From ASCII Art to Comic Sans

Typography and Popular Culture in the Digital Age

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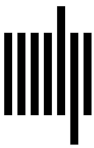

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COMPUTER PICTURES BEFORE COMPUTER GRAPHICS

THE PRACTICE OF ASCII ART

ASCII art was practiced long before the ASCII code was developed. The making of text-based art with the help of typewriters dates back to the nineteenth century, and the practice was encouraged by competitions arranged by typewriter manufacturers.[1] Beginning in the 1920s, teleprinter operators created pictures and sent them to each other over radioteletype (RTTY) and printed them out on paper, until the 1980s, when personal computing won over many radio amateurs.[2]

The American Standard Code for Information Interchange (ASCII) became an official standard in 1963. It is an encoding system for representing the alphabet and other characters in computers, where each character is assigned a unique number. Pictures were also made with the help of other encoding systems, including IBM's binary-coded decimal (BCD) system, IBM's extended binary-coded decimal interchange code (EBCDIC) system, and later the American National Standards Institute (ANSI) system, which was used on bulletin board systems from the 1980s to the beginning of the new millennium. However, the term *ASCII art* is now an umbrella designation for an art form that has become part of a broader visual culture.

In the 1960s, the large computer systems were monitored by an operator sitting at a console with switches, knobs, buttons, and indicator lamps. Paper tapes and punch cards were used for the input, output, and storage of data and programs. Printouts were produced by line printers and repurposed teleprinters. When visual display units (VDUs) became common as terminals in the 1970s, they were usually monochrome and character-oriented. Pen plotters and graphical terminals also could handle images, but such exclusive equipment was not needed for processing

Figure 2.1 Typewriter art. Julius Nelson, *Artyping* (New York: Gregg Publishing Company, 1939), 66.

Figure 2.2 RTTY art. Screenshot from "Santa Arrives via Model 19 Radio Teletype @ 60 WPM," YouTube, December 25, 2013. Courtesy of the Telecommunications History Group.

discrete symbols like the alphanumeric characters of the ASCII code. Computer graphics was in its infancy in this period.[3] But the computer operators and programmers of the early days took up the baton from the teleprinter operators and the typewriter artists, found ways around the limitations of the mainframes and the line printers, and made text-based images long before computer graphics came of age.

A Dictionary of the Internet defines ASCII art in the following way: "A collective term used to describe pictures, sometimes pornographic, which have been produced by just using the ASCII character set. The advent of graphical programs has meant this form of graphic display has declined markedly."[4] I consider this definition slightly biased. Although it is true that pinups were a popular ASCII genre, they were not necessarily pornographic, and many other genres were popular, notably celebrity portraits and cartoon characters. The statement about the decline of the art form is also questionable, since ASCII art has been quite persistent and has lived on in different shapes and contexts to this day.

A different way of approaching the subject of ASCII art is taken in *Encyclopedia of New Media: An Essential Reference to Communication and Technology*, which proposes an explanation for why ASCII art was made:

"Originating as a way of enriching the text environment and allowing for a greater range of human expression, ASCII art can be viewed as an argument against technological determinism, as it shows that individuals can shape the uses to which technology is put."[5] Here ASCII art is presented in a more positive light as an instrument for creativity and as a means for humans to gain the upper hand over the machines.

The material base on which ASCII art was usually printed was continuous-form paper (also called fanfold paper) that was fed through the printer and was often green-striped and 132 columns wide. These green and white bars made it easier for users to follow the computer code as it printed, but there was also plain white fanfold paper. The wide format and the continuous form made it suitable for images and oblong posters. A horizontal perforation made it possible to separate the individual sheets, and a vertical perforation along the margins allowed the strips with sprocket holes to be torn away. This procedure created some paper dust, and the resulting single sheets had serrated edges.

The aim of this chapter is to examine some of the uses to which ASCII art was put in the days before computers developed into the image-making machines that today's film industry and the gaming industry rely on. Specific attention is paid to printed ASCII art within computer centers, an environment that was an important breeding ground for the art form. Key questions asked in the chapter include these: What kinds of ASCII art were created? For what purposes was ASCII art made? How was ASCII art displayed, circulated, and published? How is it now being collected and archived? How could ASCII art be seen as a postdigital practice?

THEORY AND METHOD: INTERVIEWS AND VISUAL PERCEPTION

A suitable method for finding out how people use a certain technology is the interview. I reached out to a number of people who worked in the computer trade in the 1960s, 1970s, and 1980s, asking for interviews. I also did a small number of phone and email interviews. For the subject of ASCII art, I started out locally. A retired employee of the computer center at Gothenburg University agreed to an interview and provided me with valuable information. I then contacted other Swedish IT history researchers, who recommended that I speak with a former head of the

computer center at Stockholm University. After our interview—where he, among other things, pointed me to an interesting instance of ASCII art used in the context of medical research—he emailed some of his colleagues, one of whom had saved a large number of printouts with ASCII art and was willing to share his memories of the art form and its context with me. Some of the people recommended to me had no memories of ASCII art. They had been retired for many years and had either lost interest in or never had an interest in this marginal phenomenon of their working life.

Simultaneously, I searched for and contacted bloggers and website owners who mentioned an interest in ASCII art. One American engineer agreed to answer my questions via email and also forwarded the questions to three of his contacts. Another method I tried was to contact nongovernmental organizations (NGOs) and computer museum volunteers, but I received few or no answers. I realized I had to target specific persons, and a later attempt directed at computer museums in Great Britain and in Germany rendered me two more answers. This account is meant to illustrate the meandering paths that sometimes must be taken to find informants who are able to share information about events and practices that took place half a century ago. Perhaps my study of ASCII art would have been more successful if it had been conducted ten or twenty years earlier. Nevertheless, the interviews provided me with valuable material, context information, and pictures.

VISUAL PERCEPTION: SHIFTING BETWEEN DIFFERENT MODES OF SEEING

Letters are usually disciplined, carrying out their duties in the lines of text like soldiers in an army platoon. In ASCII art, the soldiers have broken free from their usual positions in order to perform a piece of modern ballet, where they appear in unexpected and irregular constellations and can even stand on top of each other. The original purpose of the letters and the other characters has become subverted, and they have lost their conventional semiotic compass. Their bodies now constitute pictorial elements from which a larger picture is built. This is not a new phenomenon in the history of art. Mosaic is one of the oldest artistic techniques. But

in contrast to mosaic shards, halftone dots, and pixels, the elements of ASCII art are carriers of meaning and are meant to be read. The perception of art made of small elements involves switching between looking at a picture from a distance and looking at it at close range. At a sufficient viewing distance, the image as a whole emerges, whereas if the viewer moves closer to the image, the elements themselves become more noticeable, and it becomes harder to perceive the motif in its totality.[6] In addition to this, ASCII art entails switching on and off between reading the letters and seeing them as abstract forms. Sometimes these two modes of perception have to coexist, as when an ASCII artwork contains a signature of the artist. There are also more elaborate hybrid forms, as when the characters function simultaneously as pictorial elements and semiotic signs, as is shown in the medical examples below.

Even when the characters do not fulfill their usual function, it would be wrong to regard the characters as meaningless in ASCII art. With their different forms and the thin and thick parts of their bodies, they help create a new pictorial meaning.[7] ASCII art is a form of abstraction, in one way as it thins out the fabric of representation and in another way as it adds to it by turning the picture into a riddle to be solved. ASCII art engages viewers by inviting them to adopt different positions and modes of reading/viewing, and I would argue that this aesthetics constitutes much of the allure of ASCII.

ART AND EXPERIMENTS

ASCII pictures where the characters are used for drawing lines and contours are called *structure-based ASCII art*, whereas pictures with grayscales that resemble photography are called *tone-based ASCII art*.[8] In 1965, H. Philip Peterson, who worked at Control Data Corporation Digigraphics Laboratories, made a tone-based version of Leonardo da Vinci's *Mona Lisa* that became widely known. Control Data offered Peterson's printed picture as a gift to customers of the company.[9] It also made use of the picture at the beginning of a 1968 promotional film for a CalComp plotter, where a large *Mona Lisa* poster is seen hanging on a wall. During the film's enumeration of suitable applications of the plotter, examples from different disciplines are shown—meteorological maps, scatter plots from

atomic physics, molecular structures, architectural drawings, computer programming, and music—all made in the manner of line drawings. The film's last example features the *Mona Lisa*, during which the voiceover says that the CalComp plotter can produce "even complex pictorial presentations, directly from the output of any standard digital computer." The tone-based *Mona Lisa* is shown first in close-up, so that the digits that make up the greyscale picture are discernible, and then, when the camera zooms out, the motif as a whole becomes visible.[10]

Beginning in 1963, the journal *Computers and Automation* held competitions for computer art and displayed such art on its covers.[11] Peterson wrote an article about his *Mona Lisa* for the journal. He found that the journal's covers so far had been too dependent on analog forms and claimed that, based on the method used for creating it, his version of the *Mona Lisa* could be regarded as a "pure" digital artwork. He explained that he divided the picture into cells, scanned a color projection slide of the painting to measure the density of different parts of the picture, and then filled the cells with digits that matched the density of the slide of the *Mona Lisa* painting. Peterson designed a special font for the experiment: "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."[12] The creation of shades in a picture was not something that could be achieved with a plotter in its normal working mode, hence the designation "complex pictorial presentations" in the film. Peterson's article contains much quantitative information concerning the working process, the size and number of cells, the number of plotter steps, and the number of hours (sixteen) it took to plot the work.

Peterson's picture became known by the name *Mona by the Numbers*. The picture is mentioned by computer pioneer Ted Nelson in his book *Computer Lib / Dream Machines*, where he refers to it as "Lizzie of the line printer." A cruder version of it is reproduced in Nelson's book, and he clarifies his stance on this kind of images by adding "NOTE: this is not a 'computer picture.' There is no such thing. It's a quantization put out on a line printer."[13] There was no consensus about what constituted a computer picture at the time.

Figure 2.3 H. Philip Peterson, *Mona by the Numbers*, 1965. Courtesy of the Computer History Museum.

Similar experiments in digitization and visual perception took place at Bell Labs in New Jersey, which provided a fertile ground for experiments in the intersection of technology and art in the 1960s. According to computer art pioneer A. Michael Noll, "The digital art at Bell Labs was both a result of research in computer graphics and a stimulus for that research. As an R&D organization, Bell Labs was keenly interested in the display of scientific data and also in computer graphics as a form of human-machine communication."[14] Two of his colleagues, Leon Harmon and Kenneth Knowlton, devised a method to scan photographs and convert them to numerical data. They made several pictures with this method, using communication symbols instead of letters and numbers. Strictly speaking, these pictures were not ASCII art, but they built on the same principle. The aim was "To develop new computer languages which can easily manipulate graphical data; To explore new forms of computer produced art; To examine some aspects of human pattern perception."[15] A picture of a reclining nude, called *Studies in Perception #1*, attracted the most attention and became famous through exhibitions and publications.

