

# A SIGN TO WRITE ACOUSMATIC SCORES

Jean-Louis Di Santo

SCRIME

Jean-Louis.Di-Santo@wanadoo.fr

## ABSTRACT

This paper aims at describing an approach meant to build a sign adapted to acousmatic music and based on reduced listening. The sign, to be efficient, must obey to a certain number of requisits: precision, ergonomics, relevance... It must be both easy to use and able to create relations between sounds. A simple description of their qualities is not enough: it must be able to create or analyse sound compositions and structures, such as instrumental scores. To fulfill this purpose, it must be able to give each sound a value, in a saussurian meaning of the word. I will try to show the genealogy of my sign, how I took elements of reflexion from musical knowledge, linguistics, semiotics and aesthetics. From there I deduced the concept of minimal unit of sound applied to electroacoustic music and I created a sign combining symbols to describe its features. I'll show how I have reorganized sound parameters described by Schaeffer and how this sign works. At last, I will show the possibilities of writing scores sound by sound and I'll show two kinds of analysis: the analysis of a pure acousmatic work from a formal point of view and the analysis of a work for tape and instruments both from a formal and a symbolic point of view.

## INTRODUCTION

In the middle of the twentieth century, the concept of reduced listening by Pierre Schaeffer and his description of sound based on perception parameters was a real revolution. But if this description, which is to be found in the TARSOM, was really new and interesting, it could not be used for composition or analysis because of its complexity and because there was no system to create relations between sounds. The classification he done in the TARTYP did not really describe sounds: it only established a typology. Lasse Thoresen proposed a "spectromorphological analysis of sound objects" by "the introduction of graphic symbols as opposed to letters or

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verbal designations to represent the analysis". In other terms, he created a notation corresponding to Schaeffer sound objects. After Schaeffer, Denis Smalley built a new approach of the sound based on sound perception that he called spectromorphology that mainly aimed at describing a relation between sounds and archetype of gestures, and at being a help to composition. Manuella Blackburn translated these concepts in graphic symbols.. Yet in all these approaches, in my opinion, the matter parameters of sound were not precise enough. It was thus necessary, looking at the TARSOM, both to simplify some sound parameters and to complexify others. This is what I did to build my sign. In this paper, I'll call sign what represents all the features of a sound, and symbol what represents only one feature. As a sign is the result of the combination of several symbols, I'll also call sign each virtual result of all the results of these combinations and system of sign both the possibility of these combinations and the fact that each sign can make sense with another. Once the sign elaborated, I separated matter parameters from shape parameters to write scores. I call it score and not sound representation, for example, because it is possible to create sounds corresponding to the signs, like the software Acousmoscribe did (on Mac OS 10.6), in the same way than instrumental scores. This sign aims at writing acousmatic scores as tools both for composition and musical analysis, from a phenomenological point of view.

## ORIGINS OF THE SIGN

### Theoretical origins

#### TARSOM

Historically, electroacoustic music is linked to P. Schaeffer's work and his phenomenological approach of the sound. It is based on the concept of reduced listening, and the description of the sound that is in the TARSOM. The TARSOM describes seven criterions of musical perception (mass, dynamic, harmonic timbre, melodic profile, mass profile, grain and gait) and nine criterions of qualification/evaluation distributed in 6 categories (types, classes, kind, pitch, intensity and duration). These criterions describe the sound as perceived from a

phenomenological point of view. The TARSOM works with the TARTYP which aims at fixing acceptable sound objects. These sound objects are considered from their beginning to their end.

#### *Linguistics*

My sign is based on the concept of minimal unit, or discreet unit, that comes from linguistics (Benveniste, Jakobson). It refers to the smaller sonic element that cannot be divided. For instance, a word can be divided into syllables, a syllable can be divided into phonemes, but a phoneme cannot be divided: it is a minimal unit. This minimal unit is the result of the association of different distinctive features. As linguistics and music are dealing with sounds, I applied this method to electroacoustic music. This way I obtained smaller units than TARTYP units that can be combined to describe bigger units like phonemes can be combined to create syllables and syllables can be combined to create words. I called electroacoustic sound minimal unit phase and bigger units entity or group. The distinctive features of a phase are the sound features that are described in the TARSOM, and that I reorganised.

