STUDENT ARTICLE

Three analysis models for *L'oiseau moqueur*, one of the *Trois rêves d'oiseau* by François Bayle*

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This article deals with the analysis of a work by François Bayle, *L'oiseau moqueur* (1963). I worked at the INA-GRM (Paris) in order to realise a graphic record of the piece using their proprietary acousmograph software. To work from this graphic record, I used three methods of analysis: identification and classification of sound objects using a Schaefferian typology, comparison of objects with one another following a paradigmatic approach, and presentation of the results obtained through enumeration of a certain number of values (duration, density of objects, etc.).

1. INTRODUCTION

I decided to use three methods to analyse *L'oiseau moqueur*, an extract from *Trois rêves d'oiseaux*. The first details the sound objects according to the approach developed by Pierre Schaeffer (Schaeffer 1977), the second by semiology. To analyse the structure of the objects, I adopted a more personal approach based on a precise enumeration of certain values; a method which, I believe, enables one to highlight certain roles played by the sound objects in various sets from a small group of objects to the whole piece.

L'oiseau moqueur (3′28″), written in 1963, was originally included in the *Trois portraits de l'Oiseau-Qui-N'existe-Pas*. This work, created in the same year at Knokke-le-Zoute (Belgium), included five instruments (oboe, French horn, harpsichord, harp and vibraphone) and tape. The work accompanied animated images by the painter Robert Lapoujade and a poem by Claude Aveline. The *Trois portraits*... consisted of three parts: *oiseau carnassier*, *oiseau mouche* and *oiseau chanteur*, the latter becoming *L'oiseau moqueur* in 1972. The presence of instruments on stage in the original *Trois portraits de l'Oiseau-Qui-N'existe-Pas* explains why these instruments are found on the tape.

L'oiseau moqueur, *L'oiseau zen* (composed in 1971 with the title *Uirapuru* and integrated in *l'Expérience acoustique*) and *L'oiseau triste* were brought together in 1971 to compose the *Trois rêves d'oiseaux* created on 6 February at the Guimet museum in Paris (Bayle 1993).

* Translated from the French by Claire Parker.

2. SCHAEFFERIAN ANALYSIS

2.1. Prelude: from listening to the acousmograph record[1]

2.1.1. Listening is everything...

The first part of the analysis was performed by listening only. I made a record of the sound objects that seemed the most pertinent. This first approach led me to divide the objects into four categories as follows:

(a) *Manufactured sounds*: **thin held note**, **thick held note**, scratch, **short and deep sound**, glissandi, **rapid synthesised impulsions**.

(b) *Instruments*:

- oboe: **held note**, **held note with appoggiatura and trill**, short note, short note with rhythm, fairly fast passage, very fast passage,
- French horn: **held note**, held note with crescendo, held note with crescendo and decrescendo, **glissando**, **short note**, short note with rhythm, fast passage,
- strings: **arco**, **pizz**, and
- bell: **simple note**.

(c) *Bird*: simple, **soundmass**, trill.

(d) *Man's laugh*: sly laugh ('he'→'hai'), **nervous laugh (regular 'hai')**, accelerated laugh, laugh on vowels ('yo'), **guffaw ('ho')**, **cut-off/irregular laugh (on 'ha')**.

[1] The acousmograph is a PC-based software tool developed at the GRM. It is used to produce a record of any sound source. The first step is to produce a sonogram. The second step is to work on interpreting the sonogram by adding graphics or texts representing the sounds. From this record, we can select the elements to print (for example, delete the sonogram and retain the text or graphic elements only). There are several very useful features, including modification of spectral and/or time scales. The software is still in the development stage, and future versions will integrate a certain number of additional features that were unavailable for this study.

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Of these thirty-two sound objects, only eighteen were retained (those in bold above) for the final classification. Others were added to obtain the final twenty-four classified sound objects.

It is to be noted that the decision to perform an analysis of sound objects was taken on the first listening as it was obviously the most fruitful method. François Bayle's work here is based on montage. If I had chosen one of his more recent works, I would probably have approached the analysis by examining specific sound criteria or object macro-structures.

2.1.2. Working with the acousmograph

Following the first summary obtained through listening, I went on to work on the spectral record produced by the acousmograph. The work with the software consisted of reinterpreting the spectrogram using more or less complex geometric drawings to represent the different sound objects (figure 1). In addition, the four categories previously isolated were reorganised into five categories:

(a) oboe sounds,
(b) French horn sounds,
(c) bird sounds,
(d) voice sounds, and
(e) miscellaneous sounds.

These categories were originally represented by colours. Unfortunately, I am unable to show this on figure 1 in black and white.

The objects grouped in the instrument category are found in (a) oboe, (b) French horn, and (e) strings and bell. The form of the objects depends essentially on their spectromorphology (Smalley 1991) (examples: ob held, horn held, held, bird d, etc.[2]), or sometimes on their pitch, particularly for glissandi, trills and runs of short notes (examples: ob sn, horn sn, horn gliss, bird wh, etc.). However, the forms are also influenced by a purely personal and aesthetic interpretation (examples: the different laughs, deep 2, arco, pizz, bell, etc.). Note that pitch is only represented in an approximate fashion. In the case of this work, I did not consider that a detailed representation of pitch would be a significant factor for the analysis.

In the end, I retained twenty-four sound objects. The origin of each sound is specified in the list below (where possible) with description and abbreviation. The objects are listed, by family, in the order in which they appear in the piece.

- *Oboe*:
  (1) short note (ob sn),
  (2) held note (ob held), and
  (3) trill (ob tr).
- *French horn*:
  (4) short note (horn sn),
  (5) held note (horn held),
  (6) trill (horn tr), and
  (7) glissando (horn gliss).
- *Birds*:
  (8) deep bird (bird d) in four variations: bird d1, bird d2, bird d3 and bird d4,
  (9) complex bird (bird comp),
  (10) whistling bird (bird wh), and
  (11) laughing bird (bird lgh).
- *Voice*:
  (12) exclamation 'uh' (voice uh),
  (13) laugh 'nervous hai' (laugh hai),
  (14) accelerated laugh (laugh acc),
  (15) exclamation 'yai' (voice yai),
  (16) laugh 'yo' (laugh yo), and
  (17) laugh 'ha' (laugh ha).
- *Miscellaneous*:
  (18) beginning held note (held),
  (19) deep sound (deep 1),
  (20) held deep delta (deep 2),
  (21) deep impulsion (deep 3),
  (22) arco note (arco),
  (23) pizzicato (pizz), and
  (24) bell (bell).

The arco, pizz and bell objects are classified as 'miscellaneous sounds' as they only appear at the end of the work, and infrequently. In addition, the arco object probably originates from the harpsichord and the bell from the vibraphone. I nevertheless decided to retain the names given following the first listening, even if they correspond to different instruments, as these names better represent the sounds.

