PAINT SYSTEMS AS A DESIGN TOOL .... "OH WOW!"

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ABSTRACT
The use of computer graphics paint systems is investigated as a primary design tool in the architecture studio. Paint programs are more conducive than CAD systems to providing a supportive environment for the exploration of design concepts.

DIRECTION OF THE SCHOOL
California College of Arts and Crafts is a school with a broad and dedicated curriculum in art and related disciplines. Aside from the Department of Architectural Studies, the school is known for its curriculum in graphic design, glass, ceramics, textiles, furniture design and film/video. As a result, students who are in the Architectural Studies program often have a background in other applied arts and, as such, their design vocabulary is correspondingly enriched. This makes for students who bring to their architectural studies an openness to explore "whatever works".

THE PROBLEM
Computer aided design has been part of the architectural studies program for about four years. It has always been our intent to use CAD primarily as a design tool instead of a drafting tool. This has been harder to effect than we expected. CAD seems to quickly lead students to fix their solutions too soon. The interactive dialogue of most currently available CAD programs seems to insist on dimensions, coordinated, specific layers and precision. Even with the intention to ignore the specificity of the system, the drafting orientation of the system is difficult to ignore. The imposed precision is perfectly welcomed at the production stage but it has a dampening effect on the design concept stage.

FOCUS ON DESIGN
The concept design stage is an inward-looking one. The designer takes the project requirements, and around this he/she constructs a fabric made up of past experiences, knowledge of archi-
tectural forms, and personal vision. Away from the computer, this phase expresses itself in a kind of doodling - pencil thinking as it were, that helps keep the designer working in this fluid state until he/she is satisfied with the direction the design is taking.

To foster this state, we explored various techniques and design problems. The object, simply stated, was to keep the students design stage fluid and open to the many influences which mix and meld during the time when the design is evolving. Things which freeze solutions prematurely and move the student into a "production stage" too soon are counter-productive to design exploration, and ultimately to the final design solution.

Some aspects of CAD were more conducive to design exploration than others. Some of the studio problems which were more successful were:

- Designing a space in 3-D using only panels.
- Using and moving shapes around in 3D.
- Limiting the use of linetypes - i.e. working with only orthogonal and 45 degree lines, or only circles, arcs and lines tangent to them.
- Using color in lines, solid areas and textures (hatches).

Limiting the choices allowed the student to focus more on the problem than on the tool. Quick studies worked well, and the limited selection sets produced work that was more spontaneous and creative.

It seemed that the more demanding the problem in terms of time and complexity - the less "good" was was the solution. Good in this instance means a creative and novel approach to the problem. Any extra effort expended by the student was spent in refining the original design concept - the production end rather than the front end of the design process. Often students worked out design concepts on the "back of an envelope" before sitting down to a CAD session. For working on a design concept, what we wanted was a tool, ideally transparent, one that would amplify a skill, heighten awareness and allow the mind set associated with creativity.

COLOR

The introduction of color in the CAD program always had an immediate and exhilarating effect on the students. Color was first used for layer definition. Students, on their own, proceeded to use every available color and to make drawings showing the entire palette. It is interesting that it was color that they chose to explore, not linetype, not hatch patterns, nor the eight ways to draw arcs.

The response to color was so universal that I introduced a professional paint program (Easel) as a post processor to AutoCAD. Using Easel with our Scion graphics boards allowed us to import AutoCAD drawing files into the paint program and then to color and further modify the original drawing. We also used the newer AT&T Targa series of graphics display adapter boards with the MaitTips paint program to get similar effects. Most professional graphics paint programs provide a great number of tools to manipulate shapes and colors. With paint systems using color mapped
boards students could change an existing palette, and have the respective colors changed in the
drawing. This makes it easy to experiment with the relationships among the various hues and in-
tensities in the drawing. Colors can be randomly cycled to produce an animation effect. This cy-
cling of colors causes varying elements in the design to be accentuated and points up how the dif-
f erent elements in a building can effect the overall design.