Studies in Perception #1 was based on a photograph specifically taken for the purpose of being digitized. The picture appeared in the Museum of Modern Art's exhibition *The Machine as Seen at the End of the Mechanical Age* in New York in the winter of 1967–1968 and in the Institute of Contemporary Arts's exhibition *Cybernetic Serendipity: The Computer and the Arts* in London in 1968.[16] According to an anecdote regarding its origin, Knowlton and Harmon printed out the picture as a large mural and attached it to the wall of a colleague's office. It was considered too risqué by Bell Labs and had to be taken down, but when Robert Rauschenberg showed it during a press conference about the organization called Experiments in Art and Technology (see below), the picture made it to the front page of the *New York Times* and was subsequently deemed as respectable art.[17] However, as this statement by Johanna Drucker shows, these visual experiments hold an ambiguous position in art history:

> Engineers tended to downplay aesthetics, emphasize functionality, and call anything with any pictorial value at all a work of "computer art." By the mid-1960s, experiments at Bell Labs and a handful of other industrial and academic sites had created enough of this "art" for computer graphics to begin to be exhibited and appreciated, if only as curiosities.[18]

Figure 2.4 Installation view of the exhibition *The Machine as Seen at the End of the Mechanical Age*, Museum of Modern Art, New York, November 27, 1968, through February 9, 1969. Gelatin-silver print, 6½ × 9½ in. (16.5 × 24.1 cm). Photographer: James Mathews. © The Museum of Modern Art, New York. Photographic Archive. The Museum of Modern Art Archives, New York. Catalogue number: IN877.22. @ 2022. Digital image, The Museum of Modern Art, New York / Scala, Florence.

In the early 1970s, one of the established artists who made works based on the principles of ASCII art was the Brazilian artist Waldemar Cordeiro, who created a series of prints with a political intention. In contrast to Harmon and Knowlton, who came from the technical side, Cordeiro had a long career within the field of abstract and concrete art, but like them, he was interested in human perception. He did not scan images but used a more manual method to enter the information into the computer: "Cordeiro had to hand-input every dot making up the layers of figures in the final output. He had to decide how dark each spot would be, and then input that information by hand."[19] His computer-based works took pictures from newspapers and magazines as their starting point, in a way that brings to mind the photographic works that the German artist Gerhard Richter made in the 1960s. However, whereas Richter manipulated the photographs by converting them into oil paintings with a smearing effect that was at odds with the usual appearance of an out-of-focus

photograph, which made viewers unsure of what kind of image they were looking at, Cordeiro's processing atomized the images without jeopardizing their photographic integrity. One of Cordeiro's works, *Gente Ampli*2* (*Amplified People 2*) (1972), which shows a crowd protesting outside the University of São Paulo, was shown in the exhibition *Thinking Machines: Art and Design in the Computer Age, 1959–1989* at the Museum of Modern Art in 2018, fifty years after *The Machine as Seen at the End of the Mechanical Age*.[20]

Which of these three works can be considered art, and which can be considered mainly as methodological experiments? Does the answer depend on the work itself, the training of the maker, or the institutional context? This is a complex question, and the answer is probably that all three factors come into play but that the context of a work's production and the institutions that exhibit the work are decisive for its inclusion in the art world, as is argued by institutional art theory.[21]

Peterson's *Mona by the Numbers* became famous, but it did not enter the art world in the same way as Harmon and Knowlton's *Studies in Perception #1* and Cordeiro's *Gente Ampli*2* did. It is included in compArt daDA: the database Digital Art, which is an online repository for digital art in its early phase and uses the designation "digital art" in a broad sense.[22] The repository is headed by computer art pioneer Frieder Nake and is part of a project at the University of Bremen. Peterson made a couple of other pictures—including a portrait of William Charles Norris, president of Control Data, for an article published in *Fortune*—but remained relatively unknown and was not considered an artist.[23] He did not collaborate with artists and was not involved in a research environment like the one at Bell Labs. His article about his *Mona Lisa* appeared in *Computer and Automation*, a journal for computer professionals. In the introduction to the short article, Peterson writes somewhat self-mockingly, "I have sent you, for your consideration, a 'pure' digital-work of art (admittedly not original)," and he finishes with a comment about a detail of the picture: "A close-up of her enigmatic smile would probably be the most interesting way of demonstrating the technique used." In this way, he emphasizes that he is not the originator of the artwork and that he is aware of that one cannot get at the "core" of an artwork by this method. Simply put, he does not claim to be an artist. In his book on early computer graphics in

Australia, media scholar Stephen Jones comes to the conclusion that the portraits made with a similar technique by the Australian physicist Iain Macleod could not count as art but that they paved the way for future advances in the field.[24]

The experiments by Harmon and Knowlton attracted the attention of the art world when they participated in Bell Labs experiments and in the organization called Experiments in Art and Technology (E.A.T.), which was founded after a performance called *9 Evenings: Theater and Engineering* that took place in New York in 1966. These large-scale performances are considered a milestone in the history of art and engendered new collaborations and crossover art forms.[25] But Knowlton never felt at ease with the title "artist." This is evident from another anecdote:

> Because Art-and-Technology was the rage, and The Museum of Modern Art had a "Machine Show," and the Brooklyn Museum and other places had similar parties, and in each case Leon and I submitted the Nude to demonstrate a collaboration between artist and techno-geek (or whatever). One of us had to be an artist. So by the whim of a spin-launched coin, Leon became the artist and I remained a technologist (pretense aside, so did he).[26]

Nevertheless, *Studies in Perception #1* is positioned firmly in the history of art. Its motif, the reclining nude, has been reiterated throughout art history, with Titian's *Venus of Urbino* and Manet's *Olympia* as notable examples. Nudity was acceptable when it was cloaked in allegory and presented in an antique setting, but *Olympia* caused a scandal for breaking these rules and showing a real-world prostitute. The tension between pornography and art is a long-standing issue, and a motif in itself does not position a work in either category (for further discussion on pinups and their connection to art history, see below). The position of *Studies in Perception #1* in the art world was consolidated by the restoration, concluded in 2016, that enabled it to be exhibited anew in London and Berlin in 2017.[27]

Figure 2.5 Waldemar Cordeiro (1925–1973), *Gente Ampli*2*, 1972. New York, Museum of Modern Art. Computer output on paper, 52 15/16 × 28 9/16 in. (134.5 × 72.5 cm). Latin American and Caribbean Fund. Account number 585.2016. © 2022. Digital image, The Museum of Modern Art, New York / Scala, Florence.

Cordeiro was an established artist before he ventured into computer art, and he made works with an artistic intention that went beyond experimentation with new means of expression. He worked together with a physicist, Giorgio Moscati, a relationship built on mutual exchange. In the work *Gente Ampli*2*, the motif of the image and the technique chosen to represent it collaborate in constructing the meaning of the work, granting anonymity to the people depicted in a politically charged situation. As an artist, Cordeiro could put the method to use in order to express an artistic idea. He was one of the pioneers of computer art in Brazil, and being included in *Thinking Machines: Art and Design in the Computer Age, 1959–1989* consolidated his position on the international art scene.

SCIENTIFIC VISUALIZATIONS IN COMPUTER SCIENCE, PHYSICS, AND MEDICINE

In *The New Hacker's Dictionary*, originally published in 1975, the section on ASCII art begins with "a serious example"—a diagram of electronic circuits. Further down, some "very silly examples" are given, showing animals and cartoon characters.[28] This categorization demonstrates a clear awareness of the playfulness that dominates the art form, although it was also put to many serious uses during a time when there were no other ways to generate images.

For a number of reasons, ASCII art is still the preferred form of visualization in some contexts. One of the advantages of ASCII art is that it is readable by any text editor and not dependent on a specific graphic software. In a blog post from 2019, "Explaining Code Using ASCII Art," computer scientist John Regehr gathered a collection of examples showing how ASCII art is used in the source code of computer programs to illustrate the shape of data structures.[29] In this way, the documentation is integral to the source code itself, in contrast to external documentation, which can be lost. One of the respondents to my survey on ASCII art, an American engineer in his late seventies, gave this reason for using ASCII art: "I have been making ASCII-art schematic diagrams for decades, to avoid my work being trapped in proprietary formats."[30]

In addition to file formats, it is also a question of workflow. For developers, maintainers, and users of complex software packages, shifting to

```
o----)||(--+--|<----+   +---------o + D O
  L  )||(  |        |   |             C U
A I  )||(  +-->|-+  |   +-\/\/-+--o -   T
C N  )||(        |  |   |      |        P
  E  )||(  +-->|-+--)---+--|(--+-o      U
     )||(  |        |          | GND    T
o----)||(--+--|<----+----------+
```

Figure 2.6 A power supply consisting of a full wave rectifier circuit feeding a capacitor input filter circuit. *The New Hacker's Dictionary*, version 4.2.2.

A tree rotate in Musl:

```
7  static int rot(void **p, struct node *x, int dir /* deeper side */)
8  {
9          struct node *y = x->a[dir];
10         struct node *z = y->a[!dir];
11         int hx = x->h;
12         int hz = height(z);
13         if (hz > height(y->a[dir])) {
14                 /*
15                  *   x
16                  *  / \ dir          z
17                  * A   y            / \
18                  *    / \   -->    x   y
19                  *   z   D        /|   |\
20                  *  / \          A B   C D
21                  * B   C
22                  */
23                 x->a[dir] = z->a[!dir];
24                 y->a[!dir] = z->a[dir];
25                 z->a[!dir] = x;
26                 z->a[dir] = y;
27                 x->h = hz;
28                 y->h = hz;
29                 z->h = hz+1;
30         } else {
```

Figure 2.7 Data structure. John Regehr, "Explaining Code Using ASCII Art," *Embedded in Academia* (blog), February 18, 2019.

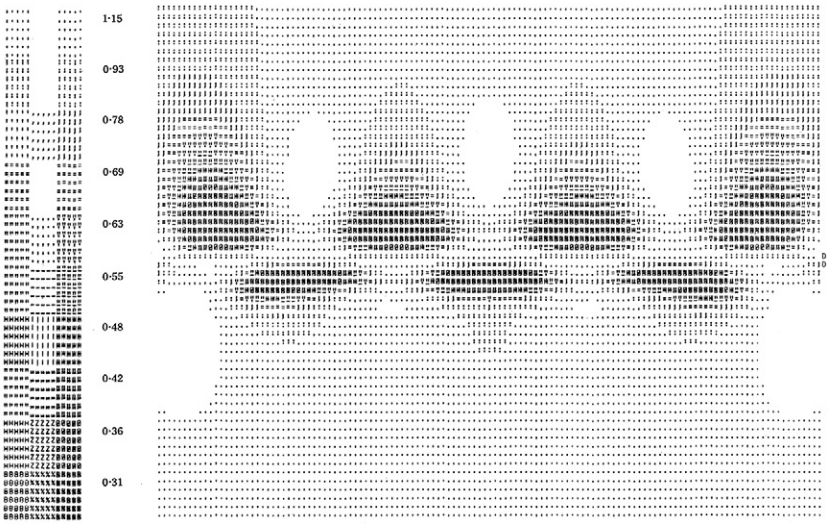

Figure 2.8 A grayscale line-printer picture. Alan K. Head, "The Computer Generation of Electron Microscope Pictures of Dislocations," *Australian Journal of Physics* 20 (1967): 561. Reproduced with permission from CSIRO Publishing.

a graphical tool in order to access a visualization of the software would be disturbing and would interrupt the workflow in a way that an ASCII-based visualization of the software would not.[31] In Kirschenbaum's terminology, the formal materiality of an ASCII-based visualization is different from that of a visualization made with a graphic software package.

