



The Computer Museum

NEWS

AARON, the Robotic Artist Premieres in Color

It's taken me 20 years to teach AARON how to draw. How can I possibly teach it to color before I die?

—Harold Cohen, 1989

Remarkably, Cohen has—and only six years later—accomplished the task, at the University of California, San Diego, where he directs the Center for Research in Computing and the Arts. “AARON,” an expert system with its own painting machine, built by the celebrated artist, premieres at the Museum on April 1.

Every day until May 29, the computer-driven robot controlled by AARON will create a painting.

Each morning, Cohen will review the drawings composed during the night on a Silicon Graphics workstation, and choose one for the day's work. The file containing the chosen image will then be sent to a 486 computer controlling the painting machine, a flatbed device that moves a small robot arm around a 8-ft. x 6-ft. table and is equipped with an array of different-sized “brushes,” bottles of dye and mixing cups.

The machine will mix the colors from a palette of selected hues that can be diluted to achieve desired luminosities.

Grabbing a cup, AARON places it under a bottle, opens and closes the dye tap, puts the cup in a holder, picks up a brush, dips it in dye, and paints. Over three or four hours, a 25-sq.-ft. colored image will emerge. These paintings mostly depict imagined people—“sometimes looking remarkably like people I know,” said Cohen.

Dialogue: Cohen and Computer

“Harold explores creativity as no one else has—by programming a computer to create a model of art-making that proves itself by making art,” said Pamela McCorduck, author of *AARON'S CODE: Meta-Art, Artificial Intelligence, and the Work of Harold Cohen*.

AARON represents “the most intimate, sustained dialogue any single human being has ever had with a computer,” said McCorduck. This dialogue started in 1973, when Professor Ed Feigenbaum invited Cohen to Stanford's AI Lab. He stayed two years, probing the question: What is the minimum condition under which a set of marks acts as an image? His explorations led to the birth of AARON. Embodying ideas from AI and rules derived from Cohen's experience as an artist, AARON has evolved from a few rules generating simple shapes to composing complex figures, requiring detailed knowledge, both of its subject matter and of the methods of visual representation. The program draws autonomously, relying on its own knowledge, on a branching structure of rules and on feedback paths from what it has done to determine how to proceed.

Cohen began writing the program in C, running it first on a DEC PDP-11/45, later on a VAX 750. By 1985, when he moved to a MicroVAX-2, AARON had drawn its first human figure.

Challenge of Color

It troubled Cohen that a program smart enough to create original drawings could



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In his studio at the University of California, San Diego, Cohen tests his painting machine. On the wall is a portrait drawn by AARON and hand-colored by Cohen.

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not color. But color is staggeringly complex. Since AARON can't see, writing the program is a bit like telling someone over the phone, "use this bright red," when you know he can't visualize exactly the shade and intensity red that you see. Cohen observed, "The central problem is that we don't deal with color symbolically, as we do in thinking about subject matter or composition. In writing the program, however, I can only deal with those aspects of color that can be represented symbolically."

He began by developing a set of strategies for coloring on the screen of his Silicon Graphics workstation, writing in Lisp. But coloring in this domain involves additive mixing, and the next task was to translate these strategies into terms appropriate to the subtractive mixing of the actual dyes he would use with the painting machine. Then, Cohen had to build a robot that could mix and spread colors in a style befitting a fine artist. Problems arose—from finding archival paper that wasn't too heavy for hanging to trying to make the machine quieter.

Quest

In 1968, when Cohen was in full command of his art with a "reputation as a painter equal to that of any British artist of his generation," according to Michael Compton, Keeper of Modern Painting at London's Tate Gallery, he left that world. "He had all the accolades, but the quest—to express what he knows and sees—took him somewhere else. The quest is the same. He just changed the means of achieving it, choosing the more difficult path," said McCorduck.

A limited Museum Edition of signed Cohen paintings will be available in the Museum's auction on the World Wide Web, starting May 22.

The Robotic Artist: AARON in Living Color is being sponsored by Gordon and Gwen Bell, American Airlines, the American Association for Artificial Intelligence, and Silicon Graphics.

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For general Museum information, e-mail: computer_info@tcm.org with **request** in subject line and **send help instructions** as the body of the message.

Via World Wide Web: <http://www.net.org/>

Summer: Open daily, 10am-6pm, through Labor Day

Winter Hours: Open Tuesday-Sunday, 10am-5pm. Closed Mondays, except Boston School holidays and vacations. Closed Thanksgiving, Christmas, and New Year's Day.

Admission: Adults \$7.00, students, children five and up, and seniors \$5.00. Half price Sunday 3-5pm. Free to Museum members and children four and under.