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The transformation of musical listening: the case of electroacoustic music

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Introduction

The twentieth century¹ brought significant changes in the aesthetic expectations of composers as well as listeners. The musical crises of 1900-1920, together with significant scientific and technological developments, transformed the composer's purely musical mental universe into a hybrid one, incorporating visual and sonic sensitivity. Arguably, the postMTV digital era has heightened this transformation.

The present paper discusses the case of early (1942-1954) and classical (1955-1970) electroacoustic music of the Parisian school. This music, while apparently based on Schaeffer's theories of "acousmatic music" and "reduced listening" from 1966, is marked by a curious paradox: its thinking and sonic operational categories are clearly the result of a visual transformation. As we will see, words like "grain", "allure", "profile", "sound projector", and the frequent existence of graphic scores in musical sketches of acousmatic pieces testify to a new musical sensitivity "contaminated" by the visual domain. I suggest that Schaeffer and his colleagues were "listening with images".

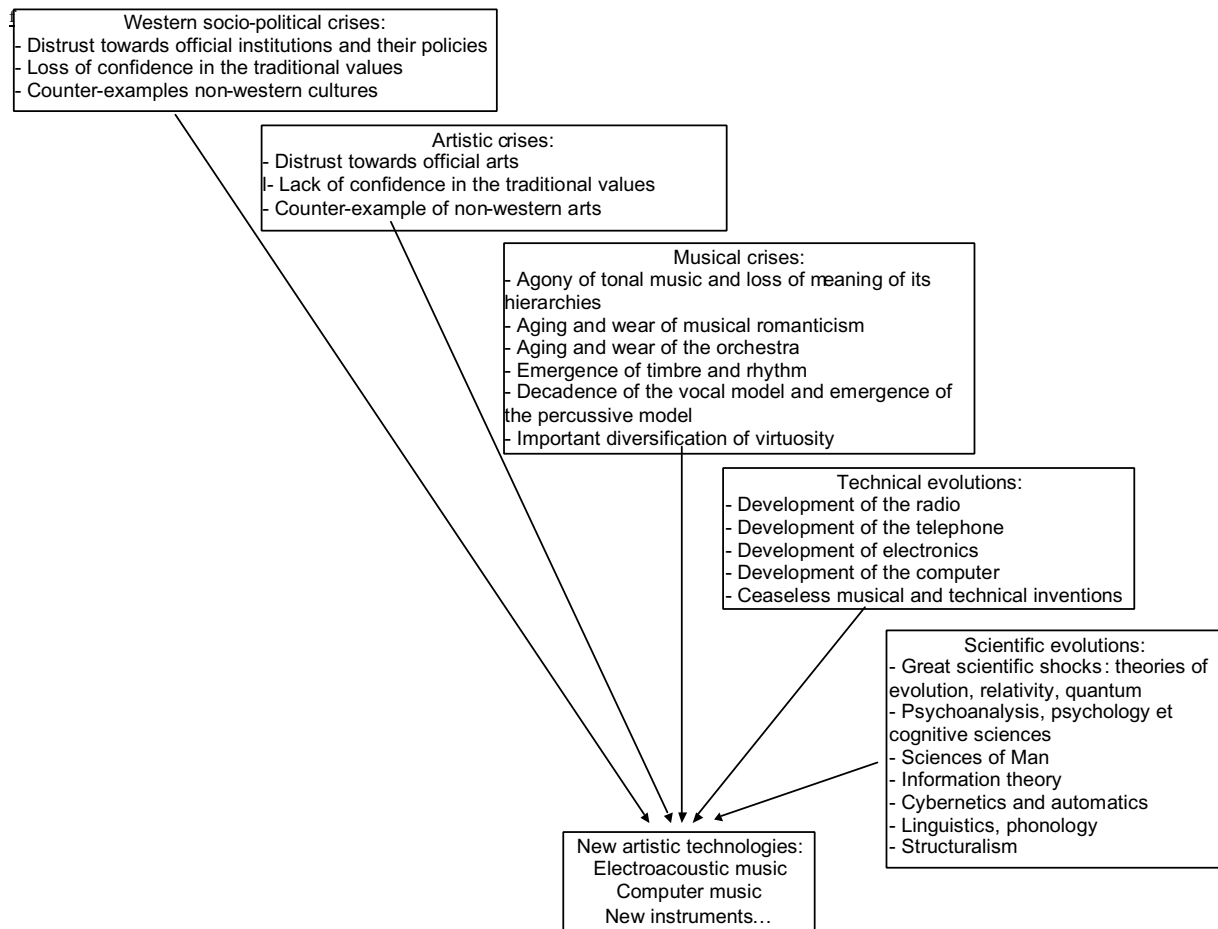
To shed light on this important development, several electroacoustic concepts are discussed, and many examples of visual influence are offered. To arrive at a new understanding, the paper draws on various reissues of Schaeffer's texts as well as recent findings from his personal archives. The transformation thus presented might also elucidate the surprising ease with which some types of auteur cinema have employed electroacoustic music since the 1950s. A few cases of resurgent electroacoustic sensitivity in auteur cinema are presented to illustrate this point (Tati, Tarkovski, Lynch).

1 Before electroacoustic music and sound cinema

1.1 A time of crises, evolutions and experiments

¹ The author wishes to thank Dr. Joyce Shintani for her help in putting this paper in a better English.

Electroacoustic music arrives at a defining moment in the history of Western arts. It is a time of many crises and converging factors, creating difficult problems but also opening the door to many creative solutions.



Ex. 1. Converging crises around 1900

As Ex. 1 tries to convey, music at the beginning of the twentieth century faced a series of converging crises in many areas, chief among them:

- Social and political erosion
- Artistic erosion
- Musical erosion (“fatigue”)

The musical crisis (the overuse and fatigue of its language, models, means and aesthetics) called for solutions, as one can gather from sources such as Arnold Schoenberg’s writings (1911). In tonal music, expressive chromaticism had reached a saturation point: no further note could be added to chords after the altered 13th with all its variants. Once the symphony reached Mahlerian proportions and the opera attained Wagnerian length, the development of musical form, too, reached a limit. More pertinently to our argument, the overuse of particular orchestral instruments created a need for new instruments capable of producing music better adapted to evolving tastes and aesthetics. In addition, deterioration of the traditional “vocal” musical model

paved the way for the emergence of a “percussive” model, as well as a renewed vocal model². Edgard Varèse rejected bowed strings precisely for such reasons: these instruments were overused and possessed a sound too traditional for his aesthetics (Ouellette 1989: 64). He preferred winds and percussions and hoped for new instruments.

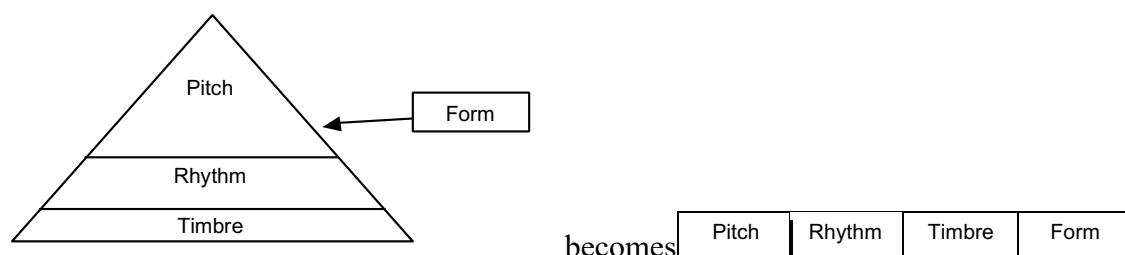
1.2 A graphical or plastic transformation

An important aspect of the musical crises of the period from 1900-1910 was a profound change in the composer’s thinking. The ineluctable transformation of Western music was triggered by one of the “solutions” to these crises. In order to replace the “dead” system of tonal music with a strong and efficient way of organising music, the mental landscape of the composer – and of the listener – had to become more graphic, more plastic.

A case in point is Schoenberg’s evolution from traditional musical hierarchies towards a spatial sensitivity, which is clearly traceable in his writings. His demonstration advances as follows. Since all chromatic tones are to be found in every harmonic series, if one listens to the higher harmonics, the fundamental notion of dissonance is called into question, and equal temperament along with it.

