# Interacting with Operatic Contents

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## 1 Abstract
We hereby present our VIRTUALIS project, an interactive computer-based opera. It combines artistic requirements and computer science approaches in such fields as data presentation (music, sounds, texts, images) and input presenting to the computer. We present examples based on screen hardcopies of the ALMA application developed to be able to design 3D open musical worlds.

### 1.1 Keywords
operatic contents, 3D data visualization.

## 2 Introduction
In this paper, we present VIRTUALIS, a project of an interactive computer-based opera. It gives its spectator/user, no longer sitting in an opera hall but facing his/her computer, possibilities to play and interact with operatic contents: plot, graphics, characters, sounds, texts, and sometimes complexes of some of these. It is not a recreation of an opera hall nor of a previous work in virtual reality, but a complete creation.

This interactive opera is an open form, exploring with multimedia means possibilities already considered by composers in the 1950s and 60s, either in the field of instrumental music (for instance Boulez' *Third Sonata* or Boucourechliev's *Archipel IV* both for piano) or in the field of opera with Pousseur's *Votre Faust*. But instrumental open forms would address the issue of interactivity between a score and its performers, where members of the audience do not feel much concerned. On the contrary, Pousseur proposed basic collective interactivity in *Votre Faust*, where the audience could vote at some points to decide what would come next in the plot. It seems to us important to be able to give to each user/spectator an individual feedback in the interactive frame proposed. Since it is still difficult to implement such possibilities for a collective audience, we focused our opera project on human-computer interaction.

## 3 Interaction modelling
We have first set a modelling of the activities undertaken during a classical opera performance [Bonardi 2000], using a method inspired by the MADEINCOOP one [Zacklad 2000, Rousseaux 1995], with agents, tasks, and communication, coordination and problem collective resolution models (see an example on figure 1).

| | |
|---|---|
| **Human agents** | ▪ "actors" producing sound and visual contents (singers, stagehands, machinistes, electricians, etc.),<br>▪ "directors" ordering and synchonizing the activities (conductor, stage director, etc.),<br>▪ members of the audience. |
| **Artificial agents** | stage machine and lightning systems ("stage systems") |
| **Goals** | ▪ to celebrate a rite,<br>▪ to produce "singing",<br>▪ to live intensely. |
| **Means to reach these goals** | ▪ spaces for the artists (stage, orchestra pit, dressing rooms, etc.),<br>▪ spaces for the audience (hall, bar, etc.),<br>▪ "singing bodies"<br>▪ instruments,<br>▪ scores and indications (oral and written)<br>▪ stage systems,<br>▪ control devices (stage cameras, opera glasses, etc.) |
| **Tasks** | ▪ to execute an indication,<br>▪ to interpretate a score,<br>▪ to keep up with the performance and its evolution,<br>▪ to interpretate what is seen and heard,<br>▪ to order the play of "actor" agents and the response of artificial agents,<br>▪ to update earlier conceptions (of the work and also of oneself) |
| **Chronological dependances** | synchronization. |

**Figure 1.** *Global model of an opera performance.*

Then we set the same models for *Virtualis* performance. It puts the emphasis on the evolution of the nature of agents

and of their tasks. From this differential modelling we have induced several principles of interactivity for *Virtualis* :

- interactivity possibilities should be suggested not imposed, giving the ability just to play the opera straight forward. Rather than interrupting the flow, we prefer to give means to orientate it.
- as in any interactive application, taking into account the user's intention and correlating it with the "answer" of the computer is the main question raised [Jorion 1990]. In *Virtualis*, we have tried to set a non psychological model: the user's behaviour and motivations are not described in a model. As said above, the user is considered as an external element that may disturb the opera as an autonomous system. To achieve that purpose, we have used a model of interaction based on physical forces.

The opera includes three types of scenes: games on opera dialectics, transition scenes named "Music Wandering", and narrative short moments named "The Story". We will now present the features of the last two kinds of scenes in terms of multimedia data and input presenting to the computer.

