

Analysis of *Incidences, résonances* by Bernard Parmegiani with an acousmatic score (acousmoscribe)

Jean-Louis Di Santo

SCRIME

jean-louis.di-santo@wanadoo.fr

Abstract

The works I presented in previous EMS (EMS06, EMS09, EMS11), about the augmentation of the precision of sounds typology and their notation, based on Pierre Schaeffer's reduced listening, were a necessary stage but not a purpose in themselves. The goal is to write or analyse acousmatic works using a score made with this notation, like one can do with an instrumental score. To realise the first score using the symbols describing sound parameters, that I call acousmatic score, I choose *Incidences/résonances* by B. Parmegiani because this work has already been transcribed by Parmegiani himself and has already been analysed by P. Mion, J.-J. Nattiez and J.-C. Thomas with the help of Parmegiani. Does my sign system enable to see and understand some elements that this transcription and this poietic analysis do not? Is seeing all of the sound's parameters in two dimensions on a score more efficient than to locate some of them with a sonogram? On the other hand this very rigorous work which purpose seems very clear is particularly adapted to our goal: does fixing the sound in two dimensions in a visual simultaneity and keeping it out from the linear and irreversible flow of time enables what a purely hearing analysis does not? In other words, does an acousmatic score that aims to describe sound parameters allow a better comprehension of a work?

My sign aims to favour a formal approach of electroacoustic works. I mean to describe the sound morphologies that the composer used and the structure of the over all form. Through this, I hope it allows a semiotic approach and can show TSU (Temporal Semiotic Units).

Here the analysis no more depends on the sound itself, but depends on the possibilities that the transcription offers, transcription that itself depends on the precision of the parameters that are chosen to be written. Thus, my sign is based on the linguistic model of the minimal unit made of a set of distinctive features. The distinctive features described here are those described in the TARSOM. This model is very efficient because it is based on a few numbers of elements that allows both a great number of combinations and a great flexibility of use.

To make the analysis of this work, I used several methods: the one used in traditional analysis of instrumental score, taking into account that each sound has its own track, the one used in hearing analysis, and the one that emerge of the sign I used, that depends on its possibilities and on its limits, that I should develop. Due to the fact that this was never done before, a certain number of questions must be answered: how to list all the sounds that are used in composition? How to organise them on the score? Is it necessary to copy the instrument disposition in an instrumental score, classifying them by family and then from the lower to the higher from bottom up? Or is it more efficient to put them in order of appearance?

From there it is possible to elaborate a “key signature” that can show what I called “soundality” and “soundulation”, looking towards instrumental music and adapting it to “sound based music”. Besides, acousmatic score allows seeing the different parts of the overall form and their proportion, morphological figures that I called “phase”, “entité” or “groupe”.

Quick presentation of the sign and of the organisation of the score

I’ll present a formal analysis of *Incidences, résonances* by Bernard Parmegiani through an acousmatic score. This score was made with the sign I have been developing for several years, which is based both on reduced listening parameters established by Pierre Schaeffer and the concept of minimal unit that comes from linguistics. Applied to electroacoustic music, the most simple minimal unit definition would be: a sound remains the same as long as it doesn’t change. As soon as we hear that one or several parameters are changing, it is no longer the same. To have a clear example, we can look at the first page of the score: the long sound at the bottom is divided in several pieces even if it does not stop and even if, in a certain way, it is always the same sound. But there are internal changes: first, there is a decrescendo, after what the dynamic becomes stable, then we can hear a little gait, then the gait becomes more important and so on... A split bar separates each internal change. The long sound made of the same matter but constituted by several minimal units is called entity (Di Santo, EMS06).

To write the score, I chose to put matter parameters as a key signature, because the matter of a sound characterises this sound and doesn’t change: it is useless to repeat it. In the first column I put what I called harmonic profile, which is more or less timber, and in the second column what I called melodic profile which is more or less tessitura and calibre. This way, referring to the different categories of sound (see fig.1 and Di Santo EMS11) we can conceptualise sound and place it in a system where each sound has a value, in the saussurian meaning of this term.

This way I can put shape parameters only on each track. This presentation offers a lot of advantages. First, the sign becomes very easy to read. Second, the user can organise tracks as he likes: classifying sounds by families, from lower to higher, or by order of apparition, which I chose. Everybody can see the amount and the kind of sounds that are used in the piece. One can easily see the evolution of sounds from the beginning to the end of the piece. With this kind of disposition, each change of matter appears very clearly on the tracks. Each track is given a number from the bottom to the top. 1 is at the bottom, 2 just above and so on.