Another idea I took from linguistics to build my sign is to use a small amount of elements to create a great number of combinations. One can write several thousands words with only twenty six letters. This way, it prevents from having to memorize a great number of elements and it is easy to use them.

#### *Ch. S. Peirce Sign Theory*

Peirce defined a sign as a triadic relationship between the object, the *representamen* and an its *interpretant*. Only considering the relation between the representamen and the object, he established three kinds of relation: icon, index or symbol. I wanted my sign to be easy to read: on the one hand, I used iconic representation every time I could because it is very easy to understand it: for example, concerning dynamic profile, pitch increasing or decreasing and gait. On the other hand, in its symbolic part that needs an interpretant and that is more complex for this reason, I used the same symbols applied to different parameters of the sound to represent the same indications: dot means little, dash an dot middle and dash big, a broken line means random. This way I reduced the number of symbols one has to remind.

#### *Nelson Goodman's Theory*

In his book *Languages of art*, Nelson Goodman was comparing notation and art work. According to him, the characteristics of notation are semantic and syntactic non ambiguity. In other words, each sign must not be confused with another, and its interpretant must be clear. Other conditions are syntactical and semantic disjuncture.

It means that a sign or a meaning must not have something in common with another. To aim these goals, it is necessary to avoid analogic representation. This is the reason why, for example, a small gait is represented by one curve and not by a small curve, a meddle gait by two curves and not by a meddle curve, and a big gait by three curves and not by a big curve.

#### *Temporal Semiotics Units*

The morphological description of Temporal Semiotics Units often describes a certain number of "phases". That means that a big sonic unit can be constituted by several small units and that each small unit has a value, like it has in linguistics. These phases can be a process concerning one sound parameter, or concerning several sound parameters at the same time. In fact, the idea of musical minimal unit was born from a research that was aiming at transforming these analytic tools in compositional tools<sup>1</sup>.

#### *Music Theory Notation*

Of course, the music theory notation offers an excellent example of music notation: it is clear and as simple as it can be. It also uses minimal units and tries to indicate the most important features to realise sounds or analyse score. In a certain way, it is an open system because it allows to add any sort of indication. The simplification of the sound reduced to pitch and rhythmic parameters do not prevent any other precision. The keys and key signatures allow to avoid the repetition of what does not change, and they are very ergonomic.

### **Simplification Of TARSOM's criterions**

#### *Criteria of Musical Perception*

In order to create a sign quite simple to read, I reduced the seven criterions to four profiles: concerning criterions of form, I established the dynamic profile and the rhythmic profile. Concerning criterions of matter, I established the melodic profile and the harmonic profile. One finds here the four traditional dimensions of sound. The term of profile refers to three kinds of processes: augmentation, diminution, or stability which is a particular kind of process but not the only one. Why and how has the modification of Schaeffer criterions been done? In TARSOM or TARTYP, Schaeffer is describing sound objects constituted by several phases. Yet, I was interested only in one phase sound objects, but I took into account all of the possible variations. Schaeffer had already described melodic profile and mass profile. He put them in the category of criterions of sound variations. The TARSOM establishes seven categories: three

