Harmonic profile: typology and notation

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Abstract

Pierre Schaeffer, dans le TARSOM, avait déterminé 7 catégories de sons du point de vue de leur richesse harmonique : pur, tonique, groupe tonique, cannelé, nœud, groupe nodal et frange. Il leur ajoutait les qualités de sombre ou clair et de riche ou pauvre. Ces catégories avaient été établies en partant de l'expérience sensorielle et répondaient aux exigences d'une démarche de pionnier. Elles constituaient la première tentative de description et classification du son d'un point de vue phénoménologique. Cela représente une trentaine de possibilités de ce que j'ai appelé « profil harmonique » (EMS06).

J'ai repris ces catégories en les symbolisant graphiquement dans la notation servant d'interface à l'acousmoscribe (EMS09), mais la nécessité s'est faite sentir de les affiner pour augmenter la précision de la description du son, favoriser leur écoute intérieure et leur utilisation comme paramètre de composition. Dans un premier temps la méthode perceptivo-analytique, si je puis dire, semblait être la seule voie possible : réaliser une collection de sons, les trier et les classer afin de définir une typologie. Mais la transcription diasémique n'est pas neutre : le signe libère la pensée et porte en lui sa propre logique. Il permet de s'abstraire des contingences empiriques. De cette façon, la démarche se renverse et, au lieu de partir du son pour arriver au signe, avec le risque de multiplier les symboles au point de les rendre illisibles ou difficiles à mémoriser de par leur nombre même, il est possible d'explorer le signe de façon systématique, de le pousser dans ses potentialités, et d'y accoler ensuite les sons qui lui correspondent. Mais ce n'est pas tout : le signe, libéré des contraintes de la perception et atteignant le concept pur, devient un outil performant pour concevoir des sons qui n'existent pas dans notre environnement et qu'aucun synthétiseur ne peut actuellement produire, des sons inouïs suivant la formule consacrée.

Je présenterai, lors de l'EMS, le résultat de mes recherches : 40 000 possibilités de signes très simples et faciles à comprendre qui représentent uniquement le paramètre profil harmonique, dont un tiers environ de sons inouïs. Ces signes serviront de base symbolique à la future version de l'acousmoscribe (logiciel ayant pour visées principales la composition, la notation et l'analyse musicale). A la manière du solfège, ces signes découpent le continuum sonore de façon scalaire ; à sa différence, en définissant des catégories et non des points, ils le recouvrent entièrement.

De même que toutes les combinaisons de syllabes ne donnent pas forcément des mots qui ont un sens, certaines combinaisons de symboles peuvent ne pas renvoyer à un son : s'il s'avère par la suite que les occurrences du signe dépassent les performances de l'oreille humaine, cela sera la garantie d'une extrême précision dans la notation du son.

DEFINITIONS

Translation: Léa Di Santo-Navarro

The harmonic profile is one of the four elements of sound's minimal unit called "phase". The concept of minimal unit comes from linguistics and defines the smallest element that can exist alone (a vowel for example). The minimal unit is composed of different elements, called distinctive features in linguistics, that applied to sound, will be called "profile" – word used by Pierre Schaeffer in the TARSOM.
(for further details see: http://www.ems-network.org/spip.php?article235)

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, timber or rhythm). This way, one obtains 4 profiles:

- the dynamic profile: concerns the features of intensity variations of sound (crescendo, decrescendo or stable);
- the rhythmic profile: concerns the internal speed variation of sound (acceleration, deceleration or rhythm, allure or grain's stability);
- the melodic profile: concerns tessitura (pitch becoming higher, lower or stable)
- the harmonic profile: harmonic timbre richer, poorer or stable.

The harmonic profile concerns the matter itself of sound, which does not depend on pitch, dynamic or other criterions about form. Schaeffer, as one can see below (fig.1), determined seven categories of sound considering this parameter. "Son pur" is sinusoid, and "bruit blanc" is white noise. They will not be taken into account here, since they do not vary (except sinusoid 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 (fig.1).

