# More Than A Pencil: Using the Computer to Make Two-Dimensional Art

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## Abstract

*I describe my experiences as an artist in making large digital portraits along with some of the issues that make this process more exciting, and cumbersome, than picking up a pencil. The arrival of the computer and its associated technology has given the artist unprecedented ability to control precisely how ink goes on paper. By thinking of the computer as an agent, the range of detail that is possible is not limited by a person's physical ability and, therefore, new kinds of images are possible.*

## 1. Introduction

There are many ways to make art using the computer. I am going to limit my discussion to the use of the computer to create an ink on paper print. Possibly because of the many ways that are available to be creative with the computer, many artists have ignored the broad range of possibilities that spring from programming a computer to draw a line or add a color. I am going to briefly review some of the history of making pictures, emphasizing the artistic opportunities of controlling the line and placing an element of color. I will then discuss the arrival of the computer and the high grade printer in light of the leap forward in the ability of the artist to arrange these elements, which I illustrate with my own work. Finally, I will summarize the advantages and the disadvantages that currently go hand in hand with these new tools.

## 2. The Quickening of Art

One trend that has been evident in painting ever since man held colored oil in his mouth and blew it onto the walls at the caves in Lascaux is a desire to tighten the connection between intent and realization for creating an image. A series of tools has arisen to broaden the range of possible visual expressions. There was the brush, which was a vast improvement over dabbing with fingers. The introduction of oil paint during the Renaissance allowed an enormous decrease in drying times over the alternative of wet plaster fresco and made possible simple revisions. In the eighteenth century, the introduction of a finished surface on paper, making it much less absorbent, set the stage for watercolors as we know them now, with their delicate shading and precision. In the nineteenth century, the metal tube for holding pre-made paints gave artists the freedom to take their paints outside. Previously, paints required laborious preparation just prior to use and were carried in a pig's bladder. The tube provided convenience and paved the way for manufactured paints and new colors from industry. In the beginning of the twentieth century, photography made its way into the public's hands and transformed the way an image was generated, allowing anyone to generate in a moment a realistic image through simple mechanical means. By the 1960's, the introduction of acrylic paints cut to a matter of minutes the drying times associated with oil paints, and brought a new range of colors onto the palette. All of these technological improvements have been steps towards expanding the range of creative opportunities.

With the computer, this trend has continued. The significant difference is that it is now possible to use a script to describe the execution of the work. The ability to control line has always been a great quest among visual artists but with the arrival of the computer and the associated printer, visual artists, through the indirect method of software, can create a line that is 1/1000 of an inch wide as easily as one that is 36 inches wide. By controlling such a line, the artist can deploy a hierarchy of layered images to create a large image, which creates the opportunity for a grand vision seen from a distance to dissolve into intimate pictures as the viewer physically approaches the work. One popular example of this is the photo mosaic, which uses thousands of small images to create a single large image. The technological advance of precise control with scripted, automatic execution, is pregnant with many other possibilities and the exploration of it will provide a generation of new and interesting work.

## 3. Magic Marker

Sol LeWitt created a work of art in 1970 called "Wall Drawing No. 58". For this, he produced no artwork, just the following instructions:

> "A wall divided by lines drawn from corner to corner and from side to side. Lines in four directions with a different direction in color and each half square. Colored pencil."

As reported in the *St. Louis Post Dispatch* (October 3, 2004)

> "As long as one has permission, the work can be executed on any wall in any size. The same work can exist in more than one place simultaneously and even when it is painted over at the end of its use, it exists as its idea. Beautiful."

Mr. LeWitt promoted the idea of agency in art by the creation of a "team" of artists that executed his written instructions without his presence or his personal direction. Essentially, art could be a script for making art and the execution of the concept was secondary to the idea itself. His approach, however, offers a indicator of the possibilities that computers can easily expand. By having many hands make light work of the task of creating art, his team could create works that exceeded the possibilities of a single artisan. The opportunity with a computer and its software is that the single artist can create complex works that would otherwise be impossible. Like the team of artists working from a page of LeWitt's notes, the computer can accurately and quickly execute instructions to articulate the artist's intent. In a way, like the broom for the sorcerer's apprentice, the computer can become the artist's magic marker.