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<sup>1</sup> Di Santo, Jean-Louis, "Composer avec les UST", *Vers une sémiotique générale du temps dans les arts*, Actes du colloque "Les Unités Sémiotiques Temporelles (UST), nouvel outil d'analyse musicale : théories et applications", Sampzon, Delatour, 2008

categories regarding the sound itself (mass, dynamic, harmonic timbre), two categories regarding variations (melodic profile and mass profile) and two categories regarding maintenance (grain and gait). If one looks at the column two of the TARSOM, one can read on the “*timbre harmonique*” line: “*lié aux masses*” (linked to masses), and comparing the *masse* line to the *timbre harmonique* line, one can almost see the same classifications. Thus I merged these two criteria into harmonic profile in order to simplify them. In the same way, always considering the column two, the “*dynamique*” and “*profil de masse*” lines are very similar and I merged them into “dynamic profile”. However Schaeffer was mostly describing two phase profiles: following the concept of minimal unit which is based on a unity of process, I only considered one phase processes. Here too, still taking into account one phase processes and adding the stability that was missing, I kept the “*profil mélodique*” line. I also transformed the column 8 (impact) into “rhythmic profile”, with the characteristics of slow, moderate and fast that are in the TARSOM, and I added the processes of accelerando, of rallentando and irregular. The rhythmic profile refers both to the internal speed of a sound and to iterative processes of the same sound. This way, the four traditional musical criteria were redefined. At last, I respectively linked maintenance criteria (grain and gait) to dynamic profile and melodic profile. However some criteria can be linked to some others: the rhythmic profile, that describes speed variations, can be as well applied to iteration or gait. The gait also often refers to melodic profile that contains the idea of pitch, thus also the caliber, which is the difference between the lower and the higher frequency of the sound. Grain is a particular variation that is applied to the dynamic of sound. This way, some criteria that disappear from the seven Schaeffer criteria reappear applied to the four profiles.<sup>2</sup>

#### Criteria of Qualification/ Evaluation

As shown above, some of them are integrated to the four profiles. The categories of species are integrated as quantities: small, middle, big or random. The concept of random or irregular is very useful when some processes are changing quickly in different ways: for example to describe the sound of creaking wood which is sometimes fast and sometimes slow.

#### Number Of Phases Of The Sound

In the TARSOM or The TARTYP, sounds can have several phases. For the reasons I explained above my sign describes sounds phase by phase. Phase refers to any kind of sound, whatever its duration is, featuring the same

process (this process commands the same modification or non-modification of the sound and can be applied to intensity, pitch, timbre or rhythm). Phase is the name I gave to the minimal electroacoustic sound unit. This way, one obtains 4 profiles that will be described later. Profile is here the name of distinctive feature.

#### Complexification Of Mass/Harmonic Timbre

I merged the schaefferian Mass and Harmonic Timbre into the term of harmonic profile (in my sign, the species of mass are mainly linked to melodic profile). The harmonic profile concerns the very matter of sound, which does not depend on pitch, dynamic or other criteria about form. Schaeffer determined seven categories of sound considering this parameter (*son pur*, *son tonique*, *groupe tonique*, *son cannelé*, *groupe nodal*, *nœud* and *bruit blanc*). “*Son pur*” is sine curve, and “*bruit blanc*” is white noise. They will not be taken into account here, since they do not vary (except sine curve which pitch can vary depending on its height, which is not our purpose here). Thus five categories of sound remain. Their description, being very large, is very imprecise, even if the number of categories is increased by the distinction between “simple” sounds and groups. According to Schaeffer, these five categories can be rich or poor. In EMS 11, in New York, I suggested to increase these categories<sup>3</sup>. I determined three categories of homogeneous sounds, that can be rich or poor, and three categories of hybrid sound that can be rich or poor too. Combining these categories in groups or *sons cannelés* (disonic sounds using Thoresen translation), and adding stable or filtered colours (bright, dark, hollow...), one can have 40 000 descriptions of harmonic profile

		Tonique	Inharmonique	Bruit
simple	pauvre			
	Riche			

**Figure 1 :** Homogeneous sounds. The dash on each side of the symbol always means rich. It will be the same, of course, concerning hybrid sounds.

<sup>2</sup> <http://www.ems-network.org/IMG/EMS06-JLDSanto.pdf>, p. 4-5

<sup>3</sup> [http://www.ems-network.org/IMG/pdf\\_EMS11\\_di\\_santo.pdf](http://www.ems-network.org/IMG/pdf_EMS11_di_santo.pdf)

Hybrid sounds will be represented as below:

	pauvre			
simple	riche			

**Figure 2 :** Hybrid sounds. A hybrid sound is a sound that has features from two homogeneous categories. For example a fly sound has features of tonic sound and features of noise. Thus it is represented by a line (tonic sound) made of dots (noise).

