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Ce
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(Stéphane
Mallarmé)

Pierre Schaeffer's

Typo-Morphology of Sonic Objects

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to

Michael Spitzer

[1992]

UNIV DUNELM

12 MAY 1993

Abstract

Pierre Schaeffer's Typo-Morphology of Sonic Objects proposes to present to the English-speaking reader the two accomplished stages of Schaeffer's 1966 solfège, namely typology and morphology, as expounded in *Traité des objets musicaux*, situating them in the larger context of Schaeffer's musicological work, and in the specific context of the solfège. This is done through translation of and commentary on Schaeffer's writing.

Chapter I surveys the years 1948–57, exposing the shifts of priorities which define three phases: research into noises, concrete music, and experimental music. Particular attention is paid to Schaeffer's conception of experimental music, and through the analysis of 'Vers une musique expérimentale', what has generally been seen as an antagonism between the Paris and the Cologne studios emerges as the conflict between two opposing approaches to technology and tradition. Chapter II delineates three notions that underpin the fourth phase of Schaeffer's musicological work, musical research, of which the 1966 solfège is the programme: acousmatic listening, four listening functions, and sonic object. Chapter III elaborates on the premisses of typology and morphology. Chapter IV expounds typology proper, whilst chapter V presents morphology and the sketch of the subsequent operations of solfège: characterology and analysis.

From this study, it emerges that *Traité des objets musicaux* is first and foremost an inexhaustible repository of insights into sound perception. Typology, the first stage of the solfège, is doubtless a successfully accomplished project. However, as a method for discovering a universal musicality, the solfège enterprise needs to be viewed with caution. It suffers from the almost open-ended nature of its metaphorical vocabulary, the emphasis the text lays on reactive rhetoric, its reliance on 'methods of approximation', and from a gradual distancing from perceptual reality itself. This notwithstanding, *Traité des objets musicaux* appears as a fundamental text of twentieth century musicology. It brings to the fore two crucial issues: technology and the ways it alters our manner of perceiving and expressing reality, and reality itself thereby; the friction between sounds and musical structures, transparent in the text as the friction between isolated words and the discourse, transparent in Schaeffer's life as the friction between the man and the social structures he has needed to fit in.

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Full many a gem of purest ray serene
The dark unfathomed caves of ocean bear.
Full many a flower is born to blush unseen,
And waste its sweetness on the desert air.

(Thomas Gray, 1751)

— Maint joyau dort enseveli
Dans les ténèbres et l'oubli,
Bien loin des pioches et des sondes;
Mainte fleur épanche à regret
Son parfum doux comme un secret
Dans les solitudes profondes.

(Charles Baudelaire, 1851)

INTRODUCTION: BY WRITING

My curiosity about the work of Pierre Schaeffer was aroused by the reading of Denis Smalley's article 'Spectro-morphology and Structuring Processes' (Smalley 1986). A friend working in musical applications of artificial intelligence found then a copy of a triple special issue of *La revue musicale: De la musique concrète a la musique même* (Brunet ed. 1977), where fragments of Schaeffer's texts spanning the years 1948–77 were interspersed with the editor's comments. With hindsight, I believe there could have been no better introduction to Schaeffer's œuvre. Sophie Brunet's choice of texts has been felicitous, and Schaeffer emerges not only as an iconoclastic writer, but also as a musicologist (the term 'musicographer' has been suggested) with a message to the Brazilian musical avant-garde of the late seventies. In fact, I read in Schaeffer's invectives against *elektronische Musik* the materialization of Baudelaire's diatribes on the conformism of avant-gardes, and a necessary antidote to the 'rigourousness' of the Brazilian musical establishment.

LXI

Of the delight in and preference for military metaphors shown by the French. Here every metaphor wears moustaches.

Militant literature.

To hold the breach.

To keep the flag flying.

To emerge with flying colours.

To plunge into the fray.

One of the old brigade.

All these glorious phrases are commonly applied to drunkards and bar-flies.

LXII

French metaphors.

A soldier of the judicial press (Bertin).

The militant press.

LXIII

To be added to the military metaphors:

The fighting poets.

The literary vanguard.

This use of military metaphor reveals minds not militant but formed for discipline, that is, for compliance; minds born servile, Belgian minds, which can think only collectively.
(Baudelaire 1930, pp. 38–9)

The next texts I came across were 'Lettre à Albert Richard' (Schaeffer 1957^{B}) and 'Vers une musique expérimentale' (Schaeffer 1957^{C}). While 'Vers une musique expérimentale', written in 1953, represents an attempt to syncretize the techniques of concrete music, electronic music, tape music, and world music in a congruent research method beyond particular æsthetics, 'Lettre à Albert Richard' reflects Schaeffer's disbelief in the possibility of this syncretic ideal.

In the meantime, a six-month correspondence with Denis Smalley, under whom I intended to work towards a Ph.D., reached an impasse when I refused to adopt his spectro-morphological idiolect, which advertised itself as 'the most recent guise of the non-vernacular fork of the musical language' (cf. Smalley 1986, p. 61), and my spectro-morphological doctorate was brought to grief when I ventured to quote Andy Warhol: no matter what remote corner of the world you may find yourself in, there is nothing as reassuring as the certainty that there, as anywhere else, a Coke, is a Coke, is a Coke... In other words, if one can speak today of a musical language in the sense of a musical code (Saussure's *langue*), it is precisely in connection with what Denis Smalley terms 'the vernacular fork'. This paragraph of Umberto Eco's indicates what has been perhaps the most radical aspect of serial thinking:

> *Every message calls into question the code.* Each *parole* act constitutes a discussion on the *langue* which engenders it. Ultimately, it is possible to say that every message poses its own code, every œuvre appears as its own linguistic foundation, as the discussion about its own poetics, as the liberation from the bonds which, prior to the œuvre, claimed to determine it, and as the key to its own reading. (Eco 1968^{B}, p. 306; French translation p. 47)

Despite Schaeffer's objections to serialism, it is clear from this reference to Olivier Alain's 'well reasoned lines' that, to some extent, he has understood the consequences of this state of affairs:

> The composer's function today is virtually detached from his predecessors' fundamentals, that is, the assimilation of a certain state of the musical language of their times, precisely when language used to evolve in a continuous manner (for tradition read continuity). Perhaps we are tackling a brief and provisional period devoid of composers in the usual sense, because a musical language in the usual sense, that is, material vehiculating a commonly perceptible meaning, is also absent. Does the contemporary composer always know where he goes? and once he has arrived, is it at the goal he had actually chosen? (Olivier Alain, *Nouveau Larousse musical* v. II, p. 380, quoted by Schaeffer 1966, pp. 475–6)

On the other hand, Denis Smalley's insertion of his 'spectro-morphology' (equivocally presented as a better denomination for Pierre Schaeffer's typo-morphology) into the framework of Western musical tradition, of which it would be the 'legitimate heir' (Smalley 1986, pp. 61 and 93), seemed to contradict Schaeffer's antagonism to atonal tradition, and his call for radical revolution.