This system of notation allows a visualization of all the sound parameters established by Pierre Schaeffer at the same time, without having to choose certain ones and eliminate the others *a priori*. This is very important because it enables the establishment of unexpected links, that a kind of transcription less sophisticated or an auditive analysis would not show. The more precise the notation is, the subtler the analysis can be.

I call my transcription “score” because if a composer follows the indications of this kind of representation, as all sounds characteristics are described, he can recreate an interpretation of *Incidences, résonances* very near from the original, which is impossible with the transcription by Parmegiani (see fig. 2 at the end of the paper).

		Tonique	Inharmonique	Bruit
simple	pauvre	/	⌒	•
	Riche	↗	⌒↗	•↗
simple	pauvre	⋯↗	⌒	⋯↗
	riche	↗⋯↗	⌒↗	↗⋯↗

Figure 1: symbols of harmonic profile. Table 1: homogenate sounds. Table 2: hybrid sounds. For example, in the first column of hybrid sounds, there is a line made with dots. The line represents a tonic sound and dots represent noise: thus this hybrid sound is both a tonic and noisy sound. To represent groups, 2 or 3 symbols can be associated

Before presenting the analysis of *Incidences, résonances*, I'd like to precise a certain amount of things:

First: What may be wrong? Probably a little number of signs don't match with the symbolisation of their sounds because their correspondence is not scientifically established and is intuitive.

Second: What is right for sure? If, for this reason, the score that I present is not exactly the score of *Incidences, résonances*, it is the score of a piece very close to it, and its formal analysis and the method to do it are right.

Formal analysis

You can download the complete score here:

<http://jean-louis.disanto.pagesperso-orange.fr/recherche.html> (last accessed 09/14).

Globally, the difficulty for a composer is to create duration and to interest with new elements without losing the purpose. Parmegiani himself explains this to us:

This movement is like a study: there is a single writing principle. [...] It plays with attack modes, upkeeping modes, always controlled. [...]

When I reached the middle of the work, I wondered how to continue. I was afraid of a monotony. I endorsed an old technique [...]: theme and variations.¹

We are going to see how Parmegiani created homogeneity and how he created theme and variations. Three big parts constitute the development. This division is justified by the variations of the sounds that make the continuum. The first part goes from the beginning to 1'30, until the beginning of the second very long sound. The second part, from 1'30 to 2'06 is constituted by the superposition of the 2 very long sounds. The third part goes from 2'06 to the end.

¹ Philippe Mion, Jean-Jacques Nattiez and Jean-Christophe Thomas, *L'envers d'une œuvre, De natura sonorum de Bernard Parmegiani*, Paris, Buchet/Chastel, 1982.

Part 1 (from the beginning to 1'30)

The purpose of *Incidences, résonances* is exposed in the 15 first seconds of the piece.

We can see a long held tonic sound (track 1), with or without gate. The gait can vary, or not, in function of incidences. There is no silence and the long sound (continuum) is alone between each incidence. There is an alternation of moments when there are incidences and moments when the long sound is alone.

We can also see three kinds of incidences, that is to say very short sounds:

- hybrid group sound (track 3) that seems to be extended by
- the resonance of the tonic sound
- and short tonic sounds (track 2) that have the same harmonic profile than the long sound.

These incidences can be alone or associated with others to create a figure. Figure associates tonic and hybrid groups and gives a sensation of unity. The hybrid part of this group contains the principle of another kind of sound than only tonic sound.

In fact, the two first sounds contain the principle of the harmonic development of the piece: we see a tonic sound and a hybrid group. The tonic part of the hybrid sound creates an unity with the long tonic sound. Its tonic noise part establishes both the principle of difference and the principle of broadening sound categories by offering another category of sound, a very dynamic attack and a wide calibre.

At the beginning of the piece, all sounds are situated in a medium tessitura, in a narrow band pass, except for the dystonic incidence which has a large band pass. This contributes to create a very tight purpose and, in the same time, offers the possibility to enlarge the calibre of the future sounds. The hybrid sound with a large spectrum also offers the possibility to enlarge progressively the tessitura in order to avoid repetitions that can create monotony. There are harmonic differences between the held sound and the hybrid part of the hybrid group (track 3), and differences on duration variations. The tonic noisy sound (track 3) contains in itself the principle of increasing calibre that contains itself the principle of increasing tessitura.

