Unpublished draft of a chapter for the book “WRO READER 2008. From Absolute Cinema to the Film of the Future.” author : Michael Lew

«Cinema is an invention without future.»
Louis Lumière

Title
What is happening to the film form as the medium becomes computational ?

Abstract
As it frees itself from the inherent linearity of the celluloid or tape medium, the triply temporal structure of narrative becomes alive, organic, non-deterministic, algorithmic, improvisational. Fixed time flow over a material progression is no longer a given. In this new cinema, narrative imaging is endowed with the intricacy and richness of painting, the periodicity and rhythm of music, allowing the viewer to explore expressive convolutions of a complex, variable story in partnership with a real-time editor in software.
Now the timeline becomes a multidimensional narrative map and cinema becomes allographic as viewer, user and computer interpret a polymorphic film score.

Introduction

What is happening to the film form as the medium becomes computational ? What happens when the Turing machine meets the Vision machine ? What new types of experiences in the tradition of cinema are becoming possible when video and computer are converging ?
These are the questions that arise today as all the devices that we use to view moving images (projector, television, set-top box, laptop, personal data assistant, cellular telephone) are progressively all equiped with computational power (a CPU = a processor = a complex programmable device).
On one hand, a hundred years after the invention of the moving image camera, we have seen the creation of extraordinary institutions like the « cinema », the « television », « Hollywood » and its complex system of stars, studios and agencies. On the other hand, fifty years after the invention of the modern computer architecture (Turing, Von Neuman), enabled by semiconductor physics, we have the personal computer, now completely ubiquitious, and a multitude of other digital devices of all sizes and shapes, all interconnected.

3 tools for representation : hand, camera, code

In order to restrain the scope of this question, I would like to start by proposing that there exist today essentially three kinds of tools to create moving images : the *hand*, the *camera* and the *code*.

The « hand » designates the artist's hand as well as all of its analogical extensions : physical tools like the pencil, the brush, the chisel, or, in the digital world, software tools like Photoshop, Maya or AutoCAD.
These tools allow, with the artist's skill, to draw, sculpt, model, based on a representation of the world that the artist bears mentally and imitates or reproduces as a two or three dimensional object on a physical medium (clay, paper..) or in a virtual medium. Examples of art made using the hand would include a Picasso sketch, a Rodin sculpture, or a 3D representation of Superman for a video game.

The « camera » is a distinct, automated way of capturing the world. Using a camera is foremost an act of framing a subject matter and adjusting the camera's settings. By camera, we do not only mean the modern film, video or still camera, which are descendants of the camera obscura and which record at regular intervals the image of a scene formed by a lens in parallel perspective ; we also mean, by extension, any system of sensors that measures, samples and acquires over time a set of physical variables that describe an external subject, for aesthetic purposes : sound (microphone), motion (motion capture), position (GPS, 802.11 triangulation, accelerometers), meteorology (anemometer, thermometer, hygrometer..), physiological manifestation of emotions (skin conductivity, arterial tension, breathing rhythm..), etc. Examples of data captured using the camera would include an experimental film shot in 16mm by Jonas Mekas or the tracked movements of a dancer using a multi-camera array.

The « code » is the implementation, in a programming language, of mathematical, geometrical and algorithmical models, describing movements, shapes and interactions. Computational art (such as the pieces made with the « processing » software), designates the kind of art made using computer code. But by extension, I would like to propose here that the notion of code encompasses any script or meta-script that describes in an abstract conventional language, the universe of possibilities of a ludic or fictional world. It could be a video game written in C, or a theater play. Examples of art made using code would include PacMan (where the code is executed by a computer) or a French novel (where the code is a human-readable text written in modern French natural language represented with the Latin alphabet).

Today, motion pictures and interactive video games using the latest technologies are a skillful hybridation of these three techniques : characters, props and environments are tri-dimensional models sculpted by artists (hand) ; gait, facial expression and other joint movements are recorded from real performers using motion capture (camera) ; textures on walls, landscapes and objects come from videos or photographs (camera) ; character dialogs and sound effects are recorded (camera) ; gravitation, physical forces and other dynamical systems of solids are simulated to account for real-time player input (code) ; particle systems are used for generative complex animations like smoke or explosions (code) ; behavioural animation and crowd behaviour models are used for real-time interactions between non-player characters and player-controlled characters in a video game (code + camera + hand).

And yet, the cinema institution remains attached mainly to the camera as its most noble tool. In the line of thought of Bazin, the ontological question that we ask is : What is so specific to the camera ? And what is it that the camera can capture, which cannot be equalled by the hand or the computer algorithm ?