> The term 'spectro-morphology' is preferable to the Schaefferian term 'typo-morphology' for the reasons given in the text. Pierre Schaeffer's *Traité des objets musicaux* (Paris: Seuil, 1966) is the first significant work to elaborate spectro-morphological criteria, and it provides the foundations for this chapter. (Smalley 1986, p. 220)

In fact, reasons for this are given nowhere in Denis Smalley's text; the reader is not even told what Schaeffer's typo-morphology stands for, and he is thereby led into concluding that Denis Smalley's spectro-morphology has rendered Pierre Schaeffer's typo-morphology obsolete. Hence the idea of expounding Pierre Schaeffer's typo-morphology as opposed to Denis Smalley's spectro-morphology. This exposition would take the form of a semiotic reading of *Traité des objets musicaux* in which the critique of Denis Smalley's spectro-morphology would be a rhetoric device to expound Schaeffer's typo-morphology.

A preliminary survey of the literature on semiotics of music (Eco 1979, Eco ed. 1974^{B}, Jakobson 1932, Lidov 1986, Nattiez 1971, 1976^{A}, 1976^{B}, 1990^{B}, Nattiez ed. 1971, Oliveira 1979, Sebeok ed. 1986, Stefani 1974, 1975, Stefani ed. 1975, Tarasti ed. 1987, etc.) showed there was no such thing as a semiotics of music; there were as many musical semiotics as musical semioticians. And for Benveniste (1969^{A}, p. 12), if music was a *langue*, it was one which had a syntax, but no semiotics. What is more, these semiotics of music were, by and large, semiotics of the musical text.

> Wishing to describe or indicate the object of what could be a musical semiotics in the present state of research, we are led to study music as text-object, that is, represented

> or representable sonic event; in other words, semiological domains (or domains of semiological relevance) find their point of convergence in the musical score. (The terms 'object' and 'text' here have the more usual and neutral sense; they imply neither a conscious theory of the text—which does not exist in musicology yet—nor theories of the sonic object such a Moles' and Schaeffer's.) (Stefani 1975, p. 9)

Focusing on the musical text, semiotics tends to offer itself as a substitute for schools of musical analysis. However, within the domain of electro-acoustic music there is no text-object.

> One of the principal characteristics of this music (sc. computer music) is that it exists and is performed more or less exclusively on tape, without any effective visual representation. Traditionally two types of what may loosely be called a 'score' have existed: a list of operational data, or a general sketch of the musical effects obtained.
>
> The function of operational data is to give a detailed description of the use and control of the instruments employed. This is therefore linked to a specific machine and program. It is completely incomprehensible to most musicians, and directed simply towards specialists. The machines themselves, moreover, are continually superceded and replaced, and their programs are frequently modified and improved. This type of representation is therefore soon redundant, and even while it remains effective, it is only capable of producing one result. The truth is that nobody is really interested in doing exactly what the composer has done for a second time.
>
> On the other hand, there are the various schematic representations of the aural result, ranging from a number of Stockhausen's works to Ligeti's *Articulation*. But although the composers attempt to be as precise as possible, their notation is always rather crude and approximate, particularly in comparison with the complexity and perfection of traditional notation. Analysts in search of compositional method, or something more profound than a simple observation of contrast and similarity will find themselves up against a brick wall. (Stroppa 1984, pp. 177–8)

Semiotics of music were therefore unsuitable to account for *Traité des objets musicaux*, not only because they focused on the text, which is problematic in electro-acoustic music, but also because they took for granted the existence of musical works, of which it is not a question in *Traité des objets musicaux*. On the other hand, it seemed that the identification of musical semiotics with musical analysis was a debasement of the semiotic challenge.

> —concerning the first point, the scientificity of Semiology, I no longer believe—nor do I desire—that Semiology should be a simple science, a positivist science, and this for a primordial reason: it is the responsibility of semiology, and perhaps of semiology alone

> of all human sciences today, to question its own discourse: as a science of language, of languages, it cannot accept its own language as a datum, a transparency, a tool, in short as a metalanguage; strong with the powers of psychoanalysis, it interrogates itself as to *the place from which it speaks,* an interrogation without which any science and any ideological criticism are ridiculous: for Semiology, at least so I hope, there exists no *extraterritoriality* for the subject, even if he is a scientist, with regard to his discourse; in other words, finally, science knows no site of security, and in this it must acknowledge itself as *writing*;
>
> — concerning the second point, the ideological commitment of Semiology, I believe the stake has grown considerably larger: what Semiology must attack is not only, as in the days of *Mythologies,* the petit-bourgeois good conscience, but the symbolic and semantic system of our entire civilization; it is not enough to seek to change contents, we must above all aim at *fissuring* the meaning-system itself: we must emerge from the Occidental enclosure, as I postulated it in my text on Japan. (Barthes 1974, pp. 13–14; English translation pp. 7–8)

My project would require an investigation into the works of Charles Sanders Peirce, the founder of semiotics, Ferdinand de Saussure, the founder of semiology, and Roland Barthes, the ideologue (a designation whose sheer irony might have pleased him) of semiotics/semiology, in order to define a musical semiotics (the term is used here as encompassing both semiotics and semiology) suitable to explicate Schaeffer's enterprise; only then should I be able to compare, in semiotic terms, Pierre Schaeffer's typo-morphology with Denis Smalley's spectro-morphology. Given the dimensions or complexity of Peirce's, Saussure's, Barthes', and Schaeffer's œuvres, this project was evidently unfeasible.