The examples so far in this section have concerned structure-based ASCII art. One early attempt with tone-based ASCII art in physics is described next. In 1967, in an article on electron microscope pictures of metals dislocations, Australian physicist Alan K. Head presented the results in the form of line-printer pictures according to the half-tone principle, as grayscale ASCII pictures made up of punctuation marks. The grayscale used was divided into ten steps that corresponded to a number of boundary values. These pictures, which were based on calculations for dislocations, matched the actual micrograph pictures to a high degree, despite the fact that they consisted of only a limited number of shades.

The usual presentation method had been experimental profiles and graphs showing the intensity values, but with the help of equipment

originally intended for text production, Head had invented a new method of visualizing the results of physics research.[32] He concluded that "when the important information is in the topology of the picture, rather than in precise intensities, a pictorial presentation of the theoretical calculations is valuable."[33]

From 1969 to 1972, a development project called Computers in Radiotherapy and Clinical Physiology, involving medical visualization, was carried out in the Swedish university town of Uppsala.[34] It was brought to my attention by one of my informants, Bengt Olsen, who was involved in the project and was head of the Stockholm University Computing Center at the time. He sent me a leaflet that presented the project with a diverse range of visualization techniques—schematic drawings, graphs, tables, computer text printouts, and some ASCII-based pictures. Two of the subprojects concerned radiotherapy and dose calculation in the treatment of cancer. In this case, ASCII art was not deployed for its grayscale potential, but instead a new type of hybrid image was created, where the alphanumeric characters simultaneously served as pictorial elements and conveyors of therapeutical information. Figure 2.9 shows a computer-calculated dose plan for a case of lung cancer: "The asterisks denote the outer and inner contours. The numbers, which form isodose lines, indicate the absorbed dose expressed as a percentage of reference dose, i.e., 1: 10%, 2: 20%, 0: 100%, A: 110%, B: 120% and C: 130%. The tumor contours are marked with $ signs."[35] "Isodose line" means that the same dose of radiation is applied along a certain line. Following this explanation, we can discern the tumor on the right, the highest doses delivered near the tumor, and the decreasing doses toward its sides. Only one position is used for each piece of information. There are more than ten steps in the dose plan, which means that single digits are not sufficient and letters are therefor used for values over 100 percent of the reference dose.[36] This is the trade-off between functioning as a conventional sign of the alphanumerical character set and functioning as a pictorial element stripped of its usual semiotic meaning.[37] To represent a dose of 110 percent with the number 11 would have used two positions and in that way displaced the isodose line it was simultaneously drawing. Using the letter A to represent 100 percent requires only one position.

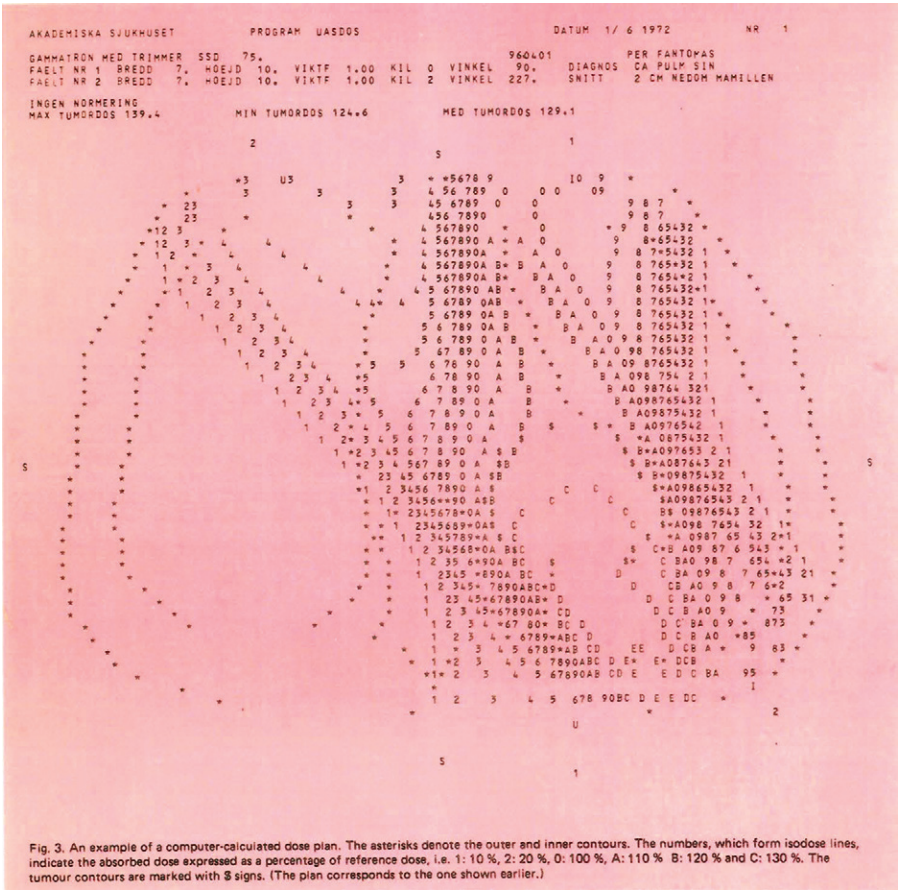

Fig. 3. An example of a computer-calculated dose plan. The asterisks denote the outer and inner contours. The numbers, which form isodose lines, indicate the absorbed dose expressed as a percentage of reference dose, i.e. 1: 10 %, 2: 20 %, 0: 100 %, A: 110 % B: 120 % and C: 130 %. The tumour contours are marked with $ signs. (The plan corresponds to the one shown earlier.)

Figure 2.9 A computer-calculated dose plan for a case of lung cancer. *Computers in Radiotherapy and Clinical Physiology*, Presentation of a development project, Internal report, Siemens-Elema, EC60.470.B01E (1972), 21.

Another example, concerning the treatment of cancer of the uterus, shows a section of the body seen from the patient's head end, where the levels of radiation that should be applied in the therapy are indicated by the numbers, which, at the same time, form the isolines (that is, the area where a certain dose should be applied) in the same manner as in the previous example.

Since there are only six levels of radiation in this case, the numbers 1 to 6 are sufficient for representing the doses, and letters need not be used for dose levels. This frees up alphabetic characters for other purposes. The

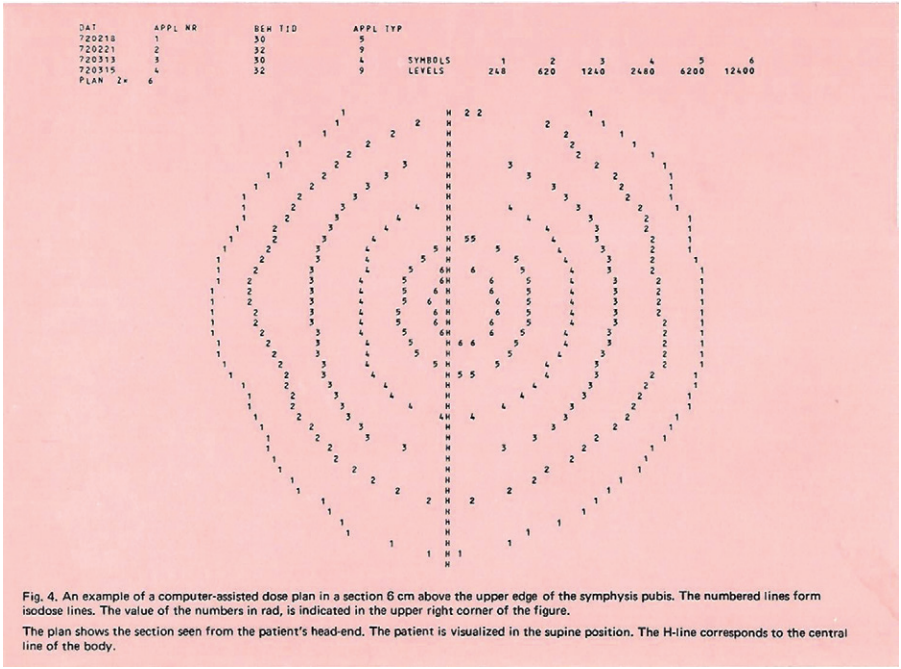

Figure 2.10 A computer-calculated dose plan for a case of cancer of the uterus. *Computers in Radiotherapy and Clinical Physiology*, Presentation of a development project, Internal report, Siemens-Elema, EC60.470.B01E (1972), 26.

letter H has been used to mark the central line of the body, to which it is suited by the straight lines of its constitution.[38]

Both these examples have demonstrated that using ASCII characters for pictorial representation presents readers with new perceptual and cognitive challenges. In order to take in and digest the information in the visualizations, readers need to be able to shift between two modes of perception—reading letters as semiotic signs and seeing them as pictorial elements. Readers also need to shift from understanding letters as linguistic units to deciphering them as numeric characters.

PICTURES FOR FUN

Computers were serious business. The large mainframes of the 1960s generally were used for scientific, bureaucratic, and military purposes.

However, as a diversion, some technologists used the machines to create music, images, and games.[39] ASCII art depicting pinups, calendars, celebrities, fictional characters, and games were printed out on the line printers, often over several pages so that they could be displayed as wall banners. In the online resource *The Dictionary of Digital Creation*, the entry "IBM" is illustrated with a picture of Abraham Lincoln being printed on a large IBM printer that was commonly used in the 1960s, with the caption "Printing an image on an IBM 1401: a cinch [*sic*] of humor and art in a very business minded industry."[40]

It would be wrong, however, to regard the creative practices that emerged in computer environments simply as entertainment that had no further uses. In a time when computers were starting to play a more important role in society, many people had concerns about surveillance and unemployment due to automation. According to Stephen Jones, ASCII art was one of the things that could give computers a more human face:

> Partly as an attempt to reduce the public's fear and partly as a recruiting practice, all the academic computing systems of those days featured strongly in university Open Days, which were held each year. Many of the second generation of programmers got their first sight of a computer at one of these events. Banners, calendars, and other images—nudes, Snoopy, Michelangelo's *David*, the *Mona Lisa*, and so on—were often printed out as posters or the picture for a calendar, and this was as close as most people got to one of the big machines.[41]

When the art form became more widespread, it also was used for marketing computers. One of the leading computer manufacturers that competed with IBM in the 1960s was Honeywell Information Systems. In 1964, Honeywell and its customer Abbey National Building Society are featured in a full-page advertisement in *New Scientist*, and more than half the page is devoted to the logotype of the bank, rendered in ASCII art. Despite the resulting low resolution, the image of a woman and man walking under an umbrella was easily recognizable, and the accompanying text read: "This familiar Abbey National symbol was produced by the Honeywell computer now getting down to some more serious work."[42] This advertisement demonstrates the ambivalence that Honeywell's leaders and marketing team felt toward associating computing with this frivolous artform. On the one hand, the Honeywell marketing department realized the attention-grabbing potential of ASCII art. On the other, it

needed to insert a disclaimer that emphasized the seriousness of its business. This also demonstrates a dilemma faced by the computer companies in general: their physical products looked like boring cupboards, and the actions they performed were abstract and hard to visualize.[43]

