# Building live opera open forms using collection paradigm

Alain Bonardi
STMS, IRCAM-CNRS, France
alain.bonardi@ircam.fr - http://www.ircam.fr

Francis Rousseaux
University of Reims and IRCAM, France
francis.rousseaux@ircam.fr - http://www.ircam.fr

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**Background in performance practices.** For performing artists attached to human voice on stage, singing is the spinal column of improvisation. This is the leading modality in many musical theatre works, where improvisation plays an important role. For instance, *Stripsody* by Cathy Berberian (1966).

**Background in computer science.** We are interested in the elaboration of syntheses in the framework of human to computer dialogue: for instance, being able to build intelligent and adaptive playlists on demand; they are extracted from recorded music files stored in large amounts of digital contents. Assuming that listening is always listening more, many computer scientists work on automatic classification to generate playlists, using *a priori* ontologies based on descriptors, trying to model such notions as genres.

**Aims.** The main goal of our *computing/performance* collaboration is the creation of computer-assisted opera open forms. It means designing modalities of singer to computer dialogue that enable to build forms from vocal material. We have been working on a digital opera named *Alma Sola*, which stages a feminine Faust, and proposes score fragments (let us say opera blocks) that can be performed in any order. After each block, the machine has to propose possible blocks to the performer, to continue: the proposals should be 'intelligent' and 'musical'. They are embodied on stage as light effects integrated in the set, as the various opera blocks correspond to various regions of the stage. Then our Faust either follows this indication or makes another choice.

**Main contribution.** Our main contributions are on the one hand the understanding of the nature of automatic classification systems. We discovered that rather than *a priori* ontologies, we could use a fruitful approach based on continuous shaping of similarities thanks to singer to computer dialogue: the performer is continuously provoked by the machine, permanently adjusting relationships between opera blocks without any pre-defined structure, thanks to captors to indicate her selections. We then, on the other hand, developed an implementation on Max/MSP realtime plateform based on Hidden Markov Models, which are models of artificial learning specialized on sequence modelling.

**Implications.** For musical practice, they are new approaches of opera design, of opera performance, and of course the modification of the relationships between composers, performers and members of the audience. The main implication for musicological interdisciplinary is the understanding of the scope of the classification approach, which is deeply linked to gesture. Preparing a mix for a party or performing *Alma Sola* are both based on the same paradigm: gesture enables the handling of playlists and of various operations on audio files (for instance, cutting, pasting, deleting, etc.). This leads to a rather surprising activity, we could name 'Music-Ripping', that musicology would find difficult to describe, where gestures without precise musicological qualification are used to shape an audio material.

Building musical playlists is one of the most widespread activities today in the field of digital leisure. Millions of listeners practice music classification, which the help of such softwares as iTunes that enable the constitution of music collections. These collections are not only the result of requests on criteria using metadata: an important aspect is their never ending shaping by users.

We have very interested by this collecting activity using computers to apply some of these ideas to the field of stage performance. The context of our stage productions is based on performer to computer dialogue using captors. The first step of our research was therefore to wonder about the notion of collection, how artists, collectors, computer scientists would understand it and practice it. This will contribute to the first part of the paper. We then applied the collection principle to an open form digital opera named *Alma Sola* we will present in the second part of this text. We then come to musicology and see how it could

understand these new practices of listening and musical creation.

## The strange status of collections

### The fascination of artists for different systems of collecting

Artists have always been sensitive to the rebellious nature of collections, and have demonstrated this in their own way. Were Walter Benjamin (Benjamin, 1989), Gérard Wajcman (Wajcman, 1999), and others (Pomian, 1987; Tourangeau, 1996) able to sketch a different portrait of collections that strangely contrasts with painting as we define it?