For anyone undertaking research into Schaeffer's work, the almost total lack of a critical literature has two consequences: on the one hand, the researcher is free to move in whatever direction he chooses; on the other, he has to take into account that nothing or very little is known to the reader. In English, there is only Peter Manning's twenty pages on Schaeffer's early experiments (Manning 1985, pp. 19–42); in French, the few significant works are Michel Chion's *Guide des objets sonores* (Chion 1983), which fulfils the modest (but extremely useful) function of being the lexicon and the index of *Traité des objets musicaux,* and Marc Pierret's very apposite *Entretiens avec Pierre Schaeffer* (Pierret 1969). Other than that, there are dictionary and encyclopædia entries (Mâche 1980, Xenakis 1963, etc.), articles, interviews and reviews in periodicals (Nattiez 1976^{A}, 1976^{B}, Schaeffer and Hodgkinson 1987, Schloezer 1953, etc.), and the usual caricatures: Schaeffer, the intellectually and technically not so well endowed loser of the *musique concrète* versus *elektronische Musik* antagonism (Maconie 1976, pp. 98–9, Nyman 1974, pp. 40–1, etc.), and Schaeffer, the esoteric guru of outsiders (GRM). Hence my decision: the useful thing to do, and the feasible thing, is to present an overview of Schaeffer's musicographic (in

so far as it acknowledges itself as writing) work, focusing on what seems to be its greatest achievement, typology and morphology of sonic objects, whilst looking more closely into some fundamental and often misunderstood concepts. The foremost objective of this work is to let Schaeffer's text speak to the English-listening reader. Its most ambitious hope is that the pragmatic maze of Schaeffer's writing may resound in today's music-making in Britain, America, and beyond.

Quotations presented in this work follow the typographic conventions of the original text, rather than those adopted by the author.

M. Pierret *— Can we go as far as saying that, if you wrote today* La coquille à planètes *or* Orphée, *then you'd show more care for the œuvre, you'd no longer be the victim of your own experiments...*

P. Schaeffer *— Certainly not! We always commit the same mistakes again, and 'je ne regrette rien'! I tell you: I prefer an experiment, even aborted, to a successful œuvre.* (Pierret 1969, p. 105)

CHAPTER I

From Research into Noises to Musical Research

The name of the writer, dramaturge, musicologist, radio producer, sound-effects man, sound engineer, researcher, and composer Pierre Schaeffer remains attached to concrete music,[1] which he created in Paris during the late forties. Concrete music sought to explore the possibilities which sounds sampled on 78 records (and, from 1951 onwards, on tape) afforded as musical material. Outside France, and even there, not much has been said about Schaeffer's thinking. There are various reasons for this: a large part of his literary œuvre is out of print; apart from a few articles (1959[C], 1960, 1971[A]), Schaeffer's texts remain untranslated into English; finally, his writing is anything but simple. As a result, Pierre Schaeffer is still seen within the context of the largely anecdotal Schaeffer/Boulez antagonism, and while Pierre Boulez's IRCAM today represents the state of the art of music technology, the GRM, which Schaeffer created (but distanced himself from), perpetuate Schaeffer's image as an outsider, neither poet nor composer, a sort of Antonin Artaud undiscovered by The Living Theatre. In reality, Pierre Schaeffer has addressed himself, with the refinement of a fiction writer, to one of the great questions of our time: the relationship between human beings and technology. He has done this from a privileged position: that of someone who is both an artist and a technician, and, being furthermore an intellectual, is capable of articulating the artist's and the technician's experiences.

In 1941, seven years before his systematic experiments with noises, Schaeffer drafted some observations on what he termed 'relay arts': radio and cinema.

> ...We therefore see that this competition between direct art, in its full bloom, and relay-art, in full experimentation, has three matches which generally define three phases:
>
> First phase: the instrument deforms Art.
>
> Second phase: the instrument transmits Art.
>
> Third phase: the instrument informs Art.
>
> In the first phase, one forgives the instrument for anything, because one admires its novelty without taking this instrument seriously. There is no fear of competition. Furthermore, the instrument is so obviously unfit for the fight that it is appreciated above all for its goodwill. In the second phase the instrument improves, and these improvements, far from admired, are reproached for not being fast enough, because it is precisely when the image resembles the model that awkwardness and deformations

> appear. Direct art expects to be scrupulously served by this relay, which is likely to offer undreamt-of diffusion and unheard-of conveniences. Now not only does one demand from the instrument more than it can give, but one also expects it to give that which, by its own nature, it cannot give. A classical phase finally comes, which cinema is reaching but the radio is still far from approaching. This phase is rendered possible by the knowledge of the instrument, the discrimination between its limits and possibilities, and also between its two roles: to retransmit in a certain manner that which one was used to see and hear directly; to express in a certain manner that which one was not used to see and hear. (Schaeffer 1941[B])

In 1942 Pierre Schaeffer joined the stage director Jacques Copeau and his pupils in the foundation of the Studio d'Essai de la Radiodiffusion Nationale, which became a centre of the Resistance movement in French radio, being responsible, in August 1944, for the first broadcasts in liberated Paris. In October the same year, Schaeffer was dismissed from the direction of the Radio; the Studio d'Essai was renamed as Club d'Essai and placed under Jean Tardieu's direction. In 1946, its official name was Club d'Essai de la Radiodiffusion-Télévision Française. Schaeffer started research into noises in the Club d'Essai in 1948. Research into noises became publicly known as concrete music in 1949 and, two years later, the work of Schaeffer, the composer Pierre Henry and the sound engineer Jacques Poullin won official recognition: the Groupe de Recherches de Musique Concrète, Club d'Essai de la Radiodiffusion-Télévision Française was born.

This chapter proposes to outline Pierre Schaeffer's 1948–53 work, that is, the period comprised between the beginning of his research into noises and the writing of 'Vers une musique expérimentale' (Schaeffer 1957[C]).

1. RESEARCH INTO NOISES (1948–49).

Schaeffer's research into noises commenced as an experiment with the sound-effects warehouse:

> I cannot overemphasize this deal you make with your conscience, which leads you to grab three dozens of objects in order to make noise, with no dramatic justification at all, with no preconceived idea at all, with no hope at all. (Schaeffer 1950, p. 32)

These experiments led to the creation of five 'noise études', broadcast by the Chaîne Parisienne on 5 October 1948: *1. 'Déconcertante' (Étude aux tourniquets), 2. 'Imposée' (Étude aux chemins de fer), 3. ' Concertante' (Étude pour orchestre), 4. 'Composée' (Étude pour piano)* and *5. 'Pathétique' (Étude aux casseroles).* These pieces brought to light some

possibilities afforded by the use of sampled sounds as compositional material.

The *Étude aux chemins de fer* (*Imposée*) posed the problem of musically organizing sounds produced by six locomotives at the Batignolles station. Schaeffer recorded the stokers' improvisation. Rhythmic leitmotivs were then isolated, and montage attempts led to both dramatic and musical sequences. Dramatic sequences, referring the listener back to events (departure, stopping, etc.), were considered unmusical by Schaeffer. He then discovered how to obliterate the referent: a fragment having a particular *shape* was followed by another fragment which, although having the same shape, showed *matter* variation (for the complementary notions of shape and matter, see § 12). Dramatic sequences were not eliminated, but the discerning listener was expected to prefer the musical ones. Thus, a musical architecture emerged.