Variations of melodic profile are only constituted by a gait on the long sound. In all other cases, it does not vary. The last element concerns the attacks: they all are straight. This is an important aspect of this work that contributes to the global unity or homogeneity to use Parmegiani's word.

For all these reasons, this introduction gives us the impression of a totally controlled purpose. The principles of development are clearly exposed.

This introduction also creates a general linear sensation and place us in what Pierre Boulez called "no directed space" (*espace non dirigé*): the sounds don't drive us in any direction. In fact, all the piece, except in its end, is based on a kind of suspended time. This offers a double advantage: on the one hand it is a real unit of process (incidence/resonance), and on the other hand it reinforces the present moment and limits the impact of the changes. Thus it gives us a sensation of strong linearity and unity.

At second 24, a new sound appears with a resonance, first time pianissimo then piano in 26" (track 4). This way to introduce new sounds will be used several times in the piece. This process allows the introduction of new sounds very softly with a unit of process. Besides, the

hybrid sound of the beginning is placed in the middle of the figure to integrate this new sound. This new sound very strong in its medium frequencies prepares us to hear “desequilibrated” sounds. It is also the first true resonance and it confirms and develops the principle of resonance exposed in the beginning. This resonance is short and is not aiming at any place. This fact is underlined by the disappearance of the gait at this moment; the sound has no movement. The gait reappears in 30” without any obvious reason.

At 34”, a new impulsive dystonic sound appears (track 5). It is also integrated in a figure made of sounds that have often been heard since the beginning. Its noisy part, due to the attack, offers a large calibre.

At 46”, the end of the first under part is announced by the first impulsive sound quickly repeated (the little dot in the base of the symbol means quick iteration), and the long sound ends in an iterative way, as if it were influenced by it. This strong rhythmic figure is justifying the apparition of rhythmic features in the second under part. At the same time, the principle of the disappearance of the long sound is established, even if this sound reappears later. It will end definitively in the same way in 2’06”.

The second under part begins both with the first granular sound (notated with dots at the top of the symbol, track 6) – and we can consider that grain is a kind of rhythmic feature – that have a large calibre, and with a long sound made of a regular rhythmic loop (track 7). There is another analogy with the end of the first under part: the granular sound has a double attack, just like the two iterative sounds just before. Its resonance is made of the first electronic long sound, as it is in the beginning, without gait, as it is in the beginning, but higher because the granular sound is higher. This change of pitch creates a little tension. When the tonic rhythmic loop is installed, Parmegiani uses the first dystonic impulsive sound to drive the long tonic sound to its initial pitch. The recall of the beginning in 1 minute has three functions:

- a classical recall of the theme;
- at the same time the process that consists in an impulsive sound that introduces a long sound is re-exposed. This process is very important because it will introduce the soundulation at the beginning of the part 2;
- it allows the integration of all the news elements from the beginning.

The granular sound that introduces this under part also shows its end and stops the long tonic sound for the second time. When it stops definitively, it will not be surprising.

The third under part begins with the same granular sound as the second under part. The long electronic sound stops again and reappears with the same sound as in the beginning but higher, as it already did, always with the same three functions. The new rhythmic loop is constituted by a tonic lower sound (track 10). The irregular rhythm creates an expectation, just before the soundulation. It is constituted by a tonic sound dystonic by its attack that is noise. The transition with the second under part is also performed by the recall of the previous loop that is repeated pianissimo and irregular.

Looking at the harmonic profile key and at the melodic profile key at the end of this part (page 3 of the score), we can see how Parmegiani has very progressively enlarged the tessitura, the calibre and the harmonic profile of sounds. However, for the moment, all of the sounds belong to tonic category except dystonic sounds that contain a noisy part. He has also gradually and logically introduced a great variety of rhythmic elements (gait with speed

variations, grain, iterative sounds, rhythmic loops). At last, he has introduced processes of break of the continuum, of increasing its pitch and of the repetition and variation of the figures. Now, he has enough possibilities to continue the piece without losing the purpose.