2.1.3. Transformations and examination of object microstructures

Throughout the piece, these twenty-four sound objects undergo various transformations. The composer has used six types of transformation:

(1) transposition,
(2) variation in duration sometimes leading to a transposition,
(3) inversion,
(4) reverberation,
(5) cutting or decomposing into several fragments, and
(6) mixing to form a composed object.

The first five types of transformations do not pose any particular problems for identifying and isolating the object. I did, however, encounter a difficulty concerning 'mixing to form a composed object'. I was unable to reliably decompose a certain number of sections into the different objects they are composed of,

[2] These abbreviations are used to designate the sound objects in the analysis (see list of sound objects).

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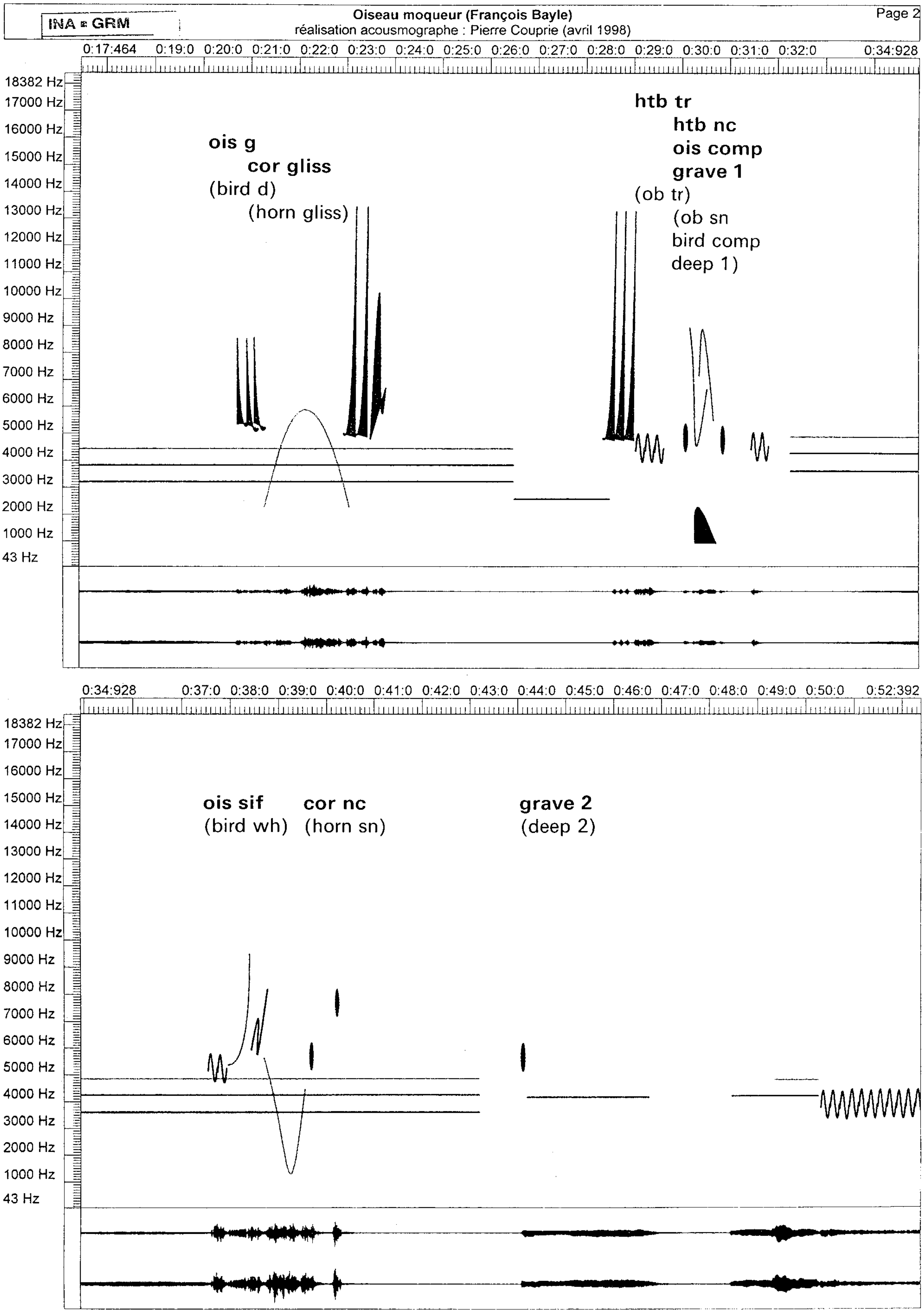

Figure 1. Acousmograph: graphic element and dynamic (extract).

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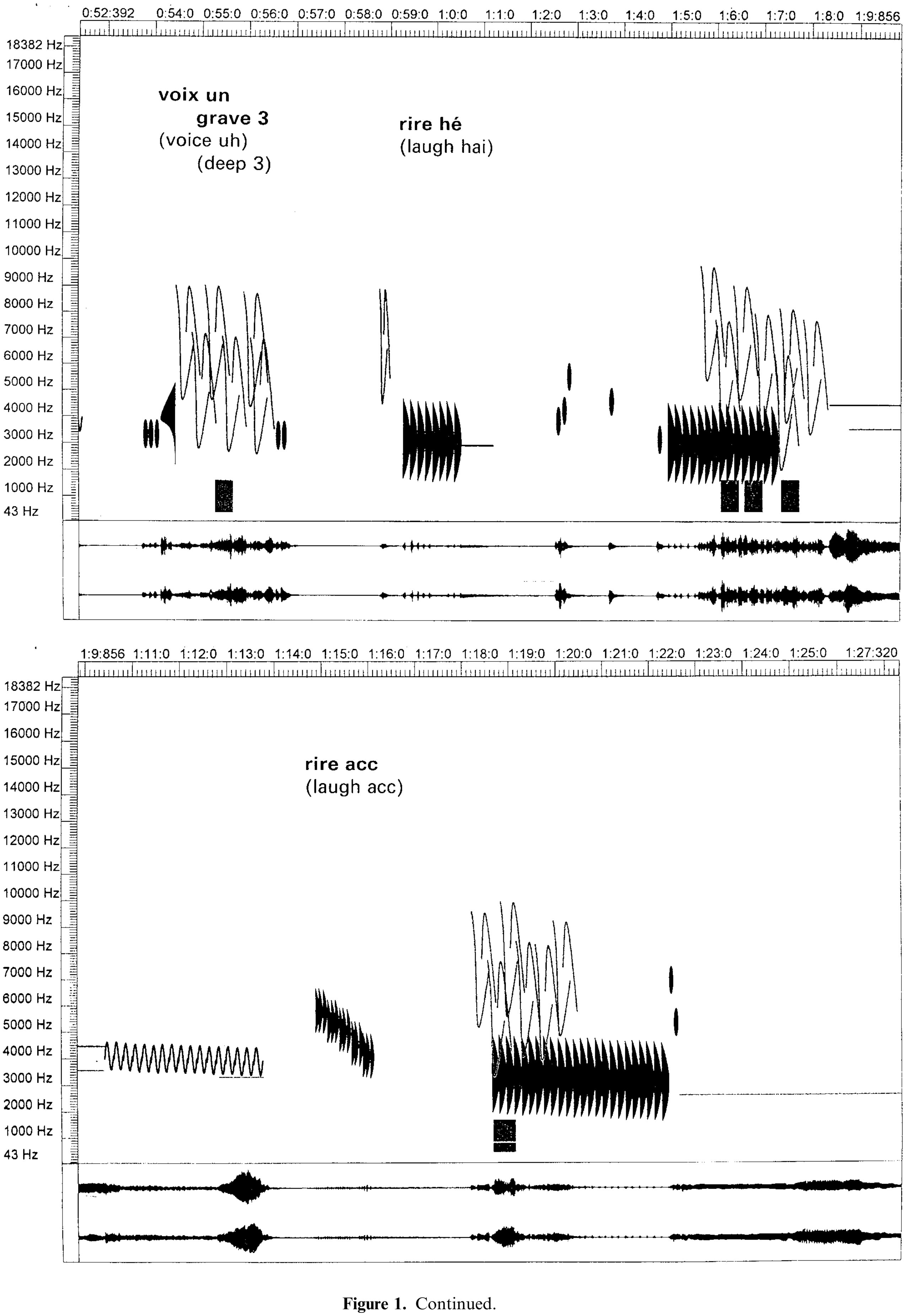