> The railway theme is treated freely in a first part which gives rise to various rhythmic developments. This part is not unlike a theme and its variations; then comes a second part which intentionally moves away from the anecdotal character of the noises, even though it has been manufactured with the same elements. Finally, a coda recalls the initial theme. (Bayle 1990, p. 68)

Schaeffer describes the general procedure followed in the creation of this étude:

> *To distinguish* an element (to hear it in itself, for the sake of its texture, its matter, its colour).
>
> *To repeat it.* Repeat the same sonic fragment: there is not an event any more, there is music. (Schaeffer 1952^{A}, p. 21)

An accidental finding at the early stages of research into noises contained all the seeds of concrete music (cf. Schaeffer 1952^{A}, p. 16): a bell sound was recorded after its attack, being thus rendered unrecognizable. After the creation of *Étude aux chemins de fer*, the studio was emptied of heterogeneous sound sources; sound recordings were raised to the status of compositional raw material, and Schaeffer focused on their transformation (variation of playback speed, backwards playing, cutting, looping of a single groove). These manipulations tended to make the original source of the sounds unidentifiable, but they could affect the idea of the referent: the engine, recorded at 78 RPM and played at $33\frac{1}{3}$, could became 'casting in a smelting furnace' (Schaeffer 1952^{A}, p. 23); all the same, Schaeffer preferred not to enlarge upon this possibility.

The *Étude pour orchestre* (*'Concertante'*) brought him back to the domain of sounds which,

like the bell sound, were musical in the traditional sense. The raw material was provided by an orchestra tuning up. 'A series of manipulations operated on this initial recording, whose character is shapeless, gives rise to a great variety of randomly produced themes, which one chooses and then composes' (Bayle 1990, p.68). Difficulties with montage led Schaeffer to call on a soloist 'enjoying all the instrumental ease of ordinary music' (Schaeffer 1952[A], p.24), so as to establish a dialogue with the orchestral fragments. He observed that, although the sonic matter of pianistic and orchestral parts was essentially similar, manipulations created shapes which were radically different from those of traditional sounds. This étude, which later became the *Diapason concertino,* comprised four movements.

In the *Étude aux tourniquets* (*'Déconcertante'*) Schaeffer reverted to a recording produced at the early stages of research into noises, when Gaston Litaize was asked to prepare a score for African xylophone, four bells, three zanzas and two whirligigs. The recording of Litaize's piece was treated in the same manner as the orchestral recording in the previous étude: fragments were extracted, transformed, and put together again. 'The main themes were repeated at $33\frac{1}{3}$ RPM, and a number of rhythmic articulations were isolated to be more richly orchestrated' (Bayle 1990, p.68). Schaeffer tried to distance himself from the original performance, which was considered too elementary.

> The musical ideas of the original score almost entirely disappeared, for the cuts engendered new structures which had no relation with the former compositional intention. If initial elements could be recognized in these new structures, it was rather like fossils, whose chemical composition alone interests us. Thus, the proliferation of shapes annuls the shape, which becomes matter again. (Schaeffer 1952[A], p.26)

The creation of the *Étude pour piano* (*'Composée'*), which originated the *Étude violette* and the *Étude noire,* is described by Schaeffer in these terms:

> There is no instrument to play concrete music. This is the biggest difficulty. Or else, it is necessary to imagine an enormous machine, of the cybernetic type, capable to perform millions of combinations, but we have not yet got there. So long as I have only two or three record players to realize approximative chains, I shall remain trapped in a discontinuous style where everything seems to have been hacked out. Is there a compromise?
>
> I instinctively turn to the piano. The previous manipulations have actually taught me that a piano advantageously replaces all sound-effects tools. It is possible to hit the strings directly, scratch them, or touch them lightly, and it is also possible to consider the keyboard as, rather than a musical instrument, a convenient means of attacking

strings which have undergone a certain 'preparation'. Thus, to each keyboard note corresponds a more or less musical noise, whose mixture can be precisely regulated. In this case, the keyboard is no longer a modulating tool, instead it must be considered as a switch.

However, it is not by playing the 'prepared piano' that one gets concrete music; the characteristics of instrumental performance remain and safeguard traditional forms: the performance is always relatively measured and melodic. When amplified by acoustic means, the piano can nevertheless become a super-drum. Thus, using the piano as both a percussion instrument and a source of concrete sound, one attains a technique which certainly does not solve the aforementioned difficulties, but gets round them to a certain extent.

If I ask Pierre Boulez to record a series of chords in different styles (classic, romantic, impressionist, atonal) on a given theme, by manipulating this 'sound paste' I can construct ensembles which will keep a certain similarity with the initial sound, without being as clearly recognizable as the whirligigs. At least, these series will have the merit of providing a continuous element, and even a melodic unfolding, while the concrete concertante fragments maintain their discontinuous character. The merit of these first piano études is to have avoided resorting to the 'prepared piano', which was to yield soon more brilliant, though less pure effects. (Schaeffer 1952[A], pp. 26–7)

The *Étude aux casseroles* was created in a more leisurely mood. Over five hundred records had been gathered together, providing Schaeffer with abundant raw material. A trip to Washington was going to interrupt work. On the eve of his departure, he produced a 'virtuosity exercise on four faders and eight ignition keys' (Schaeffer 1952[A], p. 28), which blended recordings of Sacha Guitry's singing and coughing, a barge, American harmonica, and Balinese priests.

2. CONCRETE MUSIC (1948–58).

The interest arisen from the Concert de bruits led to the publication of the article 'Introduction à la musique concrète' (Schaeffer 1950), where Schaeffer felt reassured enough to replace the phrase 'research into noises' by the more ambitious 'concrete music'. He had nevertheless been using this term in his journals since 15 April 1948 (cf. Schaeffer 1950, p. 39) or 15 May 1948 (cf. Schaeffer 1952[A], pp. 21–2).

More than the simple use of sampled sounds as musical material, concrete music represented an inversion in relation to the traditional musical démarche. According to Schaeffer, the traditional (or 'abstract') composer followed a path which led him from abstraction to concretion: the traditional piece was mentally conceived, symbolically notated, and finally

performed. In concrete music, the effects created by different manners of exciting sound-producing bodies, and by electro-acoustic manipulations of recordings of these sounds, could not be conceived *à priori*; besides, traditional notation, accounting essentially for pitch, was inadequate; the performer was unnecessary. The new (or 'concrete') composer could do no better than manufacture his material, experiment with it, and finally put it together. For Schaeffer, the two démarches were not incompatible: 'Were I a composer, then I should have liked, based on the étude *Noire* or *Pathétique*, to create an original work, of which the concrete étude would have been the sonic blueprint and the inspiring atmosphere' (Schaeffer 1952^A, p. 36). How the concrete composer could profit from the abstract démarche was not so clear to him. In his next work, the *Suite n° 14 (Suite pour quatorze instruments)*, started in August 1949, the following working hypothesis was assumed: if even fragments of noises could lend themselves to musical construction by means of electro-acoustic manipulations, a less arid material should produce better results.

