file.

To create (or update) a pattern, the artist is presented with a magnified version of the pattern on his colour monitor. Using a joystick, the cursor is positioned to a particular element of the pattern and a code is entered specifying the colour of that element.

CHART MODE - The chart mode of operation provides the artist with a simplified method of creating and updating four standard chart types: pie charts, horizontal histograms, vertical histograms, and graphs. Since the actual drawing of such charts is generally routine, this task is left to the CAVIS system. The artist need only specify the data and choose certain drawing options in response to questions asked by the system. The lines, arcs, points, etc., which might otherwise be tediously drawn in creative mode, are drawn automatically by the system.

Upon initiation of this function, the artist is presented with a menu specifying the parameters which are to be entered. This includes items such as colours, axes labels, data values, comments, etc. As each parameter is entered, it is checked for validity. If errors are detected, then an error message detailing the reason for the rejection is presented to the artist.

Update of an existing chart is accomplished in a similar manner. After the artist has identified which chart he wishes to modify (since there may be more than one within a given picture), the chart parameters are displayed as they were originally entered. To make changes, these parameters are simply overtyped with new values. Subsequent re-display of the chart will then incorporate all amendments.

After a basic chart has been created, it may be embellished with titles, background information, etc. These are added in creative mode.

CREATIVE MODE - In the creative mode of operation, the basic creative functions are used to enter points, lines, arcs, circles, curves, text and freehand drawings in such a way that they combine to form the desired picture. The manipulative functions are then used as required to move, rotate, size, mirror and colour the objects.

To manipulate an object the artist must first identify the object that is to be adjusted. A rectangle, to be used as a reference, is then displayed around the object. This reference is then manipulated, with the joystick, to the desired position, size, proportion, or angle (depending on the current function). When the function is terminated, the object is re-drawn within the bounds of the modified reference.

As objects are drawn on the screen, they are normally stored in the order created, within the system picture file. Therefore, where objects are superimposed, the last one created will cover anything which preceded it. However, the insert capability may be used to insert new objects into the picture file at some position other than the end.

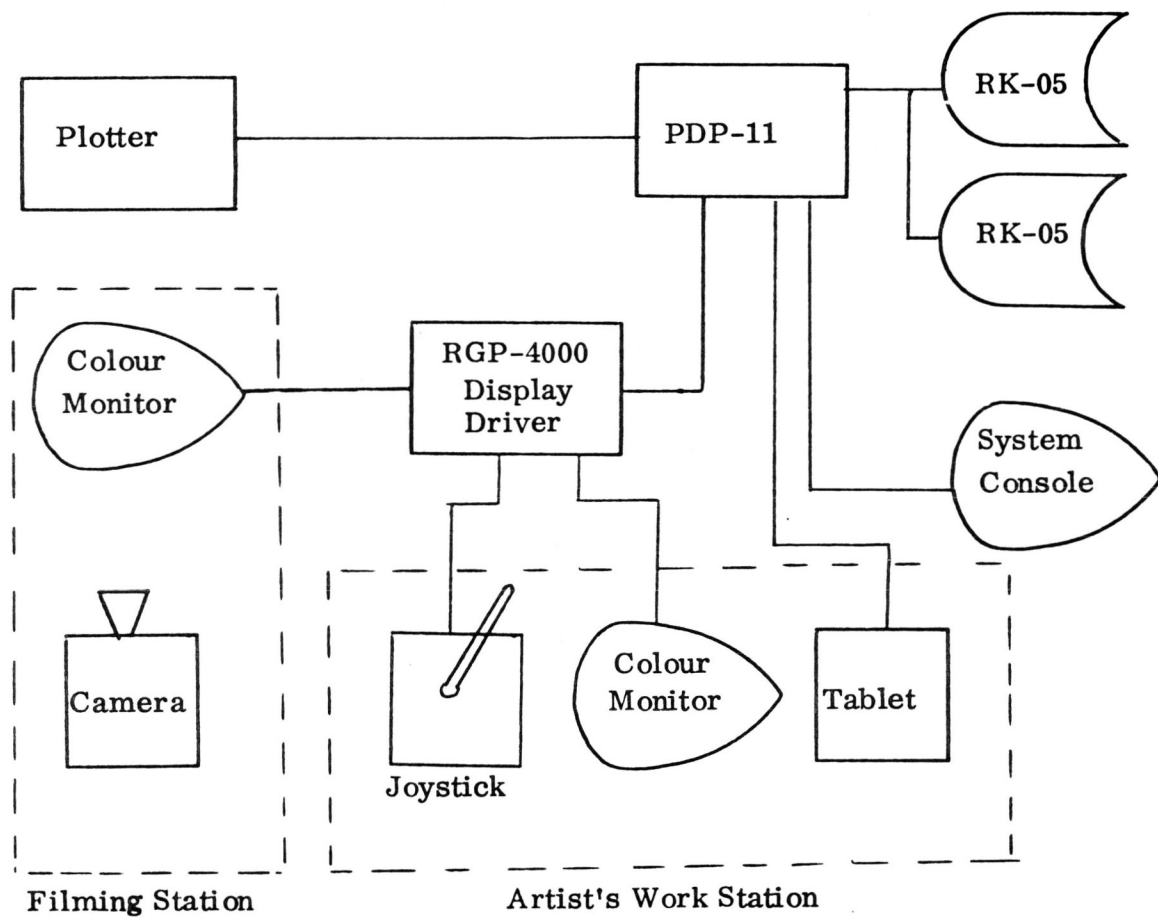
THE FINAL PRODUCT

There are two methods of obtaining graphic output from the system. The first is photographic – a quality television monitor is placed in a darkened environment and is directly photographed to produce 35 mm colour slides. The resulting slides provide a bright, clear, multi-coloured image with colour selection from a palette of over 4000 colours.