Here, for example, is the analysis of Gérard Wajcman (*Catalogue for the inaugural exhibit of the Maison Rouge*) on the status of excess in a collection:

*"Excess in a collection does not mean disordered accumulation; it is a fundamental principle: for a collection to exist as such-in the collector's eyes – the number of objects must exceed the physical possibilities of exposing and storing the entire collection at home. Therefore, someone who lives in a studio can have a collection: it is only necessary for him to have at least one work he cannot hang in his studio. That is why the reserve is an integral part of collections. Excess also applies to the capacity of memorization: for the collection to exist, it is necessary for the collector not to be able to remember all the works he owns…. In fact, the number of objects he owns must be so important that it becomes too important, so that the collector can* forget *one of them or leave a part of his collection outside of his home. To say it differently, for a collection to exist, the collector must not have full control over his collection any more.*

Certainly thinking of Gertrude Stein (*Collection*), Gérard Wajcman goes on saying, "*If nobody ever looks at a collection, it is because the collection is not a whole made up of works but a vague series of unique objects, a work + a work + a work…"*

The collection, as opposed to formal ontology, seems to appear to be a metastable balance resulting from the dynamic tension between structures that are categorical and others that are unique. Contrary to what is organic, the collection only exists for each of its parts (like the flock in the Gospel according to Saint Matthew) and, in contrast to the whole, it does not exist as a normalizing and equalizing unity.

The dominant theme in the donation of a collection (its reception by a visitor or the collector himself, be it during the act of acquisition or even of re-collecting) is the paradox of the impossibility of a donation as a coherent whole except in the simplistic system of management**.** From this point of view even a jumble of objects can be seen as a coherent whole: scattered objects become a part of the jumble using the logic of *being different* before later becoming similar in that they are all different, thus forming what Jean-Claude Milner calls the paradoxical class.

### Digital Collections: Between Order and Disorder

Object-oriented computer science was created to simulate our tasks of classifying objects in identified and labeled structures (Perrot, 1998), (Granger, 1994), (Baudrillard, 1968). Its success was, as we know, immediate.

Recently, an innovative trend is mobilizing computer objects for the organization of our collections, considered like a group of objects waiting to be organized in ad hoc categories that must be created simultaneously (Pachet, 2004), (Rousseaux, 2005).

Collections seem to be closer to classificatory order than disorder – no matter if they appear to be a stack, a heap, an assembly, a hodgepodge, or any other sort of jumble – they always seem to aspire to a system of classification, even if it remains temporarily incomplete and unfinished. Wasn't the scholar's cabinet of curiosities the ultimate destination for collections that then fell into a system of classification through a procedure of categorization and finally of sorting? Regarding stamp collections (as another example), aren't they waiting for their categories to be completed through the achievement of series that have been *started?*

Therefore, in a certain sense, it was inevitable that one ended up comparing collections to classes because in several ways, they seem to be pale imitations.

Nevertheless, something resists this comparison, and in some ways collections remain slyly rebellious to the idea of classification. This is how they come to be pushed together with singularities – sharing with them a strange magic spell to definitively escape any attempt at classification (see the examples of journeys, opera, of Don Juan-ism, and of the evangelistic flock (Rousseaux, 2006)).

## How do computer scientists treat collections?

Undoubtedly impressed by artists and philosophers who considered the strange status of collections, "object-oriented" computer program designers realized that the modeling of collections of objects would rely on hybrid computer objects that combine characteristics coming from the private world (where we encounter objects) and characteristics from activities in which the collected objects engage.

### A conservative and attractive approach

The approach chosen to characterize a collection is often parsimonious and consists in overdetermining the private referencing of the collected objects through a minimal description detailing the collective activity's context, even overrating the *becoming-classification* of the collection**.**

This practice presents the advantage of not fundamentally opposing the modeling of objects, but does not always live up to the collectors' high standards. This is how François Pachet (Pachet, 2003) describes a curious phenomenon to which he was subjected. As a user of indexing tools for music, he ended up not listening to the music he downloaded; he was so concentrated on the organization of his collections that this activity stealthily replaced listening. Quite by accident, it was discovered that his music listening system had been unplugged for a long time without it affecting his zeal for indexing whatsoever.