THE PAINT LEARNING CURVE

Paint systems differ from CAD systems in some very substantial ways. Most of us who use CAD
for architectural purposes have accepted the fact that it takes time to assimilate a CAD program.
It may come as a surprise that professional paint programs, while fun to use, are equally complex
programs which require time for the user to become sufficiently competent so that the software
can become transparent to the design process. Paint systems are geared to graphics, and students
miss some of the architectural tools found in CAD systems. In addition, to effectively manipulate
colors, the student must acquire a basic understanding of the RGB color space. Students often ex-
pressed the desire for the paint program instruction to have been introduced earlier, and for the
manuals to be more attuned to architectural instead of graphic needs.

THE EASY PART

While "sketch" is rarely used in a CAD system - sketching is the standard mode of drawing in a
paint system. This sketching is an old friend to most students and when it reappears, it is most
clearly welcomed. In addition to setting various brush widths and shapes, there are speciality
brushes which can be made from what CAD users think of as symbols. Airbrushing provides an
easy way to incorporate foliage and trees into designs. Backgrounds can be shaded in graded
colors to suggest sky. Parts of drawings can be masked to allow for easily adding color to, or ex-
cluding color from various sections of the drawing. Colors can be easily altered in parts of the
drawing to allow experimentation with various visual effects and alternate schemes. Erasing
simply involves "painting over" objects with the background color - very different from the
"breaking" of lines in CAD systems.

All these techniques are easily acquired by the architectural student. Some of these, like sketch-
ing and erasing, come from the non-computer experience of the student. The use of blocks as
brushes, the ease of multiple solutions for a design problem, and the computer amplified
manipulation of color and image had a precursor in their previous experience with CAD.

THE HARD PART

After dealing with the precision of a CAD system, students experience a lack of control over the
manipulation of the geometry of drawing. Accustomed to the benefits of vector storage, the in-
ability to redraw, zoom and query the image database comes as a shock. Once the difference be-
tween the vector and raster world become apparent, students do more easily utilize the new tech-
niques.
What is more difficult for the student to assimilate is the controlled use of color. Color Theory is one of the required classes at our school. This class, while it is an extensive study of color systems and their application to architecture and design, does not prepare students to understand the concepts of additive color. What hertofoer had been accepted as an ease and competence in dealing with color brings the student up sharply to the need to learn a new system for dealing with color. In Easel, we are working with the additive RGB color system, where colors become lighter the more color is added and where mixing red with green produces yellow. It is hard to manipulate this color space when coming from a Munsell background. Students also experience first hand the problems of trying to color match in two different color spaces - the emissive color of a CRT and the reflective color of ink on paper (Jobelove).

In spite of this, the use of color was still a very useful tool for design. The assignments did not focus on trying to render the image. Rendering, as it is most conventionally used, is a tool to sell the client on design rather than to clarify the architect's design intent. As such, it is mostly a post design development technique. The renderings we all admire - the light wash on Frank Lloyd Wright's renderings or the colored pencil drawings of Michael Graves, cannot be emulated on CAD/paint systems. What can be easily done with a paint system is to use color as an exploratory design tool.

COLOR TO CONVEY DESIGN INTENT

Color can be used to indicate function, hierarchies and organization, such as the American Standards Association safety color code for marking equipment. Color can be an effective message carrier, witness such emotionally loaded words used to describe colors - radiant, earthy, cheery, intense, stimulating, powerful, tranquil and quiet (Birren). Some architects such as Robert Venturi, Susan Torres and John Lloyd Wright have explored mood color in rendering as opposed to literal rendering of the building (Nevins). In a paint system - because colorization is easy, color can be used early and often in the design phase. Students developed their design on the CAD system and then ported it over into the paint system. There was no attempt to render the project in realistic color. Instead, the student was encouraged to explore how color could suggest mood and design intent.

The 3-D CAD drawings were more extensively changed by the students using the paint program (see Figures 1 and 2). The initial stage was a simple inclusion of color, which then moved into painting on and modifying portions of the drawing. Interestingly, plan representations of buildings tended to remain more intact (see Figures 3 and 4).

PAINT IN THE SCHEMATIC DESIGN STAGE

Because the use of the paint program was so successful, other techniques were explored. An example of the use of color as a tool in the schematic design phase is shown in a design project for a youth hostel. The original design fulfilled the requirements for a sheltering structure to be built in a wooded seaside site. The student was dissatisfied with her first submission (Figures 7 and 10) and was finding it difficult to loosen up and create alternative solutions. When approached
with the need to redesign, the student chose color to help her tap her creative process. To her, "color conveys feelings, ideas, concepts ... it establishes priorities, readily acceses ideas ... and opens up corridors of thought and feelings."