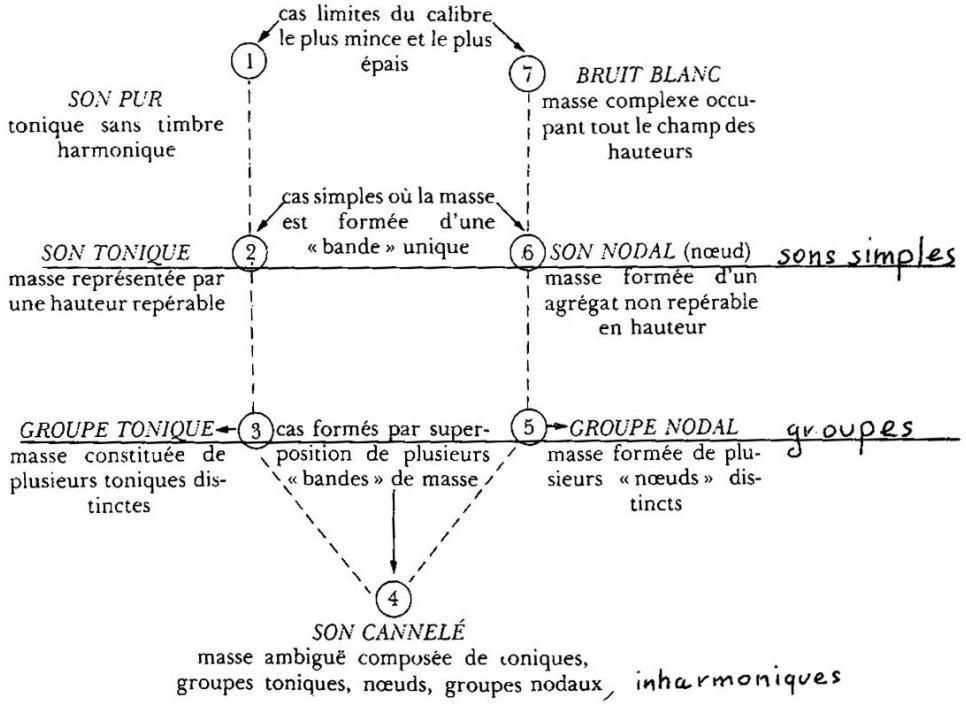


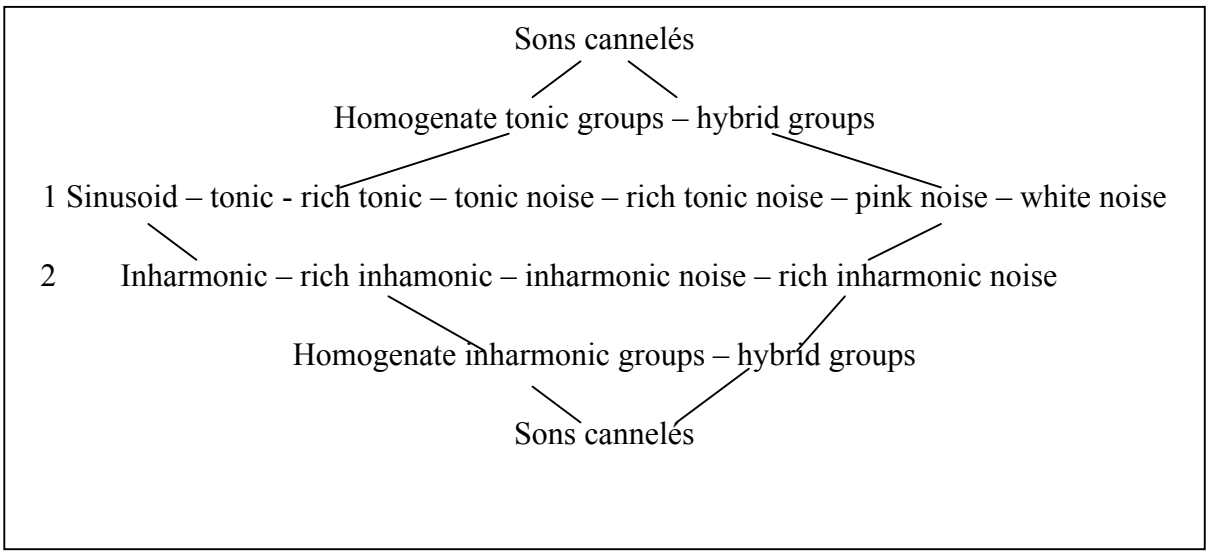
Fig. 1: mass classes by P. Schaeffer

Simple sounds, groups and "sons cannelés"