Here it is important to distinguish between figural and non-figural collections. This subtle distinction, introduced in the 1970s by Piaget and his research teams of child psychologists (Piaget & Inhelder, 1980), brings more light to the situation. There are collections that we can label as figural because their arrangement takes into account the implications of spatial configurations, considered in parallel with the typical concerns of the meaning of the classes.

According to Piaget, *"The characteristic of a collection as opposed to a class is that it only exists through the assembly of its elements in space and therefore ceases to exist as a collection when the sub-collections are dissociated. The result is that when the sub-collections are brought together in the A + A' form, the subject unites the ensemble together in the B = A + A' form. However when the sub-collections are dissociated, either in space or in thought, the subject no longer unites the whole collection and is therefore unable to carry out the operation A = B – A'."*

Curiously, here we see the opposite of what was previously exposed: the stack, heap, jumble, and other hodgepodges that only exist in the privacy of a shared space now reside with slightly different collections when the classes are situated in another state, different by nature from the organizational systems based on space.

In their work, *La genèse des structures logiques élémentaires* (lit: *The Genesis of Basic Logical Structures)* Jean Piaget and Bärbel Inhelder (Piaget & Inhelder, 1980) make a more precise distinction between figural and non-figural collections, which are still called classifications or categorical collections. For these authors, a classification has two different types of characteristics or relationships, both necessary, and satisfactory for its making (page 25, 1980):

- The qualities common to its members and those of the class it belongs to, as well as the specific differences that distinguish its own members from the members of other classes (comprehension);
- The relationship of a part to the whole (membership and inclusion) determined by the quantifiers "all," "some" and "none" applied to the members of the class in question and to other members in the class

they belong to, defined as extensions of that class.

For example, cats have several characteristics shared with all cats, others that belong to them individually, and others that can be found in other animals as well. However, using these characteristics to define a class does not bring into play any references or relationships to a spatial configuration. Cats can be grouped together or spread randomly without changing the qualities (1) and (2) in this class. Undoubtedly, the inclusion relations defined in (2) could provide a topological – and therefore spatial – structure, but it is by first using isomorphism that one is able to create a relation between the algebraic structure of the possible series and certain topological structures of envelopment without the interference of a space that is not necessary for a complete description of the class.

## Figural *versus* non-figural collections

On the contrary, Piaget speaks of "figural collections" when the placement in space is carried out according to spatial configurations that have meaning from the viewpoints of the characteristics (1) and (2). *"In a word, a figural collection would be made up of a figure in accordance with the connections between its elements as they are, while non-figural collections and classes would be free of any figure, including the cases when they are symbolized by figures and despite the fact that they can result in an isomorphism with topological structures."*

What is listening to music on-line if it is not building up a collection – certainly sometimes a transient and ephemeral one, but always *figural* in the unique way it was made under the fragile condition of continuation – that depends on the temporal figure of its use in time (Rousseaux, 2005)?

Figural collections adapt poorly to their assimilation into non-figural collections or classes; however, according to Piaget, collections are destined to become classes in the same way as subjects will grow psychologically so as to improve their cognitive capacity to classify. Still referring to Piaget, the major theme of figural collections is a radical *indifferentiation* that makes them recalcitrant to traditional modeling. Let us observe how he decodes the experimental situation of a child who is making a figural collection in *La genèse des structures logiques élémentaires* (page 51):

