NEW APPROACHES OF THEATRE AND OPERA DIRECTLY INSPIRED BY INTERACTIVE DATA-MINING

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ABSTRACT

In this paper, we show to what extent traditional theatre staging is based on a formal approach of similarity using a dramaturgical ontology and instanciation variations. Drawing our inspiration from the opposite approach through interactive data mining, we hereby account for theatre and opera researches using computers as actor partners to escape *a priori* specification.

1. INTRODUCTION

In this article, we are wondering about such stage arts as theatre and opera in the framework of human computer interfaces. Our approach is based on computer science categories. We have already dealt with the reverse approach, showing how such softwares as Powerpoint are based on dramatic concepts, more precisely on scenographic ones, linked to foreground and background principles [7].

We have first set two very different approaches of similarity in computer science –by the ontologies or by interactive data-mining. We use them to understand how traditional staging in the field of theatre and its new modalities when computers are used as partners of the actors. Our research is based on an example of staging, the inter-media theatre play *La traversée de la nuit*. We then evoke another example in the field of opera, with the open form in the digital interactive opera *Alma Sola*, where *a priori* stage specification has disappeared to the benefit of a kind of musical form "calculation".

2. THE TRADITIONAL APPROACH IN STAGING CONSIDERED IN A COMPUTER SCIENCE VIEWPOINT

Facing a theatre text, every stage director would like to propose his/her interpretation. Let us remind that the interpretation is not immanent to the text, in spite of the numerous indications (playwright foreword, stage indications, etc.). A text cannot exist on stage without an exegesis completed by the stage director.

2.1. Dramaturgical ontologies and instanciation variations

This interpretation is always an effort to create forms. Let us try to understand this approach in a computer science viewpoint. The stage director process starts by setting a synthetic ontology of the drama: it describes the characters as types (19th century light comedies work with a small number of types, mainly three: husband, wife, and lover) and instanciations[1], by telling the name of the character, his/her situation at the beginning of the play, his/her costume, etc. During the play, there are instanciation variations: the spectator discovers that such or such character is far different from what he/she imagined at the beginning. These instanciation variations may lead to ontology revisions. It is for instance the challenge, as well dramatic as metaphysical, in the play *El Burlador de Sevilla* by the spanish playwright Tirso de Molina (1630), inaugurating the Don Juan myth: may this character be saved by acknowledging his sins *in extremis* before his death ? May the character's ontology be modified at the very end of the play ?

2.2. A formal approach of similarity based on ontologies

In this traditional approach of theatre, the concept of similarity by the ontologies is essential. The director stages every scene considering it as an exemple in a set of cases provided by theatre litterature. Explaining a character to an actor consists in pointing in the proposed ontology and link this ontology to the ontology of other plays or other interpretations of the same play by other stage directors or actors. The purpose is to make it understandable by a *similar* example.

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[1] *instanciation* is a word often used by computer scientists, that comes from *instance*, and means *example*, *case* ; an instanciation generalizes in a way the operation of affectation of a numeric value to a variable: to describe the real world, computer scientists instanciate abstract classes, stating that such or such entity is a particular case of a class, which is itself linked to other classes by generalization hierarchies and/ord formal properties. This builds a set sometimes named *ontology* [4]. Ontologies are claimed to describe parts of knwoledge about the world and are very used in artificial intelligence. This can also be considered as an *object design* (an object design is based on heritage graphs in order to generate programs by simple instanciation of key-parameters).

In a more general point of view, this is **a formal approach**, where the example is represented as an instance of a general structure grasping all cases, and one looks for similarities by varying the instancation. The obvious advantage is to provide an explication of the "similar to the example" side of the proposition, and even a distance measure – this is the way to create a recapitulatory concept in **intension**. Ontologies enable to look for the similarities of an example by staying inside a concept, even if it means to move to the immediate more general concept when the search is unsuccessfull. This may be applied to many other activities than theatre, for instance the organization of compact discs distribution in CD stores [6]. Buying CDs surreptitiously specifies our musical activities and the *a priori* storing in trays, slowly evolving, is structured by CD selling and the notion of genre.

3. THE APPROACH OF SIMILARITY BY INTERACTIVE DATA-MINING

In a computer science viewpoint, there is another way to deal with the question of similarity: it is the **interactive data-mining approach**, where the example is represented as a specialization of a set of cases. One looks for other neighbouring specializations, but without having at disposal a pre-defined ontology. The user accepts to shape an *ad hoc* ontology at his/her hand with the interactive help of computers. This is an approach by extension: shaping a similarity consists in shaping a list of contents of similar form by successive amending actions. It uses computing in an interpretative and interactive way, with amending actions on contents and their forms (on the user's side, who is provoked by the proposals of the computer).

The music-ripping activity illustrates this approach [5]. It consists in interactive handling of digitalized audio contents through modification, crossover, deletion, etc. gestures using computerized devices. When this kind of activity is a signed listening [2], e.g. a listening/composition/production, its object is the basic element of listening/composition/production, a sample, constantly modified, reorganized, remixed and renamed [3] by users.