## 4 Features of interactive content presentation

### 4.1 General Requirements

Either in "Music Wandering" or in "The Story" scenes, the user/spectator is facing a 3D world where different elements appear on the screen : texts, characters, pictures, geometrical shapes, etc. At the same time, sounds are played : musical fragments, noises, spoken voices, etc. The purpose is to give as much interest as possible to the user's wandering, so that it becomes "creative" in a way.

In that purpose, after examining standard software solutions (Director, Max, etc.) we have designed and created a new application named ALMA to implement these open spaces. This application includes two modules: an "easel" where the open spaces are created, and a "player" to perform created files in realtime, with user interactions. The ALMA "easel" enables:

- To create 3D open graphical and musical spaces, by setting 3D entities and links between them. Each entity is either a musical fragment, or a sound, or an image, or a movie, etc. Links may be one-to-one, sequence (first time, play this entity, second time play that entity), or random (play any among the possible entities). The figure 2 shows an example of such a space.
- To correlate the shapes of any 3D entity to musical properties, so that musical fragments should be "represented" by 3D objects (see figure 3). These properties may be simple one or more complex using an automatic extraction of most salient musical patterns.

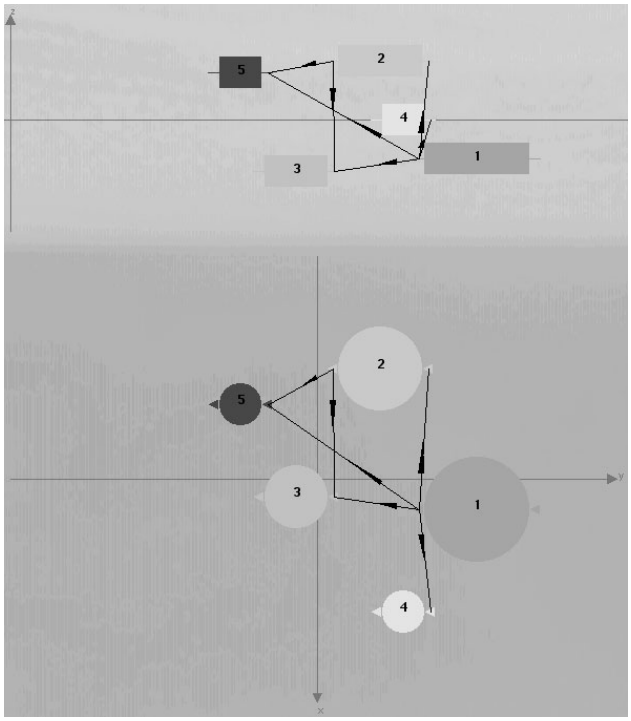


**Figure 2.** *The main window of ALMA "easel".*

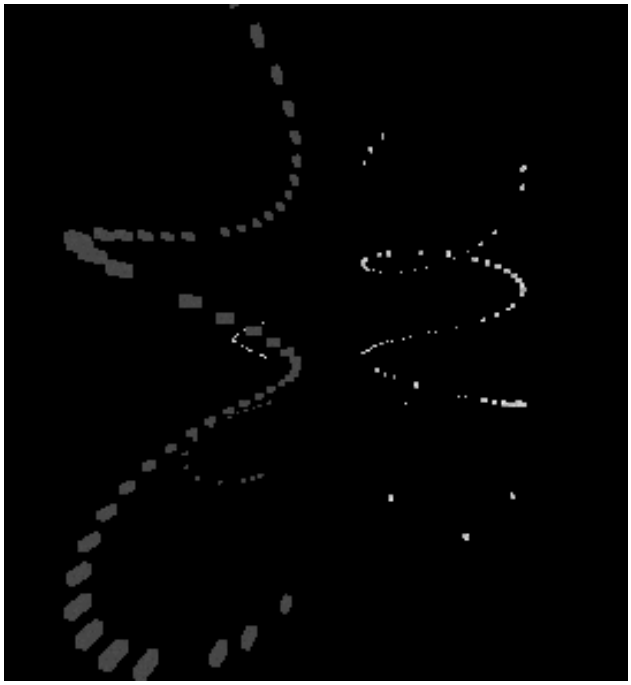

**Figure 3.** *An example of 3D representation of musical entities.*

- To group music fragments by kinds, using multi-variable analysis on music, thanks to a fine encoding of it (using GUIDO format [Hoos & Hamel 1997], see figure 4) very close to paper scores.