Figure 1. Continued.

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even using the sonogram provided by the acousmograph. I made approximations, but cannot guarantee that there are not additional objects present. On the other hand, in certain cases I was able to identify the constituents of a composed object using the computer.

One thing is immediately noticeable on examining the sonogram provided by the acousmograph even without a first listening of the piece. The composer appears essentially to have used montage for the sound objects. Most objects appear well differentiated, following on from one another. However, if we consult the graph while listening, we can see that many sounds are held, and are often masked by other sounds that are superimposed. The latter are often much louder, and create a rupture on their arrival as compared with much longer sounds.

In this way, between seconds 20 and 25 of the sonogram, I am unable to discern whether the three sounds (held, ob held, and horn held) that begin around the 15th second continue or stop. I then rerecorded this passage with a better dynamic contrast, extended the timescale and changed the frequency scale (limited to 12,175 Hz) in order to highlight finer details. The three sounds do indeed continue while other objects are superimposed on them (figure 2).

Contrary to this, between seconds 28 and 32, we observe the extreme clarity of six sound objects (bird d, ob tr, ob sn, bird comp, ob sn, and ob tr). On the acousmograph record, there are a mass of low frequencies under the fourth object (bird comp), and it is difficult to analyse whether they are part of the object or not (figure 3). However, on listening, this mass of frequencies becomes the seventh object: deep 1. So, in this case, listening completed the work achieved using the sonogram.

It is impossible to perform separate analyses using the acousmograph record and listening. It is necessary to alternate between the two.[3]

2.2. Analysis of sound objects inspired by Schaeffer's classification

2.2.1. Description of sound objects using an analysis form

In order to classify the different sound objects, I first decided to include them in Schaefferian typology. I created an analysis form (figure 4) to enable me to describe characteristics or criteria for these objects. I retained four of the seven criteria described by Pierre Schaeffer:[4] masse, dynamic, texture and aspect. I added two transformation criteria: effects (reverberation, echo, miscellaneous) and spatial effects.

2.2.2. Classification of objects in Schaefferian typology

Next, I attempted to classify these sound objects in the 'summary typology table' as presented by Michel Chion (Chion 1983). In figure 5, the sounds that are considered as balanced[5] by Pierre Schaeffer are found in the bold rectangle. These are the ones that François Bayle mainly uses. According to Schaeffer these are the best adapted to use in music. In brackets you will find abbreviations for certain types of sounds not present in this work.

The case of the object named complex bird (bird comp) is problematic. This is why it appears in two cells with a question mark. Should it be considered as a prolonged eccentric discontinuous sound, or a 'grosse note', a medium-length eccentric sound? From what duration on does a medium-length sound become a prolonged one?[6] In addition, this sound never has the same duration. It can certainly be placed in one or the other of the categories according to its duration.

Finally, it should be noted that the laughs ha and yo are present as impulsions or iterations.

3. THE PARADIGMATIC POINT OF VIEW

3.1. Sound objects in relation to one another

There are in fact few sound objects in this work that benefit from being studied using paradigmatic analysis (Nattiez 1973). This type of analysis involves studying the variations in one object, or similarities between different objects. If we observe the sound objects from this angle, we can separate them into three categories:

(1) objects with few or very simple variations (pitch, duration, etc.),
(2) objects rarely present (between 1 and 3 times), and
(3) objects present a number of times with significant variations.

The first category includes all the instrumental sounds, some voice sounds (laugh) and some deep sounds (held or impulsions), the second includes objects that appear at the end of the piece in particular, and the third category essentially includes the

[3] The acousmograph enables one to select a passage on the screen and then listen to it whilst following the cursor on the graphic.
[4] Masse, dynamic, harmonic timbre, melodic profile, masse profile, texture and aspect (Schaeffer 1977).
[5] Balanced objects are those which present 'a good compromise between the over-structured and the over-simple' (Schaeffer 1977).
[6] Here we are faced with one of the problems posed by Pierre Schaeffer's typology/classification. The terms are often 'vaguely precise' or even totally imprecise.

