Automatic production of paths within audiovisual "narrative space" by making use of genetic algorithms

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This paper documents the theoretical aspect of a research project that deals with the application of an artificial life (AL) approach to engraving coherent paths within the narrative space of video fragments. These paths, which are constituted by the succession of short video segments, represent the best way to juxtapose isolated elements in the overall narrative landscape. In this case the notion of space is being used in a metaphorical way. Once this has been clarified, the concept of "narrative space" is used as a metaphorical representation of a database comprising all the fragmented/autonomous narrations that are being used.

Therefore, the creation of an "intelligent" system that will be able to automatically create cinematographic narration is being examined. This project in particular investigates the possibility and the consequences of producing an autonomous cinematographic narration system, in which meaning results from a kind of hyper-montage (Hakola, http://www.kromaproductions.net/HYPERMONTAGE.htm: Jan 2003) conditioned by genetic algorithms.

A different type of spatial experience emerges when the video fragments used are automatically "put together" by the system. Video as a medium could be considered as representing crystallized shortcuts within physical reality. Since video fragments constitute the database, different elements of constructed space are parts of the same ensemble. From the composition of such fragments, there emerge new paths within the same spatial context and certain spatial experiences are formulated which are different from the ones experienced by actors during the shootings.

Keywords: *Non - linear narrative; cinematic language; Artificial Life.*

Introduction

Audiovisual narrative is inextricably linked to spatial experience, since video as a medium could be considered as representing crystallized shortcuts within physical reality. Actors, creators and technicians exist physically in specific spaces, which they direct and edit, so that the audience can experience view points and scenarios defined by them. Reading video image results in experiencing space in an im-

material/ intellectual and predetermined way.

Becoming familiar with the grammar and syntax of cinematic language constitutes the first stage of reading, which is essential for conceiving and further comprehending the message communicated through new media. A person may watch the input and output of information between herself and the computer, through a monitor or a projector, which constitutes the visualization field of moving images, accompanied by sound. The projected image follows, to a great extent, the visual and semiotic conventions already known to us, originally from cinema and later from television.

This paper documents the first phase of a research project that aims to study the production of cinematic narrative via the use of Artificial Life (AL) techniques. Considering the notion of database as a greater "narrative space", we attempt to create a system that will automatically engrave coherent paths leading to successions of audiovisual data, without human intervention.

Thus the project ultimately aims to design, construct and study a narrative production system, in which the process of creation follows an evolutionary path. The would-be product is to be non-predictable by the system designer. Upon such a process for producing meaning, the computer holds a key role. Composition is removed from the hands of a human and is mainly conducted by a machine.

Interactive narrative

With reference to interactive narrative and more specifically in the case of interactive cinema, there exists a "live" spectacle, the narrative and duration of which are activated, controlled and affected by the viewer. The latter does not remain a mere observer: she is simultaneously assigned the role of director, editor and often the lead actor. The computer provides the potential for an interaction process. If the director (author) of linear movies is considered as the architect of single and unilateral paths, then the creator of interactive narratives can be seen as the one who

creates several potential paths, so that the user has the freedom to choose her own succession of fragments and be the composer of the final output.

The notion of *hypertextuality* is a key element of new media pluralism. Practically, it is the feature that provides the user the right to choose, therefore to build up directions within narrative space.

In the case of interactive narrative, the various potential paths of an interactive play are finite. The creator of the system is in position to forecast in advance the potential forms that the play may exhibit, as a result of interaction with the user. Even in cases when the system has been programmed to pick up an element over a group of elements at random, through the "random" command, it is easy to find all possible combinations that may be applied by the computing system, by means of probability theory. The number of options for interaction and navigation, as well as the consequent results, are predetermined by the system creator. The user follows predetermined paths engraved by the creator. She stands in a "constructed" space within which she has the possibility to navigate.

The research project presented here, investigates the possibility of constructing a narrative, that cannot be predicted by the system creator and in which the creation process follows an evolutionary path. In that case the role of the computer is vital: the process of composition is to be conducted by the machine instead of the human.

Generative narrative

The computation system that is adequate for exploring evolution as a creative process, entailing any random and indefinite elements of nature and culture, shall be more effective if it operates upon a mechanism simulating natural evolution stages. The discipline that attempts to simulate nature and living organisms in order to study and comprehend their mechanisms is Artificial Life (AL). Artificial Life is often depicted as an attempt to comprehend complex behaviors through simple rules (Adami, 1998).

The term AL was coined in 1989 by Christopher Langton[1], who defined it as "*the study of man made systems exhibiting behaviors typical of natural living systems*".