«I photograph what I don't want to paint, and I paint what I can't photograph.»
Man Ray

A short genealogy of the camera and the computer

After the camera obscura and lucida, photography comes along with lithography, when chemists find a way to fixate the trace of light on metal. George Eastman founds Kodak by making the substrate flexible (paper), and thus makes chronophotography much easier. As you run the celluloid through the camera, you can record films of a short duration.
In New York, theatres converted into cinemas let you watch a short film for a nickel (nickelodeons). These first films roughly have the duration of an animated GIF (popular in the 90s), or of a youTube movie (popular today). But it will take 30 years of trial and error, to standardize the 35mm format. Different ratios, different resolutions, different grains, different ways to record color and sound along with the pictures, distinguish the competing formats. Then comes television, and portable formats such as 16mm or 8mm. Sony releases the Portapak. Analog electronics allow to modulate a video signal and record it onto a magnetic tape. Discrete electronics allow to digitize video and store it as a series of bits, on tape, or on a hard disk. Signal processing defines compression formats, such as JPEG or the MPEG series.
In parallel, we can look at the genealogy of the computer. At the time of early and sophisticated watches and programmable automats/automata ?, the engineering is limited to the mechanical domain. With the invention of semiconductor physics, mechanical forces are replaced by electronic forces, which allow the miniaturization of devices. The equivalent of a mechanical machine which would take the size of a whole building fits in a few square millimeters. With the computer models of Turing and Von Neuman, we have the architecture of the modern computer.
This is the moment in time where the camera meets the computer, because we have, on one hand, a universal computing machine which is able to manipulate huge quantities of numbers, and to perform operations on them. On the other hand, images from the camera can be represented and stored as numbers, and thus computed. Computers can generate, capture, process and re-process images.

Freed from the inherent linearity

By the ability to store moving images digitally, footage has been freed from the inherent linearity of the tape or celluloid medium. This has consequences both in the temporal and spatial domains.
In time, it means that a film no longer has to be a static sequence of shots. The film can be edited in real-time. This notion of real-time editing can mean two things :

- either that the film is edited as a live performance in front of an audience (live cinema) ;
- or that an engine is programmed to edit the film according to certain interaction rules, and explored by a viewer, online or offline (interactive film).
Within the space of the frame, it means that a film can consist of multiple layers and independent video elements (video sprites), that are animated separately, and can be programmed to react to the user, etc.

It also means we can make polyptychs, which are films running on multiple screens (physical screens or computer windows). Typically, within the conventions of a computer graphical user interface, a « screen » acquires the properties of a « window », ie : it can be resized, scaled, scrolled, moved around, duplicated, etc. We can imagine that the user can create multiple viewpoints in different floating windows of the same film, each window being one possible perspective on the action taking place in the film, thus giving the viewer the ability to operate the camera, for example.

I explored the possibility of having multiple layers of videos, and multiple characters in the frame (video sprites) with individual behaviour, in the piece « Polydock », which was choreographed and shot in Annaghmakkering, Ireland, in 2004. It was made with max/msp/jitter, and all takes are based on a single camera setup (no camera move).

Triply Temporal Structure

This liberation from the linearity of the medium means that the duration of the piece is no longer fixed.
To understand this concept, we would like here to extend a notion used in classical narratology to explain temporality in a narrative. Genette explains that there is the time of the story (plot or fabula) and the time of the narration (*syujhet* or presentation).
The time of the story is the diegetic time. If we take a simple folktale such as the Red Riding Hood, this timescale is one day : the girl leaves her house in the morning, fools around in the forest around noon, and arrives at her grandmother's house in the afternoon. But the time of the narration depends on the medium used to tell the story : it might take 30 minutes to tell it orally, as a bedtime story, or 8 x 52 minutes to produce it as a TV series. Now, if the story is told interactively, it becomes hard to measure time, because the experience of the viewer depends on how much time he or she wants to spend with the piece. Therefore there is a third axis of time, which we call here the time of the viewing, and which accounts for the phenomenological experience of time.
So an interactive narrative is made of this triply temporal structure : the intertwinement of the story time, the presentation time and the experience time.

New relationship to the time flow

In Russia, in the 1920s, filmmakers realized that cutting the film in chunks, and piecing it together, was a perfectly understandable way to make films. It was the creation of a new film language, which gave birth to the conventions of storytelling in film : parallel editing, montage, etc. Film editing works at the articulation of the story-time axis and the

narration-time axis. Interaction design works at the articulation between narration-time and viewing-time.
Tarkovski said that making a film is like sculpting time. With interactivity, the openness of the work leaves some of that work in the hands of the viewer, changing the relationship to the time flow. Watching such an interactive film can be compared to watching the play Tamara, by John Krizanc, or the Familie Schneider installation in London.

But if a computational film is different everytime it is viewed or « executed », to use computer language, what makes it the same film ? This ontological question inherent to the nature of interactive film is resolved by Nelson Goodman, in his book « Languages of Art », who proposes the notion of an « allographic » piece. That piece has an identity which makes it uniquely identifiable, but at the same times exists under multiple instantiations (a viewing, a performance).

Watching an interactive film can be compared to navigation. But to navigate without the risk of getting lost, one needs a map : a map of the film. This map represents the media space of the film. It represents all the shots that the film consists of, and it lets the viewer navigate through it.
At this stage, one realizes that the design of a good interactive film depends very much on the creative design of a good map. In video games, it is common to design « levels », which are topological structures representing a world that can be explored by the player. But this map could represent the fictional space, the emotional space, or any other space that helps to organize the material and to give meaning to the viewer. For a classical story, this could be done by drawing a map of the filmic space. Many critics have studied the differences and similarities between real space and imagined space : Umberto Eco in « Six paths into the fictional woods », Nabokov with his comment on Kafka's « Die Verwandlung », Thom Andersen with the city of Los Angeles (in the film « Los Angeles plays itself »).
This emphasis on the map as the structure of an interactive film essentially means that the structure of the film is no longer one single timeline, but it can be a multidimensional timeline, or a media space.

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