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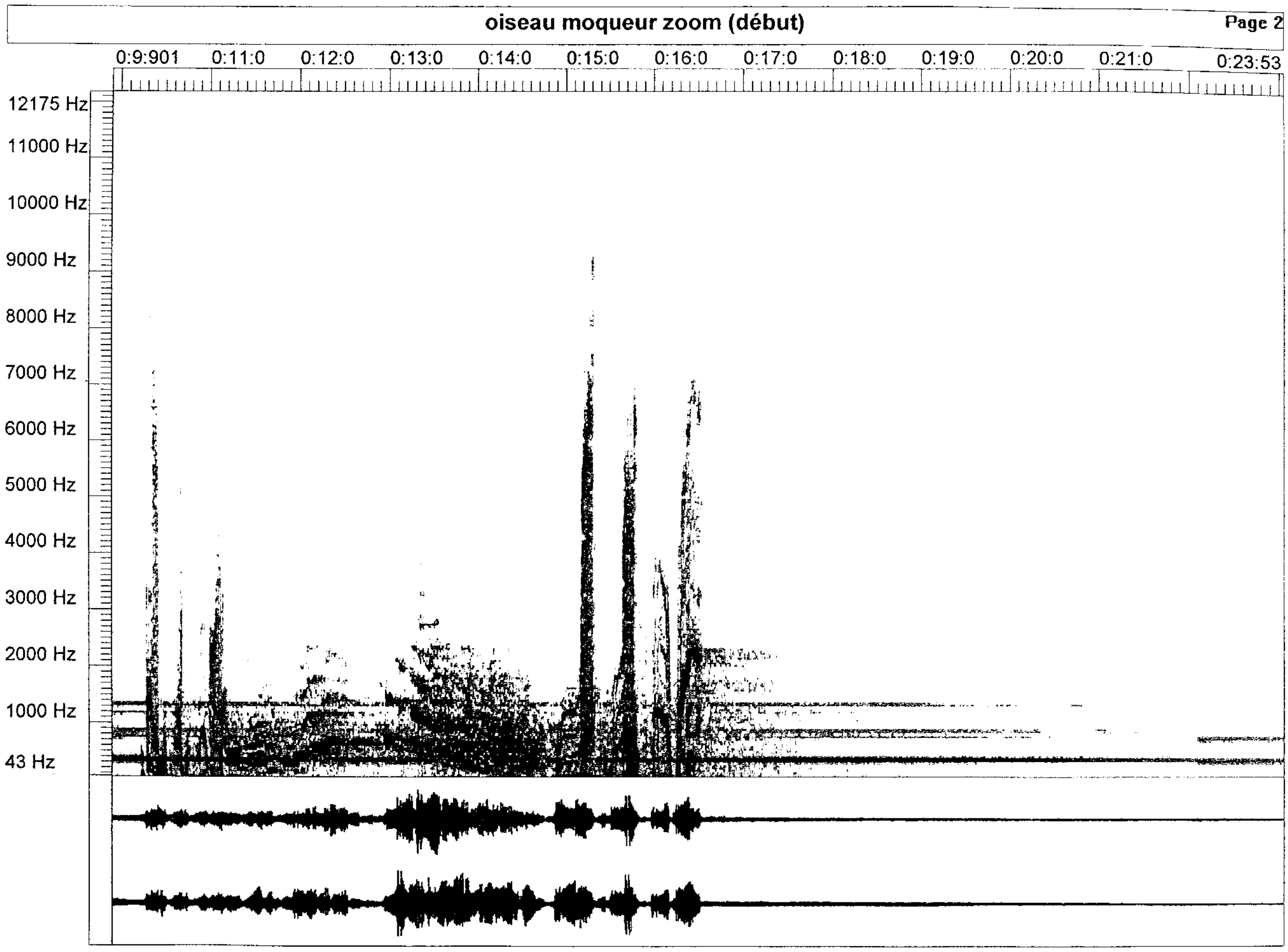

Figure 2. Sonogram (extract).

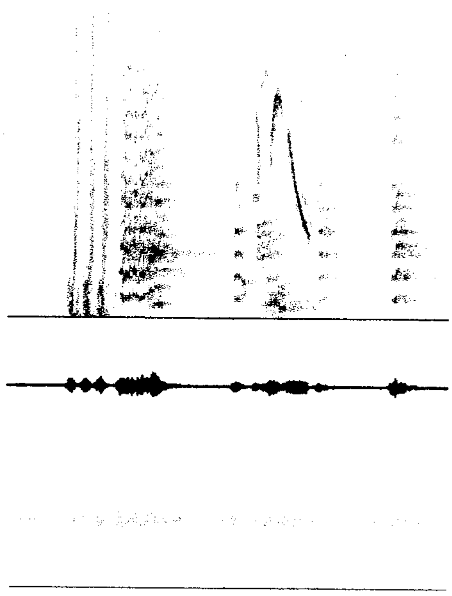

Figure 3. Sonogram (extract: 28″–32″).

bird sounds. Figure 6 documents the different transformations for each object.

To observe similarities between different objects, we can use the typology table (figure 5) described above. Sounds are grouped in this table according to their duration and spectrum. The majority of sounds are grouped in the upper six cells, which include the tonic sounds and the balanced complex sounds.

3.2. Special case: complex bird (bird comp)

This sound object, which occurs twenty-two times during the piece, merits closer examination. Each time it appears, the object is identified as being one and the same, and so is sufficiently stable, if complex. When we examine its sonogram, we realise that its spectral characteristics change throughout the piece.

If we place the sonographic records of the object side by side, we notice sometimes significant spectral differences between the different records (figure 7). If we scrutinise these, we can attribute the differences to the following:

(1) Differences in dynamics: numbers 6 and 9 are soft, and numbers 2, 15 and 17 with contrasted shades are similar.

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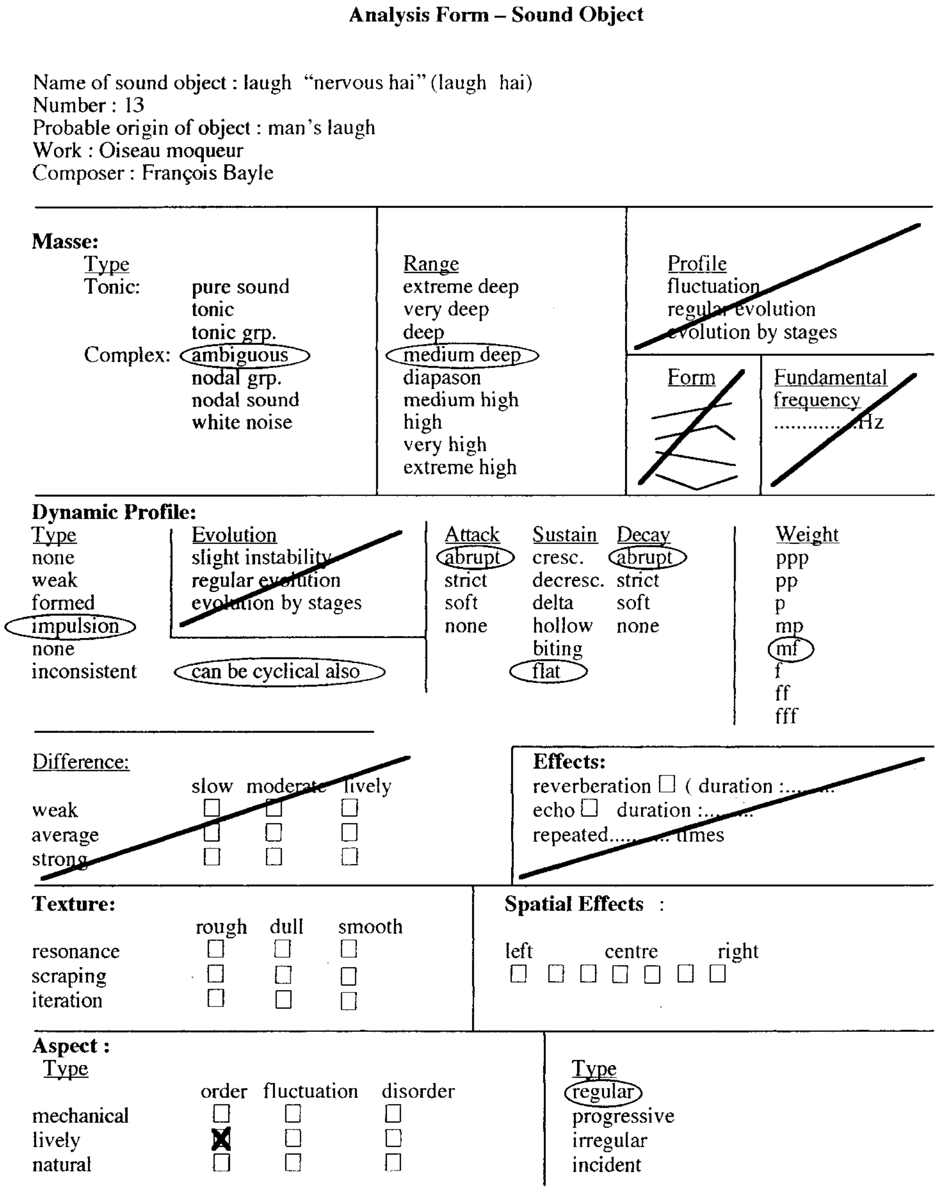
Analysis Form – Sound Object