All along the first part, Parmegiani prepares the second part and when it comes, we do not really hear it because we are used to the variations exposed just above, but also because he has already superposed 2 long sounds several times before the superposition of the first continuum with the second continuum. The second part appears in continuity with the first part. There is no crescendo to avoid to break the linearity of the piece. In the same line, we will see that when Parmegiani increases some parameters, he decreases other ones to produce variations and to keep the same global tense.

Part 2 (from 1'30 to 2'06)

This part is mainly a very long transition from the first soundality to the second soundality. 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 *EMS11 conference* (see fig. 1 above). These categories are: tonic, inharmonic, noise (homogeneous categories) and tonic inharmonic, tonic noise, inharmonic noise (hybrid categories). In the first part of *Incidences, résonances* we can clearly see (on the score) and hear that it is a tonic soundality. If we look at the harmonic profile key (first column of the score), we see that all the sounds only belong to the tonic category. At 1'30, two inharmonic sounds appear. One of them, the homogeneous inharmonic sound, is a long sound that will continue until the end and that will constitute the continuum instead of the first long homogeneous tonic sound when it will stop at 2'06. At this moment (1'30), we can admire the great ability of Parmegiani: on one hand, he announces this change with the irregular rhythmic loop, as we have already seen, and with two impulsive sounds in 1'29 that function like a signal. This justifies the appearance of new sounds. On the other hand he obviously hides this change because he wants to create a linear piece. He uses some processes to reach this goal:

- the first long sound remains 36" more;
- the first motive (impulsive sound and long tonic sound) is repeated for the fourth time (beginning, 1', 1'20 and 1'30) – but for the last time. It will disappear at the time when it seems firmly established;
- the progression of the harmonic profiles from the beginning to 1'30 (see harmonic profile key page 3 of the score) prepares the appearance of new sounds;
- the number of events increases and gets our attention. In this way we do not pay attention to the new continuum;
- the first continuum has a little crescendo before the appearance of the 3 new sounds both to announce it and to avoid a sudden change of velocity
- last point: the inharmonic sound appears with a tonic sound (track 13 from the bottom) and a tonic inharmonic sound (track 12) that create a link between all these new sounds and the former sounds.

The new continuum presents some similarities with the first one: it has a gait that varies, it is in the same tessitura, and, of course, it is long. But it has also some differences: its calibre is larger, because it is a group (several sounds of the same category all together), and it has

grain. These two features create more tension than the first continuum, probably to keep the attention of the listener.

Some of the first impulsive sounds (track 2 and 3) are still heard to keep continuity with the beginning. Six new sounds appear, two of which are inharmonic (tracks 17 and 18), and now all the tessituras, from very low to very high are present. Some figures (page 4 and 5, in blue and red) are repeated, with a little variation each time but without progression. The blue ones are integrated with ancient sounds. But here it becomes very difficult to hear if these short sounds have been already heard or not, especially if they belong to a category of sound already heard.

This second part finishes in the same way than the first under part, with exactly the same sounds: the iterative sound (track 3) drives the continuum iterative and the first granular sound (track 6) stops it. A tonic group (track 15), tonic like the first continuum and group like the second one, is building a dishing from the second part to the third part. So the end of the first continuum goes unnoticed.

Part 3 (from 2'06 to the end)

In the first under part, the soundulation is achieved: the long inharmonic sound definitively replaces the long tonic sound that we were hearing from the beginning. This sound definitively disappears. Sounds become rarer and rarer until the end. As we have already seen, the new sounds are introduced in a figure that contains sounds already heard. As it is the case all along the piece, these figures do not drive anywhere and let us in a no directed space. The progressive relaxation is underline by the long extinction of the tonic group, from 2' to 2'29. Most of the time is occupied by the extinction of resonances.

The very low sound, very soft until there, pops up fortissimo in 2'30, at the time when the pitch of the continuum becomes higher, as if Parmegiani had wanted to compensate this change of pitch. However this change is necessary to increase the tension – and the attention – when the events become very rare and when a listener could be bored. In the same time, the global ambitus and the calibre of the sounds become smaller.

This under part finishes like the first under part of the first part with an interruption of the continuum, in 2'37 and 2'40, followed by the same granular sound as in the first part (track 6). However, the rhythmic variation is here replace by variations of the speed and the deviation of the gait.