The same type of hesitancy is evident in a 1960s promotional film for the Digital Computer Lab at the University of Illinois. The film presents the equipment and the facilities available at the university and shows stacks of punch cards being read, operators and users examining printouts, and tape reels spinning. Part of the soundtrack consists of "Sabre Dance" by Aram Khachaturian, adapted for computer and played on switching circuits. The presenter says: "It may not compete with the sounds from your most favorite recording group, but it does emphasize the versatility of that electronic marvel, the digital computer." Then there is a cut, and the presenter is shown in close-up, turns to the audience, and continues: "All is not fun and games, of course. The real importance of computers is to be of service to the ever-increasing demands of a mathematically oriented society."[44] This film uses the same strategy that was used in the Honeywell advertisement: the viewer is teased with a piece of art or music, but the window to "fun" that is opened a little is soon closed again by a disclaimer that stresses the seriousness of the enterprise. These examples show that entertainment and art were recruited in order to increase the acceptance of this new and menacing technology.[45]

I have found very few photographs of ASCII art in the context of production. None of the people I interviewed could remember seeing any such photographs. Finding the following three images involved many searches. Figures 2.12, 2.13, and 2.14 show men holding up ASCII printouts in the vicinity of computers and printers. In the first two photographs, men are grasping pictures that have just emerged from the printers; in the third, a man displays an ASCII picture of Brigitte Bardot with one hand and two punch cards with the other. Caricatures, pinups, and film stars were staples of popular culture, and pinups and films stars were common motifs for ASCII art. The information about these photographs is sparse, but they are likely press photos. The first, and oldest, photo is from 1957, and its legend at Getty Images says "Caricatures of US statesmen Dwight Eisenhower and Adlai Stevenson printed by a Universal Automatic Computer."[46] It is an editorial image from the Hulton Archives, an archive connected to

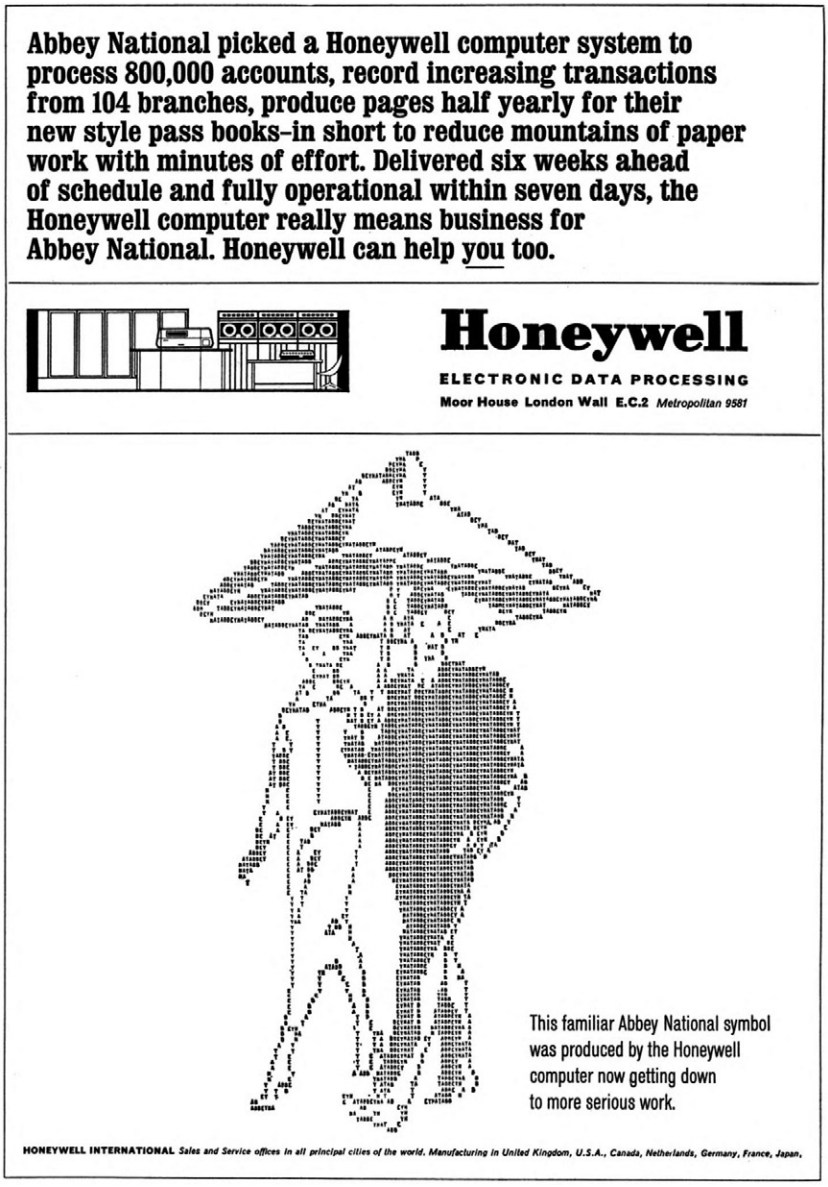

Figure 2.11 An advertisement for Honeywell and Abbey National. *New Scientist* 21, no. 381 (March 5, 1964): 589.

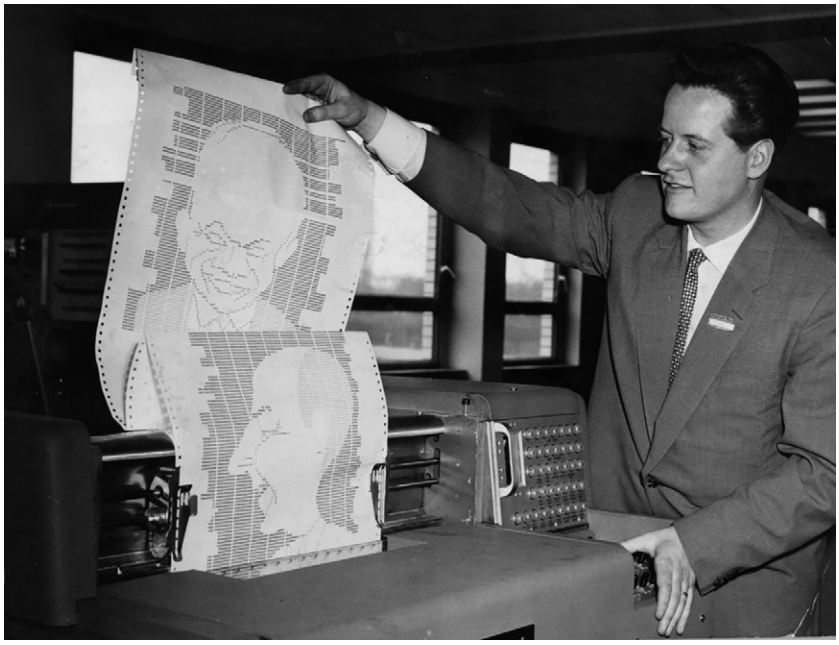

Figure 2.12 Caricatures of US statesmen Dwight Eisenhower and Adlai Stevenson printed by a Universal Automatic Computer, UNIVAC Art, March 13, 1957. Photo by Keystone / Getty Images.

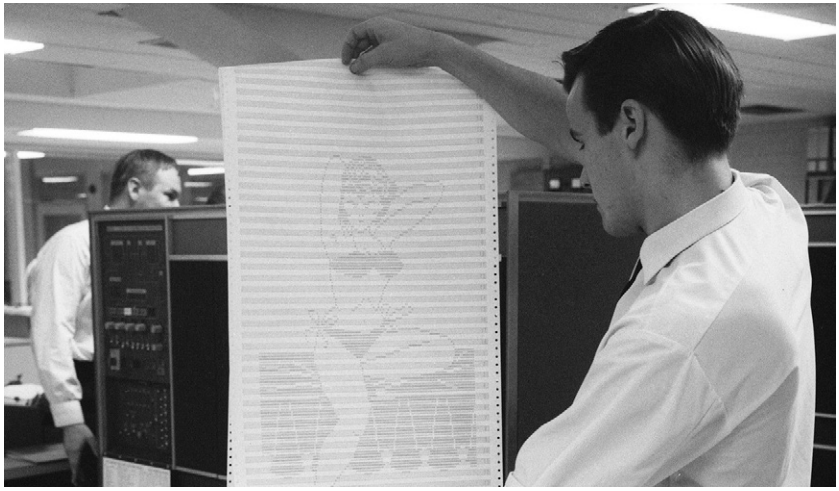

Figure 2.13 A portrait of Sophie. Computing Center of the City of Helsinki, December, 11, 1964. Photo by Olavi Kaskisuo / Lehtikuva.

Figure 2.14 Inauguration of the computer center at the shipyard in Uddevalla, Sweden, January 24, 1967. Photo by Arne Andersson.

the British magazine *Picture Post*, which was famous for its photojournalism.[47] The second photo was taken in 1964 in the Computing Center of the City of Helsinki by the Finnish photographer Olavi Kaskisuo, who became known for his celebrity photos but also ran a studio and a photo agency together with other photographers in the 1960s.[48] The last photo was taken in 1967 in connection with the inauguration of a computer center at the Uddevallavarvet shipyard in Uddevalla, Sweden.[49] The photo was published in the staff bulletin with the caption "Head of punch cards Lars Westlund with the portrait of Brigitte Bardot that the computer playfully presented at the 'grand opening.'"[50] Here we have yet another case

of a disclaimer, with the word "playfully" stressing that this is not what the computer normally does when it is busy with more serious work. The other two pictures might have been published in a similar context or in a newspaper report. These institutions shared with computer manufacturers the difficulty of visualizing computing. In order to avoid showing machines that hid most of their activities behind dull panels, the photographer probably asked for a staff member to pose for a picture, preferably showing something visually interesting. Including a piece of ASCII art would then be a natural choice for the setup of the photo shoot. Even if photographs such as these were not advertising photographs in any strict sense, they contributed to creating a softer image of the computing business, and ASCII art was a helpful resource in this endeavor.