Consider the following art work as examples of the possibilities. In the first, "Tiha in his primes", Figures 1 & 2, I have portrayed a friend who is enthusiastic about mathematics by using the first 70,000 prime numbers arranged in rings. The existence of a list of so many primes is a direct tribute to the power of the computer. Their arrangement which, at best, would have been tedious by hand, was straightforward to program.

In the second, "The Crowd Within", Figures 3 & 4, I have created a portrait of a young man through the placement of individual stick men. Each unique stick man was created from a stick man model: the head was drawn with Bezier curves along random points, and the angles of the limbs, hands and feet were randomly assigned. To create the picture, an iterative procedure was used to drop stickmen randomly in an area in proportion to the tone of the underlying image. Thus, at each small point in the large drawing, the computer creates a separate image that is related to the overall view.

**Figure 1. "Tiha in his Primes" 36x48in, 2004**

The third, "Sign of the Times", Figures 5 & 6, is a portrait of an engineering friend who left me a voice mail. I created a graphic image of his voice from the recording and added it to a sine carrier wave whose frequency was proportional to the underlying photograph. The result is a portrait that shows not only his physical appearance but also describes his speaking voice. Because the computer can precisely record and draw a voice pattern, the portrait has another layer of meaning other than the subject's appearance. Conceptually, the voice print in the picture could be replayed, giving the timber, tone and voice of the sitter, thus providing another, aural dimension to the visual image. It is difficult to imagine how such a picture could have been made without a computer.

In "Ben in Morse Code", Figures 7 & 8, the picture style is a direct descendant of the photo-mosaics which use software to create a large picture from a library of smaller images. In this case, however, I have used three principal images: Ben with his eyes open, which represents a dot; Ben with his eyes closed, which represents a dash; and Ben with his head turned, which represents a space. These are, of

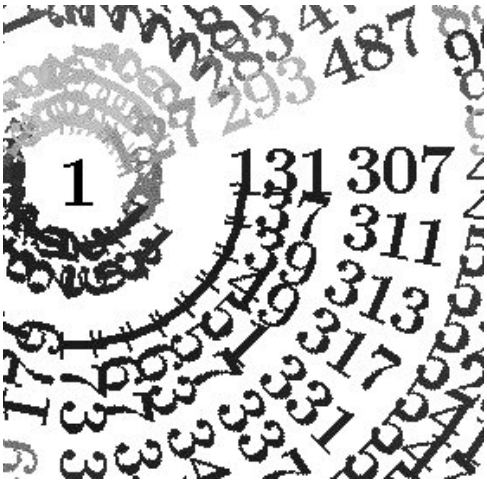


**Figure 2. Detail of eye: "Tiha in his Primes"**

course, the elements of Morse Code. I then took an essay that Ben had written describing himself, translated this into Morse Code so that the essay was rendered into a sequence of the three pictures. I placed these in order, beginning in the upper left and moving to the right and down so that his entire essay is literally written over his face. Each picture is adjusted in tone to render the overall image. There are therefore several layers of meaning incorporated in the portrait: the appearance of Ben (which becomes clear at a distance to the picture), the images of him with eyes open, shut and head turned, and his own personal self-description. It is this ability to use the small in the context of the large that makes the computer such a powerful tool.

In all of the above examples, the work relied on the ability to draw a fine, dark line or to manipulate and place a small picture. One odd result of making pictures like this is that they are not easily communicated through current electronic means. The pictures are generally 30x40 inches or larger and part of their appeal is that the details merge into a larger picture as the viewer changes his distance from them. This ability to step back is not a common practice when seated in front of a computer. Thus, the pictures are best appreciated by standing and when walking forward and back from the print to see the different levels of detail. Ironically, although computers are required for their creation, using a computer inhibits their proper viewing. The size and detail of the picture really require a physical interaction with the image despite their electronic origin.