This work aims to get more precise categories of harmonic profile to analyse and note sounds one uses to compose, and particularly to enlarge the signs used by the acousmoscribe drawing acousmatic scores: http://www.ems-network.org/spip.php?article235.

To achieve this purpose, one will conserve the categories of "son tonique" (tonic sound) and "son nodal" that will design here only pink noise. The first important innovation of this work is the addition of the category of "son inharmonique" (inharmonic sound). Spectral music (Grisey, Murail…) often uses it, and the GRM tool plug-in "reson" shows many examples of this kind of sounds.

The second important innovation is the introduction of the concept of "sons hybrides" (hybrid sounds). Hybrid sounds are sounds that belong to two categories. There are three kinds of hybrid sounds: tonic noise (a fly for example), inharmonic tonic (sheet steel that one hits for example) and inharmonic noise (a crowd in a hall for example). Of course, these kinds of sounds can be rich or poor too. This way one obtains different scales, or more exactly paths, from sinusoid to white noise:



Path 1 is the tonic path and can be taken from sinusoid to noise through simple sounds or groups. Path 2 is the inharmonic path.

To these two basis paths can be added different kinds of groups we are about to study and that can be considered as a sort of variations. One will expose it in details.

As said above, the typology/notation system of harmonic profile proposed here is based on the concept of minimal unit of the sound and belongs to a larger notation system used by the acousmoscribe. To recall it briefly: dynamic profile is represented by "boxes" which shape is varying depending on the kind of attack, in which will be inserted different symbols representing:

- Rhythmic profile (inferior basis): none, slow, meddle, fast or irregular;
- Grain (upper side): thin, clear, fat, none;
- Melodic profile: a line on a side (left or right depending on dynamic shape) can represent five different tessituras (from down to high: very grave, grave, medium,

high, very high) and three different calibres[1] (thin, meddle, thick). Melodic profile can go up, down, be stable or vary irregularly.

If the sound has an allure, a curve with the same features as the line's replaces it.

For further details see: http://www.ems-network.org/ems09/papers/disanto.pdf.

The harmonic profile can be a combination of several parameters if it is not a simple homogenate sound. We distinguish three families of sounds: Tonic sounds, inharmonic sounds and noises (white or pink). These pure categories will be called homogenate sounds. White noise and sinusoid are not represented here because they cannot vary (fig. 2):

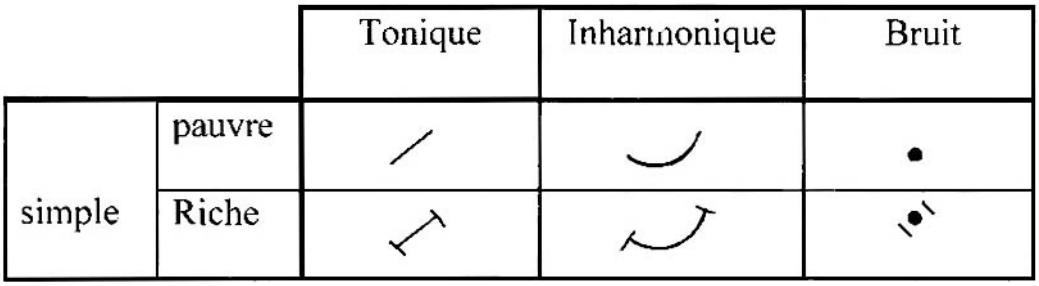


Fig. 2: homogenate sounds

Hybrid sounds will be represented as below:

Fig. 3: hybrid sounds

Tonic noise is notated by a line (symbol of tonic sound) made of dots (symbol of noise). Inharmonic noise is represented by a curve (symbol of inharmonic sound) made of dots, and inharmonic tonic is drawn by a curve made of dots.