Keeping the design stage fluid, the student explored her feelings about shelter and the site... what produces a feeling of shelter, and what is the building sheltering from? These are concepts critical to a valid design solution and the more open this phase is kept, the more the designer can bring to the solution. The student spent a fair amount of time "playing" with the site. Her conclusion was that this environment was beautiful and non-threatening and that her structures should be more related to nature.

What happened next was the breakup of the monolithic structure into smaller units more responsive to the site (Figure 8). Instead of a barracks environment the sleeping space became small tent like structures housing four people each (Figure 11). Communal activities were housed in a separate building (Figure 12). At this point the student was working back and forth between paint and CAD. She used the paint system as an exploratory tool into which she fit the design which was evolving in the CAD system.

The new CAD solution (Figure 9) is very different from the original. The monolithic building has evolved to tent type structures of canvas and wood, and the scale of the buildings are more appropriate to the site. In the final CAD drawings the tightness of CAD began to reappear. At this point it would have been interesting to see what would have evolved if we had brought these CAD drawings back into the paint system.

VIDEO CAPTURE

We experimented with this technique to see what kind of insights it might provide for design exploration. The use of video images is still relatively new to the architecture profession. It is currently being used to superimpose new buildings onto videos of existing sites.

We videotaped various views of the school and experimented with making design modifications. Aside from giving the students an opportunity to indulge in some harmless graffiti, this technique provided an easy method to explore changes to existing buildings. Students worked in various ways. In some cases there was a close adherence to the original design, in others the original video image became a jumping off point for an entirely new design. A view of the entrance gate to the CCAC campus (Figure 5) was transformed into an abstract drawing (Figure 6). One of the interesting side effects was the way that color emphasized building planes and pointed out design elements which were easy to overlook. In effect, they were "seeing the building in a different light". This was strictly the function of color. This technique works equally well with photographs and can be used to explore and gain additional understanding of historic buildings.
EQUIPMENT

The computers we are using are IBM PCs with 512 K of main memory and a Televideo 286 with 640 K main memory and 1.5 MB expanded memory. We use Truevision Targa M8 graphics adapters with Tips, the Targa 16 with Lumena 16/32, and the Scion board with Easel for color graphics display. The CAD program is AutoCAD. Black and white output is produced on a QMS PS810 laser printer which has PostScript. Color output is produced on a Diablo color inkjet printer.

The Targa graphics boards allowed us to move a CAD image into the paint system. Both the Targa M8 and Scion board provide color mapped graphics. The Targa M8 provides 256 colors out of 16 million while the Scion board has provides 16 colors out of 256. The Targa 16 has 32,000 colors and does not have a color map. The video capture program for the Scion board was written by Don Day in the video department at California College of Arts and Crafts. For our video images, we used a standard black and white video camera and video recorder. We made a video tape and then "captured" the images so we could work on them with the paint program. We also could have worked from photographs. This would have allowed us to use historical buildings and sites.

CONCLUSION

We have found that students respond very favorably to the use of color. It is especially useful in providing a supportive environment for exploring design concepts. Our next step will be to import the paint image back into the CAD program for design development and production. In this way we can use the strengths of paint and CAD systems to produce finished results. The additional benefits from exposing students to various techniques, is to teach them to look beyond CAD and to expect more from computer systems. Demanding more and better tools for the design profession is one way of assuring that more and better tools will be made.

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BIBLIOGRAPHY

Figure 1. The CAD axonometric of a Japanese house.

Figure 2. Color accentuates the CAD design.
Figure 3. The original CAD plan view.

Figure 4. Color added to plan view.

Figure 5. Video captured image.

Figure 6. Design modification from video capture.
Figure 7. Original design submission - youth hostel - site plan.

Figure 8. Site exploration using a paint program.

Figure 9. Final site plan.
Figure 10. The original youth hostel design.

Figure 11. The "test" sleeping structures.

Figure 12. The communal building.