# New Tools and Practices for Electronic Music Distribution


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## Abstract


Apart from the traditional uses of computing in the fields of music and musicology, human-computer systems are emerging in reaction to this tradition, which is already effective, though still young.

Whereas these unique systems operate in the usual fields of music's expansion, they cannot be systematically referred to known musicological categories. On the contrary, the experiments made possible by these systems inaugurate new uses where listening, composing and music transmission are merged in a gesture sometimes described as "music-ripping".

We will show how music-ripping practices provoke traditional musicology, whose canonical categories are powerless for our purpose.

To achieve this purpose, we will:

- give an explicit minimal set of categories sufficient to underlie the usual models of computer assisted music;
- do the same thing for human-computer (anti-musicological?) systems which existence is disturbing to us;
- examine the conditions necessary to reduce the second set of categories to the first;
- conclude on the nature of music-ripping.

## 1. A viewpoint indicator of the positions of computer science in musical and musicological practices

What is the position of computer science in musical and musicological practices? Starting from our experiences and observations over several years, we hereafter propose a viewpoint indicator. It goes beyond the framework of music computing, mainly considered in its customization for composers and creators since its beginnings forty years ago.

Three typical positions can be observed, which do not at all cover the functional partition of musical and musicological practices:

- the use of computers in traditional practices;
- the position of computing as a universal music substratum;
- the creation of computer devices to question current practices.

And against these positions, marking a break:

- the implementation of singular human-computer systems that do not imply any reference to musicology.

These four positions are of course the stylized and discrete version of what is in reality a continuum that often slips between their marks.

### *1.1. When computers are used in traditional practices*

This use of computing is the most widespread: activities handled by human operators before are "reorganized" by adding computers, whose processing and storage capacities are cleverly used. This approach is efficient and productive, and elements related to music (historical knowledge, theoretical knowledge or archive documents) can be shared in the form of text, music, graphic or video files and in the form of more or less refined processes based on data extraction.

*Examples:*

- the cards on musical works in resource centers become databases, that make the musicologist's investigation work easier, enabling the cross-checking of information; thus, the Ircam Digital Library database allows to look for references by the numbers of musicians needed for a piece, or by the composition or the creation date [Fingerhut 1999];
- computers are used as remote music writing professors through Internet, and are able to propose and correct exercises in tonal harmony [Jouvelot 1998].

### *1.2. When music "gives a voice" to computer science*

Reversing the previous point of view, several approaches have used the strong combinatorial and symbolic capacities of computers to produce music, by proposing generative algorithms. What makes these approaches interesting comes from their ability to "give a voice" to structures that are not initially musical ones.

*Examples:*

- the musical generative grammars proposed by Lerdahl et Jackendorff [Lerdahl & Jackendorff 1985] are directly inspired by the works of Chomsky in linguistics;
- in many compositions, Iannis Xenakis [Xenakis 1981] makes use of various probabilistic techniques (stochastic, markovien) that musicians must work with, often facing an excessive importance of the model over the players' capacities, and therefore a necessity to filter musically this raw material, as the pianist Claude Helffer testifies [Albèra 1995].

### *1.3. When computerized devices question practices*

Beside these two extreme positions, designers of creative CD-ROMs have proposed during the 1990s original devices that question the tradition of interpretation, analysis and composition itself.

*Examples:*

- the *Prisma* CD-ROM dedicated to the composer Kaija Saariaho[i] considers composition as an interactive game. The piece called *Mirrors* for flute and cello was split into short fragments that the user can recombine freely or following composition rules;
- the CD-ROM named *Les musicographies*[ii] designed by Dominique Besson and implemented by Olivier Koechlin proposes to create sounds from their graphical representations. This also questions the literary modalities of musical analysis.

### *1.4. When singular "a-musicological" human-computer systems are born*

Over the last years, musical systems that do not make any systematic reference to musicology have been implemented. Musicological categories are missing as such, only a few musicological notions are used on a few ephemeral occasions. This is why we will temporarily refer to them as "a-musicological", since usual ways to talk about music cannot be used.