The twelve simple signs described above will be used to build all the other signs, and particularly what one will call “group” and “son cannelé”. One will call “group” sounds of the same category combined between them. A group made of homogeneous sounds will be called homogeneous group and a group made of one or two hybrid sounds will be called hybrid group. The sign that represents a group is made of two symbols. The lower one represents the sound one hears the most (called fundamental), and the higher one represents the sound one hears the less or as much as the other (called harmonic).

groupe					

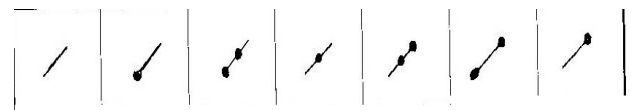
**Figure 3 :** Homogeneous groups. Hybrid groups will be represented either by a symbol of homogeneous sound and a symbol of hybrid sound, either by two hybrid sounds symbols.

Tonic	Inharmonic	Noise
Tonic fundamental/ Homogeneous harmonic	Inharmonic fundamental/ homogeneous harmonic	Noise fundamental/ homogeneous harmonic
Tonic fundamental / Hybrid harmonic	Inharmonic fundamental/ hybrid harmonic	Noise fundamental / hybrid harmonic
Hybrid fundamental/ Homogeneous harmonic	Hybrid fundamental/ Homogeneous harmonic	Hybrid fundamental/ Homogeneous harmonic
Hybrid fundamental/ Hybrid harmonic	Hybrid fundamental/ Hybrid harmonic	Hybrid fundamental/ Hybrid harmonic

**Figure 4 :** Categories of dystonic sounds.

If the sounds of the group belong to two different categories, one will call it *son cannelé* (for example a bell sound is made by a first audible tonic sound and a thin inharmonic halo. Now, tonic sound and inharmonic sound belong to two different categories, so a bell produces a *son cannelé*. This sound will be represented by a tonic symbol under an inharmonic symbol). In order to have clearer signs, one will limit the number of symbols to two by group and three for *son cannelé*. To build all the possibilities of *son cannelé*, one will use the table from Figure 4.

There are also symbols to describe the “colour” of the sound, if it is more or less dark or bright. The symbol is a dot put on symbols of harmonic profile, except for noise that can't have a colour because of its very rich spectrum.



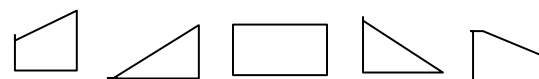
**Figure 5 :** Seven different “colours” of sound put on the symbol of tonic sound (the same thing can be done for inharmonic sounds). From left to right: equilibrated sound, strong low frequencies, weak high frequencies, strong medium frequencies, weak low frequencies, weak medium frequencies and strong high frequencies. These colours can be filtered and can change but I don't reproduce the symbols here.

## PRESENTATION OF THE SIGN

The all sign is built assembling symbols to describe minimal unit of sound. Of course, different minimal units can be assembled to create a higher level of unit, like in linguistics. These symbols represent the different profiles of the sound. The concept of profile is very useful to create a link between the continuity of reality and the categories without which it is impossible to think. Basically, the sign represent four profiles. These profiles correspond to distinctive features in linguistics<sup>4</sup>.

### Dynamic Profile

It concerns the features of intensity variations of sound (crescendo, decrescendo or stable). It is represented by a quadrangular or a triangle. The bottom of this figure indicates speed variations of sound and the top indicates grain. The sign offers five possibilities of dynamic profile:



**Figure 6 :** Dynamic profiles. From left to right: soft, support, flat, straight attack, straight truncated attack.

<sup>4</sup><http://www.ems-network.org/ems09/papers/disanto.pdf>

If the dynamic profile irregularly varies, a broken line is added at the top of one of these figures.