Genetic algorithms constitute the core method applied to simulate biological genetics through digital computation. A genetic algorithm contains the "genotype" that is a string code specifying a "phenotype". The phenotype may as well be any digital apparatus: artificial organism, three-dimensional form or software part. Via simulation of genetic alterations caused by sexual reproduction and mutation, the genetic algorithm alters the genotype and the phenotype. Since the whole process is computed and does not involve biological processes, fertilization is rapid and productive. Wide ranges of phenotypes may come out, which are often automatically evaluated with respect to their "fitness", in accordance with special criteria. As to operational applications, a rapid process of artificial evolution is applied so as to solve a complex problem through the consideration of a wide range of potential results.

In most cases artificial life systems comprise two levels of application: computation and emergence. This bipolar state can be understood in a sense that broadens the concept of emergence and its application to AL related art practices. The computation level may be conceived as a more general technological layer, a designed framework of software and hardware. On the other hand, the global emergence level may be conceived as a phenomenal and behavioral product of the above technological layer. Such a distinction can be easily made in a common computation system between the software and the material "machine" and its phenomenal[2] products, the screen image and the sound produced: each level supports and generates the other. The key distinction lies in the relation between those two levels: within the daily operational use of the computer, causality is precise and instant: I type and, with some luck, let-

ters appear on the screen. In artificial life systems there does not exist such simple correspondence between the essential and the phenomenal (cause and effect) but rather a complex tangled causality generating facts and events that appear to be introducing a novelty, something more (Whitelaw, 2004, p. 215).

The existence of causality that is not unilaterally linked to its cause is not a new concept. Julia Kristeva (1974) coined a multilateral definition of the text, borrowing from the terminology of biology:

"...According to the new restrictive principle, the text is redefined as any language practice such that the functions of the geno-text are projected on the pheno-text, asking the reader to create the meaning anew".

The relation between the reader and their subject of study becomes unrestricted. The text is dealt with as a living organism interacting with the reader and evolving. The theoretical approach proposed by Kristeva is being put to practice today as a result of scientific and technological progress, that enables theories originally appearing as utopian to become feasible in practice.

Creation as a process is not limited to a single product. It entails an entire system, whose component parts convert into others that further evolve in turn. Tenhaaf (1998) makes the connection between artificial life and art according to their common feature: interpretation. Both activities build up associative stories based upon their "chaotic environment". Interpretation and representation are features that both art and artificial life have in common. Tenhaaf supports that both artificial life and art project metaphorical notions. Artists often recognize artificial life techniques as innately representative and use them as such. The notion of representation includes and entails the notion of metaphor and therefore that of interpretation. Is there a correlation between the interpretation of an artwork and scientific results? Is it possible to set objective criteria for the evaluation of an artwork or subjective and arbitrary criteria for the assessment of scientific-purpose simulation?

[1]   http://www.vieartificielle.com
[2]   In this case the term "phenomenal" stands for apparent, visible.

Creating generative narrative

For the creation of a cinematic work both the creator and the viewer make use of cinematic language. Encoding and decoding processes are both governed by the same rules. As to the planning and making of a film, the director uses a group of cultural (daily habits, social conduct, etc.) or purely cinematic (montage and rhythm) codes, with the aim of producing meaning.

With reference to the generative narrative production system that this project aims to develop, the output of such a system would also make use of cinematic language. The viewer is once more faced with an audiovisual narrative, which she decodes according to the terms already known to her from cinema. However, the composition of the play follows entirely different paths. The role of the director lies precisely in the organization and the plan of the composition process. Hence she disregards the cinematic codes of montage and rhythm and attempts to attribute objective qualities to the properties of isolated footage, in order to divide them into groups/categories. She acts as a collector of fragmented audiovisual data, which she deposits in a non constructed space and then she builds up the software mechanism, which will engrave coherent paths within the aforementioned narrative space.

In the system under study, the narrative prod-

ucts that could be built, as a result of the same work functioning, may be countless. Every time the viewer commands the system to start screening, it starts editing the database elements anew. Given the fact that the process is being conducted by genetic algorithms, which constantly alter the produced outcome, the composition of paths is unforeseeable and so is the number of the potential results. Due to the high complexity of the whole process, there is practically no chance of two outputs being the same.

In an evolutionary cinematic system, the creator functions as a driving force, a stimulus of a process that goes beyond the scope of the creator's imagination and may acquire unpredictable forms, in compliance with strict and specific rules. The designer of such a system examines the potential, the limitations and the power of the rules she establishes. She also monitors the formation of the rules she has set.

Systems that "imitate" natural selection processes for the evolution of an entity, set strict rules for the control of the evolutionary process. The results after each stage of evolution may be unpredictable for the constructor but the rules remain unaltered. The application of the same structural rules upon specific material ends up in the creation of various and unpredictable narrative constructions.

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Figure 1.
Narrative space