Russell Kirsch
The Language of Shapes

How the creator of the world's first digital image influenced artists, architects and designers

by Kennedy Smith

Portlander Russell Kirsch is an unassuming character – an aging man with a warm smile and eyes that reflect years of constant curiosity and learning. But you probably wouldn't guess by looking at him that he helped change the way architects design their buildings, how artists create their works and how young design students study their discipline.

Without Kirsch – the creator of the world's first digital image – it's arguable that there would be no computer-aided design, no picture scanner and possibly no way for a computer to recognize images. The computer, without Kirsch's contributions, would potentially be blind.

Kirsch's interest 50 years ago about how to get computers to "see" eventually led to the notion of a "shape grammar," the computer's ability to recognize a particular shape and its place in the larger context of a picture, whether it's Frank Lloyd Wright's Guggenheim or Picasso's "Guitar Player."

Twist of fate

Fifty years ago, Kirsch was a young Harvard grad with two job offers: one from the United States Naval Research Laboratory and the other from the National Bureau of Standards (now known as the National Institute of Standards and Technology, or NIST).

His skills at the time were a commodity – he was one of the only people in the country who had studied computer science. This was before computers were a staple in everyday life. In fact, this was before computers were smaller than a Laundromat-sized room.

The Naval Research Lab paid better, Kirsch remembers, so that's where he thought he'd end up. But a twist of fate led him in another direction, one that would change the way we use computers today.

"I got (to Washington, D.C.) early, so I thought I'd go to the Bureau of Standards and see what they were doing," he recalls. "By gosh, they were building the first computer in this country. I was intrigued, and so were they. They'd never seen anybody who'd actually studied computer science, so it was love at first sight."

In the beginning ...

In the late 1940s, the U.S. government wanted to buy a computer, and so the Bureau of Standards created SEAC, the Standards Electronic Automatic Computer, the first programmable computer.

"The interesting thing was that once you had the opportunity to provide programs, most of us felt the way that it says in Genesis: 'Nothing will be withheld from them which they have conceived to do.' So the question was, 'What would we like to do?' " he says. "I decided I wanted to know what would happen if computers could look at pictures."

So, Kirsch built a scanner and created the world's first digital image – a black and white, pixilated image of his infant son.

Enter the linguists, stage right ...

At the same time Kirsch was working with computer recognition of images, linguists started setting their sights on what computers could do for them.

It was around 1953 that linguist Victor Yngve joined the Massachusetts Institute of Technology to head a study that was then called "mechanical translation of languages." Essentially, he began using computers to study language.

"Yngve showed that language had certain interesting properties which could be exploited by finite-based grammars," Kirsch recalls. "It became quite a popular study, to use computers to study grammar, and by 1957 I was intrigued by what the linguists were able to do with grammar on computers – that is to say, a grammar was a device for doing several kinds of things, writing the rules for how you could make sentences out of words, or conversely, disarticulating the sentences. So I asked what seemed to me to be sort of an obvious question: Could you do the same thing with pictures?"

Parts of the whole ...

What Kirsch developed next would change the way artists, architects and designers conceive and create their works – the notion of a picture grammar, building pictures out of parts.

His foremost example is his work with the late artist Richard Diebenkorn's "Ocean Park" series of paintings. Comprised of vertical and horizontal lines intersected by straight lines of varying degrees, the paintings depict a series of rectangles and triangles in varying shades.

Kirsch and his wife, Joan, decided to create a program – made up of about 42 rules – that would prompt the computer to create lines and patterns in the style of Diebenkorn. When finished, the Kirsches showed their generated image to the artist himself, who agreed it looked strikingly similar to something he would be likely to paint. In fact, the computer simulation was almost identical to one that Diebenkorn had already painted.

Sowing seeds ...

Kirsch's idea of a picture grammar soon spawned architects to create grammars for their own discipline.

In 1971 MIT professor George Stiny and Boston College professor James Gips wrote "Shape Grammars and the Generative Specification of Painting and Sculpture," the foundation of modern shape grammar in architectural design. The paper explained that shape grammar, like Kirsch's picture grammar, consists of shape rules and a generation engine that selects and processes those rules.

A shape grammar generally has three shape rules: a start rule, at least one transformation rule and a termination rule. The start rule begins the shape-generation process. The transformation rule sets limits on how the shape can be changed. The termination rule makes the shape-generation process stop.
Shape grammar has been used to study historical architecture such as Victorian windows, and to create new designs like those of architect Alavaro Siza's "Malagueira Quarter" housing project in Portugal, with contributions from José Duarte at MIT.

Into the great beyond ...

"What is very interesting is that shape grammars have become very important in design work, in manufacturing, in architecture, in a number of areas for purposes of documenting the design process," says Kirsch.

Documenting design has become a very critical problem nationally, he explains. For example, a manufacturer can build an airplane that has a lifetime of 30 years, but 30 years later, all of the information about how that airplane was designed is in danger of being lost, "which makes it very hard for people who have such an airplane to be able to maintain it."

An excerpt from the book "100 Photographs that Changed the World"

DIGITAL IMAGING 1957
The camera and the computer had yet to join forces when Russell Kirsch set out to create the first computerized photo. To achieve this, he invented the photographic scanner as well as computer-imaging software. The first image Kirsch scanned - apparently seeking a Kodak moment - was of his infant son, Walden. It was the initial step toward NASA's planetary pictures and, close to home, today's increasingly popular digital snapshots.

Oddly enough, he says, "shape grammar turned out to be a useful tool for the solution of that problem, because the idea of a shape grammar is to capture a process, the design process. We addressed the problem of how something is made. How can we document the process, conjecturally, not by somebody who created the art but by somebody who's studying it?"

Today, in manufacturing, people can document the design process using something like shape grammar, says Kirsch, and help preserve documentation onto the indefinite future.

"The irony of the situation is that linguists contributed the notion, which I modified to deal with pictures and George Stiny modified to deal with shape grammar in design," Kirsch says. "Paradoxically, the parent discipline, linguistics, still hasn't done it. No major writer tries to document the process whereby he constructs his sentences in a novel. So, we've taken an idea and run with it farther than the parents have."

Kirsch says he never would have predicted how far computer science has leaped over the last 50 years, but then again, he's not a big fan of predictions.

"You do find a lot of people who try to predict what's going to happen, but the most interesting people are those who decide they want to make things happen," he says. "Not the people who say why, but why not."

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