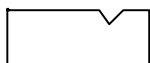


Figure 7 : A flat dynamic profile varying irregularly.

### Rhythmic Profile

It concerns the internal speed variation of sound or its speed iteration (acceleration, deceleration or rhythm, allure or grain's stability). It is notated by dots, dashes and dots or dashes at the bottom of the rhythmic profile, as explained above. If the rhythmic profile irregularly varies, a broken line is added at the bottom of the figure. A vertical dash at the beginning or the end of the figure means *rallentando* or *accelerando*.

### Melodic Profile

It concerns tessitura (pitch becoming higher, lower or stable). It is represented by five dots on the left or right side of the figure that represents dynamic profile. The lower one indicates very low tessitura, the one above, low tessitura and so on until very high tessitura. A line is attached to these dots to represent the tessitura of the sound. This line can be straight and horizontal if the tessitura is always the same, or can also come up or down if the pitch increases or decreases. This line is curved if the sound has gait. At last, this line indicates the caliber of the sound: a line made with dots if the caliber is thin, dash and dot if it is middle, and a dash if it is large. The same symbols can be applied to a curve. If the melodic profile irregularly and quickly varies, a broken line is added at the end of this symbol.

### Harmonic Profile

The term harmonic profile replaces the terms of Mass and Harmonic Timbre in the TARSOM. It concerns harmonic timbre: richer, poorer or stable. The harmonic profile is represented by symbols inside the geometrical figure: a line for a tonic sound, a curve for inharmonic sounds and a dot for noise. The sound can be homogeneous or hybrid if it has the features of two different sorts of sound (see above). Each category, homogeneous or hybrid, can be rich or poor.

Tonic and inharmonic sounds can have a colour (see above, EMS11, New York). The sign allows to represent seven stable colours and fourty two filtered colours.

The combination of two symbols belonging the same category represent a group (tonic, inharmonic or noise) that can be homogeneous or hybrid. The combination of two symbols belonging to different categories represent dystonic sounds.

### Number of combinations

A complete sign is made assembling symbols on the different sides of the dynamic profile or putting them inside.

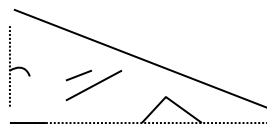


Figure 8 : An example of complete sign. The triangle shows the dynamic profile and means *straight attack*. The line at the top of this figure shows that there is no grain. At the left one can see the melodic profile in a medium tessitura. This full line shows a large caliber ; this line is curve, that means that there is a gait. This gait is small because there is only one curve. At the bottom of the figure, dots indicate that the speed of this gait is fast (rhythmic profile). The broken line in the rhythmic profile means that this rhythm is irregular. At last, the two lines inside the figure represent the harmonic profile: they mean *tonic group*.

A sign, to be efficient, must be precise. This precision depends on the number of possibilities it offers. The Acousmoscribe's sign offers five symbols for dynamic profile, three symbols for grain and three symbols for rhythmic profile. Dynamic or rhythmic profiles can be regular or irregular, thus the number of possibilities is doubled.

There are five possibilities of stable melodic profile, ten possibilities describing increasing pitches (from very low to low, from very low to medium, from very low to high, from very low to very high, from low to high and so on...), and ten possibilities describing decreasing pitches. Of course, all these possibilities can offer irregular processes. The symbol supporting melodic profile also represents caliber. There are three possibilities of caliber and, for each of it, the possibility of being irregular. If the sound has a gait, the line representing melodic profile is replaced by one, two or three curves, depending on the amplitude of the gait.

At last there are three basic symbols for harmonic profiles becoming six merging different features, and becoming twelve adding a symbol meaning "rich". As already said above, adding the different colours and the possibilities of groups and dystonic sounds, there are 40.000 possibilities of harmonic profile.

The different combinations of all these different symbols allow approximately five billions possibilities to build a sign always easy to read.