Let us notice that this point is one of the major differences between mathematics and artificial intelligence. Mathematics state the equivalence of **intension** and **extension**. The concept of equivalence class for instance exists on both sides: on one side, two individual elements may be linked by checking they belong or not to the same class; on the other side, sets of integers are recovered with a minimal number of classes. On the contrary, in the field of artificial intelligence, there is no equivalence of **intension** and **extension**, certainly because the equivalence between a specimen (as particular instance of a category) and a singularity (perceived as going through the real world) can only be accepted as poor heuristics (since it denies the concept of situation).

4. BACK TO THEATRE: THE INTER-MEDIA PLAY *LA TRAVERSÉE DE LA NUIT*

What can this computer science approach based on interactive data-mining yield in the field of theatre stage direction? It assumes the use of computers according dialogue modalities between actors and machines. May a stage direction no longer be in accordance with a pre-defined ontology? May it escape to *a priori* specification being grounded on multi-modal interactions? This is the framework of our research. It was lead in the inter-media theatre play named *La traversée de la nuit*[1], a text by Geneviève de Gaulle-Anthonioz [1], telling her imprisonnment in the bunker of the Ravensbrück camp at the end of the World War II.

4.1. Multi-modal interactions

The stage direction in *La traversée de la nuit* is based on an autarkic human to machine system: an actress, Valérie Le Louédec, tells the whole text. A danser, Magali Bruneau, performs a certain number of gestures inspired by Nô theatre and a there is a multimedia computer, as an artificial actor.

The computer projects images onto a very large screen at the back of the stage (the actress and the dancer can see part of it at any time), provoking the reaction of the comedians, especially the dancer adapting her gestures to the movements and qualities of the image. However the two actresses on stage represent the two sides of the same character – conscious and unconscious, according to the traditional *shite* and *waki* in Nô theatre. Accompanying the movements of the dancer, the actress also adapts her declamation. She may also have a look at the screen at certain moments of the play. To complete the loop, the computer grasps the emotional states of the actress's voice.

Figure 1. Example of image generation on the backstage screen in *La traversée de la nuit* (Valérie Le Louédec on the left, Magali Bruneau on the right; photography: Julien Piedpremier).

4.2. Technical description of the human-machine system

The technical implementation of the human-machine system is based on a neural network to analyse the actress's voice as an input and a multi-agent system to generate projected images as an output. The whole system was coded using the realtime Max/MSP/Jitter plateform.

The neural network was trained in supervised mode during several months. The actress would impose herself a list of emotional states and read the whole text using one of them. The input voice is computed one sentence after another. A twelve-component vector is computed from each of them: four components represent vowel prononciation (formants), four of them have to do with rythm (durations), and four of them have to do with its amplitudes. For each vector presented as an input, the neural network provides an emotional state "acknowledged".

The multi-agent system enables the realtime generation of images projected on a screen at the back of the stage. The agents may be compared to dynamic "billstickers" that would build together images always new (each of them carries a small part of image, still or animated).

- Each agent has a small psychological model of sensitivity (positive or negative), that reacts to the emotional states provided by the neural network according to the text sequences (that affect sensitivity weights). The result is a "mood" that conditions the agent willingness to achieve its goals.

- The agents cooperate towards one goal by optimizing an utility function computed from the appearance qualities of the images generated. There is one different utility function per text sequence. Agents may move, twist, enlarge, reduce, make more or less transparent their own small images.

- Agents are coordinated in the execution of these common goals in relationship with the emotional state acknoledged by the neural network by a "mood compensation" mechanism: the ones who are in a very good "mood" (high positive value) grant part of their willingness to the ones who are in a very bad "mood" (high negative value).

- Agents communicate together peer-to-peer by exchanging their "moods" at fixed periods.

The environment of agents includes the emotional states acknowledged by the neural networks, the event number indicating the current position inside the text, the loaded values for each text sequence, and the indications of an observer agent indicating the qualities ot the global image generated.
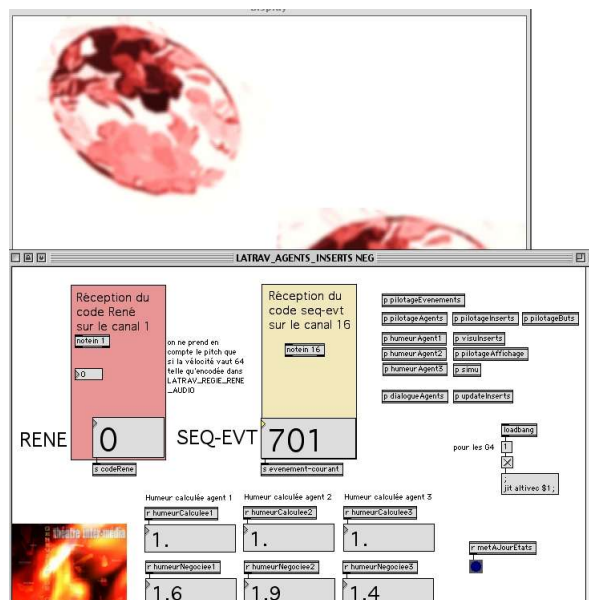

Figure 2. Examples of Max/MSP/Jitter patches. The background window shows two autonomous agents carrying image fragments in La traversée de la nuit ; the foreground window shows a part of the control window (source: Alain Bonardi).