“Das Bestreben, die fernerliegenden Konsonanzen (die man heute Dissonanzen nennt) als Kunstmittel anzuwenden, mußte also notwendigerweise zu manchem Irrtum, zu manchem Umweg führen. Der Weg der Geschichte, wie er sich kundgibt in dem, was an den gebräuchlichen Dissonanzen das Gebräuchliche ist, führt hier kaum zu einer richtigen Beurteilung der wirklichen Verhältnisse. Das beweisen die unvollständigen oder sonderbaren Tonreihen mancher Völker, die sich aber sicher auch auf die Natur berufen dürfen. Vielleicht sogar sind ihre Töne oft natürlicher (das heißt: genauer, richtiger, besser) als unsere; denn das temperierte System, das nur ein Notbehelf zur Bewältigung der Materialschwierigkeiten ist, hat ja nur in wenigem Ähnlichkeit mit der Natur. Was vielleicht ein Vorteil, aber kaum ein Vorzug ist” (Schoenberg 1911a: 21)³.

Then, since pitch and dissonance are thus now debatable, other musical dimensions can take the lead in renewing ways of composing music. Arguably, Schoenberg’s famous “emancipation of dissonance” results from the diminution of the role of the note or pitch in favour of other musical dimensions (Rosen 1979: 53-56). Thus, the old musical hierarchy is transformed, ex. 2:

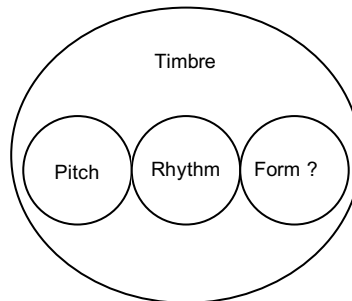


² For many developments of this proposal, see, Martin Laliberté (2014) and (2008).

³ “Efforts to make use of the more remote consonances (today called ‘dissonances’) as artistic means thus led necessarily to many an error, to many a detour. The way of history, as we can see it in that which has a cruelly been selected by practice from the practicable dissonances, hardly leads here to a correct judgment of the real relations. That assertion is proved by the incomplete or unusual scales of many other peoples, who have, nevertheless, as much right as we to explain them by appeal to nature. Perhaps their tones are often even more natural than ours (that is, more exact, more correct, better); for the tempered system, which is only an expedient for overcoming the difficulties of the material, has indeed only a limited similarity to nature. That is perhaps an advantage, but hardly a mark of superiority (1911b: 21).

Ex. 2. Equalisation of musical dimensions

The musical dimensions are now “democratic”⁴, equal in importance, with one or the other dimension taking the lead for a while, such as timbre in *Klangfarbenmelodie*. Finally, at the end of his treaty, Schoenberg renders musical dimensions in even more explicitly spatial terms, Ex. 3:



Ex. 3. Musical territories

“Ich kann den Unterschied zwischen Klangfarbe und Klanghöhe, wie er gewöhnlich ausgedrückt wird, nicht so unbedingt zugeben. Ich finde, der Ton macht sich bemerkbar durch die Klangfarbe, deren eine Dimension die Klanghöhe ist. Die Klangfarbe ist also das große Gebiet, ein Bezirk davon die Klanghöhe. Die Klanghöhe ist nichts anderes als Klangfarbe, gemessen in einer Richtung” (Schoenberg, 1911a: 506)⁵.

Schoenberg’s equalisation of the musical dimensions and his spatial or “territorial” approach reveal a considerable evolution of the musical imagination. Schoenberg’s thinking moves its focus away from the usual musical score toward an investigation of new concepts; in this case, a many layered “map” of musical dimensions. Significantly, this evolution coincides chronologically with multidimensional mathematical approaches (the “manifolds”⁶) in Albert Einstein’s work. Moreover, Schoenberg’s personal and artistic proximity to the *Blaue Reiter* group in the critical period 1910-20, as well as his personal experiments⁷ in painting tend toward the deployment of colour and motion in space rather than the representation of traditional figures and forms, confirming the mental transformation⁸.

Schoenberg was far from alone in this. A similar thought is observable in Debussy:

⁴ The political parallel is relevant at the time of the downfall of the Austrian Empire (Schoenberg 1951).

⁵ « Je ne puis admettre sans réserve la différence que l’on a coutume d’établir entre couleur sonore (timbre) et hauteur sonore. C’est en effet par sa couleur sonore - dont une dimension est la hauteur - que le son se signale. La couleur du son est donc le grand territoire dont une région est constituée par la hauteur du son, Cette dernière n’est rien d’autre que la couleur du son mesurée dans une direction.» (Schoenberg 1911c : 516) Interestingly, the French translation given here is closer to the German original in its use of a territorial metaphor, whereas the usual English translation (Schoenberg 1911b : 421) uses a much more traditional figure of speech, that of direction, masking the important spatial aspect. This detail might contribute to a useful debate on the translations of Schoenberg, someday.

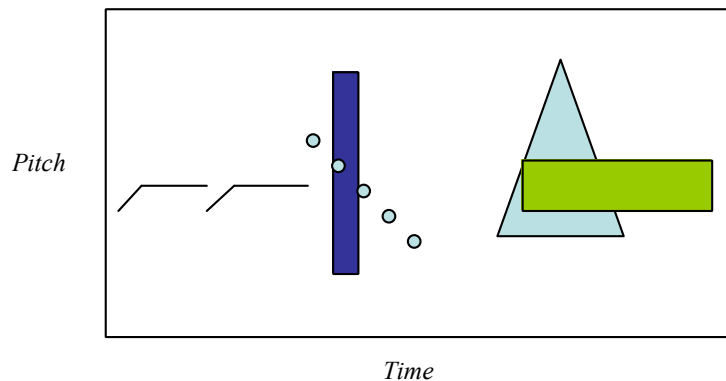
⁶ Associated with Gauss and Riemann. See “manifold” in *en.wikipedia.org*. Retrieved in March 2013.
http://en.wikipedia.org/wiki/Riemannian_manifold.

⁷ The website of the Arnold-Schoenberg Center is rich in details on this and many other topics. Retrieved in March 2013.
http://www.schoenberg.at/index.php?option=com_joomgallery&Itemid=339&lang=en.

⁸ Before his return to a more traditional predominance of the pitch in the twelve-tone system in the 1920’s.

« ...je me persuade, de plus en plus, que la musique n'est pas, par son essence, une chose qui puisse se couler dans une forme rigoureuse et traditionnelle. Elle est de couleurs et de temps rythmés.... »⁹ (1907, cited in Horodyski 1998 : 223).

One could also evoke Igor Stravinsky with his very developed rhythms¹⁰ and timbres. Varèse is also quite clear on this kind of plastic transformation. As Horodyski (1998) and Ouellette have pointed out (1989: 58), Varèse' imagination was marked by the emerging science of acoustics as well as by Schoenberg. It operates in a spatial world of at least two dimensions, where notes become points, melodies curves, chords masses or blocks in opposition, and so on, ex. 4:



Ex. 4. Varèse' "mental map" ?

Such representations become more frequent throughout the century, leading to many later electroacoustic graphical devices such as the UPIC¹⁰ or the iPad¹¹.

It is significant that electroacoustic music was born in this new graphical or plastic mental context. It will be a complex French artist and thinker who takes the crucial next step in this evolution.

2 Electroacoustic music

2.1 Pierre Schaeffer. A revealing biography

Pierre Schaeffer (1910-1995) is the main character of the next evolution of music. The son of a violinist and a singer, himself a telecom engineer graduate from *Ecole Polytechnique* (1929) and *Supélec* (1934), a writer of novels, plays and essays, a composer and music theoretician as well as pupil of Nadia Boulanger, Schaeffer had a lasting impact on contemporary music and sonic sensitivity. He spent his entire professional life at French Radio and Television (1935-1975). He is best known for his invention of *musique concrète* (1948), which evolved into electroacoustic music in the 1950's, and for founding the famous Paris Studio, the *Groupe de Recherches Musicales* (GRM).

Why radio? Schaeffer answers (1970: 29):

Mais parce que la radio, c'était très amusant ! C'était la fille un peu baroque d'une chanteuse de l'Opéra et d'un facteur, des théâtres lyriques et des P.T.T. Tout ça sortait d'une

⁹ Our translation : [...] I am more and more convinced that music is not, in its essence, a thing that can be put into a rigorous and traditional form. It is of colour and rhythmic time [...] ¹⁰ For more on this topic see Martin Laliberté (2007).

