Computer-drafting - state of the art

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SUMMARY

This paper briefly reviews the state of the art in computer drafting. It moves on to consider some of the limitations of computer drafting systems today. It poses a number of questions regarding the trends and future development of the subject, and suggests some points which should be addressed by the vendors and user organisations alike. The paper concentrates on marketing and management matters rather than on purely technical issues.

BACKGROUND TO COMPUTER DRAFTING

The subject of this paper, computer drafting, covers a range of computer hardware/software systems. The common purpose of these is to provide facilities for users to work interactively with a computer to build up the drawings for engineering or architectural projects.

Some computer drafting systems were initially developed during the 1960s and 1970s. At that time they could not be considered as practical and fully economical production tools. The turning point came around 1980. But even during the early years of this decade, each implementation involved a large capital expenditure. The result has been that most systems were installed by the larger design organisations.

In some respects the pace of technical development has been impressive, and this continues unabated. The multi-user systems running on minicomputers are now meeting a challenge from cheaper systems on technical workstations like the Apollo and Sun, while low-cost systems on Personal Computers (PCs) have begun to make a large impact.

Frost & Sullivan, 1986 forecast that the total European sales during 1987 of computer drafting systems for Architecture, Engineering & Construction could reach US$ 12 million. Sales of extension software modules for special applications could add a further US $ 21 million. These figures do not include

systems for 3-D modelling, for mapping and public utilities work, or for plant design.

These figures indicate that computer drafting is already a subject of considerable interest to many in the construction industry. This is an industry which is highly fragmented, and so we have a special need for good communications of all kinds. Yet we must question whether all is well, for we now have a plethora of incompatible computer drafting systems which make data communications between organisations very difficult.

The vendors are the source of much marketing hype. They have made many sales of what they describe as 3-b modelling systems, yet many of these end up being used for drafting work only. User organisations propagate myths about the benefits, but in many organisations the optimistic economics of use would not stand up to a close examination. For new purchases and even for upgrading existing facilities, users find it difficult to decide whether to turn to the well-established systems, or to go for the low-cost PC systems.

Perhaps now is as good a time as any to take stock of events. In the hope of stimulating thought and discussion, I am posing some questions and making some personal observations under a number of headings.

P.C.-BASED SYSTEMS - WHO WANTS THEM?

Early PC systems were very limited although the limitations only became obvious to new users after weeks or months of operation.

The developers of the best and most advanced drafting software tend to be those firms that have years of experience behind them of selling and supporting mini-based systems. Most of these vendors continue to shun PCs or have taken to them grudgingly. This may be either because they feel that the PC is still not powerful enough, or because they fear the effect that these cheap PC systems would have on their sales revenues and profits.

Are users of PC systems sacrificing too much in the way of technical features and capacity just to save some money?

If the best systems enhance drawing productivity by a factor of two or three only, do cheap and inferior systems enhance drawing productivity at all? We night dispute the figures of the typical PC-system advertisement, but are 70% of the features worth even as little as 20% of the price?

However time is on the side of the PC systems. Software is steadily improving and the microcomputers of today are much more powerful than those of yesterday. The micros of tomorrow will be better still.

My own view is that PC systems are certainly here to stay, and will coexist with the bigger systems. At the very least, they have introduced a large new population of users to the concept of computer drafting. Some of these will move up-market to better systems. Others will be moved up-market when they come to upgrade their existing PC system with a later version of the software or with the then-current hardware.

It seems to me that the big systems will be best for dedicated users who need to achieve high productivity. Also they are better suited for design, for mixed design and drafting, and for large projects where several designers have to work together. The smaller systems are better for the more casual or intermittent uses, for operators who work as individuals and for those who can confine themselves mostly to drafting only.

SIMPLE DRAWING OR 2-D MODELLING

I believe that users should distinguish clearly between simple drawing' and '2-D modelling'. The former i5 the closest equivalent of manual drawing office practice. The unit of production remains the drawing sheet, and the computer is used to input, save and then plot one drawing sheet at a time. The method is easy to institute because the idea i5 familiar to drawing office personnel. They just have to find out now to handle the computer input and the plotting instructions.