As a provisional conclusion, we can state for this inter-media play:

- there is no text-based ontology, neither for the character nor for dramatic situations,
- movements are writtten as a choreography,
- multi-modal interactions are based on an autarkic human-machine system.

5. GOING FURTHER WITH OPEN FORMS: THE ALMA SOLA OPERA

In *La traversée de la nuit*, the approach of similarity is no longer based on a psychological model infered from the analysis of the text and from formal relationships to other plays or other characters. The purpose of the artistic team was to go further in the exploration of "computer-assisted" stage forms no longer based on *a priori* specifications.

We have been working since may 2003 on an interactive opera named *Alma Sola*[1]. It is based on an open form. This means the libretto is written in a specific way. It shows a feminine *Faust(e)* trying to experience non ordinary feelings through virtual worlds. The libretto is divided in various universes (pleasure universe, love universe, wealth universe, etc). Each universe includes different text fragments the character may rearrange in realtime, selecting and recombining them. For instance,

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in the "love universe", there are fragments belonging to "white love" and "black love" the character has to set together while playing. The opera is therefore different at each performance.

Music is also based on an open form. It is mainly realtime-produced music using Max/MSP:

- to analyze and transform voice and guitar sounds,
- to synthetize new sounds,
- to generate parts of music from the live recorded captures,
- to influence the processing of live video capture,
- to orientate the open form for the character (we have modelled an open form as a sequence using Hidden Markov Models) and suggest by small lights the possible fragments to be played after the one currently played;

One of the most important things in the design of *Alma Sola* is that the open form is visually embodied on stage: the universes are physically implemented, matching scenographic zones where captors are set. Captors used may be sensitive carpets or interactive sensitive tiles. This is a way to make the open form explicit for the audience, and not only a game for performers. Members of the audience can easily associate the different parts of the opera to scenographic zones. Moreover this enables to give up the traditional use of scenography as an illustration of the plot: the role of scenography consists now in supporting the open form.

There is a cameraman on stage who is a kind of puppet handler dressed in black as in japanese *bunraku*. The image provided by the cameraman is processed in realtime by the Arkaos software (linked to the sound machine by Midi). Faust(e) wants to control her image but at the same time she is manipulated by her image.

If we compare this situation to the previous one in *La traversée de la nuit,* we obviously notice that there is also no *a priori* specification of a dramaturgical ontology, since the text itself is not set in advance but given from pre-defined fragments in realtime. This leads to consider stage direction no longer as setting an ontology from a text, but rules of possibility of a work. Moreover, we are very close to mechanisms of interactive data mining in the field of "music-ripping" since our computerized environment tries to provide solutions of open forms as "playlists".
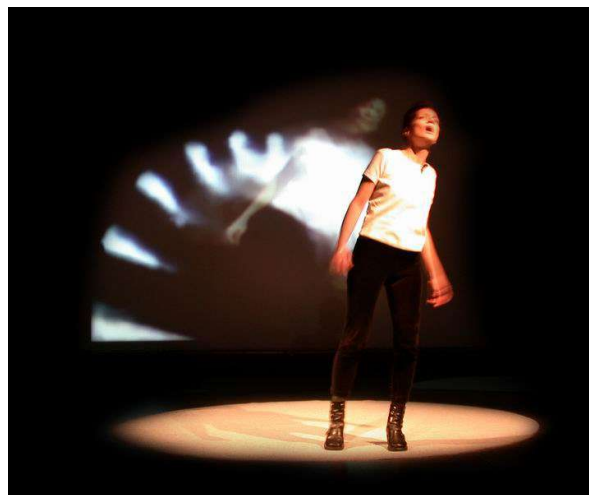

Figure 3. A picture from the Prologue of *Alma Sola* (Faust(e): Consuelo Karoly ; source: Alain Bonardi) with realtime transformations of the image of the character.

6. CONCLUSION

We have shown how in computer science the approach of similarity based on interactive data mining may inspire new modalities of stage direction associating actors and computers. Giving up traditional stage direction based on ontologies irreparably leads to fade instanciation to the benefit of active handling of digital contents through data transformations that often are irreversible. In this way, mixing a musical compilation or a sequence in an *ad hoc* software deeply works the same as establishing *live* a dramatic continuity when computers, which become actors, and comedians, provoke each other. In both situations, computers work in a heuristic way.

7. REFERENCES

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