Each of these six categories of harmonic profile can be rich or poor: so that one obtains twelve symbols (six for poor sounds, which, if added a dash, represent rich sounds) that will be used to build groups (for example a piano chord belong to the tonic group).

The general philosophy of this notation system is taken from linguistics: a few simple elements combined between them can generate a great number of elements. 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 homogenate sounds will be called homogenate 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).

[1] calibre: distance between the higher and the lower frequency in the same sound spectrum.

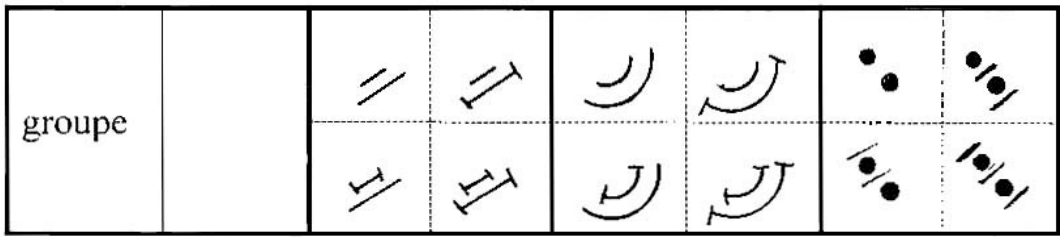


Fig. 4: homogenate groups

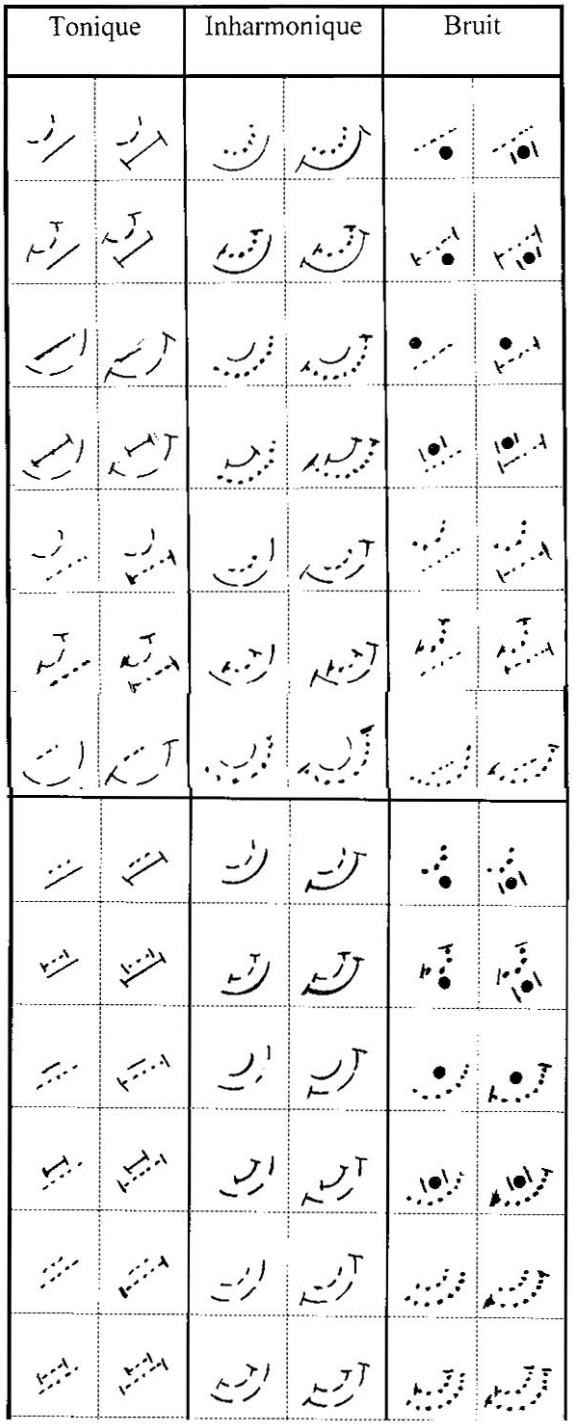


fig.5: hybrid groups

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 following table:

	tonic	inharmonic	noise
cannelé	Tonic fundamental/ Homogenate harmonic (see e.g.)	Inharmonic fundamental/ homogenate harmonic (see e.g.)	Noise fundamental/ homogenate harmonic (see e.g.)
	Tonic fundamental (fig. 2 & 4)/ Hybrid harmonic (fig. 3)	Inharmonic fundamental (fig. 2 & 4)/ hybrid harmonic (fig. 3)	Noise fundamental (fig. 2 & 4)/ hybrid harmonic (fig. 3)
	Hybrid fundamental (fig. 3 & 5)/ Homogenate harmonic (fig. 2)	Hybrid fundamental (fig. 3 & 5)/ Homogenate harmonic (fig. 2)	Hybrid fundamental (fig. 3 & 5)/ Homogenate harmonic (fig. 2)
	Hybrid fundamental (fig. 3 & 5)/ Hybrid harmonic (fig. 3)	Hybrid fundamental (fig. 3 & 5)/ Hybrid harmonic (fig. 3)	Hybrid fundamental (fig. 3 & 5)/ Hybrid harmonic (fig. 3)

Fig. 6: categories of sons cannelés

This way, one obtains 1 188 possibilities of son cannelé, using only “sons composés”, but they can also be “composites”. According to Schaeffer, one calls “son composé” sound where different frequencies always resound all together (e.g. a bell). When one of the sounds appears from time to time, it is “son composite” (e.g. fire). It is not worth it drawing all of them. One will only show the first level as example: homogenate fundamental (using fig. 2 and 4)/homogenate harmonic (using fig. 2):