¹⁰ <http://en.wikipedia.org/wiki/UPIC>. Retrieved in August 2013.

¹¹ <http://www.ipadmusicapps.ca>. Retrieved in August 2013.

boîte à lampes et d'un micro à charbon type 1929, et tout ça, bien entendu, étant contrôlé par un Père Fouettard délégué par la rue de Rivoli pour surveiller le tout. Ça me fascinait bien plus que de me retrouver dans le laboratoire d'une entreprise privée. C'est poétique, les ondes, et puis le service public, ce n'est pas rien pour qui a l'inspiration civique¹².

Indeed, this multi-talented man chose radio as the field of research best suited for all his interests. It is the convergence of science, sound, music, literature, administration, and politics.

2.2 The far-reaching impact of microphone and radio

The invention of *musique concrète* was not at all accidental, rather the cumulative result of historical currents mentioned in the first part of this paper. Pierre Schaeffer came to its invention by degrees, but things accelerated during a research seminar on the artistic possibilities of the radio in Beaune in 1943. Theatre director Jacques Copeau and Schaeffer, the group leaders, along with a few radio art enthusiasts quickly came to the conclusion that the microphone could provoke a fundamental upheaval in the perception and transmission of meaning (Schaeffer 1966: 88-89):

...Le microphone, comme le microscope et comme la caméra, grossit, accuser, exagère tout ce qu'il saisit.

...Devant le microphone, il faut réprimer les habitudes du jeu scénique : la gesticulation — qui se sent — les attaques abruptes (qui produisent de l'insécurité), les brusques écarts de ton (qui nuisent à la perception distincte).

Dans tous les tons, il faut soutenir l'émission de la voix parce que ni la mimique du visage ni celle du geste ne sont là pour compléter le sens, pour rendre intelligible par le jeu ce qui n'est pas nettement audible pour la diction.

... L'interprétation devant le micro est une lecture.

...L'attitude devant le micro est une attitude purement intérieure.

Ce ton modéré, ce ton discret et tout intime où s'insèrent les moindres inflexions de la voix, les moindres nuances d'une sensibilité et jusqu'aux moindres tics d'une personne, si bien que l'auditeur croira, au bout d'un peu de temps, connaître le personnage qui lui parle mieux que s'il avait vu son visage, ce ton à lui seul ouvre un champ considérable à l'art du micro, un champ qui lui est propre, qui lui est exclusif.

...Privée de visage, privée de l'autorité du regard, privée de mains et de corps, la voix de celui qui parle n'est pas désincarnée. Au contraire. Elle traduit l'être avec une fidélité extrême. Elle le traduit même avec indiscretion.

... La voix qui n'a rien dans le cœur ni rien dans la tête ne peut guère toucher au micro.

... La Radio pourrait donc être une école de sincérité¹⁴.

Pierre Schaeffer also realised that the recording of sounds and voices and their replay at will on a "blind" apparatus (the radio with its speakers)¹⁵ profoundly transformed the nature of listening, which became "acousmatic", referring to Pythagoras' use of a curtain during initiation of his disciples. This acousmatic music was severed from its source and could be listened to at will, permitting concentration on sonic details and properties, on its inherent "meaning", regardless of acoustic origin.

¹² Our translation from French: "But because radio was very amusing! It was the baroque daughter of an opera singer and of a postman, of the lyric theatre and the post-office. And it all came out of a lamp-box and a coal-microphone of type 1929. And all that, of course, controlled by a bogeyman from the rue de Rivoli to watch over everything. It fascinated me much more than being in the laboratory of a private enterprise. It's poetic, the waves, and public service is something for those who have civic inspiration". Note that the Ministry of Finance was then located on Rue de Rivoli.

¹⁴ Our the French: “The microphone, like the microscope and the camera, enlarges, exaggerates, emphasizes everything it picks up.

...In front of the microphone, one must repress the habits of stage performance: gesturing — which is felt — abrupt attacks (that produce insecurity), brusque changes of tone (that ruin distinct perception).

In all tones, one must sustain the voice because both facial mimicry and gestures lack to complete the meaning, to make intelligible by performance what is not clearly heard in the diction.

...Interpretation in front of a mike is reading out loud.

... Attitude in front of the mike is a purely interior attitude.

The moderate tone, the discreet tone, all intimacy, where the least inflection of the voice, the least nuance of sensitivity and even a person’s little twitches, so much so that the listener will believe, after a time, to know the character speaking better than if he had seen his face – this tone of its own opens a considerable field to the art of the mike, a field that is proper to it, that is its exclusive.

...Deprived of the face, deprived of the authority of the gaze, deprived of hands and body, the voice that speaks is not disincarnate. On the contrary. It translates the being with extreme fidelity. It even translates it with indiscretion. ...The voice with nothing in its heart nor in its head cannot be touching in a mike.

... Radio, therefore, could be a school of sincerity.”

¹⁵ Schaeffer (1941-42) talks about “handicapped arts”: the mute cinema and the blind radio.

In 1944, Schaeffer had conducted a series of further experiments for the radio play *La coquille à planètes*; he wrote the script and did most of the Foley work for it, but not the music. Thus, by 1948 the stage was set for a series of experiments in composing in a new style, perhaps even a new genre¹³. Thinking modestly at first that he was “improving Foley”, he discovered step by step an entirely new way of composing with sounds and noises. One can follow the daily account of these discoveries of the “most general music possible”¹⁴ (Schaeffer 1952).

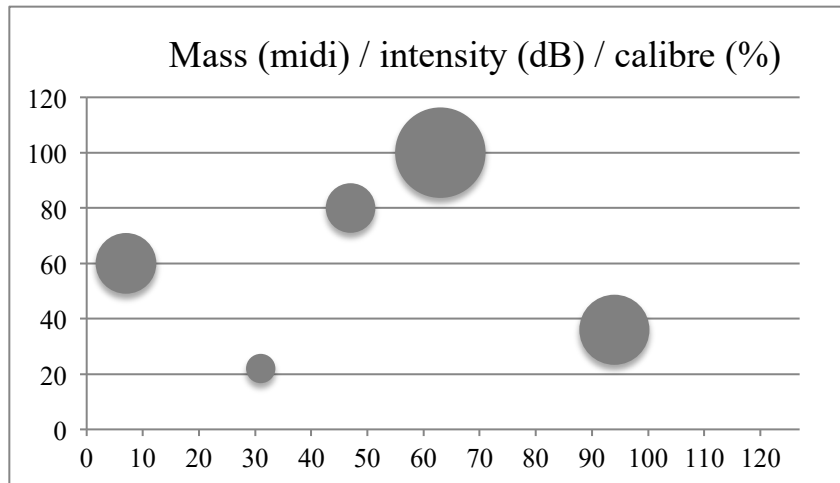
Schaeffer was a man curious about his times and he strove for a modern reconciliation of traditional poetry, literature, theater, arts as well as religious speculations, with the requirements of technocracy: science, hard facts, organisation, and big structures. To understand the impact of his work, one must accept this strange hybridisation and not separate his different sides from one another. It took a curious man to hear and see in primitive radio technologies a tool for renewing music. The implications are far-reaching, as he develops in his *chef d’œuvre*, the *Traité des objets musicaux* (1966). After this initial step of 1948, as is well known, Schaeffer went on to found the *Studio d’essais*, the GRMC, the GRM and even the INA¹⁸, organising and leading one of contemporary music’s main institutions. For those reasons, Schaeffer is rightly known as a radical acousmatic researcher.

But is the picture complete? Were Schaeffer and his team really “blind”?

This article attempts to demonstrate a more nuanced view. Indeed, a detailed study of Schaeffer’s writings reveals the graphic sensitivity outlined in the first part of this communication. As suggested, several of the words chosen by Schaeffer to describe sonic properties reveal a graphic or plastic/spatial sensitivity: *projector*, *grain*, *fringe*, *node*, *allure*, *channel*, *mass*, *calibre*, *site*, etc. are all taken from the visual domain or are often associated with vision, either explicitly or in more subtle ways. For instance, “mass” (Chion 1983) and its different “calibres” and “sites”, generalise the former notion of “pitch”; but mass and its nuances are obviously conceived in 2D space pitch/intensity, or even in 3D pitch/intensity/calibre space, perhaps such as this, ex. 5:

¹³ Ever since there has been a lasting debate as to whether electroacoustic music is really music or an entirely new media.