In *Computer Lib / Dream Machines*, Ted Nelson explains the commercial aspects of computing. The section called "How computer stuff is bought and sold" is illustrated with a page from a sales leaflet of a software company. Under the heading "Additional programs," some programs that generate ASCII art are listed, including "Santa and Reindeer," "Birth Announcement," "Snoopy," and "Calendar." The "Calendar" section is presented as follows:

> This FORTRAN program can produce a calendar for any year from 1968 through 2100. The calendars are printed at the bottom of a Playboy bunny who is perched atop a bar stool.[51]

These posters sometimes stayed in the memory of their owners for a long time. One example can be found at the website of a software engineer who looks back at his long career in the computer trade and shares some memories from his college years in the 1970s. He remembers working with punch cards, paper tapes, and teletypes; interacting with the computer; and running programs:

> But what really impressed me the most about teletypes was, hanging on the computer lab wall of this almost all-male school, a printout of a Playboy Playmate centerfold, her form made up of ascii characters. The work that went into generating that! But that was the dawning of the age of internet porn, the birth of the killer app![52]

One of the most popular cartoon characters was Snoopy. Media theorist Peter Lunenfeld recalls "the early days of computer art when Snoopys

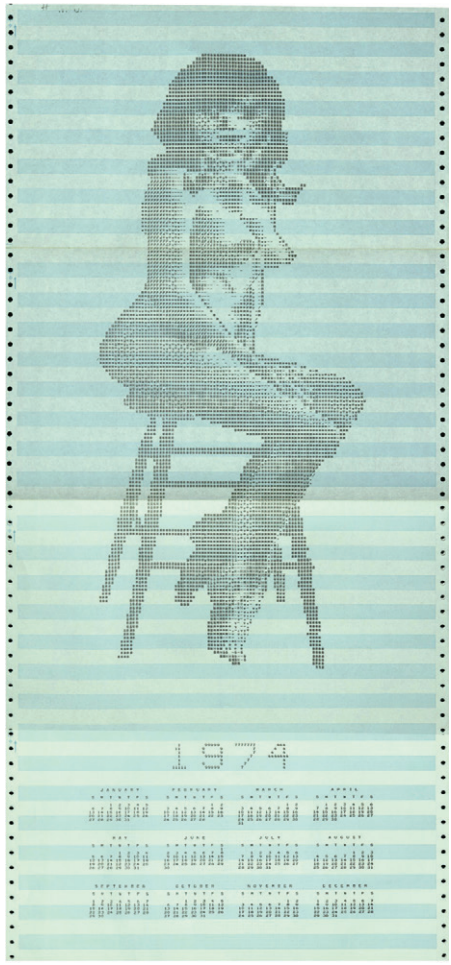

Figure 2.15 A pinup calendar. Courtesy of the Computer History Museum. Perhaps this is the picture that was referred to in the sales leaflet reproduced in *Computer Lib / Dream Machines*.

and Christmas trees were spat out by teletypes in computer labs around the country."[53] There are many variations of this Peanuts character, which seems to have been something of a gateway to computing. On the website of a retired chemist and scuba diver, I found this recollection of how he first learned to program:

> I started to learn to interface with computers in the mid-1960's. At that time, input to machines was primarily via punch cards (one card per line of code). This led to a computer art form, commonly called typewriter or ASCII Art. (ASCII from the set of rules that defined digital values for all the alpha-numeric characters found on a keyboard). The goal was to create a printed, recognizable image that appeared as if it were done on a typewriter. While the generation of ASCII art was entertainment, it was also a learning tool because it forced the "artist" to develop a sense of input and output using the computer devices of the time. Because of the immense popularity of the Peanuts cartoon strip, Snoopy, Charlie Brown, and the whole assembly of the Charles Schultz created characters were a frequent target among computer students to be assembled into an ASCII image.[54]

The collection of the Computer History Museum includes a number of Snoopy and other Peanuts pictures printed on an impact printer.[55] Other devices were also used, which gave a different appearance to their images. Software engineer Klemens Krause, head of the Computer Museum of the Department of Computer Science at the University of Stuttgart, Germany, recalls:

> Snoopy was my second computer-program. I made it in 1972 when our high school bought the first computer, a Wang 600. Output was done by a modified IBM-ball-typewriter. The snoopy was not printed line by line. It was plotted as line art. The print head on this machine could be moved by 1/100″-steps, also the paper drum. So it was possible to plot in very small increments.[56]

The position of Snoopy as something of an emblem of computer culture is evident from Ed Post's 1983 essay "Real Programmers Don't Use Pascal," which became a meme of its time. Post enumerates the characteristics of real programmers: they live in front of the terminal, which is surrounded by piles of program listings, half empty coffee mugs, and operating system manuals, and "taped to the wall is a line-printer Snoopy calendar for the year 1969."[57] The calendar was fourteen years old when the essay was written, which can be interpreted as showing the attachment "real programmers" had to this kind of pictures. They did not care

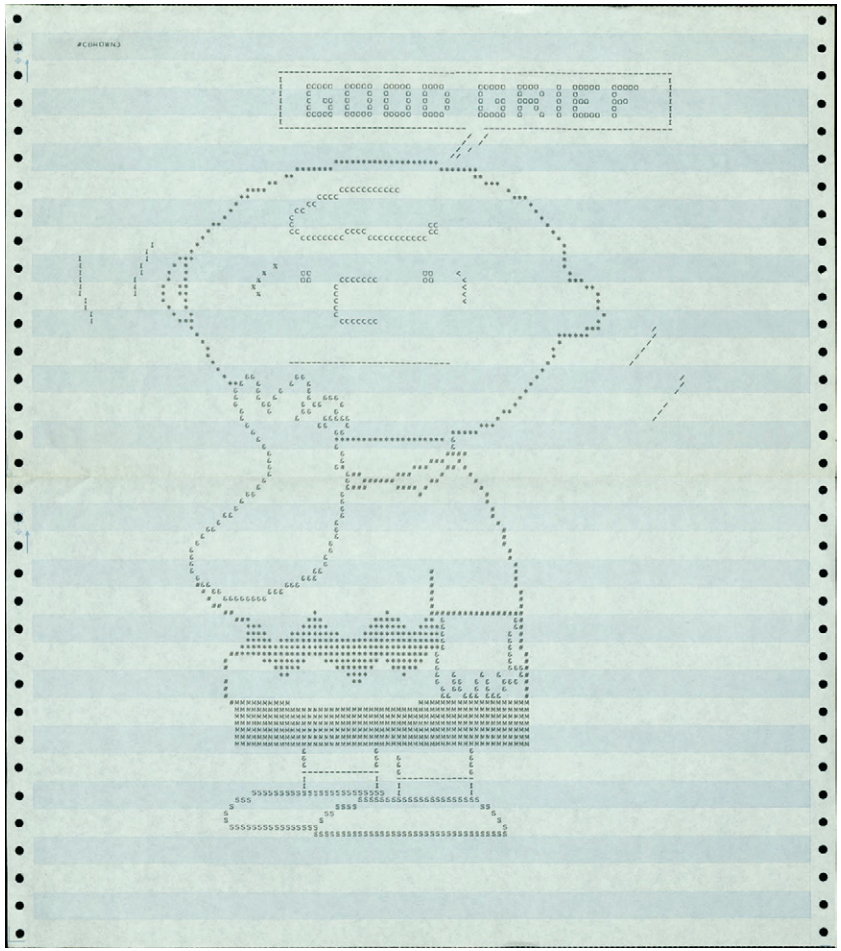

Figure 2.16 Charlie Brown. Courtesy of the Computer History Museum.

about food or sleep, but they cared about relics from the good old days of computing.

In the category of fictional characters, the Star Trek characters stand out. In 1976, a series of ASCII portraits of Star Trek characters, printed on card stock, was published by the magazine *Creative Computing*. The cover of volume 1 of *The Best of Creative Computing* (1976) features a "computer picture of Mr Spock by Sam Harbinson Carnegie-Mellon (formerly Princeton Univ.)."[58] In an interview in 2009, Samuel P. Harbinson explained how he made this picture in 1973, when he was still a student.

Figure 2.17 Snoopy by Klemens Krause. Made with a Wang 600 computer, printed on a modified IBM ball typewriter, 1972. © Klemens Krause.

He remembers having made other ASCII pictures as well: "There were about a dozen of them: a large picture of the moon; Buzz Aldrin on the moon; Mr. Spock; a Playboy Playmate (Lenna Sjooblom, Nov. 1972, and probably others); my girlfriend's terrier; a close-up of my cat's face; others I can't remember."[59]

The visual repertoire of ASCII art is to a great extent taken from popular culture. Most ASCII art falls into the art historical category of the portrait, including portraits of animals. A special subcategory of the portrait is the nude, from which the pinup is derived, albeit with a few detours from Sandro Botticelli's *The Birth of Venus* and other iconic nude paintings. Art historian Abigail Solomon Godeau has argued that the erotized imagery of women became a cornerstone of commodity culture and a symbol of modernity. Mass-produced images of seductive females were part of the

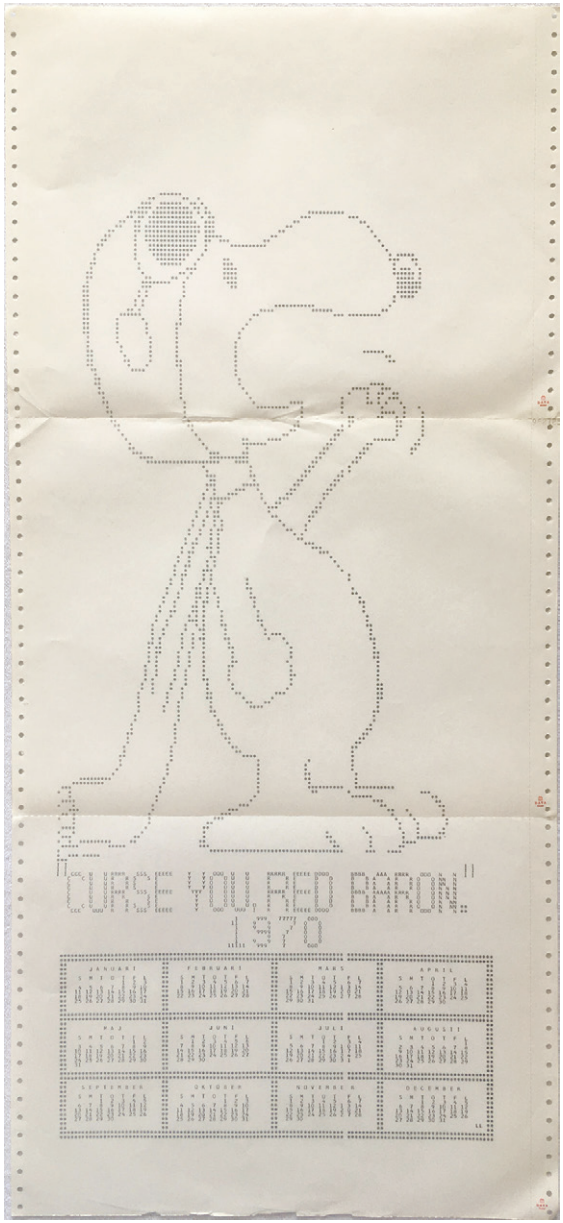

Figure 2.18 A Snoopy calendar by Peter Olofsson, 1970.