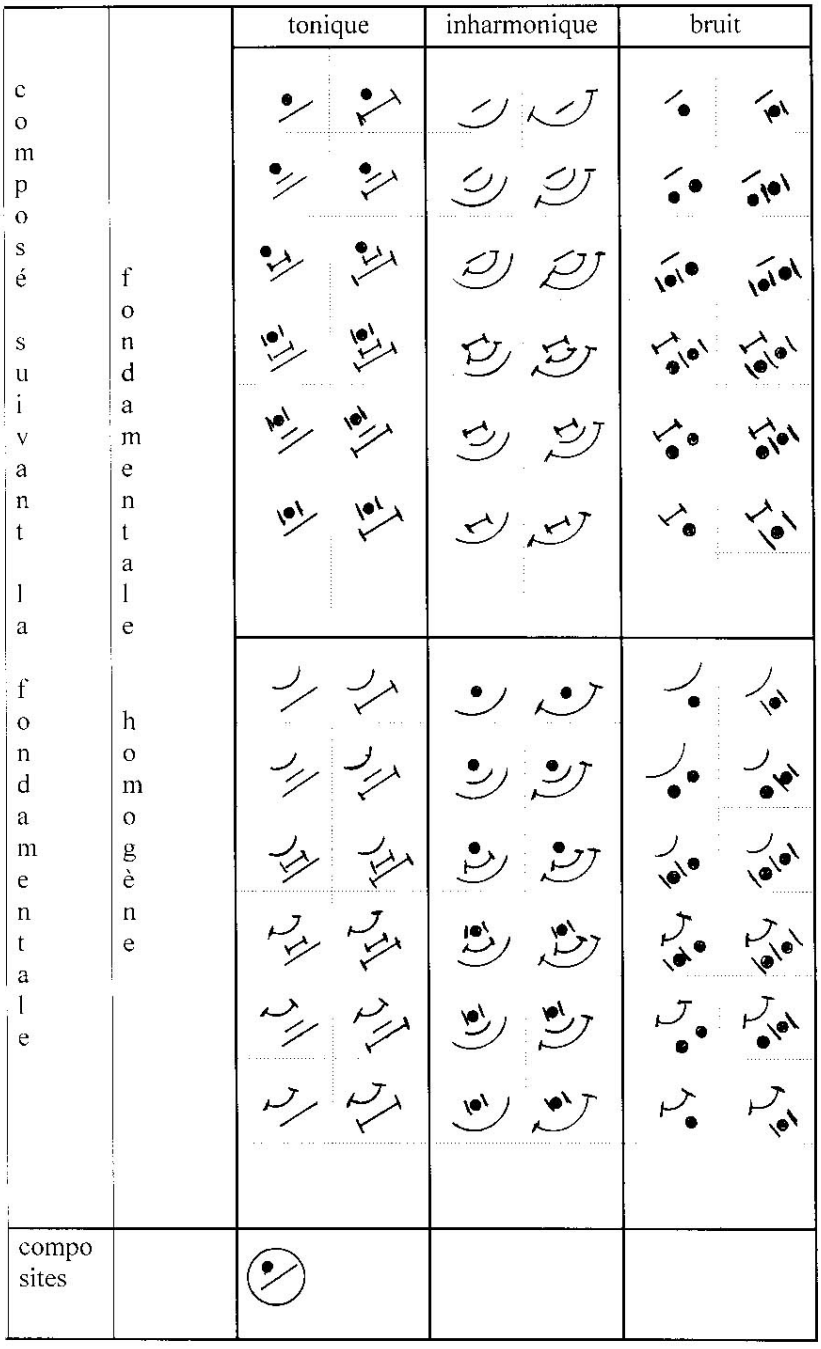


Fig. 7: sons cannelés made of homogenate fundamental/homogenate harmonic

This new typology not only considerably increases the number of sound types, but it also creates relations between sounds. It organises the perception of the sound and allows working with sound families, like music theory does for instrumental music (organising chords, tonality…). The high number of categories enables one to use harmonic profiles for formal composition of what Leigh Landy calls "sound-based music" in a lot of ways.

Colours

Each sound can have a colour according to the repartition of frequencies inside its spectrum, and these colours can be filtered. In the table below, one represents horizontally the seven possible colours as original colours and the same colours in the first column if the sound is filtered as final colours. In the first line, from left to right: equilibrated sound, strong bass frequencies, weak high frequencies, strong medium, weak bass, weak medium and strong high frequencies.