In the second under part, the principle of superposition of hold sounds, previously already used by Parmegiani, is amplified with the same goal: to allow the rarefaction of the incidences. The long tonic inharmonic hybrid sound (track 22), from 2'41 to 3'18, because it is hybrid makes a link between the two continuums of the piece (the first one was tonic and the last one inharmonic). It resumes all the processes used in the continuums to announce the final: variations of gait, of pitch, of speed and interruptions. The very high sound disappears and is heard pianissimo for the last time (page 6). Only very short sounds (track 9) conserve a large calibre. This under part ends with a decelerando made with an impulsive pink noise, from 3'23 to 3'27, that is the first directed space in the whole piece. It drives us straight to the finale.

The finale, the third under part, begins by an impulsive tonic sound, with thin calibre in medium tessitura, with strong medium frequencies that stops the gait of the continuum. The continuum is staying alone, except one incidence in the same tonic sound, without any kind of

variation until 3'37. In 3'37, the tonic sound functions like a signal that causes both a long decrescendo of the continuum and variations of the gait. It is repeated five times and, each time, causes a small pitch variation that create the sensation of a lower pitch. The last incidence comes just before the end of the continuum and underlines it.

Conclusion

According to Parmegiani himself, the work is built on the principle of theme and variation. This means that a certain amount of elements guarantees its unity. Yet, this unity is also based on variation processes always identical that ensures its unit in its variations.

The piece works with an internal logic that comes from its own organisation, as it was determined in the exposition

The work as a whole gives the impression of a great linearity through the almost continuous presence of held sounds and the complete absence of silence. Tracks of incidences alone or in groups of figures and tracks with only held sounds come one after another. Parmegiani only uses one kind of attack, that is to say a brutal one, despite duration and pitch variations, which contributes to the work's unity, cohesion and dynamism. This could have created weariness on the duration. To fix this, Parmegiani uses a certain amount of devices. As soon as the first two sounds appear, Parmegiani establishes some variation principles:

- tonic held sounds from the beginning become inharmonic but still have a determined pitch. They become more and more tense and rich, almost imperceptibly thanks to a very long transition and to long sounds that create a link between them. At the same time these processes create tense to avoid boredom that could result from a too big homogeneity;
- from smooth they become slightly rough. The grain is brought by the rhythmical elements of the during impacts, by the held sounds that ends rhythmically and by the sound at 48 seconds which is the first granular sound of the work;
- the use of gait and its variations that exists in the 3 continuum on which the work is based both generates unity and variations.

The variations also come from an always-identical process of variation of the pitch, globally increasing in a first time, and then globally decreasing at the end to a more peaceful atmosphere. In a more general way, variations always follow the same processes: variations of pitch, changes of harmonic profile justified by insertion in a figure and preparation through the introduction of a new sound pianissimo, and relations of soundality. Appearing highly linear, the work uses a progressive increasing and decreasing of the frequency of events (more and more regular until 1'30, high density form 1'30 to 2'18, which matches the moment following the end of the soundality, less and less regular until the end), of the harmonic profile variety, and of sound's tessitura and calibre. For all these reasons, the real global form of the piece is an arch even if we perceive a great linearity. In this way, Parmegiani avoid weariness.

Globally there are no directed spaces, except by short resonances, yet leading anywhere or ensuring a transition between different undirected spaces. Therefore, there are two exceptions: the *rallentando* from 3'19 to 3'27 that brings on the finale through an endless trajectory, and the final itself that is a specific kind of endless trajectory: fading away. However, this fade away obeys to the principle of resonances and very long resonances are often exposed all along the piece. Thus, this is not a new element and it doesn't break the identity of process.

To conclude, the linear aspect of this work is underlined by the use of Temporal Semiotic Units and specially TSU that makes a structure (Di Santo, MIM's proceedings, 2008). The first one is "floating" in the first under part, from 0" to 48". The score is a perfect illustration of this definition. This TSU creates a kind of expectation, but nothing happens. (floating: uncircumscribed in time unit, in quite a slow temporal proceeding, temporary sound occurrences that follow each other without forming a structure, on a "smooth" continuum, with no beat. This continuum can be underpinned or can be silence. MIM, 1996).

The following under part, from 48" to 1'16, illustrate the TSU "Stationary". Even if we can hear a pulse, no place is aimed and the time seems to stay always the same. (Stationary: uncircumscribed in time unit with quite a slow temporal proceeding. With a temporal regularity or permanency at a global scale. Can include, at another scale, random or pseudo random elements).