Jean-Michel Damasse helped Schaeffer in the orchestration of a score for fourteen instruments. To some extent, the score was shaped by the manipulations envisaged. Once recorded, the suite was 'decomposed, shortened, magnified, dissected, inverted, exploded, pulverized' (Schaeffer 1952^A, p. 39). Its montage proved problematic though. The suite had the following movements: prologue, courante, rigaudon, gavotte and *sphoradie*. Each of these pieces was an experiment with a particular technical procedure; these procedures were used in such a manner that the relation between original score and final result was made increasingly remote in each successive movement. In the prologue, no more than reverberations, echo, doublings, and rhythmic counterpoint were added. The *sphoradie* in turn was meant as 'an essay of expression properly speaking' (Schaeffer 1952^A, p. 39), freely employing various technical procedures. The aim of the suite was to demonstrate the existence of a new music. However, what emerged were the contradictions of concrete music. Schaeffer concluded that, despite having discovered powerful techniques, concrete music lacked a theoretical grounding: a method was necessary, as well as criteria to classify the infinity of sound material available.

In the courante, Schaeffer systematically used the looping-groove technique, an effect similar to that of a scratched record. Sounds thus isolated appeared to him as words in the state of liberty they enjoyed in a dictionary: separated from their contexts (decontextualized), they were heard in themselves. More than a compositional technique, the looping-groove was a means of aural analysis, and the source of a particular kind of listening, upon which Schaeffer would enlarge later (see Schaeffer 1966, pp. 91–156, Chion 1983, pp. 18–20, 33–4, chap. II herein). He noted: the precondition to concrete music is that the samples be isolated not only from dramatic or anecdotal context, but from their original musical context too. Paradoxically, the works that followed were undeniably dramatic.

About two years later, looking back on this period (cf. Schaeffer 1952[A], p. 53), Schaeffer would observe that: the method for concrete music was latent in the works created thitherto; if, in the next pieces, concrete music became a counterfeit of itself, this was because his thinking needed to mature, and machines needed to be conceived, built and experimented with; the construction of new machines, and the development of theoretical knowledge through the study of sonic fragments and of rules for composing these fragments, were preconditions for further developments.

Symphonie pour un homme seul (1949–50), created in collaboration with Pierre Henry, was a reaction to the *Suite n° 14*, in so far as the raw material included noises. The dramatic element, that is, the referential character of these noises, played an essential role in the *Symphonie*. However, two listenings were envisaged: one dramatic, the other abstract.

When Schaeffer began his next major work, *Orphée* (1951), also with Pierre Henry, the repertoire of recorded sounds had been extended by the latter to the point of becoming almost unmanageable. It was clear that, in concrete music, two complementary scores were feasible: an effect score, accounting for aural results, and an operative score, accounting for the electro-acoustic manipulations to which these effects owed their existence. The starting point of *Orphée* was a cinematographic idea: 'the tearing of Orpheus' veil, an excessively slow tearing, whence a noise arises which constitutes the main component of one of the sequences' (Schaeffer, 1952[A], p. 89). Schaeffer expected to follow rigorously a plan he would prepare for this piece (the scenario for the *Symphonie* had undergone various writings), but he also hoped for godsends in the studio. A score was problematic though: 'How to imagine *à priori* the thousand unpredictable transformations of the concrete sound, how to choose from among a hundred of samples, if neither a classification nor a notation has yet been defined?' (Schaeffer 1952[A], p. 87). Prior to notation, the problem posed by *Orphée* was: how to structure sampled sounds? how to establish a 'concrete' structure that is not based on cyclical repetition (noise études) or on a series (initial sequence of the *Symphonie*)? Contrarily to what was expected, no solution to the problems of concrete music was provided by technical developments such as Jacques Poullin's potentiomètre d'espace (a device for controlling the trajectory of sounds between four loudspeakers) and phonogènes (machines which allowed chromatic or continuous transposition of sounds recorded on tape whilst).

At this point, Schaeffer defined the notion of pseudo-instrument (see § 11): if a particular sample retained a certain invariance after electro-acoustic manipulations, it could play the role of a pseudo-instrument. 'Some sounds have, for instance, an attack that may be characterized by portamento, forcefulness, or opening out (that is, by moving swiftly from piano to forte). If these characteristics remain throughout the modulations the sounds undergo, such sound sources may play the role of orchestral instruments' (Schaeffer 1952[A],

p. 95). A music conceived in terms of such pseudo-instruments would admit of an effect score. From this period are also Schaeffer's first comments on the relation between music, linguistics and Gestalt psychology (cf. Schaeffer 1952[A], pp. 100–3).

Moreover, *Orphée* represented a tentative answer to another problem posed by concrete music: the absence of the visual element which characterized the traditional concert. 'In fact, concrete music apart, everything happened as at the Opéra' (Schaeffer 1952[A], p. 110). Olivier Messiaen, Henri Michaux and Claude Levy-Strauss, all advised Schaeffer to extract the full consequences of concrete music, breaking ties with tradition.

Still in 1951, Schaeffer lectured at the Darmstadt festival, where the *Symphonie* was enthusiastically received. His ideas were likewise warmly welcomed by German technicians. Schaeffer nevertheless sensed that concrete music would end up being assimilated into *elektronische Musik.*

In *À la recherche d'une musique concrète* (Schaeffer 1952[A]), the year 1952 is characterized by a reflection upon the experiences of concrete music. The label 'concrete music' started being questioned by Schaeffer: concrete pieces seemed to have the value of experiments, rather than that of accomplished æsthetic products. The phrases 'concrete experience in music' and 'experimental method' came to the fore. Schaeffer tried to define points of contact and discrepancies between his démarche and Schönberg's dodecaphony. For Schaeffer, Schönberg was an experimental composer in so far as his serialism had none of the dogmatism which characterized 'the lesser students of Mr Leibowitz' (Schaeffer 1952[A], p. 138). He put Schönberg's approach into the following terms: 'If I impose myself such a rule, what will result from it? An experiment would follow' (Schaeffer 1952[A], p. 138). Schaeffer saw experimentation and expression as somehow opposed: the former implied the recognition of the fact that the creator could no longer be sure of how his work would be perceived by the listener, of whether or not his message would be understood.

