Cinema and Digital Media

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PUBLISHED IN:
PERSPECTIVES OF MEDIA ART, JEFFREY SHAW AND HANS PETER SCHWARZ (eds). Cantz Verlag, Ostfildern, Germany, 1996.

1. Cinema Gives Birth to a Computer

Let us reverse a well-known wisdom: that a modern digital computer is a typical war time technology developed for the purposes of calculation and real-time control and that its current use to create moving images is a rather specialized and recent application. Not only were computers used to create moving images within a few years of their "birth" but, in fact, the modern digital computer was born from cinema.

What is cinema? If we believe the word itself (cinematograph means "writing movement"), its essence is recording and storing visible data in a material form. A film camera records data on film; a film projector reads it off. This cinematic apparatus is similar to a computer in one key respect: a computer is controlled by a program stored externally in some medium. Therefore, it is not acidental that a diagram of the Universal Turing Machine looks suspiciously like a film projector. In fact, the development of a suitable storage medium and a method for coding data represent important parts of both cinema and computer pre-histories. As we know, the former eventually settled on discrete images recorded on a strip of celluloid; the latter -- which needed much greater speed of access as well as the ability to quickly read and write data -- on storing it electronically in a binary code.

So why was the digital computer born from cinema?

1.1. Jacquard Loom

Around 1800 J.M. Jacquard invented a loom which was automatically controlled by punched paper cards. The loom was used to weave intricate figurative images, including Jacquard's portrait. This specialized graphics computer inspired Charles Babbage in his work on the Analytical Engine, a general computer for numerical calculations. As Ada Augusta, the daughter of Lord Byron and the first computer programer, put it, "the Analytical Engine weaves algebraical patterns just as the Jacquard loom weaves flowers and leaves." [1]

Thus, a programmed machine was already synthesizing images even before it was put to process numbers.

2.1. Zuse's Film

Even more interesting is the case of Konrad Zuse. Starting in 1936 and continuing into the Second World War, Zuse had been building a computer in the living room of his parents' apartment in Berlin. Zuse's computer pioneered some of the basic ideas of computing: binary arithmetic, floating decimal point and program control by punched tape. For the tape, he used discarded 35 mm movie film. [2]

One of these surviving pieces of film shows the abstract program codes punched over the original frames of some interior shot. The iconic code of cinema is discarded in favor of the more efficient binary one. In a technological remake of the Oedipal complex, a son murders his father. But the story has a new twist -- a happy one. Zuse's film with its strange superimposition of the binary over iconic anticipates the process which gets underway half a century later: the convergence of all media, including film, to digital code. Cinema and computer -- the Jacquard loom and the Analytical Engine -- merge into one.

2.2. Digital Media

This story can summarized as follows. A modern digital computer is developed to perform calculations on numerical data more efficiently; it takes over from numerous mechanical tabulators and calculators already widely employed by companies and governments since the turn of the century. In parallel, we witness the rise of modern media which allow the storage of images, image sequences, sounds and text in different material forms: a photographic plate, a film stock, a gramophone record, etc. The synthesis of these two histories? The translation, which is taking place today, of all existing media into numerical data accessible for the computers. The result: digital media -- graphics, moving images, sounds, shapes, spaces and text which become computable, i.e. simply another set of computer data.

If before a computer would read in a row of numbers outputting a statistical result or a gun trajectory, now it can read in pixel values, blurring the image, adjusting its contrast or checking whether it contains an outline of a gun. The iconic -- Barthes's famous "message without a code" -- finally became securely codified. (It is interesting that image processing and semiotic analysis of iconic signs both develop at the same time -- the second half of the 1950s.) And while the numeric coding of an image did not, of course, fulfill the semiotic desire to divide an image into units of meaning, it did come just at the right time for the enormous economic, ideological and military interests already dependent on the instrumental use of the visible and therefore looking for a more efficient way for it to be recorded, stored, manipulated, reproduced, transmited and displayed. The society of the Spectacle was destined to embrace digital media.

2. Cinema Prepares Digital Media

Cinema not only plays a special role in the history of the computer. Since the late nineteenth century, cinema was also preparing us for digital media in a more direct way. It worked to make familiar such ÒdigitalÓ concepts as sampling, random access, or a database -- in order to allow us to swallow the digital revolution as painlessly as possible. Gradually, cinema taught us to accept the manipulation of time and space, the arbitrary coding of the visible, the mechanization of vision, and the reduction of reality to a moving image as a given. As a result, today the conceptual shock of the digital revolution is not experienced as a real shock -- because we were ready for it for a long time.