¹⁴ In the sense that a generalised form of an equation (like $y=a+bx$) contains all the different forms of this equation. ¹⁸ The Institut National de l’Audiovisuel (National TV and Radio).



Ex. 5. Mass, sites and calibre¹⁵

Similar discussions can be made of other key concepts, most of which exist within a multidimensional space of perceptive sound properties.

Thus, electroacoustic music possesses a significant spatial or visual part, despite its radical rejection of graphics as musical tool and its essential concentration on listening. One of Schaeffer's quandaries resided in the need to manipulate properly and, even more importantly, to think properly a new "most general" music. In addition, since traditions concerning timbre were so limited, he had to invent a new vocabulary well before the generalisation of acoustics or electronic musical instruments — at the time almost nobody had heard of dynamic envelopes or recognised the difference between vibrato or tremolo, and most could not name different shades of noise nor even accept noises as having aesthetic potential. Schaeffer's literary sensitivity, his taste for multiple art forms, and his understanding of music all came together in the invention of this new vocabulary. Sensations of all kinds – aural but also visual or tactile – came into play.

The paradoxical importance of the visual for Schaeffer becomes less surprising if one remembers his personal interest in photography¹⁶ and movies. This important citation from the *In Search of a Concrete Music* is quite revealing in this respect:

22nd April. Once my initial joy is past, I ponder. I've already got quite a lot of problems with my turntables, because there is only one note per turntable. With a cinematographic flash-forward, Hollywood-style, I see myself surrounded by twelve dozen turntables, each with one note. Yet, it would be, as mathematicians would say, the *most general musical instrument possible*.

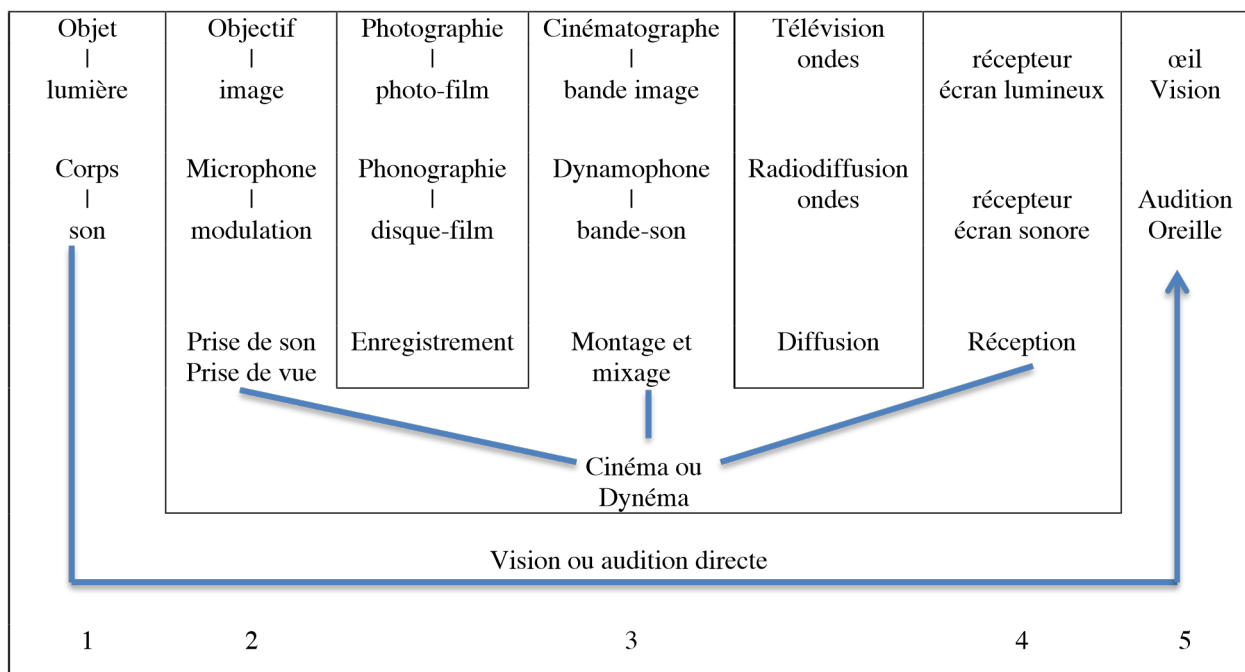
Is it another blind alley, or am I in possession of a solution whose importance I can only guess at? (1952b, 15).

¹⁵ For ease of representation, the pitch center of the masses is represented by its equivalent and the usual MIDI number, despite the anachronism of this practice. Schaeffer was using a traditional scheme of note names and numbered octaves which gives a similar linear pitch scale.

¹⁶ There were known photographers in his family and there remains an interesting collection of art photographs in his personal archives conserved at IMEC in the city of Caen.

In this citation, famous for having the intuition of the sampler as early as 1948¹⁷, one notices the cinematic sensitivity joining the poetic and theatrical as well as the scientific – all those dimensions battling in Schaeffer’s mind. Again, the terms “grain”, “projector”, “profile”, “node”, and “fringe” come to mind. Not only are these words visual in general, but they are also cinematic or photographic in particular¹⁸. In a lesser-known proposition, Schaeffer even calls the speaker a “sonic screen”, rather than a “sound projector”, thereby underscoring the cinematic analogy.

Indeed, the answers to these questions go back further than 1948. In the background preparation of the invention of *musique concrète*, Schaeffer wrote a most significant essay in 1941-42 called *Essai sur la radio et le cinéma*. In this fascinating early text, he drafts many aspects of his later theories well before he conceived of a new kind of music or prepared *La coquille à Planètes*. In the essay, Schaeffer promotes the radio drama as a carefully crafted, new, mixed media art form containing in this order: words, acting, music, and sound effects. For him, because of the technological nature of the support, this art is much more closely related to cinema than to theatre or opera. For him, both constitute “relay” or “go-between” arts (*arts-relais*) that share common traits. Among his sketches, a figure is particularly striking, recreated here for ease of reading, ex. 6:



Ex. 6. Relationship of a light object and sound body, left (1) to the eye and the ear, right (5), via the relays of cinema or “dynéma”, (2-4)¹⁹.

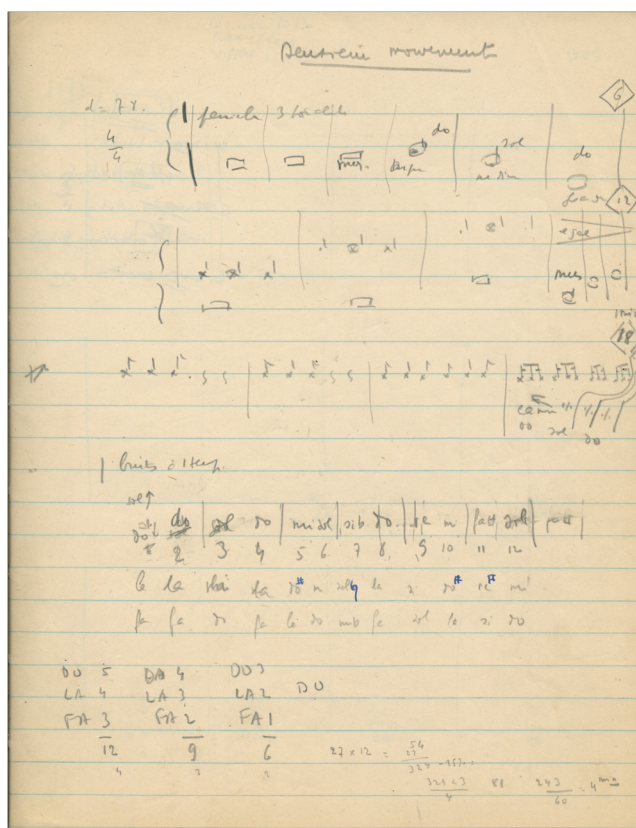
¹⁷ Harold Chamberlin (USA) had quite the same idea the very same year, this leading to his tape based instrument and the better known Mellotron (UK).

