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# computers and automation

The Digital Mona Lisa





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The front cover shows a copy of the painting "Mona Lisa" by Leonardo da Vinci, produced as a digital plot by a scanner and two Control Data Corp. computers. Each small cell contains two decimal digits reporting the density at a point on a color projection slide copy of the painting. For more information see page 13.



# computers and automation

## THE DIGITAL MONA LISA

**H. Philip Peterson**  
Control Data Corp.  
Digigraphic Laboratories  
Burlington, Mass.

In your "Computer as an Artist" covers of the past, analog forms seem to dominate. In an effort to counter this insidious tendency, I have sent you, for your consideration, a "pure" digital work of art (admittedly not original). It is digital in the following ways:

- a) It is composed of square cells, 0.115" on a side. It is 256 cells wide and 390 cells high. (The top and bottom two rows contain identification information.) Cells are marked off by ticks in the horizontal lines between rows.
- b) Each cell contains two decimal digits. The magnitude of these numbers is proportional to the density at points on a color projection slide (.9" by 1.35") as measured by a CDC 160 computer driving a special high-resolution "jumping spot" scanner. (Actually, .9 bits of density are measured at each point.) There are about 100,000 cells in this picture. My research scanner, however, is capable of examining  $64 \times 10^6$  points inside a 2" x 2" target area, extracting 9 bits from each, but this much detail would require 12,000 hours to plot using this technique.
- c) The number in each cell is the result of scanning 8 points in each tiny area and averaging their densities. About  $10^6$  points were examined which took the CDC 160 about four minutes.
- d) The digits are plotted by an incremental plotter driven on-line by a CDC 3200 computer. I designed the font in such a way that the larger the pair of digits are, the darker they appear to the human eye at that cell. Up close to the picture, you see what the computer "sees" — namely, a number field; at about 30 feet away, you see the picture shaded as well as a newspaper photograph. (Perhaps a little better, since there are 100 gray levels.)
- e) It takes about 64 plotter steps to make each digit. The whole picture took about 16 hours to plot and consists of about 16,000,000 plotter steps (300 per second). It was done on a weekend in one continuous computer run.

How digital can one get? (However, much to my chagrin, the reproduction process is analog — a sepia copy from a diazo machine.) In any case, I hope you enjoy this version of Mona Lisa. A close-up of her enigmatic smile would probably be the most interesting way of demonstrating the technique used.

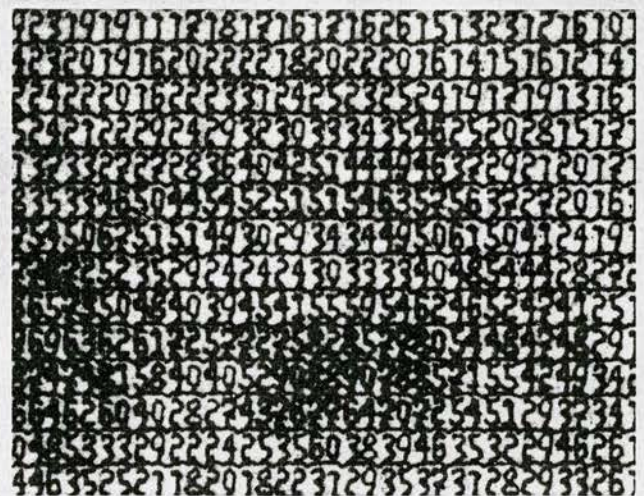


Figure 1 — This shows a close-up of one of the eyes of the digital Mona Lisa. Here the decimal digits in the cells can be seen; the digits are not visible in the reduced, screened picture on the front cover.