2.1. Sampling

Any digital representation consists from a limited number of samples, a fact which is usually illustrated by a grid of pixels -- a sampling of two-dimensional space. Cinema prepares us for digital media because it is already based on sampling -- the sampling of time. Cinema samples time twenty four times per second. All that remains is to take this already discrete representation and to quantify it. But this is simply a mechanical step; what cinema accomplished is a much more difficult conceptual break from the continuous to the discrete.

Cinema is not the only media technology which, emerging towards the end of the nineteenth century, is dependent on a discrete representation. If cinema samples time, fax transmission of images, starting in 1907, samples two-dimensional space; even earlier, first television experiments (Carey, 1875; Nipkow, 1884) already involve sampling of both. [3] However, reaching mass popularity much earlier than these other technologies, cinema is the first to make the principle of a discreet representation of the iconic public knowledge.

2.2. Random Access

Another key quality of digital media is random access. For instance, once a film is digitized and loaded in the computer memory, any frame can be accessed equally fast. Therefore, if film samples time but still preserves its linear ordering (subsequent moments of time become subsequent frames), digital media abandons this "human-centered" representation altogether in order to put time fully under our control. Time is mapped onto two-dimensional space, where it can be managed, analyzed and manipulated more easily.

Such mapping was already widely used in nineteenth-century cinema machines. The Phenakisticope, the Zootrope, the Zoopraxiscope, the Tachyscope, and Marey's photographic gun were all based on placing a number of slightly different images around the perimeter of a circle. Even more striking is the case of Thomas Edison's first cinema apparatus. In 1887 Edison and his assistant, William Dickson, began experiments to adopt the already proven technology of a phonograph record for recording and displaying of motion pictures. Using a special picture-recording camera, tiny pinpoint-size photographs were placed in spirals on a cylindrical cell similar in size to the phonography cylinder. A cylinder was to hold 42,000 images, each so small (1/32 inch wide) that a viewer would have to look at them through a microscope. [4] The storage capacity of this medium was twenty-eight minutes -- twenty-eight minutes of continuous time taken apart, flattened on a surface and mapped into a two-dimensional grid. In short, time was prepared to be recreated, manipulated and reordered.

3. Simulation

It won't be difficult to show how cinema has been preparing other concepts associated with digital media, but, given the limitations of

space, I want to focus on the most important one: simulation.

Digital media makes commonplace the simulation of non-existent realistic worlds. Examples include military simulators, Virtual Reality, computer games, television ("virtual sets" technology), and, of course, special effects of Hollywood films such as "Terminator 2," "Jurassic Park" and "Caspar." These latter films seem to demonstrate that, given enough time and money, almost anything can be simulated. Yet, they also exemplify the triviality of what at first may appear to be an outstanding technical achievement -- the ability to fake visual reality. For what is faked, of course, is not reality but photographic reality, reality as seen by the camera lens. In other words, what digital simulation has (almost) achieved is not realism, but only photorealism -- the ability to fake not our perceptual and bodily experience of reality but only its film image. This image exists outside of our consciousness, on a screen -- a window of limited size which presents a still imprint of a small part of outer reality, filtered through the lens with its limited depth of field, filtered through film's grain and its limited tonal range. It is only this film-based image which digital technology has learned to simulate. And the reason we think that this technology has succeeded in faking reality is that cinema, over the course of the last hundred years, has taught us to accept its particular representational form as reality.

What is faked is only a cinematic image. Once we came to accept a moving photograph as reality, the way to its future simulation was open. Conceptually, digitally simulated worlds already appeared with the first films of the Lumieres and Georges Melies in the 1890s. It is they who invented digital simulation.

It is hundred years later and the simulation techniques are fully perfected. And it is becoming clear that it is ultimately more advantageous to simulate the world than to film it directly. A simulated image can represent non-existent reality, it can be endlessly modified, it

is more manageable, and so on. Because of this our society will try to use digital simulations whenever possible.

Cinema, which was the key method to represent the world throughout the twentieth century, is destined to be replaced by digital media: the numeric, the computable, the simulated. This was the historical role played by cinema: to prepare us to live comfortably in the world of two-dimensional moving simulations. Having played this role well, cinema exits the stage. Enters the computer.

NOTES

1. Charles Eames, A COMPUTER PERSPECTIVE: BACKGROUND TO THE COMPUTER AGE (Cambridge, Mass.: Harvard University Press, 1990), 18.

2. Eames, 120.

3. Albert Abramson, ELECTRONIC MOTION PICTURES. A HISTORY OF TELEVISION CAMERA (Berkeley: University of California Press, 1955), 15-24.

4. Charles Musser, THE EMERGENCE OF CINEMA: THE AMERICAN SCREEN TO 1907 (Berkeley: University of California Press, 1994), 65.