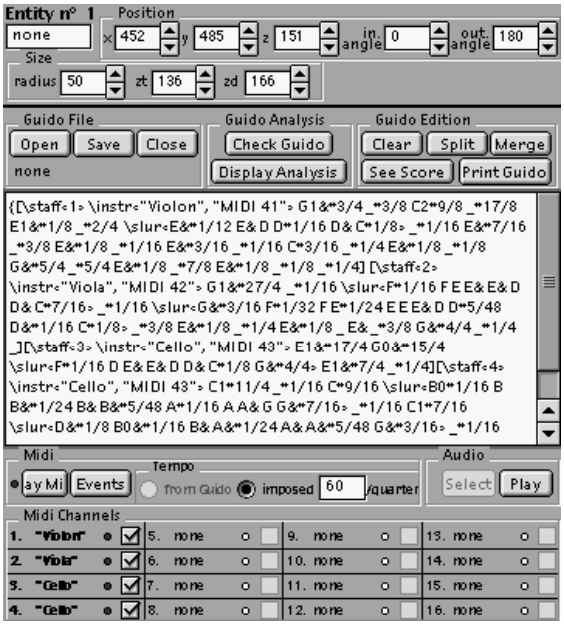


**Figure 4.** *Guido content of a musical entity.*

### 4.2 The ALMA "player"

The ALMA "player" enables:

- To animate the entities, displaying 3D objects, images, playing sounds and movies.
- To propose an interesting interaction with all these objects, taking into account the specificities of each modality (directionnality towards non-directionnality), since the same content can be handled either by the sound or the 3D shape. We have worked on three points:
  - Backgound/foreground: in realistic 3D, what is far is heard and seen from far. It is based on two features, size (object dimensions in meters, sound intensity in dB) and clearness/fuzziness of the source. In ALMA, all these parameters can be handled, using for instance transparency for 3D objects and spatialization and noise addition for sound. For instance, far objects can be seen distinctely whereas they are listened as blurred.
  - Grasping sounds/grasping objects that represent music: it is of course possible to grasp 3D objects on the screen, but also to grasp a sound, by trying to catch it (for instance by clicking two or three times when it is perceived: the computer should then "understand" this very sound is grasped).
  - Music manipulation: after selecting a musical fragment, it is possible to modify some of its properties : temporal and pitch stretch, transposition, etc. These functionalities are available using icons on the screen.

In "The Recit", we added to that environment a model based on physical forces, so that characters are submitted to attractive/repulsive forces, similar to gravitation or electric forces. The model implements four types of "masses" or "charges" (tenderness, audacity/resignation, selfishness, jealousy) for each character. According to the situation in the narrative moment, different field forces are set. They enable the animation of the characters, that remains also interactive.

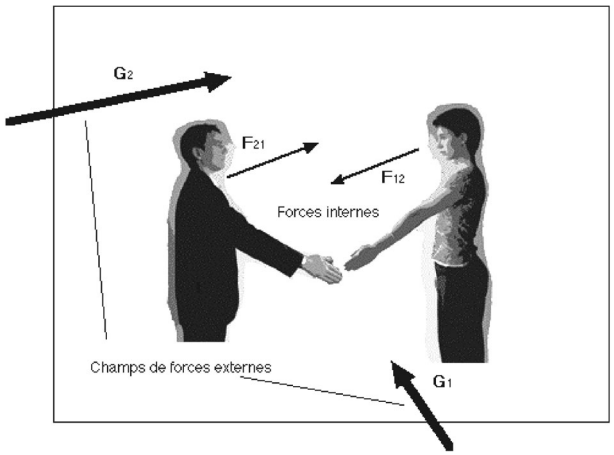


**Figure 5.** *Force fields used in the model.*

## 5 Conclusion

We have presented our VIRTUALIS project, and the already developed features to set musical open worlds. We should add new features to be able to take into account more finely the user's action, especially being able to update links and shapes from his/her previous selections.

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