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### **Harold Cohen and Aaron: The Birth of Machine Art**

While today there may not be an aspect of life unaffected by advances in computing, in 1968 it was difficult to imagine two human endeavors as disparate from one another as computer science and the fine arts. It was in 1968 that Harold Cohen was first introduced to computers. A well respected artist at the forefront of British painters at the time, Cohen had already developed a preoccupation with trying to codify his own set of rules for how images conveyed meaning. Having begun to learn the intimidating FORTRAN computer language as an intellectual exercise, Cohen found himself retreating from the conventional art world for twelve years, eventually developing what would become Aaron- an ever-evolving computer program that could autonomously create visual art. Cohen would continue to develop Aaron and create artwork in conjunction with it until his death in 2016.

At one of the first showings of Cohen's pivotal experiments in Amsterdam in 1977, the artist responded to questions about his interest in computation, "[...] As an artist I am able to make some marks on a piece of paper, and the viewer may say, 'That's a face,' when we both know the difference between a face and a few marks on a piece of paper perfectly well. Can you imagine transaction more fundamental to art? I spent a long time as a painter trying to grasp what

I was actually doing to initiate and control it. What the computer provided was a way of externalizing, stabilizing my speculations about image-making behavior: not only my own behavior, but what I thought I could see operating in drawings generally, and especially in children's drawings and in so-called primitive art" (McCorduck 78). Indeed, the exhibition's giant scrolls of paper covered in figures (made by a tiny tank-like drawing robot called a "turtle") resembled the petroglyphs of Chalfant Valley that had so inspired Cohen on viewing them in 1973 (McCorduck 61). These figures, carved in granite, have fascinated viewers for thousands of years. While not always communicating direct meaning, the petroglyph designs and others like them "feel" meaningful. It was a formula for evoking that perceptual response in a viewer using the minimum number of visual elements that Cohen was initially searching for. This was a search that he had considered a dead-end after twenty years of painting, but that he was able to realize by externalizing his thought processes into computer code. Reflecting on the switch from paint to programming in a lecture at Tate Modern in 2004, Cohen emphasized that the transition wasn't optional, but the next necessary step in pursuing his work, just as learning to paint had been (15).

The idea of computer generated drawing at the time was an oddity in both the world of art and in the nascent world of artificial intelligence- which was still struggling with its first principles and largely concerned with problems like chess play. "Computer Art" as an idea did exist in the 70's, but it consisted of human-plotted or digitized representations of existing images or of geometric, spirograph-like demonstrations of math functions. The significance of Aaron wasn't that a computer carried out drawing instead of a human hand, but rather in the unusual approach to the problem of finding a substitute for human perception that Cohen devised.

Humans utilize a system of feedback and refinement as they draw, Aaron also uses a feedback

system to actively reappraise its own work as it draws. Coupled with a simple set of rules for drawing figures (e.g. no closed shape may overlap another closed shape) and a random number generator that decides on figure types and placement, Aaron never draws the same image twice. However, each image can be recognized stylistically as being the work of Aaron and, by proxy, Harold Cohen. At one six-month exhibition in Tsukuba, Japan, Aaron made over 7,000 unique drawings, all with Cohen on another continent (Holtzman).

The trajectory of Cohen/Aaron's work changed significantly over time. Beginning as rudimentary, cave-painting-like designs, the artwork produced became more complex and eventually representational, as Cohen went from programming Aaron with what he called "cognitive primitives" to giving Aaron rules for drawing complex forms like humans, clouds, and vegetation. After a period of representational artwork, Aaron and Cohen returned to pure abstraction, but with the addition of color. Cohen had been praised in the 60's for using bold color that predated (or predicted) pop-art, and in transitioning to working through the computer, he either worked without color, or did color washes by hand on top of Aaron's drawings. In this new non-representational period, Aaron itself colored the images- at first with a complicated robotic brush and ink, and later with a large-scale inkjet printer. Teaching the software to work with color posed an exceptionally difficult challenge for Cohen, who developed a novel approach to it. Cohen used Aaron's feedback system to match the brightness of various randomly generated hues in order to create color harmonies. Cohen even experimented with a period of drawing by hand and letting Aaron select the colors for Cohen's drawings. During this late period in his career, Cohen had softened on his stance of insisting that he (Cohen) alone be credited for

artwork, and playfully began crediting artwork as being a collaboration between himself and Aaron (“Harold Cohen, artist- obituary”).

Harold Cohen’s experiments with Aaron constituted seminal work that contributed greatly to the fields of visual art and artificial intelligence. The resolve necessary to essentially leave a fruitful career for nearly a decade to pursue a tangent few could understand is impressive, but furthermore demonstrates the seriousness of Cohen’s aims. In our world today, thousands of people interact daily with software that both artificially “sees” and “draws” (art-style transfer and face-detection photography apps for instance). Fine artists also now work widely with computer generated imagery, text and sound, building their own corpuses and algorithms for creating artwork that extrapolates the artist’s sensibilities into infinite variation. The idea that it is bizarre for software to co-operate with a human in a creative work is rapidly fading, and Harold Cohen laid the groundwork for this, alongside his creation, Aaron.

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