Name of sound object : laugh "nervous hai" (laugh hai)
Number : 13
Probable origin of object : man's laugh
Work : Oiseau moqueur
Composer : François Bayle

Masse:
Type
Tonic: pure sound, tonic, tonic grp.
Complex: ambiguous, nodal grp., nodal sound, white noise

Range
extreme deep, very deep, deep, medium deep, diapason, medium high, high, very high, extreme high

Profile
fluctuation, regular evolution, evolution by stages

Form

Fundamental frequency
............Hz

Dynamic Profile:
Type
none, weak, formed, impulsion, none, inconsistent

Evolution
slight instability, regular evolution, evolution by stages
can be cyclical also

Attack: abrupt, strict, soft, none
Sustain: cresc., decresc., delta, hollow, biting, flat
Decay: abrupt, strict, soft, none

Weight
ppp, pp, p, mp, mf, f, ff, fff

Difference:

	slow	moderate	lively
weak	☐	☐	☐
average	☐	☐	☐
strong	☐	☐	☐

Effects:
reverberation ☐ (duration :.........
echo ☐ duration :.........
repeated............times

Texture:

	rough	dull	smooth
resonance	☐	☐	☐
scraping	☐	☐	☐
iteration	☐	☐	☐

Spatial Effects :
left centre right
☐ ☐ ☐ ☐ ☐ ☐ ☐

Aspect :
Type

	order	fluctuation	disorder
mechanical	☐	☐	☐
lively	☒	☐	☐
natural	☐	☐	☐

Type
regular, progressive, irregular, incident

Figure 4. Analysis form (laugh hai).

(2) Other objects are mixed, which alter the 'pure spectrum' of the sound.

Here once again we see that, in order to study variations for an object, alternating between the spectral record and listening is the best way of analysing a sound.

4. A DIFFERENT APPROACH

The work described in this section is based on the detailed and precise measurement of several values. The results obtained are shown in a number of graphics that enable one to understand the position held by each object (importance, relationship with other objects, structural role, etc.).

4.1. Formal division

In figure 8, the X-axis specifies the time (the work is divided into twenty-one 10 s time slots) and the Y-axis gives the number of sound objects. The front curve (S1) indicates the number of first appearances of objects, and the back curve (S2) gives the density of objects. We can make the following comments:

(1) The majority of sound objects appear in the first minute (less than a third of the duration of the piece). François Bayle keeps three new objects for the end, which only appear twice each in a very short space of time (10′, slot number 19).
(2) The two curves are almost opposite, except at the beginning. The fewer new sound objects there are, the higher the density of these objects.

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	measured duration				
	held	impulsion	iteration		
tonic	ob held horn held held	ob sn horn sn arco & pizz bell	ob tr horn tr		
complex	deep 2	voice uh voice yai laugh ha & yo deep 1 & 3	bird lgh laugh hai laugh yo laugh ha		
formed varied	horn gliss	**(Y')**	bird wh laugh acc	**duration unmeasured (macro-objets)**	unpredictable
varied unpredictable	bird comp ?	**(F)**	bird d	**(P)**	bird comp ?

Figure 5. Summary typology table.

(3) There is a long time slot (1′15″) during which only three new objects appear. We can thus divide these 3′25″ into three parts:

- 0′–1′00″: with a high appearance density (seventeen sound objects – 68%),
- 1′00″–2′10″: five new objects (20%), between none and one new object per 10 s, and
- 2′10″–3′25″: three new objects (12%) which are preceded by a section of 50″ with no new sound object.

pitch	duration	dyn.	inv.	%	mix.	num.
ob sn	✔		✔	✔	26%	57
ob held	✔	sig.			100%	7
ob tr	✔	sig.			54%	13
horn sn	✔				47%	38
horn held	✔	sig.	✔		80%	15
horn tr	✔	sig.			50%	2
horn gliss	(✔)	avg.			100%	3
bird d					100%	4
bird comp		sig.	✔		37%	22
bird wh	(✔)	weak			14%	7
bird lgh	✔	weak			50%	4
voice uh					100%	1
laugh hai		avg.			25%	4
laugh acc	✔				0%	3
voice yai					100%	1
laugh yo		avg.		✔	33%	3
laugh ha	✔	avg.			50%	6
held	✔	sig.			60%	5
deep 1					0%	1
deep 2		sig.			0%	8
deep 3	✔	weak			0%	12
arco	✔				100%	3
pizz	✔				33%	3
bell	✔	weak			100%	2

Abbreviations:
dyn.: dynamic, inv.: inversion, % mix.: percentage with one or several other mixed sounds, num.: number of appearances, sig.: significant, avg.: average.
✔ indicates that there is significant variation or many variations. (✔) indicates here that the sound has a changing pitch.

Figure 6. Object transformations.

The graph in figure 9 represents the sequence of sound objects (*X*-axis, time in 2 s sections; *Y*-axis, object numbers). Looking at this sequence of objects, we observe that certain objects have a significant presence. The division into three parts described above (represented here by the small arrows at the op) has been slightly transformed (vertical dotted ines). The central part takes up much more space around 2′), relegating the other parts to the roles of ntroduction (around 40″) and conclusion (around 0″).