¹⁸ “Grain”, “node” and “fringe” are also tactile. *Frangé* (fringe) has been translated as “white noise” elsewhere, which is clearer but obscures the visual analogy to the fringe of a rug. Schaeffer often uses the term *frange* for broadband noise, preferring the concrete image of a disorderly fringe around a shawl or rug to the “scientific” term that misses in his view the qualitative or perceptive point.

¹⁹ Mise en rapport de l’objet lumineux et du corps sonore à gauche (1) avec l’œil et l’oreille à droite (5) par les relais du cinéma et du dynéma (2-4).

Taken from a newly reissued text (2010), the sketch also constitutes the link between Schaeffer's literary practice and radio art. The "dynéma" he proposes remained a constant image in the *Musique concrète* group, eventually becoming the concept of "cinéma pour l'oreille" (cinema for the ear), frequently evoked in electroacoustic music circles²⁰. Very early, then, Schaeffer was contemplating a new art form akin to cinema and behaving like its visual counterpart. This analogy left many visual traces in later approaches. One can also notice that right from the start, Schaeffer used a tabular method of communication²⁵, well before his famous figures in major books appeared (1952, 1966). In my view, this is also a clear expression of the post-Schoenberg/Varèse graphic way of thinking described above.

Other graphic tools involved in early Schaeffer confirm this paradigm. In his notebooks, sketches, and early papers, Schaeffer makes use of different types of notation. Indeed, it may come as a surprise to some more familiar with the "militant" acousmatic attitude of the *musique concrète* school that Schaeffer used all kinds of notations throughout his career and urged his team to develop and use them as well, music notation having proved too limited for his needs. In his perceptive paper on the analysis of electroacoustic music, François Delalande (2009) presents several examples of notation in use at the GRM, ex. 7:



Ex. 7. Schaeffer's sketch for a *symphonie de bruits* (1948)²¹

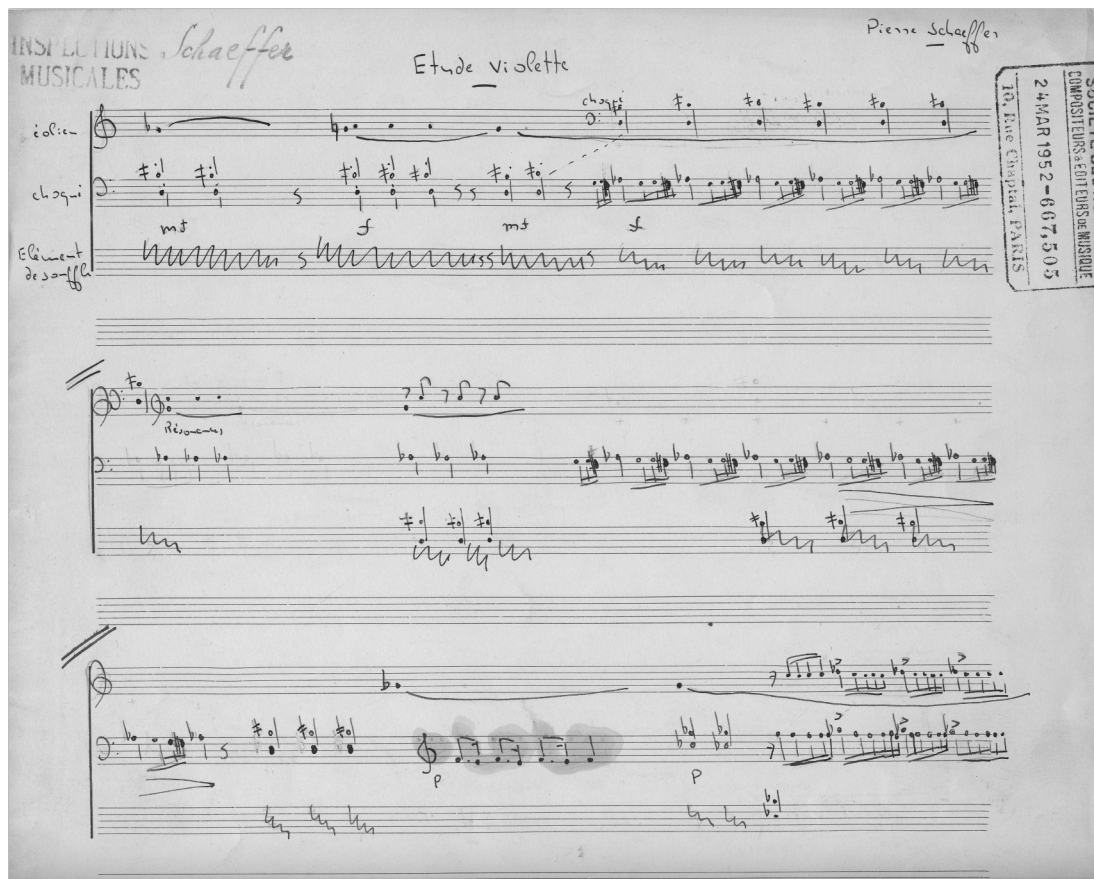
This sketch of an early version of the *Etudes concrètes*, mixing musical notation, drawings, rhythms, and measures, is closely related to the well-known sketch of the *Etude aux chemins de fer* (1948). Both reveal a dominating spatial conception inherited from musical notation that is

²⁰ Notice, for instance, the name of the well-known CD collection, edited by Metamkine. ²⁵

This can also be an inheritance of his engineering training at l'Ecole Polytechnique.

²¹ Reproduced by permission from edition Droz-HEM.

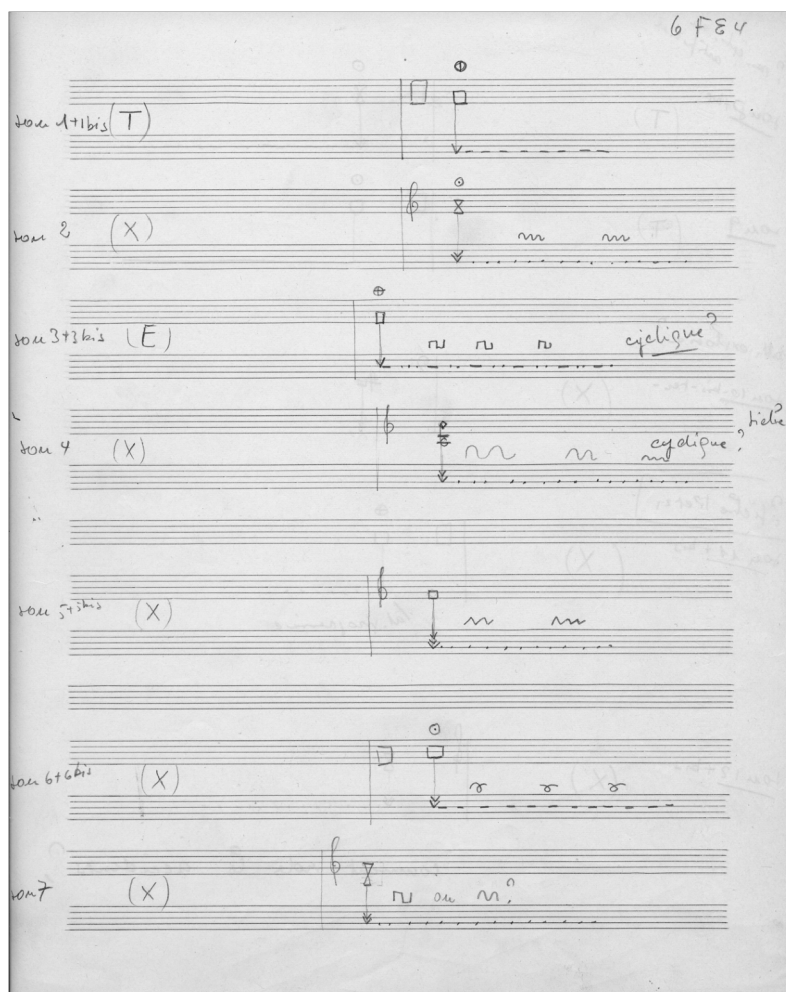
potentially multidimensional. For confirmation, let's look at other examples by different members of his teams. This example from 1952 by Monique Rollin is still close to musical notation, ex. 8:



Ex. 8. Monique Rollin's transcription (1952) of *Etude violette*²²

The *Etude violette*, being piano based, can probably be transcribed more easily than other noise-based works; nonetheless, the transcription is not quite satisfactory, for it is too “reductionist”, i.e., it does not have enough detail on matters of timbre. The next example, despite staves, is more abstract due to the “criteria” related graphics, an attempt to symbolise crucial sonic phenomena, ex. 9:

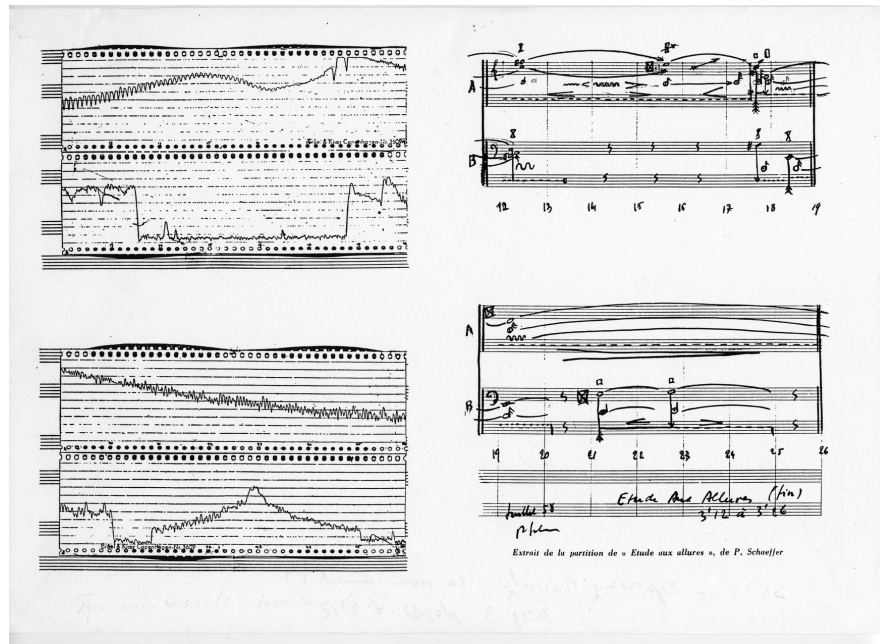
²² Reproduced by permission



Ex. 9. Mireille Chamass' transcription of seven sound objects (1959)²³

Third, let's look at an example of double notation, contemporary to example 9, including both the bathygrams and musical transcriptions, ex. 10:

²³ Reproduced by permission



Ex. 10. Schaeffer's transcription of *Etude aux allures* (1958)²⁴

With its objectively precise acoustic representation and combined with notation of perceptive results, this transcription is more satisfactory, and later visual tools will often retain such a dual approach. However at the time, bathygrams and sonograms were costly and limited to short duration fragments and thus did not become usual tools. Nevertheless, no matter how incomplete or dissatisfying the results — and Schaeffer's writings and teachings are very critical on these matters — the graphic research of Schaeffer and his group remained constant. They were certainly listening to the sounds in great detail, but images were never far away.

Moreover, the images used at GRM were a bit peculiar, often complex in nature²⁵. Let's look at some of Schaeffer's main figures in the final 1966 version. They can be deceptively simple. The scale of masses, for instance, seems clear at first glance, ex. 11a:

1. Pure sound²⁶
2. Tonic sound
3. Tonic group
4. Channelled
5. Nodal group
6. Nodal sound
7. White noise

Ex. 11 a

²⁴ Reproduced by permission.

²⁵ Possibly an inheritance of the esoteric practices that seduced Schaeffer for a time (Schaeffer 1970).

²⁶ Given here in John Dack and Christine North's translation of Michel Chion's *Guide de l'objet sonore* (1983), in EARS, 2009. Retrieved in March 2013.

Reading the texts more precisely, however, this scale can also be perceived with other symmetries: V-shaped or in espalier²⁷, ex 11b:

1. Pure sound	7. White noise
2. Tonic sound	6. Nodal sound
3. Tonic group	5. Nodal group
4. Channel- led	

Ex. 11. b Linear, “U” or “V” Symmetries

In fact, many Schaeffer graphics are similarly multilevel. An even richer case can be found in the famous *TARTYP* (1966: 459), ex. 12:

		Disproportionate duration (macro-objects) of no temporal unity		measured duration temporal unity		Disproportionate duration (macro-objects) of no temporal unity	
		unpredictable facture	non-existent facture	reduced duration micro-objects		non-existent facture	unpredictable facture
definite pitch fixed mass complex pitch	SAMPLES (En) (Ex) (Ey)	Hn	formed sustainment	impulse	formed iteration	Zn	ACCUMULATIONS (An) (Ax) (Ay)
			N	N'	N''		
		Hx	X	X'	X''	Zx	
not very variable mass		Tn Tx special wefts	Y	Y'	Y''	Zy special pedals	
unpredictable variation of mass		E general example	W	φ	K	P general example	A general example
held sounds				iterative sounds			

Ex. 12. *TARTYP*³³

Again we find a tabular and symbolic approach. But this table is extremely complex, showing at first three dimensions: variations of mass, duration, and form. Looking more closely, one sees that it employs a radial symmetry with a center (9 *balanced sounds*), a middle level (*redundant, homogeneous, wefts, pedals*), and extremes (*samples and accumulations*). Again, this table really is a multidimensional and dynamic analysis compressed into apparent 2D. The situation becomes even more complex if one takes into account the merging of the two extremes discussed by Schaeffer. The compressed 2D becomes a kind of cylinder within a timbre-space, ex. 13:

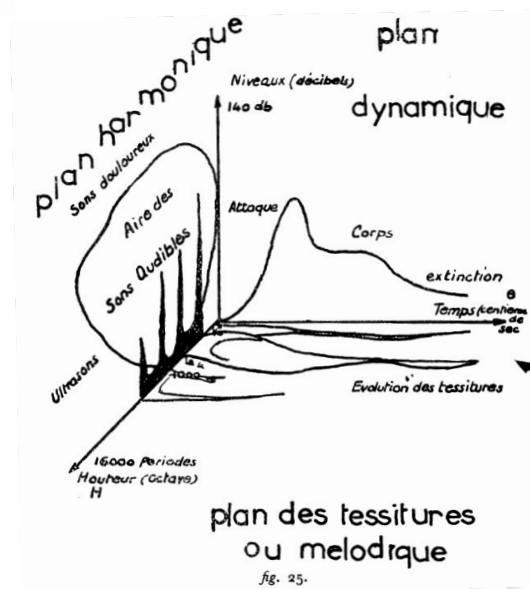
²⁷ Reminiscent of the fruit trees of the north-east of France, where Schaeffer was born. ³³ Reproduced by permission.

An	En	Hn	N	N'	N''	Zn
	Ex	Hx	X	X'	X''	Zx
Ey	Tn	Tx	Y	Y'	Y''	Zy
E	T	W	Φ	K	P	

A cylinder in multidimensional timbre-space

ximity, the communication technologies of 1966 and, most likely, time²⁸ excluded the topological complexities of “ndimensional” 2D graphics.