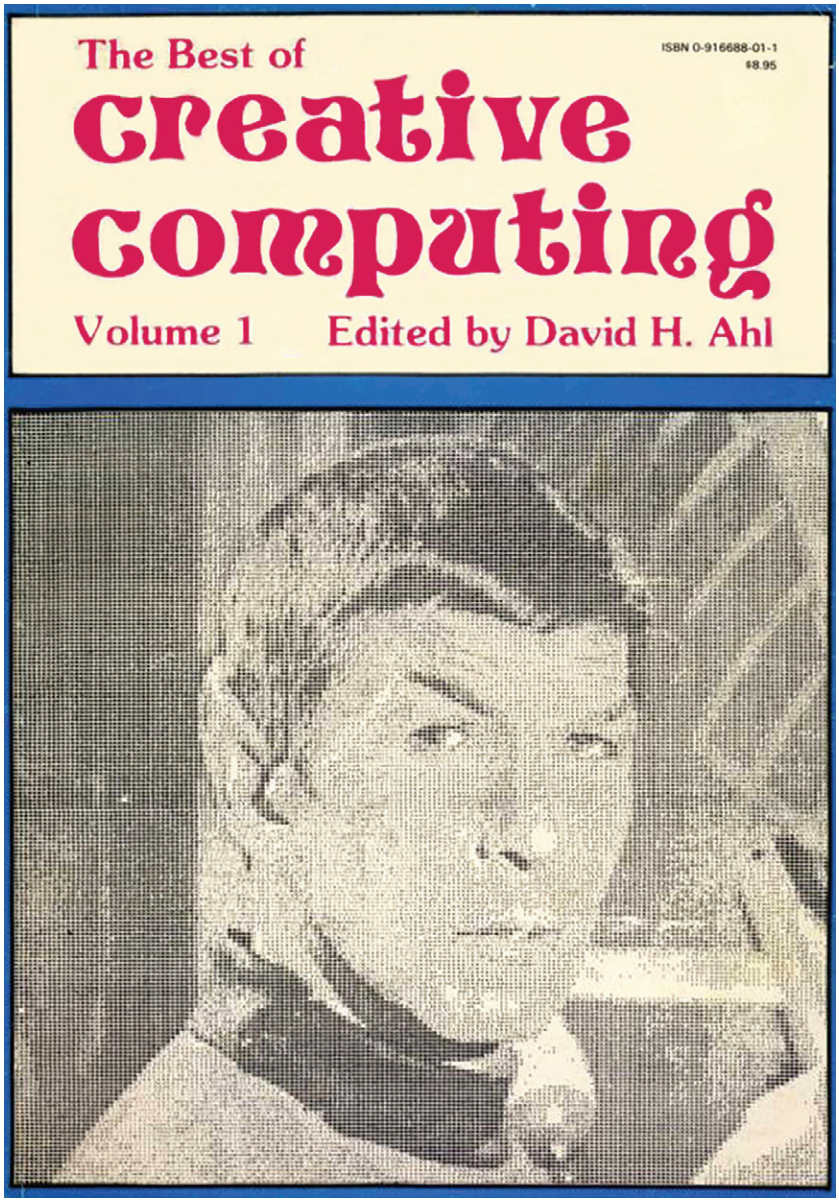

Figure 2.19 Mr. Spock on the cover of *The Best of Creative Computing*, vol. 1 (1976).

visual culture at the dawn of the era of consumption.[60] In the twentieth century, the pinup genre found a forum in magazines like *Esquire* and *Playboy*. The former emerged in the early 1930s, and during World War II, its sultry-looking and suggestively posed "Vargas girls" (painted by the Peruvian American artist Alberto Vargas) were in high demand by American soldiers. *Esquire* also published pictures of independent, working women who were a female ideal when their country needed them. After the war, women were expected to return to the home, a trend that was also reflected in the pinup style. When *Playboy* appeared in 1953, the target group was solely male, and the Playmates were supposed to be docile young women who did not challenge traditional gender roles, sexually or otherwise.[61] Many ASCII art pinups were modeled after Playmates, as is illustrated by the quotes above.

ASCII art was made as entertainment but could be used both for marketing and education. It came to represent computing to such an extent that it was often used for visualizing computing, although the attitude toward the art form was somewhat ambivalent. It had to be used with caution and supplied with a disclaimer that reminded the audience of the seriousness of the computer business. In the age of mainframe computing, ASCII art was print based, but the art form survived and even thrived as ANSI art on bulletin board systems. With the advent of the web in the late 1990s, making ASCII art became one of many playful activities that could be carried out and talked about around the digital campfires.[62]

ASCII ART IN COMPUTER CENTERS

What did computer rooms look like in the 1960s, 1970s, and 1980s? Most existing pictures look like the photograph shown in figure 2.20, which was taken at IKEA headquarters in Älmhult, Sweden, in 1971.[63] This was a time when staff members still wore white coats in the computer room. Most surviving pictures and films about computer centers from the era are promotional materials and official documentation, which makes it hard to know if everyday life in computer centers was ever documented or if such documentation has simply been lost.

In the large computer centers, which were set up by companies and universities, access to the computer room was restricted to the staff in

Figure 2.20 A computer room with an IBM System/360 Model 40 at IKEA headquarters in Älmhult, Sweden, December 20, 1971.

charge. Computers operated according to the principle of batch processing, and central processing unit (CPU) time was expensive and not to be wasted. When a user delivered a program on punch cards, an operator scheduled the job and fed the punch cards into the computer that ran the program. The user sometimes had to wait several hours for the output to be delivered to a rack in the reception area. The sorting of the pages was made possible by a job separator page with user identity and the job identity printed on it in big letters, made with the help of ASCII art.[64] In 1979, in my first year of studying informatics at Lund University in Sweden, the turnaround time was two hours. As a Cobol programmer, if I misplaced one full stop, I had to punch a new card, resubmit the program, and wait another two hours for the printout.

Making ASCII art was not part of the regular jobs of the staff members or students who used the facilities. It was often created when they had a moment to spare. In the same interview quoted above, Sam Harbinson recalls how he made ASCII art in 1973 during his time as an undergraduate in mathematics and computer science at Princeton University. He worked part-time in the Computer Graphics Laboratory of the Department of

Biochemistry as well as at the help desk of Princeton's Computer Center: "That gave me the opportunity to spend long hours with the IBM 360/91 computer, get 9-track tapes, get favors from the operators, etc."[65] At the Computer Graphics Laboratory, there was a densitometer that included a drum scanner that he used for digitizing black and white photographs. He wrote a Fortran program to render the images and mapped the densities to the overstrike patterns that formed his printer grayscale. Overstriking was a feature of the line printers that meant they could print text on top of already printed text, without advancing the paper. He could not oversee the printing himself. Printing belonged to the domain of the operators, who had to be reassured that the strange noise the printer made when overstriking was not a malfunction. Harbinson used trial and error for finding the right overstrike patterns, which were adapted to

> our printers, their EBCDIC character font, the black ink ribbons, and the paper the University used. With different printers, I doubt if the gray scales would be quite right. The programs and the raw data perished after I left Princeton. I left the print files on disk, so anyone could print out copies of the pictures after I left. It would be easy to reproduce the technique, but the interesting challenge was working within the limitations of the printers in those days.[66]

This account highlights the dependency of the art form on the materiality of its production process. The variables were several—printer, font, ink, and paper—and they all had to agree in order to produce the correct result. Anyone who wanted to transfer the files to another computer center had to redo parts of the process.

However, most students did not have access to the resources available to Sam Harbinson. In his account "Adventures of ASCII Art," computer scientist Ian Parberry, who had made some attempts at typewriter art in his teens, recalls how he made ASCII art as a student at the University of Queensland:

> In the 1970s I used the computer merely as a way to store and reproduce art created by hand. The thought of using a computer to actually create ASCII art had not yet occurred to me because I didn't have access to the scanning hardware (such as that used by Peterson in 1964) needed to input a picture into the computer, nor the amount of disc space needed to store it.[67]

In an interview I did with a person employed by the computer center at the University of Gothenburg, Sweden, from 1965 to 1997, he remembered

how he first encountered text art during his military service, when he worked with message encryption and teleprinter traffic. In 1963, when US President John F. Kennedy was shot, news agencies sent out a picture of the American president, which he and his fellow conscripts printed on the teleprinter. He also remembers a pinup that someone sent out in encrypted form. Had it been sent in plain text, the officers would have discovered it immediately. Since military personnel were not allowed to send private messages, the culprit was scolded for the mischief. The pictures were stored on punched tapes, and when he moved to his job at the computer center at the University of Gothenburg in 1970, he brought a whole library of them with him and converted them to the ASCII format. Once he came across a Fortran program that printed a calendar, written as a programming exercise by students at the Chalmers University of Technology in Gothenburg. He took the source code and added a Snoopy picture with a frame of asterisks. He also remembered printing a version of the *Mona Lisa* on book-quality white paper before Christmas 1976 and hanging it in his girlfriend's house. Among all the calculations that were performed at the computer center, the ASCII pictures were seen as a diversion. They were printed and given away as gifts to friends and as Christmas presents to children. It sometimes happened that researchers who had some computer time left on their accounts printed ASCII art to use up the time. If too many copies were requested, the operators were not happy about having to separate and sort fifty Snoopy printouts, and they regarded this as a misuse of the resources of the computer center.

THE DISPLAY OF ASCII ART

As mentioned above, I have not found any photographs of ASCII art displayed in computer centers, although there is ample written and oral evidence that such pictures existed and were displayed in various parts of many computer centers. According to my interviewees, ASCII art could be seen in the computer room, in offices, and on notice boards, both in university computer centers and in companies. In my previously mentioned interview with Harbinson, he recalled how he put together large pictures from several printouts "and, every so often, late at night, I taped them to the white cinder-block walls of the computer center's 'ready room' (where

jobs were submitted and people waited for their output to be placed in bins). Most people were impressed; no one asked me to remove them."[68]

The large size of the pictures is also pointed out in a comment on a video showing ASCII art being printed that was posted in 2016 by the Computer History Museum:

> My dad was in the Air Force and was a computer programmer. I remember him bringing home some ascii art for my brother and sister, mostly Peanuts characters with calendars and stuff. When I went to his building and saw all the rows of tape drives and mainframe equipment there was some giant ascii art in a couple offices on the walls.[69]

A large picture of a locomotive, three meters long, is known to have been displayed in the upper windows in computer centers at that time.[70] Unfortunately, I have found no pictures of this arrangement. The window display means that the picture was intended to be seen by an audience outside the building. It is similar to the contemporary visual culture phenomenon of using office building windows to display images made of sticky notes, sometimes leading to competitions between buildings on the opposite sides of a street. Text messages and images of computer games and cartoon characters appear in the bright colors of sticky notes, looking more like low-resolution early computer graphics used in game consoles and arcade games than ASCII art, but their display strategy is the same.[71]

THE CIRCULATION OF ASCII ART: A GIFT CULTURE?

A major difference between typewriter art and ASCII art is that typewriter art did not have a storage medium besides the finished picture on paper. *Bob Neill's Book of Typewriter Art* includes instructions for how to make each of the pictures in the book, which means repeating every keystroke manually on a typewriter.[72] Radioteletype (RTTY) art was stored on punched paper tapes, and the pictures were also distributed over radio. In the case of ASCII art, decks of punch cards were passed around among students and staff in university computer centers as well as among engineers in computer centers in companies. In the words of one of my informants, a female American engineer who was a student in the mid-1970s: "There were some prized card decks that got passed around for producing the

art and periodically you would see an example in the computer room or someone's dorm room." She adds that no one offered to share any decks with her, probably because of the erotic character of much of the art.