3. TOWARDS AN EXPERIMENTAL MUSIC (1953).

This section will consider the first stage in the transition from concrete music to musical research: that step whereby the Groupe de Recherches de Musique Concrète rallied concrete music, electronic music, tape music and world music, which Schaeffer termed exotic music, under the banner of experimental music.

In 1951 the Radiodiffusion-Télévision Française had offered the Groupe de Recherches de Musique Concrète, which at the time consisted of Pierre Schaeffer, Jacques Poullin, and Pierre Henry, the first purpose-built electro-acoustic studio ever. The Schaeffer/Poullin

collaboration was then in its fourth year, having resulted in the creation of the keyboard phonogène, the slide phonogène (also known as chromatic and continuous phonogènes), a three-track tape recorder, and the spatialization desk.[2] A workshop of concrete music open to outsiders took place in October 1951: Pierre Boulez brought in Michel Philippot and Jean Barraqué. The studio attracted diverse and important composers: between 1951 and 1953, Karlheinz Stockhausen, Pierre Boulez and Olivier Messiaen created concrete pieces there. A serial tendency started developing within the Groupe.

In 1953 the Groupe de Recherches de Musique Concrète de la Radiodiffusion-Télévision Française, presided over by Schaeffer, organized the First International Decade of Experimental Music, which may have been an attempt to reverse the situation created in Darmstadt, where concrete music had been assimilated into *elektronische Musik*. The 'Decade' took place at UNESCO in Paris between 8 and 18 June. *Vers une musique expérimentale*, a special issue of *La revue musicale* edited by Pierre Schaeffer and entirely devoted to the event was announced. The final proof, revised and approved by the authors and Albert Richard, editor of the periodical, was ready on 10 July 1953. Albert Richard nevertheless decided to postpone its publication. Four years later, this issue was finally printed, with the addition of Albert Richard's explanations and excuses (Richard 1957), and an introduction by Schaeffer, his 'Lettre à Albert Richard' (Schaeffer 1957^{B}). In what follows, the focus will be on some of the 1953 texts, with particular reference to Pierre Schaeffer's 'Vers une musique expérimentale' (Schaeffer 1957^{C}).

When it is said that Karlheinz Stockhausen, Pierre Boulez and Olivier Messiaen, besides Pierre Schaeffer and Pierre Henry, have created concrete pieces, this poses the following problem: how can works by such diverse composers all be classed as concrete music? or else: what is concrete music? Rather than trying to answer the latter question, this section will present concrete music as it appears in the light of extracts from the early texts of *Vers une musique expérimentale*. Thus, it is primarily the state of concrete music in 1953 that is under consideration here.

In the article 'Tendances de la musique concrète' (Goléa 1957), which supposedly reproduces a talk given at the Decade, Antoine Goléa identifies four tendencies within concrete music. There is what he terms 'directly expressive' concrete music, whose characteristics are the absence of strictly formal concerns and the relative primitiveness of material.[3] Most of the examples of this tendency are found among the early works. Goléa calls the second tendency the 'abstract' one; it finds its exponents in those composers to whom concrete music provided an unexpected field for the perfecting of researches which were essentially serial. Under the abstract label, Goléa puts together Pierre Boulez, Olivier Messiaen and—though he hesitates here—Pierre Henry as creators of serial concrete pieces. In his words: 'Rhythms, tessitura, attacks and timbres; it is in order to push always further the

refinement of these domains that musicians such as Pierre Boulez, Olivier Messiaen and Michel Philippot have come to concrete music' (Goléa 1957, pp. 39–40). Since the abstract tendency groups together all those Goléa calls 'traditional and very advanced composers' who found in concrete music a means of furthering their æsthetic advance, one might expect to find there as many personal æsthetics as composers. The third tendency identified by Goléa is the 'musical' one. The musical tendency of concrete music reinstates the traditional instrument as its main source. Thus, 'with secret and guilty voluptuousness, concrete music turns round towards music *tout court*' (Goléa 1957, p. 44). Finally, Goléa illustrates with a list of pieces the fourth tendency; the 'exemplary' one. The common trait of the exemplary pieces of concrete music is: 'to express a complete world through a means of expression itself complete' (Goléa 1957, p. 44). Goléa's *catalogue raisonné* reads as follows:

'EXPRESSIVE' CONCRETE MUSIC

1948 Pierre Schaeffer: *Étude aux chemins de fer* ('glorious and venerable');

Étude pathétique.

1949 Pierre Schaeffer, Pierre Henry: *Symphonie pour un homme seul.*

1950 Pierre Schaeffer, Pierre Henry: *Bidule en ut.*

1953 Pierre Henry: *Astrologie* (music for film, from which a four-piece suite was extracted).

'ABSTRACT' CONCRETE MUSIC

1952 Pierre Henry: *Antiphonie* (transition to 'exemplary' works).

Pierre Boulez: *Étude à un son.*

Olivier Messiaen: *Timbres-Durées.*

Michel Philippot: *Étude I* (simultaneously the classic of 'abstract' concrete music, and a work of transition to 'musical' concrete music).

'MUSICAL' CONCRETE MUSIC

1949 Pierre Schaeffer: *Flûte mexicaine.*

1952 André Hodeir: *Jazz et jazz* for piano and tape.

'EXEMPLARY' CONCRETE MUSIC

1948 Pierre Schaeffer: *Étude au piano I* (*Étude violette*).

1950 Pierre Henry: *Batterie fugace* and *Tam-tam IV*, from *Le microphone bien tempéré.*

1952 Pierre Henry: *Antiphonie.*

This analysis establishes precarious connections between material, tools, techniques, method and results, hence the untenable nature of its formulation, as if: primitiveness of material combined with a lack of formal concerns accounted for expressiveness; total serialization of concrete material amounted to abstraction; the application of concrete techniques to traditional sources were tantamount to musicality; the mixing of 'expressiveness', 'abstraction', and 'musicality' engendered exemplariness. Furthermore, Goléa's article presents serialism and abstraction in far too amicable a relationship with experimentalism, let alone concrete music.[4] Schaeffer's relation to serialism might be summarized in the following proposition: in principle, but not in practice, I object to the application of serialism to traditional material; in principle, but not in practice, I accept the application of serialism to concrete material. He gives two reasons for not accepting serialism as applied to orchestral sounds: firstly, it appears as a merely destructive gesture aiming at neutralizing tonal relationships, which would be inherent to instrumental construction and technique; secondly, it imposes on the performer an unnatural gymnastic. Schaeffer makes the first point in 'Vers une musique expérimentale': 'In so far as atonalism for instance presented only a destructive face, pretending to organize the twelve tones in ignorance of their degree quality, and considering them solely as terms of an algebraic permutation, one could be shocked by so premature a denial of a tradition which I shall call—no pun intended—dominant' (Schaeffer 1957^{C}, p. 23). The following quotation will make the second point, also demonstrating Schaeffer's preparedness to accept the practical results of serialism as applied to traditional material.