Moles Schaeffer controversy of the late 1950s, led to the abandonment of an acoustic inspired representation used then (1952: 207), ex. 14:



Ex. 14. Implicit 3D space²⁹

permeates all later approaches, thereby further complicating the and understated. The subliminal 3D space testifies to the spatial ical thinking, Schaeffer’s included despite his reluctance.³⁰

also dynamic, in the temporal sense. At a time when physicists of sound with disregard, one of Schaeffer’s major achievements tack and transition of a sound’s “dynamic profile”, its dynamic

towards extreme modernity and towards a nostalgia of simpler times.

choenberg, a “reluctant Messiah”, to borrow the term from Richard Bach (1977), or stler (1959) – never quite sure if he really wanted to go along with his avantgarde bject (2014).

envelope (Chion 1983: 174-178). This dynamic-temporal approach is even active in this simple looking figure, ex. 15:

<p>4. COMPREHENDING</p> <ul style="list-style-type: none"> - for me: signs - before me: values (meaning-language) <p>Emergence of a sound continuum and <i>reference to, confrontation</i> with extra-sonorous notions.</p>	<p>1. LISTENING</p> <ul style="list-style-type: none"> - for me: indexes - before me: external events (agent-instrument) <p><i>Emission</i> of the sound</p>	1 and 4: objective
<p>3. HEARING</p> <ul style="list-style-type: none"> - for me: qualified perceptions - before me: qualified sound object <p><i>Selection</i> of certain particular aspects of the sound</p>	<p>2. PERCEIVING</p> <ul style="list-style-type: none"> - for me: crude perceptions, rough outlines of the object - before me: crude sound object <p><i>Reception</i> of the sound</p>	2 and 3: subjective
3 and 4: abstract	1 and 2: concrete	

Ex. 15. Four ways of listening: a cycle in time, 1 to 4³¹

Drafted as early as 1942³², the four types of listening make a cycle: usually 1-2-3-4. Schaeffer also presents the interaction of abstract and concrete music as a cycle in time (1952: 35-36) : 1- from abstract to concrete and 2- from concrete to abstract. If space permitted, it would be intriguing to present here the four parts of morphologies, the *TARSOM* (Schaeffer 1966: 584-587). This elaborate figure shows complex and intricate multidimensional and temporal organisations, despite an apparent 7*9 grid.

In its place, let's pay attention to an animation film produced by François Delalande and Jacques Vidal for the GRM (c. 1970)³³. Here, one can understand just how important images were for the Paris group and how the subsequent *Acousmographie* was the crowning achievement of those attempts, as Delalande demonstrates (2009). In spite of technical limitations in this animation film, different shapes are used to represent sounds and their properties according to a more or less Schaefferian analysis³⁴. The representation derives from the musical score, being mass in function of time, and includes a representation of the dynamic envelopes and some references to timbre, although it does not yet scroll³⁵. Instead, a pointer is used in synchronisation with the music.

To conclude this part of the article, I stress that the surprising presence of visual aids for listening in GRM practices does not appear to be a contradiction of the group's founding principles. The use of visual aids does not diminish the true originality of this musical school: listening to sounds of all kinds with curiosity and concentration, reaching for ways to put them together to create satisfactory aural experiences. However, such originality does not necessarily preclude a visual approach. I have shown many cases where the eye was involved as well as the

³¹ Reproduced by permission

³² See Schaeffer 1942, p. 53 and 61.

³³ An excerpt can be found at : <http://fresques.ina.fr/artsonores/fiche-media/InaGrm00206/partition-animee-de-l-etude-auxobjets.html>. Retrieved in August 2013.

³⁴ Schaeffer himself was not a fundamentalist and kept a distanced relationship to analysis; he was, instead, rather pragmatic, seeking usefulness rather than perfection (Schaeffer 1967).

³⁵ The computer graphics *Acousmographie* of the 1990s will include it.

ear to forge a characteristic manner of listening to and composing music. In the words of one of the GRM's main figures, François Bayle, "Yes, of course, we used some visual tools, but always under the control of the ear. It would be a mistake to think that because of our concentration on listening we were blind. On the contrary".³⁶ Like Schaeffer, Bayle's approach often presents visual aspects, despite his concentration on acousmatic music.

The persistence of the visual in electroacoustic practice can shed light on a complementary discussion related to this conference's theme.

3 Some cases of electroacoustic resurgences in auteur cinema

A somewhat surprising fact of art history is the ease with which cinema integrated electroacoustic sensitivity, considering that film is a rather conservative medium concerning music. Could this be related to the half-hidden visual side of electroacoustic music? Let us discuss a few pertinent cases.

Electroacoustic thinking is a musician's approach, but sound engineers are usually musicians as well. Gradually, electroacoustic sensitivity reached the cinema world and exerted an impact, almost automatically. This impact can be explained in part by the necessity for directors and moviemakers to find new ways to use sound in the reconstruction of reality that is film. For certain avant-garde projects, traditional music is not always appropriate, diverting attention from other aspects of the film or giving a romantic or overly "produced" effect. Sound, ambient noise and soundscapes are used instead.

These two explanations converge towards a creative use of sound, where two major tendencies are observable:

1- a direct link from film to the electroacoustic community. Quite a few soundtracks from 1950 onward were composed by trained contemporary composers (Morricone, Fano, Constant, Artemiev...) or were commissioned by directors with a high degree of musical sensitivity (Disney, Kubrick, Lynch, Godard, Visconti, Coppola, Lucas).

2- a more frequent indirect link. In a technical, "mediological" (Tiffon 2005), and practical way, soundstages and cinema studios are true electroacoustic studios, often benefiting from ample budgets and the best technologies. They "exude" electroacoustic music, even without even realising it consciously³⁷. As Marshall McLuhan has clearly shown (1964), "the medium is the message": a tool contains its own immanent properties that lead the user towards a certain way of doing things and the listener of perceiving them. To paraphrase Molière (1670), several sound designers for film are doing electroacoustic music "in spite of themselves".

3.1 A problematic microphone

For better or worse, the camera and the microphone joined forces in the late 1920s. As the 1952 movie by Gene Kelly and Stanley Donen, *Singin' in the Rain*, lampoons, this marriage was not easy at first. Great creativity, artistic and technical, was necessary to overcome such problems as unwanted "microgenic" sounds and noises, conflicting needs of recording (a quiet stage and proximity of the microphone to the source) and of filming (excluding the presence of

³⁶ François Bayle, personal oral communication, January 2013. Our translation.

³⁷ I have proposed (2001 and 2003b) that pop-music studios had the same evolution towards a electroacoustic sensitivity, explicit or unconscious.

the microphone from the frame and including a noisy camera on stage), and of an adapted acting different from traditional “extroverted” theatre acting³⁸. Once more, “... radio could therefore be a school of sincerity”. The opposition between stage acting and the Actors’ Studio method also comes to mind. After “moving” pictures, from 1930 onward a new generation invented “talking”, “sounding”, or even “singing” cinema; and it achieved spectacular success in the late 1940s, as the Kelly and Donen film celebrates, including superb broadcast technical quality. Hi-fi microphones and speakers have not improved all that much since the 1950s.

3.2 Auteur cinema and music

On the fringes of the movie industry, more demanding artists in auteur cinema also adopted the apparatus of moving and sounding images. In a few cases, sonic aspects take a singular place, recalling the primitive biological function of hearing: to inform the individual about what cannot be seen. Auteur cinema also rediscovered the function that music has filled since Gregorian chant: to express what cannot be told. Finally, sound in auteur cinema took over the function of the old Greek chorus: to comment on and react to the action. This role had been fulfilled by music, notably with Wagner’s *leitmotiv*, and certainly cinema³⁹ can be described as a new kind of *Gesamtkunstwerk*. It must be pointed out that film composers tend to be Wagnerian, whereas sound designers – the sons and daughters of Roy Disney or Spike Jones – often have a more modern, i.e., more creative or even fully electroacoustic approach. We illustrate this with a few examples.

3.3 Jacques Tati (1907-1982): slapstick *concrète*

Jacques Tati, an important director for our discussion, created an original type of cinema, in which humour and slapstick thinly disguise an anguished sensitivity towards modernisation, seen as dehumanising. In Tati’s films, things dominate man, and true communication has disappeared. This is especially the case in *Mon Oncle* (1958)⁴⁰. In their ultra modern villa⁴¹, the Arpel family no longer communicates, it speaks solely in empty advertising slogans: “Tout communiquer”, “Comme c’est original”. They live in a mechanical and obsessive way, becoming the servants of their house and its furniture – of the dolphin fountain, for instance. The “uncle”, who often visits his brother-in-law Mr. Arpel, is a clumsy but charming man, never quite fitting in despite good intentions, who introduces refreshing chaos into the household⁴².

Dialogue becomes almost impossible — one is reminded of Magritte. Sounds and noises, of people, things, and places, often take its place. Tati uses a close microphone and unnatural amplification of sounds to bring sounds forward in the mix, literally constructing a study in expanded sounds similar to the Schaefferian approach. The amplified dress noises of Mrs. Arpel, the detailed and contrasting sounds of steps over various materials or the menacing machine sounds, either in the kitchen or in Mr. Arpel’s factory, are quite evident.