In '2-D modelling', the unit of production i5 the whole project, or at least the whole expanse of one level of, say, a building project. The operator is not so much creating a drawing, as drawing the project. All the graphical design information is drawn in, and as this is being done it is carefully classified by components, categories, design layers etc. Then by choosing suitable scales and particular areas of interest, and by manipulating the classification system, as many drawings as necessary can be composed and plotted for different purposes. Subsequent revisions to the stored design information will automatically be reflected in all drawings plotted afterwards.

'Simple drawing' is easier to apply, but has low potential and may bring little or no improvements to drawing productivity. '2-D modelling' is rather more difficult to implement, but has far more potential in the long run. At first sight the difference lies in the manner of application of a drafting system rather than with inherent differences between systems. However '2-D modelling' needs more processing power, more system capacity and far better facilities including good data classification features. Present PC systems do not cope well with the 2-D modelling approach.

USER-INTERFACE

Many systems still show signs of being put together in too much haste. Perhaps this is inevitable when the technology has evolved so rapidly. Systems need to mature and much more thought ought to be given to the user-interface. This includes the hardware devices which the operators use directly, and the menu or command structure. The science of ergonomics still has much to offer. Nobody should be in doubt that operators need a large, high-resolution screen. They also require controls to allow panning and zooming around the design database, and these operations nave to work fast.

Up to now, buyers have had to compromise and accept inferior facilities because of high costs. The arrival of the newer graphics-orientated professional workstations is a sign of better things on the way.

In the early days of computer drafting the operators were enthusiastic to the point where they would put up with many difficulties, and even accept them as a challenge. Those days have gone. The menus, commands and input parameters must operate in a consistent and predictable manner. Then the system will be easier to use, particularly by occasional users. Another relevant point is that the commands, prompts, messages and documentation must be in the language of the user, and this is not necessarily English.

A STANDARD USER-INTERFACE

Perhaps the rapidly-evolving entrepreneurial phase of the market for computer drafting - if not for other forms of CAD -has almost run its course. Perhaps too, it is time for users to unite and demand a standard user-interface which would be common to all drafting systems. The advantages might now outweigh the disadvantages, particularly in an industry with many small design organisations and a fairly mobile staff.

Unfortunately no authority appears strong or interested enough to force such a development to take place. The vendors are not interested. As yet, no vendor appears likely to dominate the market to the extent that a de-facto standard will emerge.

FREEDOM OF EXPRESSION

Nearly all drafting systems are still rooted in the concept of line drawings. This of course stems from the drawing board in the background and the continued prominence of the pen plotter. Before long however we should be able to capitalise on a greater freedom of expression. With electrostatic or ink-jet plotters, much greater use of infill-tone would be useful.

The rapid spread of desk-top publishing systems should create some spin-offs for computer drafting, particularly with a greater range of text fonts and better text processing generally. Unfortunately there is still no sign of a large-format laser plotter.

Plotter technology at present dictates that in most cases a drawing master only must be plotted. This master is then reproduced by the traditional dye-line or other methods. This in turn means that the issued drawings can only be in black.

A new large-format plotter technology is required urgently to permit the direct plotting in colour of all the copies needed of a drawing. This would replace two processes with one. The ability to send coloured drawings to construction sites could have dramatic effects on drawing clarity. Might improvements in ink-jet technology prove to be the answer within a few years?

DRAFTING EXTENSIONS AND INTEGRATION

Drawing work has always been kept fairly distinct from all the other work undertaken by designers. This has stemmed perhaps from the basic difference between a drawing board and a desk. The division has been perpetuated in computer operations. This is because in the past at least, systems designed for alphanumeric work have differed from computer graphics systems. This distinction is no longer necessary, because cheap alphanumeric screens can be linked in to a graphics-orientated system. As a result, we ought to be placing much more emphasis on the integration of different applications.

To a limited extent this has been happening already. Symbol and component libraries, specially devised menus, and some program developments have all brought many specialist software modules to the market. Examples include modules for reinforced concrete detailing, for surveying work and for architectural layout. Macro programming languages in some systems allow users to develop their own new high-level commands for repetitive drawing operations.