*Examples:*

- the interactive opera *Virtualis*: in this digital opera project on CD-ROM [Bonardi & Rousseaux 2002], the user can navigate inside a three-dimensional space and transform sound contents that are spatialized by handling their graphical representations (polygons, surfaces and so on); there is no occasion when the visitor is confronted to musicological categories: the computation of fragment variations is triggered by a simple mouse movement in the 3D space;

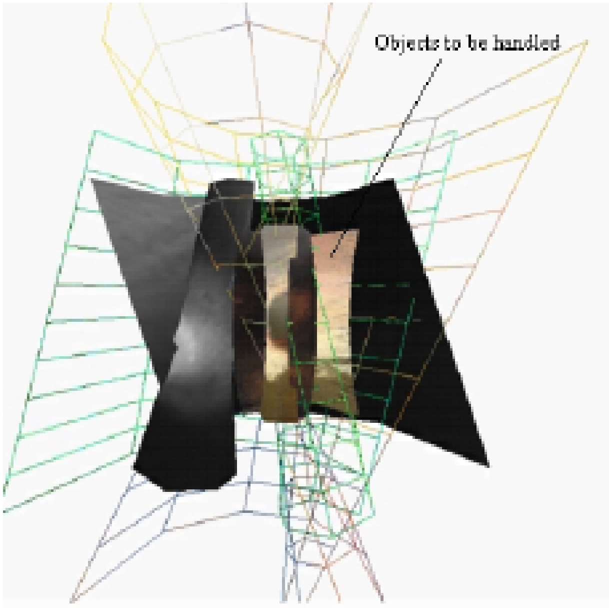


**Figure 1.** *Examples of 3D objects associated with musical material in Virtualis ( from Alain Bonardi)*

- the systems built to share MP3 files music based on "peer-to-peer" network architectures like the famous Napster website: the users of these systems used to download music pieces that they kept accumulating and reorganizing on their computer hard disks, by sequencing them, mixing them, and by building compilations. These files are often copied and recompiled for hard-drive walkmans for "nomadic" listening. As François Pachet[iii]notes, "an important part of my relationship to digital music consists in contemplating the file names, in projecting ideas of names for them, and in inferring information from them."

The design of these systems excludes them from the previous positions, since it is very clear that while using these systems, listening and handling are part of the same action. Therefore, though on a phenomenological point of view they are given as "a-musicological", nothing prevents us to consider them as musicological in the very broad meaning that they operate in the transmission of music.

But for the moment we only have at our disposal a set of examples grouped under the "a-musicological" banner, presented as what the three typical positions could not account for. However we have to explain the relationship between this *a priori* disparate set and traditional musicological categories, to clarify its problematic contribution to musicology.

## 2. Study of human-computer "a-musicological" systems

To establish the commensurability of this set of human-computer "a-musicological" systems with musicological categories, we must model the two sides.

We propose for each side a model robust and perfectible model:

- a model of musicology in its usual meaning;
- a model of human-computer "a-musicological" systems, that will enable us if necessary to categorize our set of examples.

We will then try to establish a morphism between the two models. At this point there are three possibilities:

- either such a morphism is shown to exist between the two models. It would then be advisable to refine the two models to specify the morphism;
- or we will demonstrate that there does not exist any morphism between the two models and in this case, the second model, irreducible, would become "anti-musicological," in that *ad hoc* meaning;

- or we will reach none of the previous results; in this case, the second model would keep by default its “a-musicological” reputation, such as we described it at the beginning.

### 2.1. A robust model of musicology

It is organized around four centres/attractors. The first three ones are familiar to musicologists, whereas the fourth one deserves to be specified and illustrated:

- **the set of historical and sociological corpus** proposing a global understanding of musical phenomena, and of the multiple surroundings of creators, performers, audiences and works;
- **the set of models of the “inspired” artist personality as a composer or as a performer**: psychological, psychoanalytical, hagiographic, without forgetting the “choreographic” study of musical gesture;
- **organology** and more widely acoustic phenomena, which means the study of all that music owes to instrument making techniques and to conditions and places of listening and creation;
- **the graphical reason**, which is to say everything that can be understood only in the bi-dimensional inscription of music on paper. Thus, musical theories going from scale constitution to orchestration through harmony and counterpoint, and taking as “jurisprudence” the model scores of the past, are based on the orthogonal inscription of pitches (proportional notation: the sharper the note is, the greater the number of extra lines needed) and durations (algebraic notation, where there are fixed ratios between abstract entities; it is thus said that one quarter note equals two eighth notes). This graphical reason is therefore important, and stands out as the basis of every musical theory, in the meaning of Goody [Goody 1987]. Hugues Dufourt [Dufourt 2002] upholds that ancient Greek music, following the example of philosophy, searched for “unity in multiplicity, the immutable in change”, whilst Western polyphony and the modern mentality “require a deployment of time, then a deployment of space”. This difference can be perfectly understood if we examine musical notation: the ancient Greek notation is only an alphabet expressing height, denying time and taking up all its one-dimensional scale. Western notation takes into account the full structure of its support plane, as well as the structure of the two-dimensional forms of thought, opening the way to polyphony.