> As a matter of fact, after resisting with all my strength the system-mindedness applied to the concrete démarche, and the untimely constructivism of musicians who, in my opinion, did not show enough consideration for experimental empiricism, I realized an unexpected and, so to speak, physical intersection. An experience I recently had with the work of the young German composer Stockhausen will prove it. I have had the opportunity of hearing this piece under the masterly baton of Hermann Scherchen in the excellent studio of the Nordwest Deutsche Rundfunk in Cologne. I could not help recoiling, as I usually do in the face of any atonal work (not least because I remain convinced that they impose an unnatural gymnastic on the instrumentalists). Well, in the course of the Decade inaugural conference I reheard over loud-speakers Stockhausen's work, which was recorded on tape. Often in concrete music I regret the spectacular element of the concert, and its absence was the blessing that allowed me to hear, accumulated by the loud-speaker, which played the centripetal part, the different instrumental notes then welded[5] together and forming extremely brilliant and delicate sonic objects. This phenomenon was full of consequences: Stockhausen's abstract music was meeting the concrete experience; it was more acceptable when acoustically blended and heard by an ear accustomed, for some years, to consider sonic objects as such; it became far more justifiable and more intelligible; in other words, the same work presented two faces: one destructive, denying a past I believe everlasting (that is, the reality of the scale), and another turned towards the future. (Schaeffer 1957^{c}, pp. 23–4)

The acceptability of constructing atonal pieces with traditional material will not be discussed here; what is important to stress is that, for Schaeffer, the hearing of pieces thus constructed may be validated by a particular training and the absence of the original instrumental source. What I have called 'acceptance in practice' therefore implies a material/construction dialectic which is resolved by the introduction of two extraneous elements: a new musical training and the tape performance. It has been said that, in principle, Schaeffer would admit serialism into the domain of concrete music, but not in practice. That, in principle, he opens the doors of concrete music to serialism, even leading one to believe serialism would find its true home there, is quite clear:

> From the moment one makes the discovery of a practically infinite number of sonic objects, where degree no longer appears as the single dominant quality, the notion of series is more evidently applicable, and the negative character of atonalism vanishes. Whilst the day before it seemed a desperate gesture leading only to an impasse, now it emerges as spadework, a gesture that was perhaps indispensable for the introduction of new sonic objects, precisely, to be accepted. (Schaeffer 1957^{c}, p. 23)

That these doors, in practice, are hermetically closed, is a statement Antoine Goléa seems to discredit:

> Let us now imagine original recordings of noises that are much more complex and much harder to recognize; let us imagine transformations of these noises taken beyond any known limit, thanks to devices which allow the slowing down, the speeding up, retrogradation, the reinforcing, attenuation, fragmentation, and the shifting of register from infra-low to ultra-high; let us imagine that the results thus obtained are intermingled, stuck together end to end, moved around and mixed up according to the marvellous law of algebraic permutations and combinations, then we shall have a faint idea—in fact still totally abstract—of the manufacturing procedures of concrete music. (Goléa 1957, p.37)

It has been seen that, for Schaeffer, there is nothing uncongenial between concrete material and serialism. Whether or not concrete music and serialism are compatible is an altogether different matter. To answer this question, one would first have to investigate what concrete music is, and whether it has ever constituted a coherent æsthetic, apart from the adoption of a particular kind of material. Then, it might be useful to establish a distinction between serial techniques, serial method and serial æsthetic, before defining at what levels serialism and concrete music oppose one another. By serial techniques I understand procedures which can be identified in the music of Bach, Beethoven and Schaeffer for instance. By serial method I mean the systematic application of such procedures, defined from the starting point of Schönberg's dodecaphony. Serial æsthetics would be the personal uses diverse composers make of the serial method to express themselves. From the notion of serial æsthetics one may derive an abstraction, the serial æsthetic, encompassing all those personal æsthetics based on the use of a serial method. The serial method and æsthetic are unceremoniously dismissed by Schaeffer.

> The word débris, to my mind, does not at all apply to traditional music, but precisely to the destruction wrought there little by little, of which atonalism certainly represents the gravest stage. In so far as the atonal démarche exhibits a simultaneously desperate and desperating rigour, an absolute denial of the customary musical universe, it has become indispensable to set sights elsewhere. Or else, in this dungeon, death would be ineluctable.
>
> In reality, the prison had no bars. Why twelve notes when electronic music has introduced so many more? Why series of notes when a series of sonic objects is so much more interesting? Why the anachronistic use of an orchestra whose instruments are handled with such obvious anti-naturality by Webern and his imitators? And above all, why limit the horizon of our research to the means, usages and concepts of a music after all linked to a geography and a history; certainly an admirable music but still no more than the Occidental music of the last few centuries? (Schaeffer 1957^{c}, p. 18)

A page of Schaeffer's *Étude aux chemins de fer* reproduced in his article for *Polyphonie*[6]

evidences the application of serial techniques to tape montage. This does not point to the affinity between concrete music and serial method. The new premises of the Groupe de Recherches de Musique Concrète may have been open to serial composers, that is, composers to whom serialism represented an æsthetic (and hence methodological) option; Schaeffer could not ignore the tensions of the partnership therein.

> Chance and determinism, whose uncertain implications we begrudgingly suffer, engender curious encounters. It happens that concrete music has seen two diametrically opposed categories of spirit muster around it.
>
> No sooner had I understood the necessity for musical experimentation, no sooner had I been astounded by the profusion of sonic entities that might pass out of our hands, no sooner had I requested the assistance of those who could help me in this discovery, in this sifting, in this curiosity turned above all to the object, and in this method whereof the empiricism I championed and the allegiance to the finding I treasured, than a party of musicians whose favourite instrument was the slide rule, and whose musical ideas were rigorously opposed to mine, came running.
>
> Of this sometimes stern ordeal, only the meaning is understandable. For two years, in a companionship that had nothing distinctly fraternal about it, the abstracts got down to the concrete, and vice versa, with a sort of ferocious partisanship, and with mistrust in their emulation. Maybe all this is just starting to make us smile now and, as in any companionship, fraternity is at last appearing, but seldom have such opposing procedures rubbed shoulders.
>
> From among the thousand sounds in our cupboards, Pierre Boulez and his friends would choose the most unyielding ones, carve out their full mass, and show no consideration for anything other than the series they had calculated in advance. Messiaen, whom we had invited to a feast of sounds in which everything—so we thought—should flatter his gluttony, did not even open our cupboards, but clapped his hands and whispered: 'Something like that, as little sound as possible.' And there has been even that mere nobody, a student of J.J. Grunewald's, who apparently had inherited so little of his master's taste for incarnate music as to ask, with a hint of covetous desire in his eyes, whether we deemed it possible to create a music totally devoid of evolution in tessitura.
>
> (Schaeffer 1957^{C}, pp. 18–19)

'Pierre Boulez's and his friend's' approach is contrasted to Schaeffer's and Henry's in the paragraphs which follow.