Although some software companies offered ASCII art for sale (see above) and Control Data gave its version of the *Mona Lisa* to customers as promotional material, ASCII art was mostly something that was just handed over to peers. When Harbinson finished his studies at Princeton, he made his ASCII art available to those who came after him: "I left the print files on disk, so anyone could print out copies of the pictures after I left."[73] Apart from being shared among peers, ASCII art was typically given to children who visited the computer center and those who lived with staff members. Another comment about the Computer History Museum video mentioned above, showing ASCII art being printed, testifies to this practice: "So cool . . . I sometimes received ASCII art prints when I went to see the company doing our accounting with my father :))."[74]

In a 2013 letter to the editor-in-chief of the blog *Vintage Computing and Gaming*, a woman asked for help in making an ASCII art banner for the memorial of her uncle, who had been an IBM employee:

> In 1979, when I was 9 years old, he gave me a banner for my birthday. It was from the old dot matrix printers. It had a silhouette of Snoopy on the top of his dog house and it said "Happy Birthday Chimene". I literally thought it was the coolest thing. This was before home computers and home printers for our family. The letters were made with x or o or maybe dashes. Because my brain had no conceptual framework for the world of computers, I literally wondered if it was created by magic.[75]

This letter shows the impression such a gift could make on the mind of a child. Twenty years later, the allure of ASCII art was built into the concept of an artistic installation by Vuk Ćosić. In the 1999 show *net_condition* at the Zentrum für Medientechnologie in Karlsruhe, Germany, Ćosić's *Instant ASCII Camera* took photos of visitors and printed them out on supermarket receipts that were given to the visitor as a token of the event.[76] A piece of ASCII art is still considered a suitable giveaway by heritage institutions related to computing. The Computer History Museum, for instance, prints ASCII art for its visitors.[77]

From an anthropological perspective, ASCII art can possibly be considered as part of a gift culture. In his seminal book *Essai sur le don: Forme et*

raison de l'échange dans les sociétés archaïques (Essay on the Gift: Forms and Functions of Exchange in Archaic Societies) from 1925, the sociologist Marcel Mauss outlines the characteristics of a gift economy where social bonds are formed by gifts and countergifts. Gifts are not "free." They are expected to be reciprocated and help establish hierarchies in a community. Mauss further claims that it is not possible to separate the gift from the donor, who leaves some trace of her personality in the object given.[78] The open source movement formed in the late 1990s has been characterized as a gift culture by one of the founders of the Open Source Initiative, Eric S. Raymond. In his essay "Homesteading the Noosphere," first published in 1998 and then revised a number of times in the two following years, he argues that reputation is one of the main gains for participants in the gift economy of the hacker milieu and that it is especially valuable in this kind of community, where attention can open the door to future collaborations with others.[79] ASCII art exchange and distribution can be seen as forerunners of this movement. In my study, I have come across several statements that appreciate the impact ASCII art made on children and adults. Harbinson recalls that when he put his printouts on display in the computer center, "Most people were impressed."[80] The software engineer quoted above was very impressed by the work that had gone into the making of the Playmate picture. One of my questions in the interviews asked about the purpose for making ASCII art, and one interviewee answered, "The main reasons for the real ASCII art was for the creators to, well, create really—sometimes to show how good / clever they were." In the corporate setting of Control Data, the reason for giving the customers the *Mona Lisa* print was to make them realize the great potential of the company's equipment.

If ASCII art is to be seen as a gift culture, what did recipients give back? They could help build the reputation of the practitioners, in cases where these were known. Harbinson was one of the few who put his name at the bottom of his pictures, but much ASCII art was anonymous. However, by passing on the card decks and files and displaying the pictures, the recipients paid the gift forward and made the art form into a widespread phenomenon. The effort required to make this contribution—to print a new picture from a file or make a minor adjustment to it—was rather small and could be managed by many people. Later attempts to form an

open source culture focused on computer graphics (such as the Blender Institute, a 3D computer graphics community that was launched in 1994) have proven less successful, according to a study by media scholar Julia Velkova. She argues that the organization does not really work according to the principles of an open gift economy to the extent claimed by Blender, mainly because the skill level required to make any real contribution is too high for amateurs outside the core team of developers. Instead of being peers, they can only take the weaker position of customers and users of the software produced by Blender.[81]

In the introduction to his book on typewriter art, Bob Neill explains how to read the instructions, which use the same logic as knitting patterns: "If the pattern reads:- 4@ 3: 5& 3S 4. 1@ 1' 1: 2S you would type : @@@@:::&&&&&SSS . . . . @':SS."[82] The open source culture of ASCII art shares similarities with the exchanging of craft patterns and food recipes, cultural practices that also depend on a wide dissemination of mainly anonymous artefacts. Patterns and recipes need not be invented by each new practitioner. They are freely shared and sometimes adapted or modified. In the postdigital era, the paths of ASCII art and craft are crossed, as shown, for example, by the Open Source Embroidery (OSE) project. The aim of the initiative was to investigate collaborative and material artistic practices, especially digital materiality.[83] The "hard" world of hardware and the "soft" world of textiles come together in a way that shows how the postdigital hacker attitude is prevalent in the contemporary maker and DIY culture, where the borders between the analog and the digital have been blurred. This is also what Rüdiger Schlömer sets out to achieve in his book *Typographic Knitting: From Pixel to Pattern*.[84] A search for "ASCII art" in GitHub, a software repository used for many open source projects, renders 3,785 hits. There are also some craft patterns, such as the Open Source Craft project.[85] If Bob Neill published his book of typewriter art today and if Harbinson created his ASCII art today, they probably would put their work on GitHub for the benefit of the open source community.

PRINTING AS PERFORMANCE

ASCII art was printed and displayed on walls and in windows, but it was also used for interactive entertainment in hardware demonstrations of

mainframe computers in the 1960s. The IBM 1401 was launched in 1959 together with the 1403 printer, which could print 600 lines per minute in 132 print positions, which was a great improvement over previous technology.[86] The wide fanfold paper that emerged from the printer inspired uses other than just printing business reports and source code listings. A risqué computer program called Edith was invented to run on this IBM setup, and it was circulated widely.[87] The origin of the program is unknown, but it was not an official demo authorized by IBM.[88] There were several versions, with different pictures and different languages. It made the printer into the mouthpiece of a supposedly thinking computer that shared its thoughts with audience members and urged them to take different actions in order for the performance to continue. Quite early on, it became obvious that what occupied the mind of the computer was women. The program was divided into three or four acts, according to a striptease logic, keeping the audience in suspense for what was to happen next.

When the Computer History Museum ran the program in 2018 on the request of a researcher in film studies, the crew was gathered around the printer for the demonstration with mixed feelings of expectation and embarrassment. The program they had found in one of their unsorted card deck files was about to begin. The first page that emerged said, in capital letters,

Dear friends,

We would like to show you the personality of the machine you see in front of you. You probably thought a machine was an inanimate object. This is not so, as you will see. Would you like to see what a machine thinks about. Just give me a minute and I will show you what I think about when I am idle.

[paper advances to next page]

Just a minute, please. I am almost ready.

[paper advances to next page]

Now I will show you what I am thinking about. However, before I start, I think it would be best if women and children left the room . . .

[Edith appears in bikini]

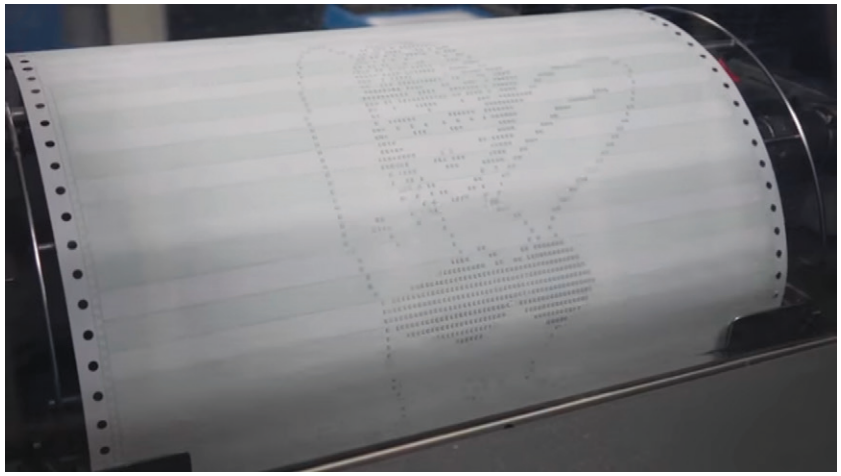

Figure 2.21 A screenshot from "The IBM 1401 Mainframe Runs 'Edith,'" YouTube, June 2, 2018. © CuriousMarc.

At this point, the program was halted and had to be rerun. This time the program went a step further, and Edith appeared topless before the program halted again. The crew found another version, stored on a PC, and punched a new deck from it. This version was in German, but the dramaturgy was the same. The audience is encouraged to flip switches on the computer, and for each switch, the woman appears with fewer clothes. A warning is issued for flipping the next switch, but when the audience is made to think that the woman will appear naked, she covers herself with a sign that says that you cannot do anything you like with a 1401 computer. If one flips the last, "forbidden" switch, she will be shown fully nude.

The suspense is built up partly by the text messages (which appear on their own pages like intertitles used to appear in silent movies to explain the action or convey the dialogue) and partly by the process of printing (which lets the image emerge gradually as the paper is fed forward in jerky movements by the sprockets). In terms of interactivity, it is a clever move to make the audience influence the action by using the switches as input devices, in an age long before screens and keyboards. The printer is turned into a media machine that is capable of narration, interactivity, and a dynamic display of images in front of audience members gathered

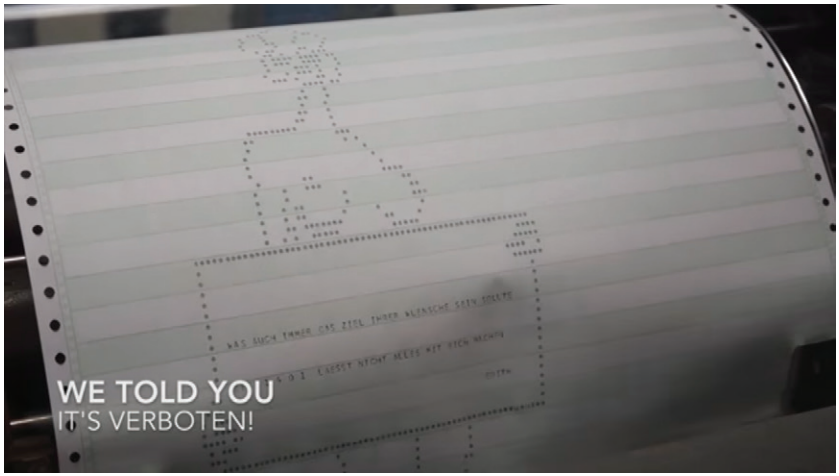

Figure 2.22 A screenshot from "The IBM 1401 Mainframe Runs 'Edith'" (German version), YouTube, June 2, 2018. © CuriousMarc.

around its bulky body. The theme of the performance taps into erotic fantasies but also into fantasies of the thinking machine. The electronic brain was not only a figment of the imagination and a common feature of science fiction in the 1960s, but it was also central to the new research field of artificial intelligence.

The reenactment of the Edith program is a perfect example of what it takes for an institution to preserve digital cultural heritage (as I mention above in the "Archives and Source Materials" section in chapter 1). First, it needs an operable computer and printer from the same era as the program; second, it needs a physical carrier with the program (in this case, a deck of punch cards); and last but not least, it needs a group of people with knowledge of how to run the program and operate the computer equipment. Without this combination, the archive would be empty or at least incomplete from a media archaeological point of view. Furthermore, the reenactment also demonstrates the implications of Kirschenbaum's concept of forensic materiality. His analyses of literary works were based on the disk storage media of the 1980s. He intended his book *Mechanisms: New Media and the Forensic Imagination* "to serve as a kind of primer on the preservation of digital literary history."[89] The Edith program is reassembled through the combination of a card deck in its original paper

format and a freshly repunched card deck made from an "electronic" file found on a PC. These are the material circumstances of the preservation of this piece of visual culture.