.2. Object/structure balance

n order to observe the relationships between the different objects, I decided to associate the density studed previously with a new factor – object durations. n figure 10, the four curves represent the following:

- series 3: object densities,
- series 4: minimum object durations,
- series 1: maximum object durations, and
- series 2: average of maximum and minimum durations.

he *X*-axis still represents the time divided into 10 s ntervals. The values for series 3 should be read on the left *Y*-axis and the other series' values on the right *Y*-axis. Comments are as follows:

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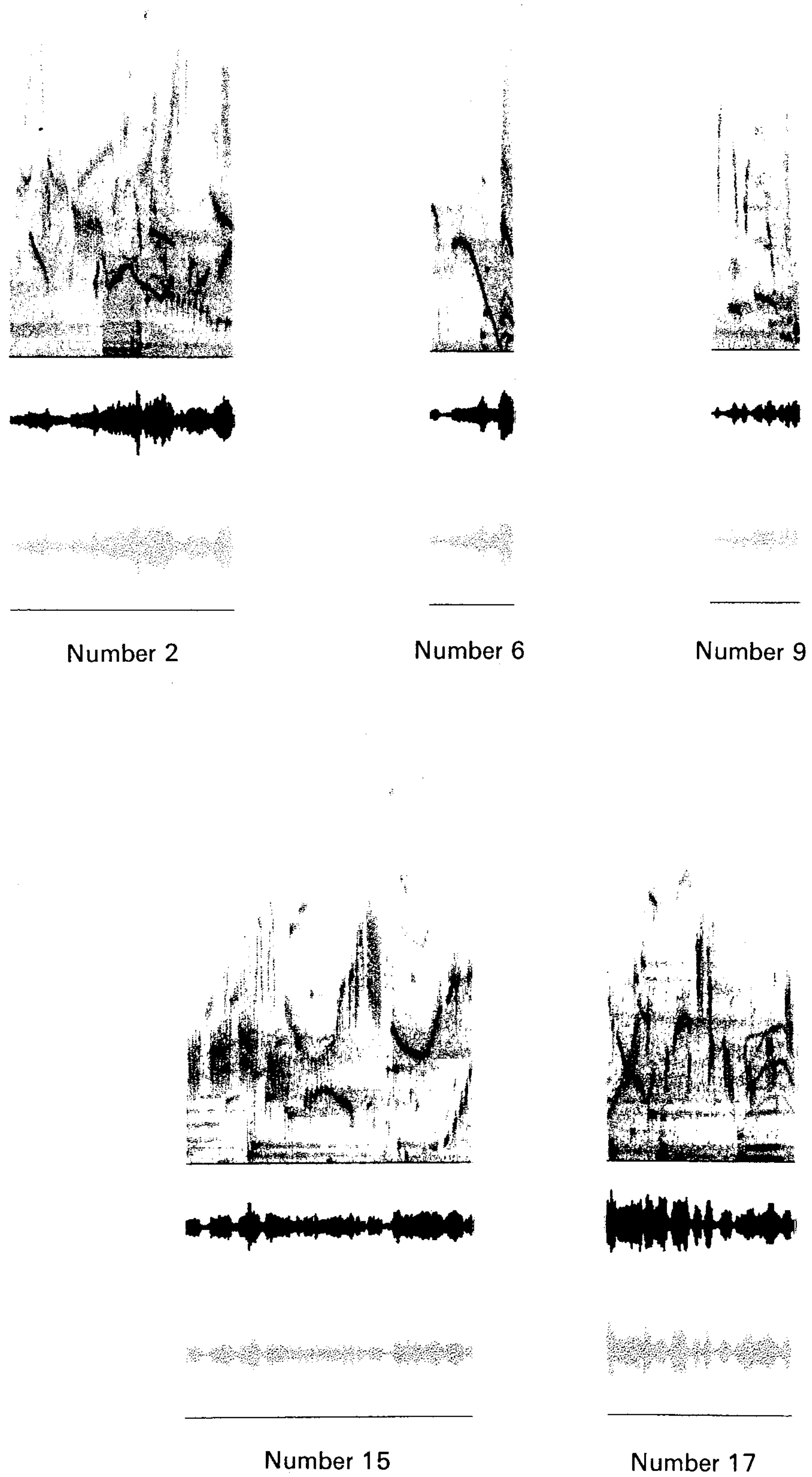

Figure 7. Sonogram (extract: bird comp).

(1) Each time the density increases, the duration curves decrease (see the points with circles round them). The opposite is also often true. The density/duration balance is therefore obtained practically every time. Structures that include a significant density of long sound objects or the opposite are not presented here.

(2) After a fall in the first 30 s, the minimum durations curve regains its base value (around 0.2″) for nearly the whole of the work. It increases as the density decreases (see comment (1)).

(3) The curves for the densities and the maximum durations have the same shape over the first 40 s

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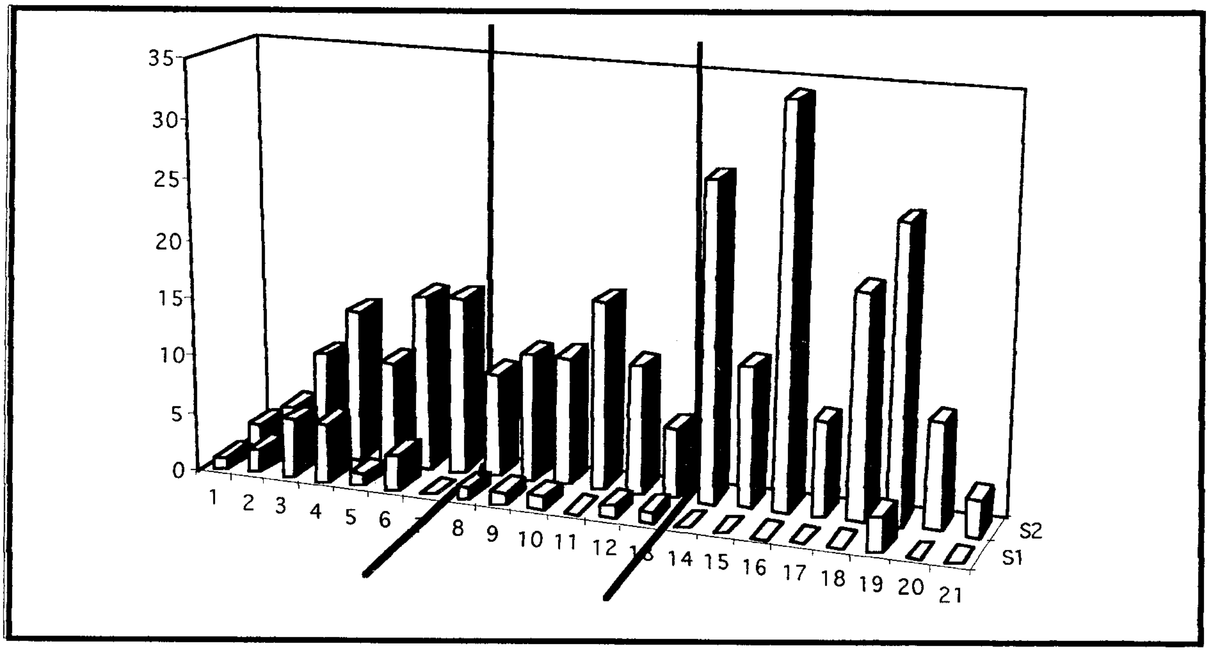