*"While the child is certainly capable – once he has reached the Sensory-Motor Stage – of successive assimilations that form resemblances, when these assimilations begin there can nonetheless exist a sliding from resemblance to relatedness, creating the principle of broader similarities originating from the geometric form of the whole, or from the empiric unity. But, above all, as these assimilations are only successive, nothing yet allows the subject to quantify his results and assign them an extension by gathering together simultaneously as a 'whole' the elements that they apply to. The problem is therefore creating a substratum that can be used as an extension of this understanding brought about through successive assimilations. Attempting to construct a collection that corresponds to his successive assimilations, but without having acquired all the tools necessary to translate these assimilations into 'whole' or 'some' that guarantee the regulation of the corresponding extensions, the subject sometimes proceeds from understanding to extension, sometimes from extension to understanding and not according to a principle of univocal and reciprocal correspondence, but through a simple lack of differentiation and through* indifferentiation *that prolongs, but also considerably reinforces the resemblance and proximity already at work from the beginning of the assimilations.*

*Sometimes the child places 'the same' with the same, and here understanding determines extension, as will be the case for later logical classification. However, sometimes the child adds an element to finalize the collection he began in the direction of its growing extension, and it is precisely this extension that establishes understanding. This establishment can thus present itself in two distinct, but equivalent manners: either it is the geometric form of a collection in which an element is joined with others as a part of a group without there being a precise resemblance among the element, or there is a group of random*

*objects and one element will be chosen to complete the others so as to make a coherent whole, so that, this time, resemblance is forgotten in favor of an empirical convention taken from past experiences in the subject's life. In both cases, only the form of the collection provides its conditions and therefore it is this physical and autonomous extension that establishes comprehension*."

## We all are collectors

In everyday life, we are often faced with collections, even when we are far from imagining that that is what we are doing. This does not concern only the collector of works of art (paintings, for example), the viewer at an exhibition, and even the shipping agent responsible for moving the collection to its next location. Collections are far more present in our everyday lives than we think.

As a matter of fact, in the expanding field of tools to assist performance, numerous existing computer applications help us in our constituent relationships to collections: music devotees looking for works using an interactive search tool, students drawing up a document browsing on the web looking for inspiration, engineers interacting with colleagues – all are forming collections.

But why let the primacy of the collection spread to the collected objects themselves? Ordinarily, a collection is understood to be a *collection of something*, and these objects are thought to have pre-existed the collection, to have value in themselves, apart from the group. Let us be clear; in affirming the primacy of the collection over the collected objects, the question does not simply lie in offering a lexical amendment to talk about collections where one normally talks of sets, classes, groups, categories, masses of objects. What we want to demonstrate by introducing the idea of a collection *being at the origin of the idea of things* is that its promotion at the foundation of our categorical and conceptual systems makes it possible to truly reexamine a number of our cognitive activities, and therefore to better target the adequacy of our computer tools that assist us in these activities.

In fact, we always act, live, and imagine in a given perspective, in a given set of circumstances that are limited and defined, like a journey by train or a performance at the opera. Of course, these circumstances are not fixed and evolve in correlation with the choices we make. Still, there is the element of *always-already* for any given set of circumstances, a staging, a project, a plan, an intent that defines our interest in and our relation to things.

And this is the reason why our interpretation activities are *always-already* involved in their continuation and their survival, and only acquire meaning in the horizon and perspective of the attempts that preceded them. This is how we can feel strong emotions at the opera, counting on the intermission and the end of the performance to extract ourselves from the fictive situations that we found so moving – even if certain of them left indelible marks on our future emotions.

In short, what I hear in a certain piece of music is a part of a project and has inherited the previous motivated-management and directed projects. It is in this precise case that the current piece enters the collection of pieces already heard, and completes the collection like a flexible whole (Deleuze, 2003).

In a way, listening to music is like collecting works, wandering through situations that "make motives"[i]

## *Alma Sola*: an open form opera

### Presentation of the opera

We have been working on a project of opera designed on the principle of a musical collection to be shaped differently at every performance. It is named *Alma Sola* and stages a feminine Faust who wanders among her own mental states. Two singers (to perform Faust and his/her shadow), a French horn, a guitar and device for realtime sound processing are requested for its performance[ii].