The Edith program seems to have been the first performance of its kind involving a printer, but it was not the first time expensive computer equipment was used for producing pinups. Edith had a precursor that was surreptitiously introduced in the US Air Force's Semi-automatic Ground Environment (SAGE) air defense system in the late 1950s. The huge computer system included a screen with a "situation display" and a light gun that could be directed at the targets to obtain further information about them. A programmer created a picture based on the December 1956 calendar girl of the men's magazine *Esquire*, and it appeared correctly on the screen if the switch between the two main computers went as it should. In other words, it functioned as a diagnostic tool.[90]

Pinups seem to be a persistent theme in the early history of computer graphics, which can be explained by the male-dominated world of computer science. The climate today is different, as the crew at the Computer History Museum seemed to be well aware of when they engaged in the media archaeological endeavor of recreating Edith. At the end of the video, the crew starts the preparation for the next regular demonstration at the museum. When CuriousMarc asks them jokingly, "You are not going to show Edith in your program, I'm afraid?," they smile and shake their heads, and one of them answers, "This is a family place."

Another case of media archaeology is the attempt to recover early personal computing software from tapes belonging to the microcomputer MCM/70 that was carried out by computer scientist Zbigniew Stachniak at the York University Computer Museum (YUCoM) in Toronto, Canada, in 2016. Among the files recovered from a 1975 tape containing demonstration programs, a program was found that printed the *Playboy* logo as ASCII art. Stachniak made the following reflections:

> the inclusion of the Playboy logo ASCII art on the tape suggests that in mid-1970s, the PC end-users as conceptualized by MCM were predominantly heterosexual males. In the early 1970s, there had been several categories of ASCII art that MCM could have used for its demo tapes. Portraits of politicians were popular subjects of such an art (e.g., of Lincoln and JFK) and so were real and fictional celebrities (e.g., Marilyn Monroe, Mr. Spock, Mona Lisa, and Snoopy).

MCM seemed to leave distributors with little choice but to present the company's unique and progressive vision of personal computing against a backdrop of the parochial computing culture of the 1970s.[91]

What was at the time seen as legitimate imagery is today seen as sexist. ASCII art was used in marketing in several ways. The advertisement for Honeywell and the *Mona Lisa* print were suitable for more public spaces, whereas Edith and the *Playboy* logo were shown in the more restricted and predominantly male circles of computer staff. However, the commercial use of the risqué material would not have been possible without the proliferation of printed ASCII pinups in computer rooms and dorm rooms that formed the base of this branch of the ASCII visual culture.

COLLECTING ASCII ART

Although the ASCII art form seems to have thrived in the 1960s and 1970s, not much remains of its printed material. Fanfold paper was not made to last, and many posters were taken down and thrown away when students graduated and left the campus and when computer centers were reorganized or moved into new venues. Some of my informants saved a few printouts as keepsakes from their student years or their early workplaces. There are some private collectors, but the folksy art form seems to have gone under the radar of most cultural heritage institutions. It is hard to find ASCII art in the collections of museums and archives. For instance, a search for "ASCII art" in the Europeana web portal returned zero hits. The art form falls between two stools and has no natural institutional residence, being too artsy for technical museums and too technical and mundane for art museums. Technical museums have focused on collecting hardware and evidence of the "real" business of computing, and that focus does not include the wanton creation of pictures with equipment not intended for that purpose. In the collection of the Computer History Museum, however, there are some posters, books, and conference proceedings related to ASCII art. One of the posters is a copy of *Mona by the Numbers*, and there is also an item cataloged as "ASCII art from impact printer," consisting of thirty-nine pages of ASCII pictures printed on fanfold paper, mainly Snoopy calendars and pin up girls, some of them running over more than one page.[92] *Mona by the Numbers* can also be found

in the collection of Zentrum für Kunst und Medien (ZKM), where it is cataloged as "computer-generated, print, plotter drawing." The museum also has a work by Waldemar Cordeiro, *A Mulher que não é B.B.*, cataloged as "print, computer-generated." There exists a great variation in the categorization of this kind of picture, and the lack of a consistent terminology makes it hard to find ASCII art in collections. This highlights how important metadata is for research, another aspect of formal materiality of digital artefacts.

Very few traditional art museums have ASCII art in their collections. The Museum of Modern Art in New York has two works by Waldemar Cordeiro (see above) but not Harmon and Knowlton's *Studies of Perception #1*, which was shown in the *Machine as Seen at the End of the Mechanical Age* exhibit in 1968 and 1969. The Victoria & Albert Museum in London, which focuses on design and decorative art, has some portraits of singers and other celebrities made by Jaume Estapà in the late 1960s.[93] The museum also has a copy of *Studies in Perception #1*: "This is a smaller and more recent version of the image, produced in 1997 as a limited edition print."[94] This information is interesting because it indicates that the work is treated according to the rules of art photography. There are vintage prints that were printed by the artist and later prints. The former are more valuable. The limited edition is a method used both in the graphic arts and photography in order to increase the value of single prints, and it is a custom that works against the potential for multiplicity inherent in these art forms.

Prints of ASCII art are bought and sold in different kinds of marketplaces. Auction houses have sold Harmon and Knowlton's *Studies of Perception #1* as well as works by Waldemar Cordeiro.[95] Prints from the popular culture sphere also are offered for sale, but they are sold on eBay rather than through auction houses. One advertisement on eBay has the caption "Extremely Rare Star Trek Mr. Spock ASCII Art Chaintrain Line Print 1979." It is printed on fanfold paper, and the pages can be combined into one large poster. The specifications read:

> This printout has never been unfolded (except to take these pictures), and has been stored in the dark since it was printed in 1979, so the paper is like new. There are 36 individual pages; when fully put together, the picture is ~3 × 5 ft or so! (the picture of the complete print is stock)

There are very few original copies of this unique piece of computer history, and especially those of the iconic Leonard Nimoy as Mr. Spock . . . so take this opportunity to own it for posterity![96]

Another advertisement for a print from 1973 also stresses the rarity of the artefact for sale (shortened version):

Rare ASCII (ASS—kee) Princeton Computer Lab Print 1973 by Samuel P. Harbison.

After some research we came to find out that this particle [*sic*] print was used to raise money for the original Princeton University Computer Programming School. The Mr. Spock first run was done in four panels.

. . .

This piece is definitely original. We asked a framing store when they thought the frame is from.

Their best guestimate was late 70's early 80's which dates the print accordingly.

. . .

Some ripples are present since it was mounted to cardboard and framed.

Overall excellent examples of the earliest known ASCII artwork!

This poster most certainly belongs in a poster only auction.

Mr. Spock is in an 17″ × 22″ Black Metal frame. Boarders of poster all intact.

This is such an unbelievable cross genre / class collectible.

Appealing to Sci Fi—Star Trek—Computer Historians—Princeton Alumni.

Serious Star Trek Collector's realize how scarce this example of ASCII artwork is.[97]

These advertisements use a similar rhetoric. As is customary on auction sites, the material qualities are described in detail—the pristine condition of the paper in the first ad and the frame and the board in the second ad. The provenance is of interest, but the rarity and the importance for computer history are perhaps the most important aspects. The assessment of an external expert of the age of the frame is used as a guarantee of authenticity and its status as a vintage print.

The collecting of ASCII art follows the same line of demarcation that was drawn up in 1960s between art and engineering and that was discussed in the section on "Art and Experiments" above. The art institutions collect the art pieces, the technical museums collect the anonymous ASCII art, and the museums with an in-between position, such as ZKM, collect both "art ASCII art" (such as Cordeiro's works) and "technical ASCII art" (such as *Mona by the Numbers*). When presented on a marketplace, the art market vocabulary and selling points dominate in both categories.

The eBay site is not an archive in the traditional sense, and it does not secure long-term storage. It is distributed and ephemeral, and listings exist only for a limited time. However, as design researcher Matthew Bird argues, eBay and similar sites are a resource for research in design history: "But increasingly, digital resources like auction websites, online museum collections, patent archives, and even eBay and Tumblr offer information about the history of design that archives do not."[98] While museums often hold objects in pristine condition, secondhand marketplaces can offer unused things as well as things with patina and signs of wear and tear. For media archaeologists, these marketplaces can supply valuable information and even allow them to buy items to start a collection of their own.[99]

ASCII ART AS A POSTDIGITAL PRACTICE

In the postdigital era, the computer has become a full-fledged visual medium. ASCII art is still being made but not because there is a lack of other options for making pictures. There are programs for making vector graphics, raster graphics, 3D graphics, and game engines, to name a few of the digital tools now available. Taking, editing, and sharing photographs with a mobile phone have become general competencies. ASCII art today is made against a different backdrop than existed when computers were nonvisual machines. There are many free tools that do not require any programming skills and that can provide social media users with design elements and give their accounts a certain look.[100] Some programmers have devoted time to the development of new, advanced ASCII art tools. On its website, the Dutch type foundry Underware presents a new ASCII art generator that retains more detail in a photo converted into ASCII art than older methods do. The company claims that

> ASCII art itself has been declared dead by Microsoft in 1998, in favour of other formats like JPG and GIF and the promotion of proportional fonts. But ASCII art is still alive as ever, at least in our own studio. We love ASCII, we grew up with ASCII. We are ASCII kids. However, current technology allows for much more advanced ASCII art than in the 1970s. This is why we imagined to develop "subpixel ASCII art." Same simplicity, but much more precise results.[101]

Developing more sophisticated methods for an outdated technique might require a postdigital hacker attitude. There are also programmers

who celebrate the old hacker culture by the "reenactment" of classic art pieces, such as the Snoopy calendar from 1969 that is mentioned in Ed Post's essay "Real Programmers Don't Use Pascal." The owner of the blog *The Abandoned Place* wrote the post "Snoopy Calendar Is Forever (C++)":

> I decided that I rewrite the Snoopy calendar in C/C++. And why? Do you think it is heresy? Is it pointless? The Fortran codes are available here and here, I can compile it in ten minutes, I just wasting my time? Well, you are right. But I wanted to feel the passion, I wanted a quick C++ project (the development of the C++ Snoopy calendar take about 6 six hours), and I wanted to compare myself to these so-called real programmers.[102]

Another blogger, the owner of *Mike's Computer Nerd Blog*, who also wanted to pay tribute to the old hacker culture and Post's essay, made a version of the calendar:

> I have a certain fondness for this particular gimmick which I can't quite explain. Perhaps it is the fact that it provides a feasible and exciting challenge for me—that of making my own Snoopy calendar. I have actually done this a couple of times. This time I used a combination of C programming and several Unix programs like `enscript`, `figlet`, `cal`, and `sed`.[103]

These blog posts show that people sometimes relate to the history of their trade by going back in time and at the same time going forward, by applying new tools for solving an old task and thereby bringing the practice of making ASCII art into a contemporary technological context. These are two good examples of what it means to adopt a postdigital hacker attitude. ASCII art lives on—not just by being reproduced on websites, on T-shirts, and in email signatures but also by being invented anew in terms of its creation process. A question that arises is whether the attitude required to make ASCII art in the 1960s was postdigital from its inception. I would argue that the creative mindset required to subvert the original intention of the line printer at the time, long before the digital became commonplace, has a strong affinity to the postdigital attitude.

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