Of course there will always be a need for 2-D drawing. It is required for symbolic representation and for diagrams which explain construction details or techniques. Nevertheless, 3-D modelling is improving rapidly to the extent that it is already practised and viable for some scheme design work. Likewise it is used for geometrically complex, frequently recurring or otherwise for very important or high-cost elements within construction designs.

2-0 drawing should co-exist with a suitable form of 3-D modelling - probably an assembly modeller. Obviously it is far better for a user if these techniques are available within the

same overall system. Then totally different design databases and different command structures do not have to be used. Moving from 2-D to 3-D should be a fairly easy and natural progression for the user.

Some systems incorporate, or are linked with, a database system for handling non-graphic attributes. This approach offers much scope for developing scheduling of materials and components, for measurement and costing, and for project management. Some of these databases are not easy for the user to handle and considerable efforts are sometimes needed to set up system files and report specifications. The most potential seems to lie in linking modern relational database management technology with the operation of drafting software.

At last, office automation seems to be extending beyond mere word processing. We should not lose sight of the fact that the project drawing is merely another form of office document. Like text documents, the drawing has to be created, manipulated, printed, communicated, saved, indexed, retrieved and so on.

Document scanning is an emerging technique which would be valuable in any office that possesses extensive records in graphical form. Sometimes the records are wanted in the computer in vector format. This is when some form of manipulation of the records is needed. Conversion from the scanned raster form to vector form is still proving to be both difficult and costly. However, not all records have to be converted into vectors. Sometimes they are intended merely as a background on which newly input graphics are to be overlaid.

Other spin-offs from office automation may arise in the areas such as:

* electronic publishing,

* slide generation,

* hard copy copiers,

* computer networking and transparent communications,

* facsimile transmission,

* computer assisted micrographics,

* electronic filing,

* bulk storage including optical disc technology,

* public databases,

* professional multi-function workstations.

TRAINING AND SUPPORT

For the vendors of the larger systems, training, support and sometimes the customisation of their systems is becoming a major activity and an important source of revenue. At last many vendors are taking this more seriously. Some are beginning to employ more staff of a calibre and experience able to cope with the demands of user firms. This trend has further to go.

Training usually begins and ends with the initial instruction of operators. However, there are other training topics which are at least as important. These are advanced operator training, training in system management, and awareness training of drawing office managers and project managers. Vendor firms are sometimes not well qualified to undertake these forms of training, and staff in educational establishments also find it difficult to acquire the right experience.

The profit margins from the sale of PC systems are usually tiny, and cannot cover the proper training and on-going support of end-users. Furthermore the distribution channels for these systems must be via local distributors and dealers. These companies cannot concentrate totally on a drafting system and cannot employ staff of sufficientcalibre for proper training and support. These facts seem to be causing severe problems and disappointments for PC system purchasers. Perhaps the only viable solution is for the PC systems to:

* remain technically and operationally fairly simple,

* be made absolutely buy-free,

* be totally self-documented and self-supporting -perhaps with the aid of training videos.

If this is what is needed, then the measures would clearly be very expensive to initiate, This would tend to favour the very few suppliers who are already well established and operating on a world-wide basis. Other vendors could find themselves squeezed out of this market.

MANAGEMENT OF DRAFTING SYSTEMS

Few can be completely satisfied with either the pace or effectiveness of implementation of computer drafting.

The requirements of a user organisation do not end with the hardware, software, training and support which are all obtainable from a vendor. The other vital ingredient which is so often missing is a proper management structure into which the drafting hardware and software, its users, and the project work must fit. This management has to be provided by the user firm itself.

System management and coordination of computer drafting work is still an imperfectly understood subject area which has many ramifications. This will have to be developed if progress is not going to be restricted in the future.

REFERENCE

Frost & Sullivan. CAD & Computer Graphics Market in Architecture Engineering Construction & Mapping in Europe Frost & Sullivan Inc., New York, November 1986.