Can we reduce musicology to these centres-attractors?
If we keep to the field of musical analysis, it is rather easy to account for various analytical methods by combining these four centres. Then the bases of a tonal plane are to be found in acoustics and in the graphic reason. It is more difficult to locate a method such as narrative analysis [Grabocz 1999], since it implies to take into account the four centres through the notion of style or topics. But we have to admit that the body appropriation necessary to understand interpretation without excluding corporal approaches [Rink 2002] cannot be integrated well in our robust model.
Nevertheless, this model is a first and rather efficient grasp of musicology.

### 2.2. A robust model of all human-computer “a-musicological” systems

We have deduced four centres-attractors from our experiments:

- **algorithmic calculation**: the calculation approach is based on the evaluation of the current state of science and (algorithmic) calculation techniques, as well on intuitions about industrial marketing. The question raised about sound and music is: is it possible to find algorithms which could be used to extract values from digital signal? Those values could be called descriptor attributes and assigned mnemonic names in order to remember the role they can play in representing the signal for particular applications. A descriptor contains a name, an extraction algorithm, and a list of potential applications increasing its value on the market. This approach is typical of the practices within the “Motion Picture Expert Group” (MPEG) consortium.
  *Example:* The “actual duration” of a sound signal is a descriptor computable from a recording: it is the evaluation of the duration during which the signal is meaningful perceptually. It is calculated on the basis of an energy envelop threshold whose value is given by psycho-acoustics studies. A percussive sound can thus be discriminated from a maintained one. This attribute will probably be integrated by the MPEG7 standardization consortium.

- **the knowledge networks** are the result of knowledge acquisition phases in a given field, leading to a specification of the vocabulary representing it. It is mainly encoded on computers in the form of classes, structures and functions. Contextualisation, which is one of the main difficulties in thought modeling, is solved by a logical processing of these reified meaning units. The implementation of knowledge networks leads to thinking that the objects of thoughts are available on the shelf, and opens the possibility to make sense through the artificial confrontation of such structures.
  *Examples:* Pierre Schaeffer proposed, in his *Traité des objets musicaux* [Schaeffer 1966] refined by Michel Chion [Chion 1983], a knowledge network in the field of sound objects: the sound description in the reduced

listening mode by. In the domain of music computing, the MusES system [Pachet 1994] is worth noting: it contains a representation of the basic concepts of tonal music and of their main properties (notes, pitch-classes, scales, intervals, chords, melodies, etc.) through objects.

- **the carnal relationship to perception and understanding reconciled**: in a musical context, facing a computer, a user acts while downloading sounds; let us remember the advertising slogan of a famous computer trademark: “rip music”. We can therefore speak of “music-ripping” practiced by “music-rippers” that catch and rip[iv] musical contents. This practice belongs to aesthetics of permanent retouching, closer that way to pottery in which one has to refine the object continuously, than to sculpture where one works by knocks and chips.
  *Remark:* Our music-ripper does not confine himself/herself to digital capture and distortion. He/she keeps transmitting his files to other music-rippers by email, through downloading, specific Internet sessions, or on peer-to-peer networks. What the music-ripper transmits is an inscription of continuously reshaped listening. His role may be compared to the role of transcribers in the past, who would engrave their listening of a symphony or an opera in a piano score [Szendy 2001].

- **the computational reason**: computers as calculation tools have the double capacity of allowing real-time processing and of simulating the representation of knowledge useful for reasoning and organization. But this double aptitude is fully exercised only through their repetition ability . It certainly makes them able to reproduce calculated results faithfully, but above all it takes part in behavior simulation, by submitting executed processes to mind investment from human users. Computers repeat, and that provokes users, who often request this repetition to try to define a model, which means to establish what belongs to the Same by figures of discrimination and difference. Users thus form representations quickly grasped again by interpretation.
  *Example:* Listening means wishing to listen more: one desires to prolong the experience. But also, paradoxically, it means wishing to listen to something else: one desires a new object to allow the experience to persist. Ideally, listening means constructing a musical sequence, in the mode of an elective affinity, which is always critical. Thanks to musical records, which are immediately accessible via access systems and restitution devices, listening means composing a sequence. The functions of direct access to musical tracks allow repetitive listening, to differentiate and group selected pieces, for instance in the form of a playlist (or favorite sequence) of musical files.

The table below is a synthesis of the elements related to each of the four centres we have been presenting. We have also included another important category that we describe as “relevant orders”. The purpose is not only to understand each center as a set, but also to grasp what makes it possible to order elements within each set.
For instance, descriptors related to algorithmic calculation may be ordered in two ways: either by dependence relationships given by calculation (the value of a descriptor can be given only after the evaluation of another one), or according to the supposed profitability.

