# PICTURE THIS

By IVARS PETERSON

Imagine how different today's computers might be if artists and graphic designers rather than engineers and computer scientists had orchestrated their development.

Early computer designs were driven by the need to calculate rather than to visualize. Given a problem, engineers and computer scientists, accustomed to working with mathematical procedures, would write a program — a list of minutely detailed instructions logically guiding the computer step by step through its assigned task. The computer would do its work in secret, then spew out the results on cards, tape, paper or, more recently, a video screen.

Artists and designers, on the other hand, rely on visualization, preferring to think and create with the aid of pictures. For them, writing a program to put an image on a computer screen is too indirect. They find even present-day methods for interacting with computers still strongly biased toward the way engineers and scientists conventionally work.

Take the task of designing a typeface — the visual appearance of letters of the alphabet. A graphic designer normally thinks about the problem in pictures: sketching, modifying and manipulating shapes to find a visually pleasing set of characters. Most computers remain ill-suited for such a strategy. Instead, the designer is forced to write a computer program to generate images of the letters on a computer screen. That tedious process bears little resemblance to the more direct approach of drawing the required characters by hand.

Nonetheless, using a computer to design a typeface has advantages. For example, given a set of characters and applying some basic rules, a computer can automatically generate all the different variations of a typeface — from italic to boldface — needed for any printing application.

"I would like people to be able to work with computers in something that looks more like pictures," says Scott E. Kim of Information Appliance Inc. in Palo Alto, Calif. Relying on his background in both graphic design and computer science, Kim recently completed a doctoral dissertation at Stanford University in which he explores ways to redesign computers to aid visual thinking.

"Scott Kim is right that visual thinkers would be best served by computers that are specifically designed for their approach to reality," says computer scientist Donald E. Knuth, who supervised Kim's dissertation. "Most people have a mentality that is rather different from what makes computer scientists tick. People like me are good at getting computers to do amazing things, but we aren't good at understanding how to design systems for people who aren't like us."

Design begins with chaos and moves toward order, Kim says. "In the early stages, you're dealing with a great deal of uncertainty, and it would be premature to put things into extremely precise form. Later on, when you've decided what to do, you can carve it in stone." Current computer-aided design systems, which force users to express their ideas in well-formed sentences, address only the later stages of the design process, he contends. In the earlier stages, fast feedback (sketching) is more important than precise description (programming).

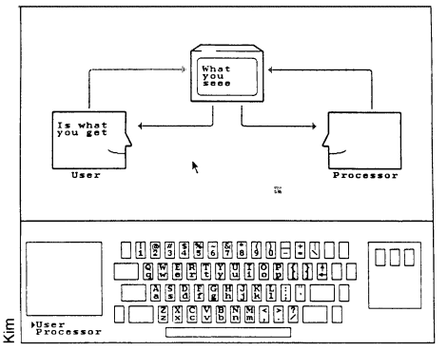
Word processing has already gone beyond the stage where users must specify beforehand exactly how a body of text is to be structured. Starting with a suitable word-processing program and a blank screen, a writer can sketch a story's outline, prepare a rough draft, then fill in, revise and correct details. In other words, a word-processing program allows a writer to put down ideas without structuring them until the final stage — a clear advantage over using a typewriter or pencil and paper.

Kim envisions a computer that enables a user to start not just with words but with any picture, no matter how ill-defined initially. Such a system would allow the user to edit the picture, making changes and filling in details as ideas develop. Furthermore, the user would not be constrained by arbitrary distinctions between text, graphics and numbers, but would retain the right to define which parts of a picture correspond to graphics and which to text and to decide where calculations are needed at any time during the creative process.

Although some computer programs for personal computers like the Macintosh already have features that allow users to manipulate graphic images, they don't go far enough, Kim argues. "We haven't yet built a truly visual computer. Despite its graphic facade, the Macintosh is still built on a foundation of numbers and abstract data structures that defy visualization."

Kim's idea is to put the relationship between a computer and a user on a more equal footing. In his scheme, everything the computer "knows" would be visible on the computer screen — equally accessible to both user and computer. "If the computer had to deal with the screen exactly the way the user did, then the interaction would be direct," Kim says.

To test his idea, Kim developed Viewpoint — a rudimentary picture editor allowing the user to draw and manipulate




Kim

*A sample screen from Scott Kim's Viewpoint program.*

pictures, design typeface fonts and write and edit text on a computer screen. In Viewpoint, the patterns of dots, or pixels, on a screen represent all the information known to both the user and the computer. The computer has no hidden agenda, stored in its memory and invisible to the user, that it can use to interpret the pixel patterns on the screen in its own way.

In its present form as a program written in the Cedar computer language and running on a Dorado computer built for research at the Xerox Palo Alto Research Center, Viewpoint is limited to a single screenful of pixels. The lower third of the screen has small designated areas, or cells, corresponding to each keyboard key. It also features a magnified cell known as a "puff box," for creating characters, which, in reduced form, may be moved anywhere around the screen by a "mouse" to build up lines of text or to create a picture (see illustration). Starting with a blank screen, a user can even custom design the shape of all the computer's keyboard characters.

The unification of text and graphics in Viewpoint makes certain kinds of text manipulation simpler than in conventional programs. For instance, because word-processing programs generally treat text in a linear fashion as rows of characters, moving a particular column of text is very difficult. Because Viewpoint deals with arrays of pixels in whatever arrangement, the task becomes much easier.

"I kept the behavior of Viewpoint as simple as possible to focus on fundamental issues," Kim says. "It's not intended as a practical system." Nevertheless, parts of it may lead to practical applications, he says. Even in its present form, people enjoy playing with it. "My role is being a bridge between graphic design and computer science," Kim says. "I'm comfortable in both worlds."

"People with their feet in different worlds . . . are gradually helping to build bridges between many separate islands of thought processes," says Knuth. "Collaboration between different types of thinkers is absolutely fundamental for advancing the usefulness of computers. We can't expect computer scientists to do it all, but they can do it if they have enough friends to work with." □