All of the above examples are in black and white. Using color opens additional creative opportunities. One that I have pursued focuses on the use of narrative elements in the portrait which describes the sitter in more detail. To do this, I created a picture style called "ink collage" which uses a series of line drawings that are layered over a color photograph. The interstitial spaces created by the lines then become the small mosaics that create the larger picture. The lines themselves have varying tones which allow them to be distinguished at close range to the picture. In "Duchamp Robert", Figure 9, for example, I have taken a photograph of Robert and layered it with a series of drawings reflecting the history and context of my friend's life. There is the large bicycle wheel that surrounds his head, a reference to the upturned bicycle wheel sculpture of Marcel Duchamp, a favorite artist of his, and to his time as a bicycle repairman. There is the drawing of his son shown in glasses in the lower part of the picture, several line drawings of Robert scuba diving in the upper part, some of the actual computer code used to create the work itself in the lower left, which is also a reference to his PhD in computer science, and a drawing of a PC along the right hand side. The sum of the drawings creates a complex mosaic which resolves itself into his portrait. The identification of the underlying drawings helps place the sitter in the context of his activities and personal interests. A viewer can thus move back and forth to inspect the drawing and, by moving closer, obtain a more intimate understanding of who the person is.

As another example, consider "Kevin", Figure 10. This portrait, which uses the same technique, portrays a man who is systematically rational, hence the drawing of the mechanical time-piece. It refers to his interest in medieval art, illustrated by the picture of a Madonna and Child in the lower half. His legal background and exposure to art auctions are emphasized by the two gavels shown around his shoulders. His experience with the company Duracell is designated by a row of batteries. All of these drawings sum to give a better description of the man himself.

## 4. A Step Forward and a Step Back

An essential aspect of the computer to make art this way is to program it and use it as a substitute for a team of hands which follows your written description. The speed and precision of the computer thus open many artistic expressions which have never been possible before. These new opportunities represent the step forward. However, the requirements of the artist to consider consciously the method of creation has its drawbacks.

In the color prints, like Figure 9, the tool chain begins with the a series of drawings which are manipulated through the open source software graphics program, Gimp. These various planes, along with a color photograph, are then combined using a Common Lisp program, written in CMUCL lisp, which controls the various libraries of the open-source computer vision library, OpenCV. The resulting pictures take about four hours of processing on a 2.4MHz dual Xeon workstation, and are usually 3600x4800 pixels.The process is iterative, since the various planes require adjustment to attain the desired image. Although

none of these steps is particularly difficult for an engineer, the precision of writing software often requires a different frame of mind than that of making artistic decisions.

One aspect is the stilted nature of programming languages. Although Sol LeWitt's instructions given above are easily understood by assistants, they are not understood by a computer. Second, even when a short, textual message can describe the visual artwork, there remains the problem that the artist must translate the visual image to a verbal description. This intellectual process is in contrast to the intuitive method which is evidenced when an artist draws and can translate with a sense of touch the "feeling" of a line. In its most basic form an artist can draw an interesting, winding line on paper with little conscious thought; on a computer, the program description of the same winding line requires significant effort (e.g. Bezier curves). So although the ability to program allows for many new kinds of drawings and is a step forward, the requirement of programming in text which interrupts the artist's image-making process is an impediment to making such art and is a step back.

The challenge to technologists is how to improve the computer tools so that they can become intuitive and transparent to user's intent without limiting the computer's capabilities. For example, a standard paint program used with a pen stylus allows an intuitive use but fails to allow for general computer programming. What is needed is a suite of methods to translate –intuitively– imaginative intent both for the desired image and for its programming.

## 5. Conclusion

In making pictures, there has been an evolution towards more expressive techniques of making art. The computer and the printer continue this march and significantly broaden the possibilities by allowing automatic execution of scripts. A number of examples of art have been provided which illustrate the unique power of the computer to incorporate high levels of detail into new kinds of large images. Although there are many new opportunities for artists using the computer, there remains the significant issue of translating artistic intent to visual reality without going through the current cumbersome process of writing programs in the non-intuitive programming languages currently used.