Figure 8

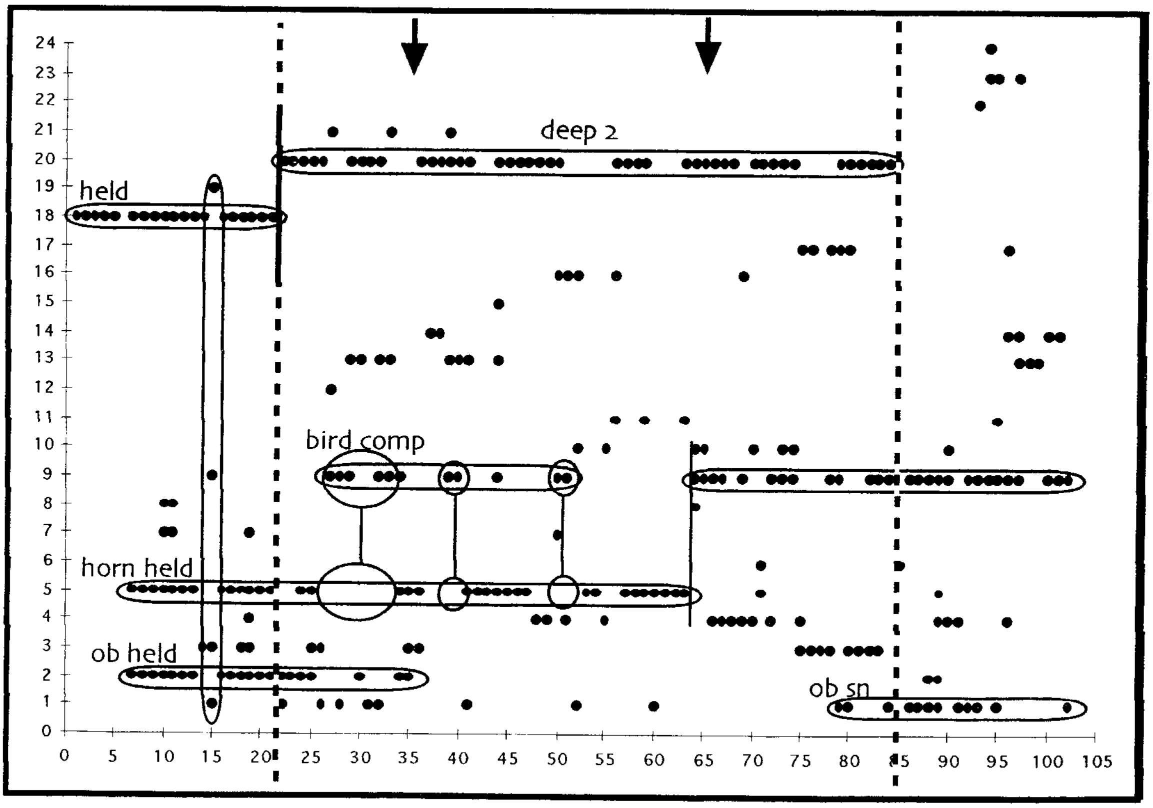

Figure 9

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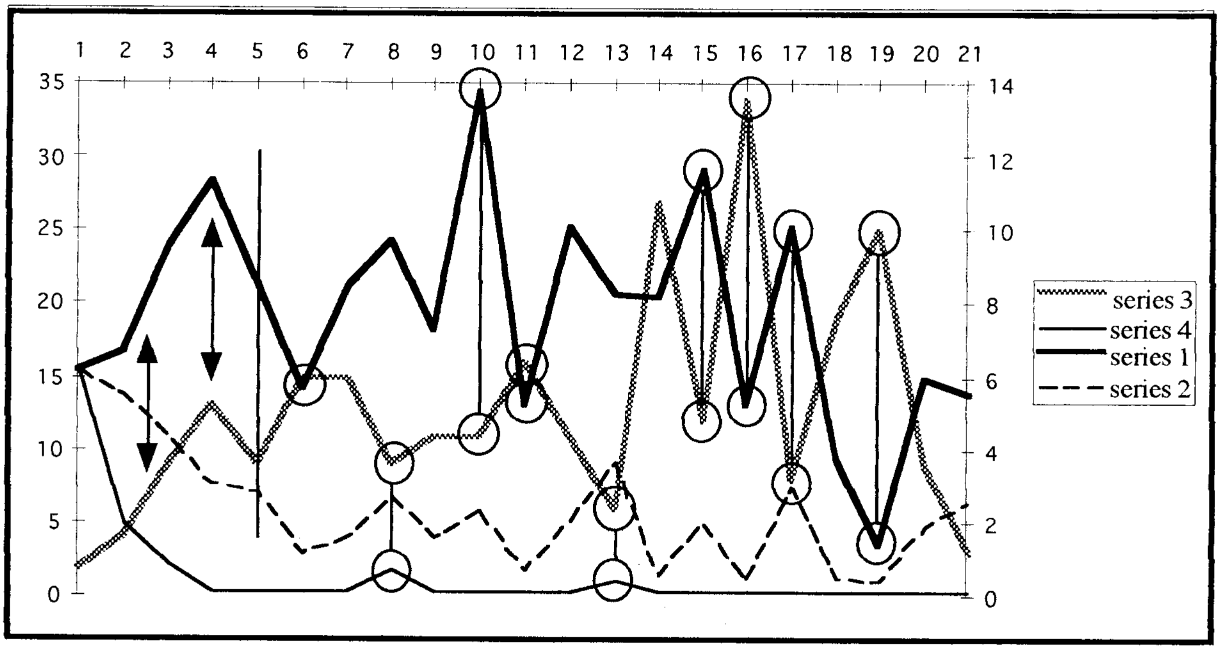

Figure 10

The musical balance of the work can be clearly seen using this graphic representation. We can read the work perfectly without it being overburdened with long sound objects.