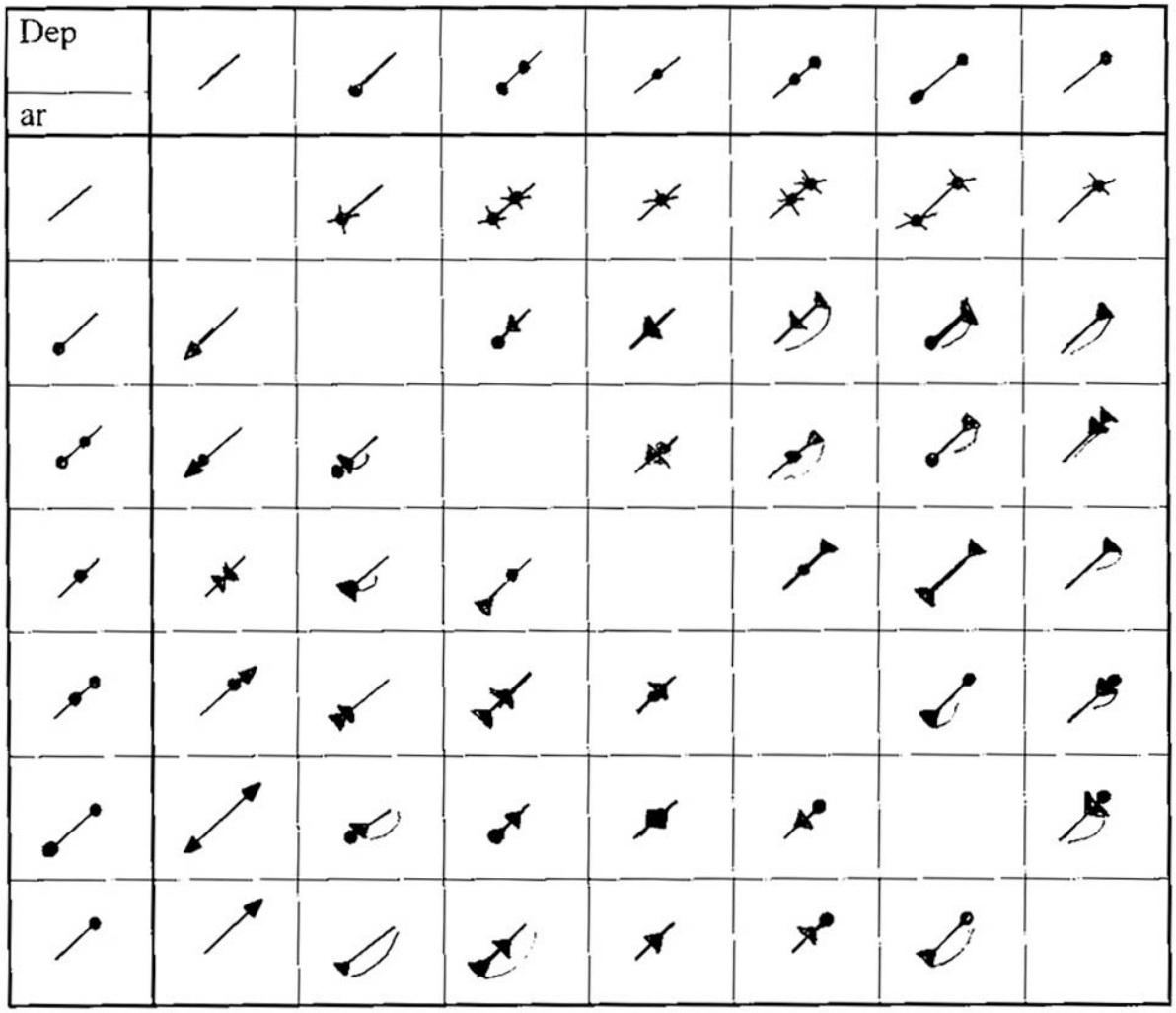
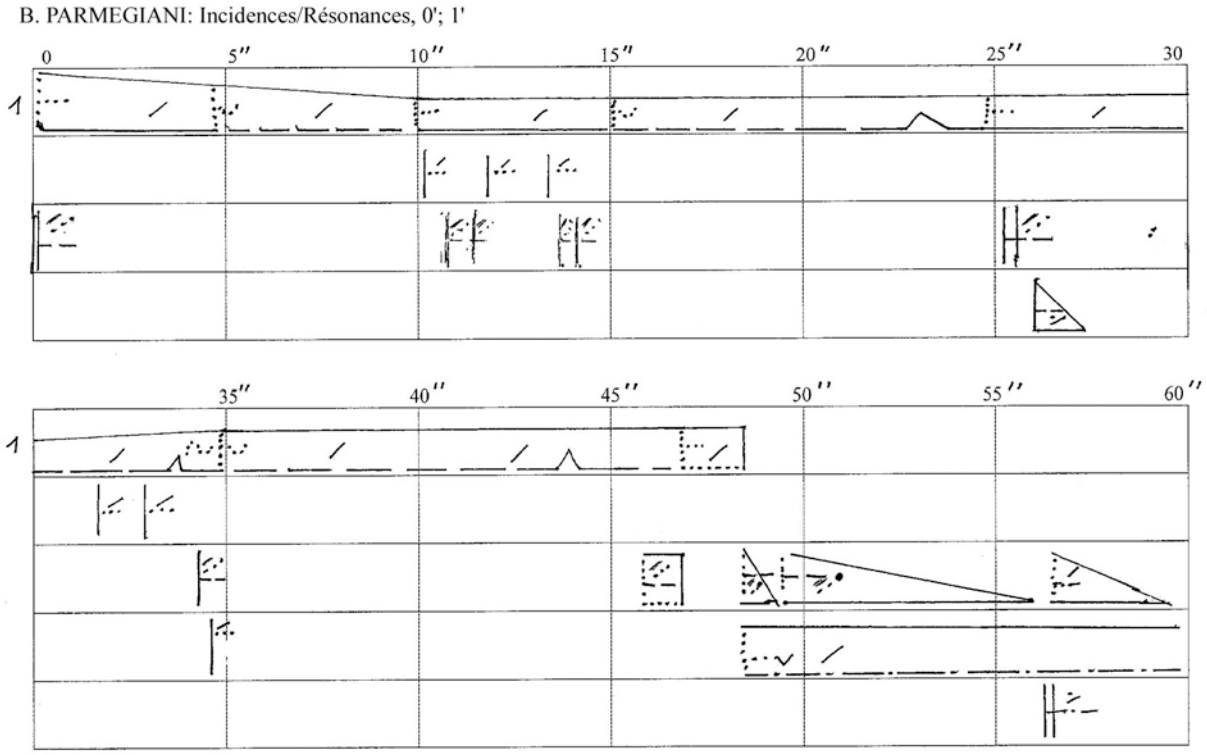