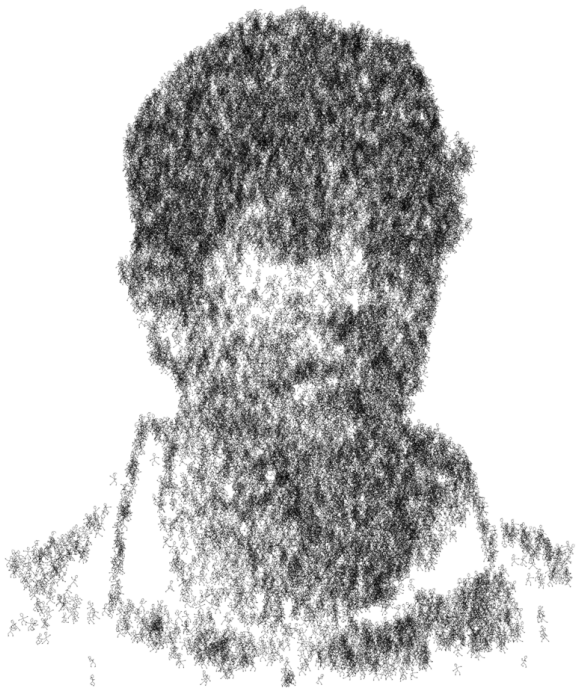

**Figure 3. "The Crowd Within" 36x48in, 2004**

**Figure 4. Detail of eye: "The Crowd Within"**

**Figure 5. “Sign of the Times” 36x48in, 2004**

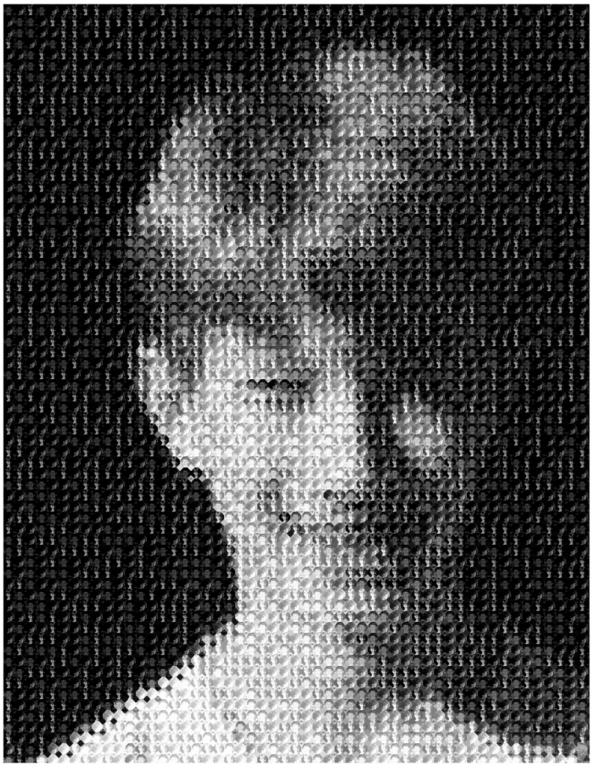

**Figure 7. “Ben in Morse Code” 36x48in, 2004**

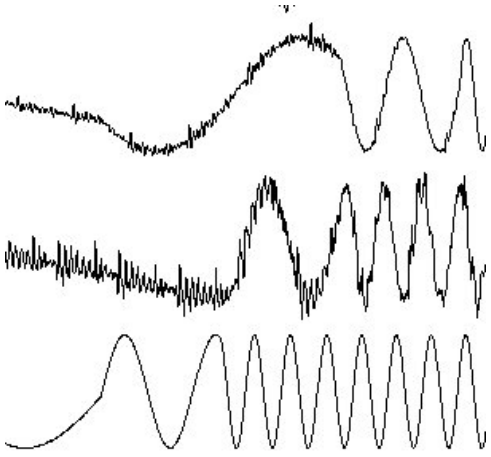

**Figure 6. Detail of eye: “Sign of the Times”**

**Figure 8. Detail of eye: “Ben in Morse Code”**

**Figure 9. “Duchamp Robert” 24x32in, 2005**

**Figure 10. “Kevin” 24x32in, 2005**