The second means of output produces a hard copy output on a multi-coloured pen plotter. This produces plots up to 11" by 15" in size with up to four different colours on paper and up to seven colours on transparent film. The plotter output, although slower than the photographic process, produces clear, high definition work which is suitable for publication purposes.

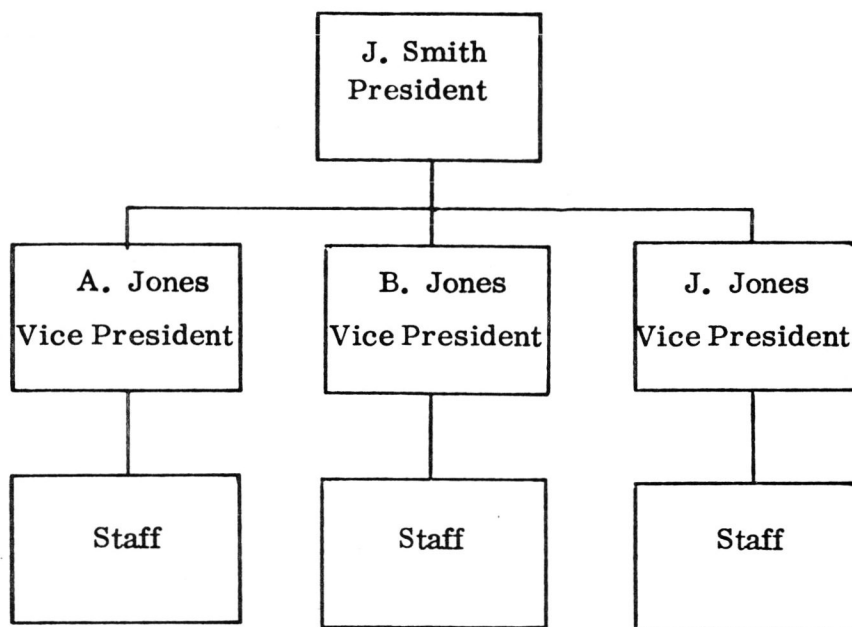
SUMMARY

The CAVIS system has made available the sophistication of computer graphics to a technically unsophisticated user. Artist response has proven favourable, resulting in a cost effective system which can allow a given piece of artwork to be produced two to five times faster than manual techniques.



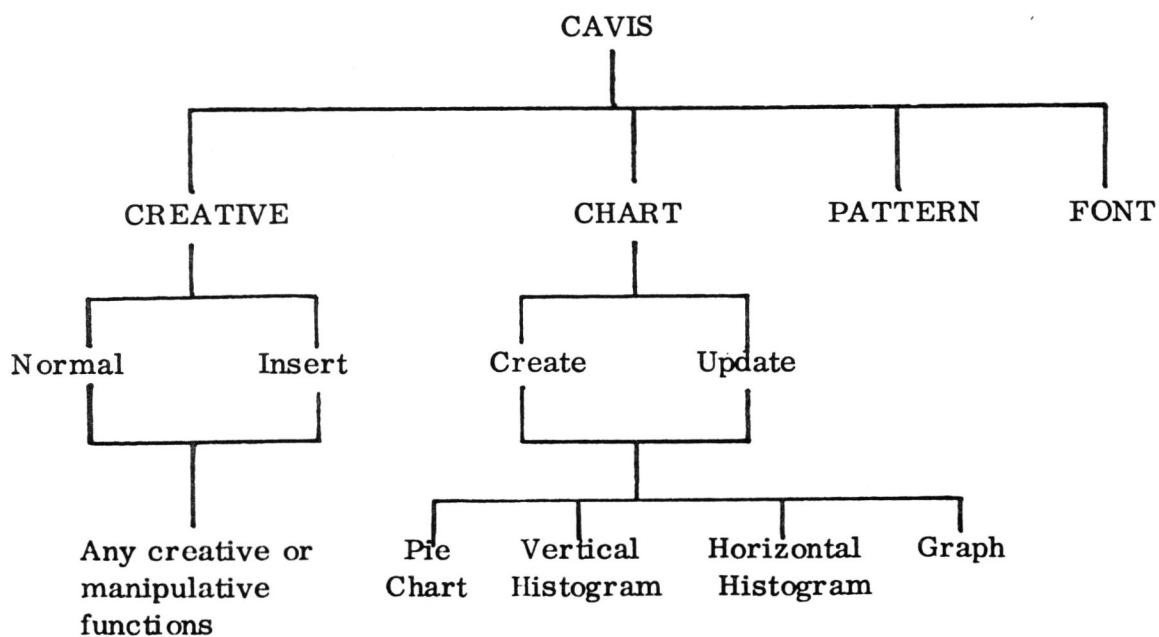
CAVIS HARDWARE CONFIGURATION

Figure 1



STANDARD ORGANIZATION CHART

Figure 2



CAVIS CONTROL STRUCTURE

Figure 3