The third under part, from 1'16 to 1'30, is mainly constituted by an irregular loop that creates expectation: this is the TSU "In suspension". (In suspension: uncircumscribed in time unit, made of a repeated and almost not varied formula, in quite a slow temporal proceeding, and which sound material and/or elements almost doesn't change).

From 1'30 to 3'23, we find "Stationary" again. Some different figures are repeated with little variations, with space between them, on an unvarious continuum.

From 3'23 to 3'27, we find a short "endless trajectory" made with an accelerando that drives us to the finale. (Endless trajectory: uncircumscribed in time with a globally uniform unique phase showing a slow and linear evolution of a sound feature).

The finale begins with a short "floating" and ends with "Fading away". (Fading away: circumscribed in time, with only one phase; progressive disappearance, by natural dissipation of energy). This change of temporality is justified by the announcement of the end of the piece.

1. Incidences/Résonances

5 10 15 20 25 30 35 40

45 50 55 1' 1'05 1'10 1'15

1'20 1'25 1'30 1'35 1'40 1'45 1'50 1'55

2'00 2'05 2'10 2'15 2'20 2'25 2'30 2'35

2'40 2'45 2'50 2'55 3' 3'05 3'10 3'15

Sources
Sonores:

- Générateurs sinus -
- Verres cristall
- Tringles durap.
- Vasque métallique
- Spirales métalliques
- Timbre sonnette bronze -

Incidentes/Résonances (suite)

3'20 3'25 3'30 3'35 3'40 3'45 3'50 3'55 4'0

Figure 2: transcription of incidences, résonances by Parmegiani

References

BENVENISTE Emile, *Problèmes de linguistique générale*, Paris, Gallimard, 1966.

BOULEZ Pierre, *Penser la musique aujourd'hui*, Paris, Gallimard, 1987.

DELALANDE François, *Analyser la musique, pourquoi, comment ?*, Paris, INA éditions, 2013.

DI SANTO Jean-Louis, "Proposition d'une terminologie structurée et de notation symbolique de la musique électroacoustique. Représentation et notation symboliques de la musique électroacoustique champs voisins : sémiotique et linguistique", in *Proceedings of the Electroacoustic Music Studies Network Conference (EMS06)*, Beijing (China), 2006, www.ems-network.org/spip.php?article235 (last accessed 09/14).

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*, Emmanuelle Rix, Marcel Formosa (eds), Paris, Ircam – Centre Pompidou, Sampzon (France), Éditions Delatour, 2008, p. 262.

DI SANTO Jean-Louis, “L’acousmoscribe, un éditeur de partitions acousmatiques”, in *Proceedings of the Electroacoustic Music Studies Network Conference (EMS09)*, Buenos Aires (Argentina), 2009, www.ems-network.org/ems09/papers/disanto.pdf (last accessed 09/14).

DI SANTO, Jean-Louis, “Harmonic profile: typology and notation”, in *Proceedings of the Electroacoustic Music Studies Network Conference (EMS11)*, New York, 2011, www.ems-network.org/spip.php?article322 (last accessed 09/14).

GREIMAS Algirdas Julian, *Dictionnaire raisonné de la théorie du langage*, Paris, Hachette Supérieur, 1993.

GOODMAN Nelson, *Langages de l’art*, Paris, Hachette littératures, 2005 (édition originale : Jacqueline Chambon, 1990)

JAKOBSON Roman, *Essai de linguistique générale, T 2*, Paris, Éditions de Minuit, 1973.

DELALANDE François *et al.*, *Les Unités Sémiotiques Temporelles*, Laboratoire Musique et Informatique de Marseille (MIM), Documents Musurgia, Paris, Édition Eska, 1996.

MION Philippe, Jean-Jacques NATTIEZ and Jean-Christophe THOMAS, *L’envers d’une œuvre, De natura sonorum de Bernard Parmegiani*, Paris, Buchet/Chastel, 1982.

SCHAEFFER Pierre, *Traité des objets musicaux*, Paris, Éditions du Seuil, 1966.

THORESEN Lasse, “Spectromorphological Analysis of Sound Objects, An adaptation of Pierre Schaeffer’s Typomorphology”, in *Proceedings of the Electroacoustic Music Studies Network Conference (EMS06)*, Beijing (China), 2006, www.ems-network.org/spip.php?article250 (last accessed 09/14).