### *2.3. Study of the commensurability of the two models*

We have produced two models with four centres-attractors each:

- on one hand, the set of historical and sociological corpus, the set of models of the of the “inspired” artist personality, organology, and the graphical reason;
- on the other hand, algorithmic calculation, knowledge networks, carnal relationship to perception and understanding, and computational reason.

How can we compare them and look for morphisms linking these two models? This question would constitute in itself a real research program, that goes beyond the framework of this paper.

A first direction of research would be the study of the relationships between some of the centres and especially between the “graphical reason” centre in the first model and the “computational reason” centre in the second one, in the light of Rastier’s and also Bachimont’s works [Rastier 1994]. To initiate the reflection, let us say that we have noticed the high dependence of computational reason on the capacity of computers to repeat, which allows discrimination and differentiation. On the contrary, the graphical reason is not based on the repetition of the mind investment experience, it directly proposes differentiated categories. Thus, to consider a musical example, sound processing in music computing software is based on the repeated listening of key-fragments (usually transitions) whereas arranging a musical composition using paper score always requires the identification of structures directly interpretable on the score.

| Approach | Calculation | Knowledge networks | Carnal relationship to perception and understanding | Computational reason |
|---|---|---|---|---|
| Sign | **Inscription** excess | Mediation of the **classification** | Merging between **listening** and **handling** | Mind investment in the machine repetition process |
| Modality | Calculation on digital signals | Knowledge representation | Corporeal practice of a listening/creation experience and its transmission | Behavioral simulation |
| Relevant orders | Two orders on descriptors:<br>- an order of dependence of calculation<br>- an order of economic profitability | Acquiring and ordering knowledge are two sides of the same modeling activity, which is either theoretical (abstraction and generalization) or practical (usefulness for a user).<br>This leads to problems of acquisition and maintenance of the ontologies. | Two orders to classify the systems:<br>- transformation potential proposed by the contents and the player software<br>- degree of interoperability of the technological support media | Two orders to classify situations:<br>- the user's confidence<br>- the productivity of human-computer systems |
| Development places | The MPEG standardization consortium | Academic communities involved in "knowledge acquisition" | Musical files sharing/hacking networks | Laboratories that design personal stereos including hard disks |
| Musical example | The "actual duration" of a sound signal is an MPEG descriptor under normalization | In his *Traité des objets musicaux*, Pierre Schaeffer proposed an ontology for sound description in the mode of reduced listening (in the meaning of husserlian phenomenology) | Music-ripping | Software to set playlists |

A second research direction would be the confrontation of the two models using a third category. We are thinking here of a category which, *a priori*, has few links with our research, the question of representation, for instance in the way it was addressed during the last sessions of the *InterArts* Seminar of Paris, coordinated by Danièle Pistone. Though one may oppose representation as an artistic and exegetic game in traditional performance against representation as a possibility condition of human-machine interaction in digital art, it may be possible to differentiate our two models on similar bases. It is worth noting that the second one imposes its handling formalisms, whereas the first one tries to represent musicological situations that impose themselves without prescribing these action codes towards machines.

## Conclusion

We have presented the three classical positions of computer science in musical and musicological practices: the use of computers in traditional practices, the musical use of generated structures that are not initially musical ones, the creation of devices that question usual practices. They all systematically imply references to musicological categories as such.
It is not the case of the singular human-computer systems that have appeared over the last few years, though they are operating in the field of music. Listening and handling are merged in a gesture sometimes described as "music-ripping".

We have proposed two models, each of them including four centres-attractors: 1° of musicological categories and 2° of all the singular human-computer systems. The difficult question of the "a-musicological" character of these systems remains: the fine comparison of these two models would constitute in itself a research program. In this framework we propose two investigation tracks: the relationship between the graphical reason and the computational reason, and the examination of each of the models in the light of the *representation* category as a third category.

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[i] CD-ROM produced in 1999 by the Finnish Music Information Centre.

[ii] CD-ROM edited by INA-GRM (France) in 1995.

[iii] Excerpt of a text to be published, entitled "File names: the name – Phenomenological attempt of description of my listening activity from digital supports – Listening music/browsing files", personally communicated by the author.

[iv] The "rip music" slogan explicitely refers to this activity of musical appropriation/re-appropriation. The verb "to rip" was universally popularized by the personality of Jack The Ripper (who experienced a musical destiny, since he appears at the end of *Lulu* by Berg).