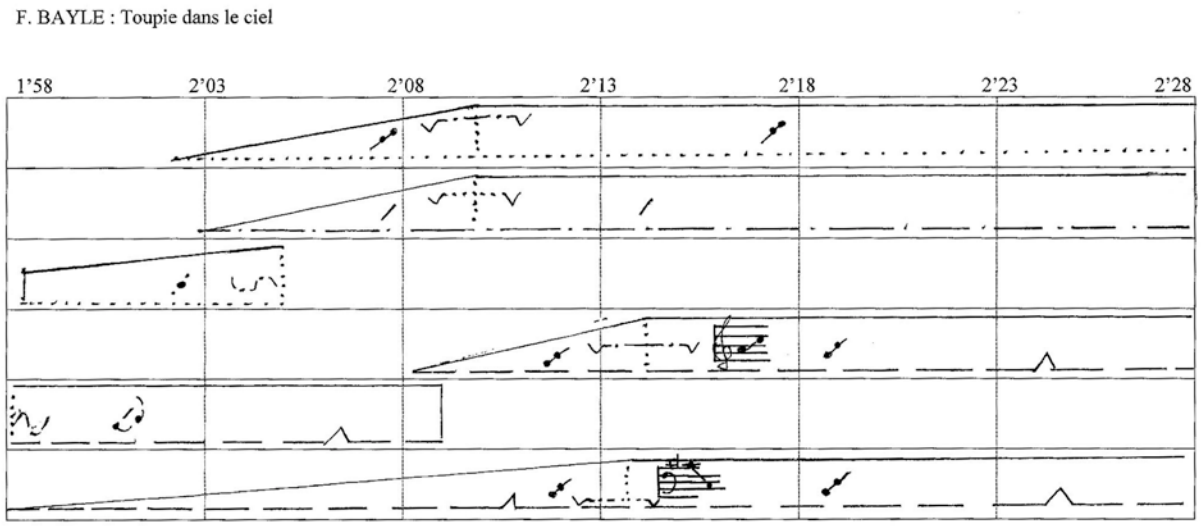
Fig. 8: stable colours and filtered coulours

Applying the 7 stable colours to the 6 simple homogenate and the 6 simple hybrid sounds, to the 12 homogenate and 84 hybrid groups, and to the 1 188 “sons cannelés” one obtains 5 656 possibilities of stable sound (one does not take in account pink noises which harmonic density does not allow colours). If we also consider filtered sounds, one obtains about 40 000 possibilities of notated sounds.

Let us see two examples of score realised with complete sign:



Excerpt from 0’ to 1’



Excerpt from 1’58 to 2’28

This notation can be used for composition, analysis, teaching and the preservation of acousmatic music’s heritage, and any other use of sound notation.

References

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