The work is organized in 30 opera fragments or blocks that can be performed in any order. This is a complete open form. Blocks belong to thematic faustian universes such as power, love, pleasure, wealth, etc. Figure

1 below shows the open form possibilities. Figure 2 shows a picture of the characters on stage: Faust and his/her shadow.

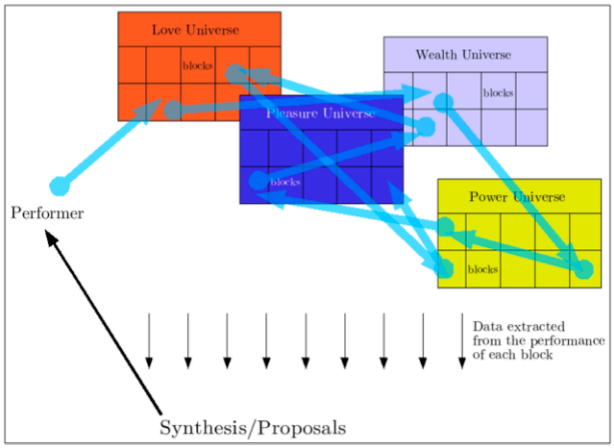


**Figure 1.** Possibilities of navigation among *Alma Sola* blocks belonging to thematic universes.

**Figure 2.** A picture of an *Alma Sola* performance. Faust on the right (Caroline Chassany, soprano), the Shadow on the left (Claire Maupetit, soprano). Photography by Philippe Monges.

Performing *Alma Sola* consists in building live an (preferably) interesting collection of opera fragments. The question is to know how computers may collaborate with performers at this step. We propose to the reader a small digression to set a few important remarks about automatic classification as it is provided by computers.

## About automatic classification

Computers provide two opposite ways of classification. The first one is based on ontologies, it means the hierarchical modeling of human activities thanks to classes. In this framework, two cases are considered as similar if they are instances of the same class. This mode has of course to do with non figural collections described by Piaget.

The second one is on the contrary based on an interactive shaping of similarities: a user puts together, with the help of the computer, elements that are similar. It has to do with figural collections, where the spatial aspect of similarity is so important.

In *Alma Sola*, we put the emphasis on the second approach. Our Faust is continuously provoked by the machine, permanently adjusting relationships between opera blocks without any predefined structure. After each block, the computer proposes possible block continuations to Faust (thanks to a lightning system on stage), who can follow or not these indications. Figure 3 shows an example of such indication with the blue light included in the step: each block is associated with a part of the stage.

**Figure 3.** A picture of an *Alma Sola* performance. Faust on the left (Caroline Chassany, soprano) and the conductor (Ignazio Terrasi). Photography by Philippe Monges.

Sequence modeling for block proposals is based on Hidden Markov Models implemented in the framework of

realtime environment Max/MSP (Bonardi & Rousseaux, 2004).

### From Alma Sola to musicology

We have already shown (Rousseaux & Bonardi, 2004) that musicology lacks defining and understanding these practices of interactive shaping of similarities. We therefore proposed the notion of 'music-ripping' which covers practices of music manipulations without any reference to traditional musicological categories.

The main point is that all these activities use the same paradigm of collection. Preparing a mix for a party as well as performing *Alma Sola* are based on the elaboration and browsing of digital collections. Their 'curators' and 'visitors' constantly switch from non-figural or ontological approaches to figural ones, necessarily embodied in space.

## Conclusion

We believe this interdisciplinary research may first lead to the shift of musical practices: as in *Alma Sola*, it means new approaches of opera design and opera performance, but also possible modifications of the relationships between composers, performers and members of the audience.

On the other hand, the understanding of the scope of the two automatic classification approaches, either based on ontologies or on collaborative similarity refinement may open new perspectives for musicology.

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[i] Sometimes the two approaches come together as in Modest Moussorgski's famous *Pictures of an Exhibition* for piano.

[ii] For a detailed presentation of *Alma Sola*, please refer to the website http://www.almasola.net