³⁸ The famous scenes found on YouTube summarizes it: <http://www.youtube.com/watch?v=OTFCctdiS04> and <http://www.youtube.com/watch?v=YMzV96LV6Cc>. Retrieved in August 2013.

³⁹ With television and multimedia.

⁴⁰ One can find many clips on YouTube, such as : <http://www.youtube.com/watch?v=gkvtE1AS6Qo>. Retrieved in August 2013.

⁴¹ Ironically, today, this is seen as a great study in modern design even a rather pretty one.

⁴² See and listen to the kitchen scene: <http://www.youtube.com/watch?v=LE9t98Gox60>. Retrieved in August 2013

In *Traffic* (1971), chaos and noise dominate the French-style derisive road movie. It, too, is at times a very attentive electroacoustic study. An interesting example is right after the tumultuous car crash⁴³. A red Volkswagen Beetle turns into a wild animal, “quacking” like a duck and making savage “grinding” noises, while a wheel “runs away” for and finally falls over with exaggerated metallic sounds. This is very close to early *musique concrète* aesthetics, where sounds metamorphose into surrealistic otherness, like the “whale” or “singing” squeaking doors of Pierre Henry’s *Variations pour une porte et un soupir* (1963). Those studies in sounds could also be compared to the *Etudes de bruits* (1948) of Schaeffer, especially the metallic sound of the falling wheel near the beginning of *Etude pathétique*⁴⁴. Both creators share a distrust of modernity, as can be gathered from Schaeffer (1970) and from the movies of Tati. Incidentally, both men are from the same “disillusioned” generation, who were born before the Great War and were young adults on the eve of the Second World War.

3.4 Andrei Tarkovski: studies in matters or elements

Another case in point is Andrei Tarkovski, director of only a few but highly regarded films in which sound, music, and noise often replace missing or impossible dialogue. Tarkovski’s personal idiom is developed not in satire or comedy like Tati, rather in “visionary”, “poetic”, even “mystic” films.

A striking feature of films such as *Stalker* (1979)⁴⁵ and *Solaris* (1979) is the director’s taste for the elements, in the old Greek sense: water, air, fire, lava, stone, wood, grass, and metal find strong places, both in images and in sounds⁵². In *Stalker*, the whole initiatory journey into the “zone”, where natural life has taken over the world from man, is a detailed study of textures, colours, and sounds, akin to mature electroacoustic music. Those soundtracks approach the work of composers like François Bayle (*Tremblement de terre très doux*, 1978) or Bernard Parmegiani (*De natura sonorum*, 1975).

Solaris also puts forward technological sounds such as cars on a highway⁴⁶, the sounds of the space station, etc. This creates a subtle comment on the state of mind of the cosmonaut and his apprehensions before his mission. Again, man seems small and menaced against such a sonic (and visual) ambience. Like the two compositions mentioned above, the soundtrack composed by Eduard Artemiev makes use of both recorded and synthesized sounds, thus being fully electroacoustic or even mixed-music rather than *musique concrète*.

It should also be noted that this film is a late but fervent inheritor of the space race, seen from the USSR side, beginning with the science fiction literature of Stanislas Lem and his cohort, possibly the result of being “red children”. This might be compared with successful US movies such as *The Right Stuff* or *Apollo 13*. The particular fervour of Tarkovski is evident in the “apparition and levitation”⁴⁷ scene at the end of the movie, where the main character and the “spirit” of his deceased wife float in the air, accompanied by an organ piece of Bach. To modernise the sound and give it distance, the composer doubles the organ with vibraphone, lending a contemporary or jazzy tone⁴⁸. Thus, the cosmonaut is presented as a kind of “secular

⁴³ <http://www.youtube.com/watch?v=aA2Oych939g>. Retrieved in August 2013.

⁴⁴ In fact in both cases, it is the sound of a turning and falling film box that was used.

⁴⁵ For instance one can listen to the trailer: http://www.youtube.com/watch?v=GM_GOpfEQUw. Retrieved in August 2013 ⁵² http://www.youtube.com/watch?v=AoZvFD_e7Lo. Retrieved in August 2013.

⁴⁶ <http://www.youtube.com/watch?v=rswYI7RLRNE>. Retrieved in August 2013.

⁴⁷ <http://www.youtube.com/watch?v=FcglyhUre4w>. Retrieved in August 2013.

⁴⁸ Something like *Jazz Sebastian Bach* by the Swingle Singers, a fusion classic of the 1960’s.

saint”, surrounded in the space station by examples of European fine art at its best. This also represents a kind of redemption of the main character (another signature of saints), confessed and blessed by the planet *Solaris*.

3.5 David Lynch and post-industrial individual anguish

Yet another example of electroacoustic sensitivity can be seen in David Lynch’s film *Eraserhead* (1977). This dark and humorous movie is an interesting case of post-space age “crash” – in drug parlance, the “coming down” of the 1970s after the “high” of the 1960s.

The tribulations of Henry with his fiancée-turned-too-quickly-wife and their baby in sordid parts of Philadelphia as he suffers from visions, hallucinations or even the real madness of the period, are constructed with few or empty words and foreground sounds, noises, and music. For instance, in the mad first meal⁴⁹ with his soon-to-be family-in-law, we hear organic bubbling and disgusting noises, revealing the embarrassment of Henry and anticipating the problematic result of his relationship: a baby, with its share of unavoidably physical and dirty aspects. The movie is often visually “drenched” in liquids and dubious looking matter, accompanied by disturbing sounds. The “man in the planet” — either a *deus ex machina* or a demon plotting and torturing Henry — is accompanied by amplified sounds and menacing machine or train-like noises⁵⁷ (perhaps those from Philadelphia’s closing factories at that time of economic crisis). On another level, the singing “lady in the radiator”⁵⁰ is a complex chimera: a woman resembling Marilyn Monroe who has cheeks that look like testicles and who sings in a man’s *false* *setto* becomes a good fairy or angel, apparently relieving Henry from his mad life.

The soundtrack is fascinating and well constructed, if one accepts noises as legitimate artistic sounds. Broken down Philadelphia recalls the basic sounds recorded there by Varèse for his 1950-54 *Deserts*, while the embarrassed silences of the family meal, the expressionist silent scream of Mary’s mother, and the organic sounds recall early electroacoustic pieces like Luciano Berio’s disturbing *Visage* (1961). Finally, the dark humour and deconstruction characterising the movie in all of its aspects are related to contemporary post-modern thinking. Berio again comes to mind, especially *Sinfonia* (1968), a landmark in deconstructive approaches to music.

To conclude: listening with images

After summarising the growing importance of visual or spatial imagination on modern and contemporary music as a solution to the post-Wagnerian tonal music crisis, this paper studied the case of early electroacoustic music. Schaeffer and his school were presented as inheritors of the pioneer musical-spatial-visual shift of paradigm by composers such as Schoenberg, Debussy, Stravinsky and Varèse. In that perspective, sounds of all kinds are deployed and interact in a mental and perceptive multidimensional space of complementary musical properties.

Recent reissues, better translations of founding texts, direct discussions with the actors, and archive findings reveal a surprising and complex use of visual aids in radical acousmatic circles in the 1950s and 1960s, despite severe criticism and distrust. Schaeffer and his teams

⁴⁹ http://www.youtube.com/watch?v=SqV41XH_dLI. Retrieved in August 2013. ⁵⁷
This appears close to Schaeffer *Etudes aux chemins de Fer* (1948).

⁵⁰ <http://www.youtube.com/watch?v=59ZHZxsqs5M>. Retrieved in August 2013.

listened with concentration and subtlety to sound, but they did so with visual assistance – “always under the control of the ear”, confirms Bayle. The key concepts, many of which stem from vision or touch rather than from hearing alone, and the tables, graphs and other visual aids were constructed and improved over the years leading to Schaeffer’s fundamental texts of 1966-67 and then, after many more years of composition and research, to *Acousmonium*, GRM’s music analysis software.

The simultaneous presence of the visual dimension in electroacoustic practice may explain the success of electroacoustic music in cinema, both in practice and in theory (Chion 2003). Many auteur films from the 1960s to the 1980s — Tati, Tarkovski, Lynch — demonstrate clear electroacoustic sensitivity, as if the electroacoustic approach was naturally cinematographic.

In all of these ways, and with these ramifications, the Paris school was listening with images.

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