## FROM SIGN TO SCORE

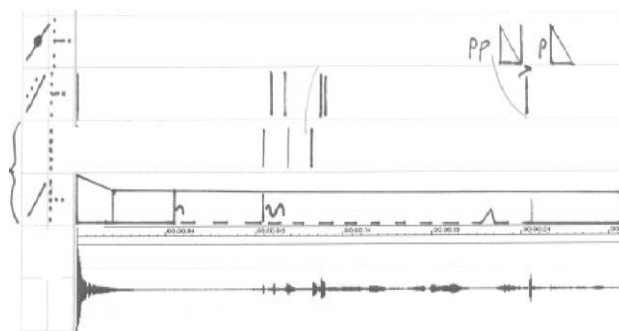
### The Acousmoscribe

The first step was the Acousmoscribe, an experimental software created in 2009 that works on Mac OS 10.6: it

allows the creation of a sign assembling different symbols that one can choose to represent different profiles and parameters. The windows have two parts: the left part represents tracks on which one can put the signs. The right part is a palette where one can create the sign assembling the symbols of the different profiles. One can assemble the symbols to create a sign and then put it in the tracks. This software was able to generate some sounds corresponding to the sign.<sup>5</sup>

### Score of *Incidences/résonances*

The following step was the analysis of *Incidences, résonances* by Bernard Parmegiani. A poietic analysis of this piece has already been made by Ph. Mion, J. J. Nattiez and J. C. Thomas, and I wanted to compare this kind of analysis with the transcription I did using my sign. I called it score because one can create an interpretation of this work following the indications of the signs, because each sign can generate a sound with the same features, even if it is not exactly the same. In this score each sound has its own track. Matter parameters that don't change are used as keys, on two columns at the beginning of each page of the score (harmonic and melodic keys), and shape parameters are written on the tracks. I chose to put sounds in order of appearance, from the bottom to the top. The analysis of the harmonic key generated the concepts of soundality and soundulation, which are the equivalent of tonality and modulation, in instrumental scores, applied to the very matter of the sound. This analysis is a purely formal analysis and the use of the sign allows to understand some processes of composition that are impossible to understand otherwise, specially the relationship between the different harmonic profiles of this work. The concepts of soundality and soundulation were born from this kind of analysis. What is a soundality? What I call soundality is a sonic configuration where a majority of sounds, or the main sounds, belongs to the same category of sound, referring to the paper I presented at the EMS 11 conference (see fig. 1 and 2 above). Of course, a soundulation is a change of soundality.<sup>6</sup>



**Figure 9** : Beginning of *Incidence/résonances* by B. Parmegiani. Matter parameters are put on the two columns on the left: first column describes harmonic profile and second column describes melodic profile. Shape parameters, dynamic profile and rhythmic profile are put on tracks corresponding to each sound.

### Score of *Six japanese gardens*

The analysis of *Six japanese gardens*, first movement, by Kaija Saariaho, realised for her nomination doctor honoris causa of the university of Bordeaux Michel de Montaigne, enables the analysis of the relationships between instruments and tape with the signs. Tape and instruments are considered from a phenomenological point of view, using reduced listening, and can be compared: what is different and what is the same, and the relations between the different sounds. But not only: this work is obviously a symbolic work and is speaking about time. The analysis of this work with my sign allows to study the semiosis, the way the plane of contents works with the plane of expression. At last, this score also shows the descriptive goal of this work. Its complete title is *Tenju-an Garden of Nanzen-ji Temple*. Looking both at a photograph of this temple and at the score, it is possible to see some isomorphisms.

### CONCLUSION

The sign I have elaborated for ten years is based on the reduced listening and describes the sounds from a phenomenological point of view. It is an open system, and it is possible to add any sort of annotation. Not only does this sign system aim at describing sounds, but it also aims at creating structures where each sound can have a value, in a saussurian meaning of this term, i.e. where sound parameters create a relation between each sound to make sense. It is now precise enough to write scores but, of course, still can and must be ameliorated.

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