4.3. Sounds grouped into three families and dominant categories

Figure 11 represents:

- series 3: maximum object durations,
- series 4: minimum object durations,
- series 1: averages of maximum and minimum durations, and
- series 2: number of appearances of each object.

The *X*-axis represents the number of each object (see the table of objects at the beginning of the article). The values for series 2 should be read on the right *Y*-axis and the other series' values on the left *Y*-axis.

Looking at this graphic, we can see that the oboe and French horn sounds are the most present, particularly in the short notes. When we listen, however, we do not get the impression that the oboe is more present than the voice; the latter conveys a stronger emotional charge. This is especially true as François Bayle lends the voice a strong personality – it calls out to us, makes us smile, and thus takes on a role of primordial importance in the work without the necessity of being a constant presence. The oboe is dominant with a very brief (ob sn) object. It has less of a strong personality, however, which in turn requires a greater presence in order to balance the voice. We can also observe that the duration curves for the sounds ob held, horn held and held are almost identical (the opposite is true for deep 2).

5. CONCLUSION

I have examined the work *L'oiseau moqueur* using three analytical approaches. Each approach provided a certain amount of information. After identification of the sound objects, the Schaefferian analysis enabled me to classify them in a typology. I noted that they could almost all be put into the balanced objects category. During the paradigmatic analysis, I observed the objects by comparing their different iterations. Some objects have changing parameters and others do not. The third second provided information concerning the behaviour of the objects in relation to one another (from highlighting form to certain structural relations between objects).

I should make it clear that this analysis based on the examination of sound objects would certainly have yielded different results had I taken certain parameters into consideration. François Delalande quite rightly pointed out that an analysis of electroacoustic music is not necessarily based on a division of the work into sound objects. As we have noted above, this division was evident on listening as well as when analysing the sonogram. I could, however, quite easily have paid attention to morphology, and thus built a graphic representation of the sound morphologies present in the work. My original objective – to study the musical structures – has only been partially achieved. I did not make extraordinary headway with the work done in the third section. Had I proceeded differently, and based my work on elements other than sound objects, perhaps other doors would have been opened to me.

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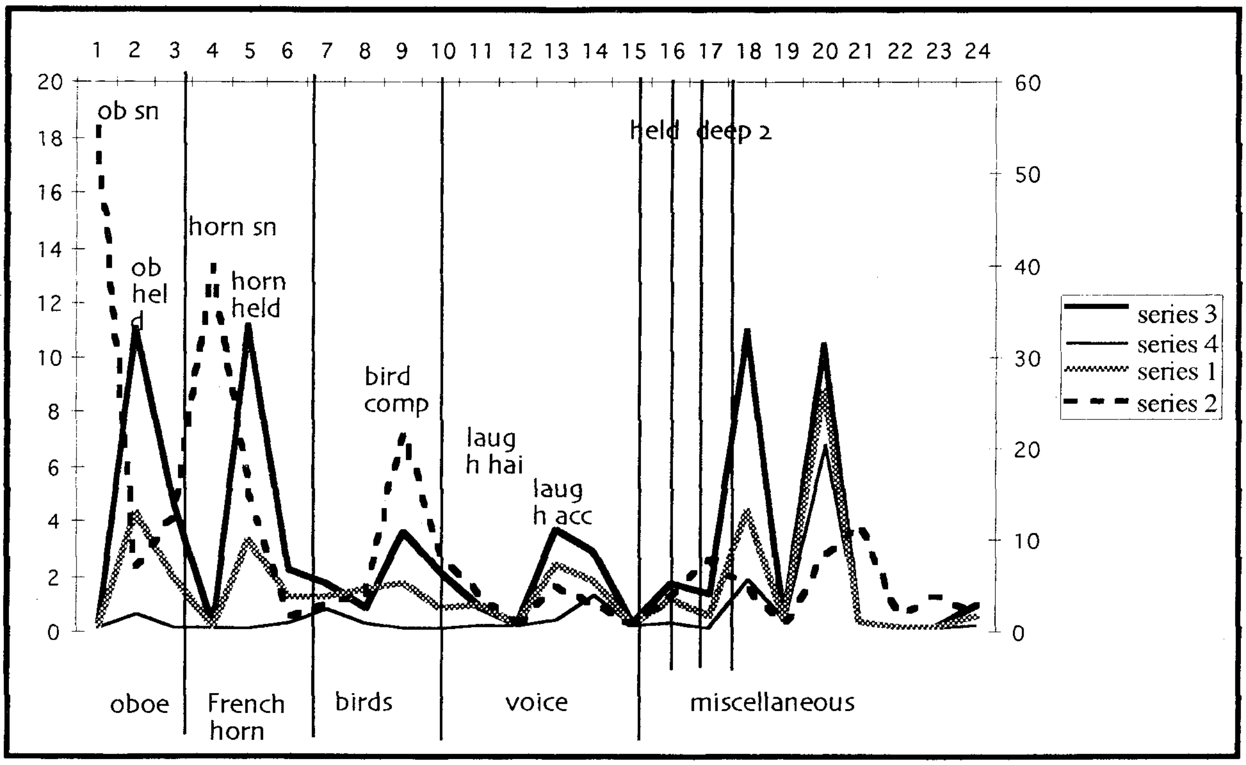

Figure 11

GLOSSARY

Below are given explanations of certain terms used in the analysis.

Masse

Type

Pure sound: no harmonics (a single fundamental)
Tonic: with a perceptible pitch
Tonic group: several tonics
Complex ambiguous: (fluted sound) composed of tonics, tonic groups, nodal sounds, nodal groups, etc.
Nodal group: sound mass formed of several nodal sounds
Nodal sound: aggregate whose pitch cannot be determined
White noise: complex soundmass occupying a large area of frequencies

Form (melodic profile)

Ranges from discernible for tonic sounds to indiscernible for white noise

Dynamic profile

Type

None: homogenous sounds
Weak: web of tonic or complex sounds
Formed: specific morphology
Impulsion: short tonic or complex notes
Inconsistent: unpredictable
Can be cyclic also: iterative (whatever the type)

Attack and fall

From the hardest to the softest

Body

Delta: ◇ hollow: ⋈ flat: □
Biting: with a slight dip after the attack

Weight

Minimum and maximum dynamic (circle two dynamics)

Difference

Difference between the weakest and the strongest dynamic with speed of change from one to the other

Texture

Resonance: (ripple effect) no maintenance but prolonged by resonance (e.g. cymbal)
Scraping: sounds maintained by scraping the maintaining agent (breath, bow, etc.)
Iteration: repeated maintenance
Combined with three classes of texture from the coarsest (rough) to the softest (smooth)

Aspect

(fluctuation of certain sound objects)

Type

From the most to the least regular

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