> Meanwhile, considering that the discovery of sonic objects was of primary importance, that it was necessary to manufacture many of them first, and to determine their categories and families, before even knowing how they could evolve and be combined, I

> impatiently started looking for musicians good enough, and unselfish enough to venture this gigantic work, which rather resembled the botanist's than the composer's. I must say that without the presence of Pierre Henry, who was nevertheless also tempted by serial construction, concrete music would probably have lacked an essential experimenter. So essential that it could have been stillborn, and no sooner discovered than, so to speak, already lost. Instead of being the starting point of a more general musical procedure, of which I am now almost sure, concrete music would have been no more than the altogether bald, and doubtless ephemeral continuation of either surrealism or atonal music.
>
> Having closed in a few years, after an initial craving for composition, the cycle of his personal impressionism, of his romanticism, of his constructivism, and of his particular atonihilism, Pierre Henry finally took the wisest course and (excluding the background sounds for radio productions or film tracks, which are absolutely indispensable to earn a living, and hence respectable) has stopped composing for the time being, giving himself up to those two researches that any future composition demand: research into sonic objects, and research into instrumental manipulations. (Schaeffer 1957^{C}, p. 19)

In Schaeffer's opinion, although concrete material validates the serial method, this material itself has little to gain from the systematic application of serial principles.

> From the twelve-tone series remains a constructivist disposition, which, applied to the new material perhaps prematurely, destroys its freshness. The blossoming of concrete sounds risks being reaped too early when there is a *parti-pris* abstraction. The results are contradictory and disappointing. (Schaeffer 1957^{C}, p. 17)

For him, the æsthetic tendencies within concrete music are two: atonalism and surrealism. However, the fundamental opposition within the Groupe de Recherches de Musique Concrète is less between two æsthetics than between two approaches to concrete material or, in Schaeffer's words, 'two diametrically opposed categories of spirit'. Rather than torn between two æsthetics, in 1953 concrete music was torn between two approaches to the same material. For Schaeffer, in order to compose with concrete material (or in order to compose concrete material), not only a new instrumental apprenticeship is necessary: the apprenticeship of sonority itself imposes. The choice is therefore between using concrete material to create œuvres, and doing research into sonority to discover musicality. When the concrete composer—by which is meant the composer who opts for concrete material—uses his material, the æsthetic results are doomed to be either atonal or surreal. If the result is atonal, the concrete material will be inserting itself within an æsthetic evolution where it does not belong: atonality defines itself in opposition to tonality, which in turn informs and is informed by the instruments of Western musical tradition. If the result is

surreal, there will be a lack of the abstract dimension, which, for Schaeffer, is inseparable from musicality: rather than music, there is literature. Thus, before using the material to produce music, the concrete composer must explore sonority to discover musicality. 'Vers une musique expérimentale' clearly points to this direction. Here though, concrete music ceases to be concrete music: it has already become musical research. Concrete music nevertheless did not become musical research in 1953, instead it placed itself under an umbrella of its own creation: experimental music. Why?

Schaeffer had need to see his research materialize into works. Sophie Brunet says in her *Pierre Schaeffer* (Brunet 1969, p. 23) that the relationship between the Clan des Rois Mages and the scout movement prefigured the relationships of the Studio d'Essai, the Groupe de Recherches de Musique Concrète and the Service de la Recherche to the institution which officially housed them: they were tolerated. This observation is ratified by Pierret (1969, p. 10): 'You have been, perhaps, tolerated only; the communities you have directed have always had a rather marginal place in the Institution, all the same, you have survived, continuously occupying positions of responsibility.' Schaeffer's anxiety to produce works is made obvious in his 1948 journal.

> One agrees to lend me the studio hoping that I shall eventually come up with some broadcastable material. The French radio is obliged to justify its allocations. So are producers. I have to admit that the researcher must hide himself carefully behind the producer. (Schaeffer 1950, p. 37)

In the same text, he asks himself: 'What is the Radio administration going to think of this squandering of records, of this apparent waste of time, of this symphony hardly even begun?' (Schaeffer 1950, p. 42). The need to appease with works the public, the administration, Pierre Henry and himself is recalled in 'Vers une musique expérimentale' apropos *Bidule en ut*.

> John Cage for his part had discovered the prepared piano. Although expressly owing him nothing at all, since the same discovery was made more or less simultaneously by ourselves with our own means, we could only be grateful to him for establishing a link between the traditional musical language and a possible *langue*[7] of concrete sonic objects. The prepared piano, a polyvalent instrument that would do anything and sound like anything, had the essential means of expression of the traditional language: the keyboard. From the new sonic universe it had the matter, that is, thousands of new sounds which could be obtained from a suitably arranged sounding board. It would be difficult to name offhand the limitations of the prepared piano—limitations of matter, the strings quickly becoming gamelans, the shape swinging between a tom-tom and the sonata—but, as such, the prepared piano helped us through some difficult

> moments, providing transitional works to appease the public, the administration and ourselves. In fact, the most celebrated of these pieces, the famous *Bidule en ut*, is hardly concrete music. Constructed by fugato combination of three monodies from the prepared piano, which were put together on record, it is, adhering to a rigorous terminology, a mixture of *prepared piano* and *Music for Tape*. Although illustrating the work of 37 rue de l'Université, it is much closer to the American school than to what seems to be emerging little by little from our Parisian researches, and which I do not yet dare to call French school. (Schaeffer 1957^{C}, pp. 20-1)

It would be reasonable to think that the events of the years 1948–53 had given Schaeffer some prominence. This supposition is confirmed by the reformulation his journal underwent for publication in *À la recherche d'une musique concrète*. The passage above demonstrates that, in 1950, he was prepared to put up with some contradictions within the concrete démarche, so far as this could lead to the production of œuvres. Such an attitude is markedly different from that which presided over the creation of the noise études. Contradictions were an essential part of these pieces. During the elaboration of the noise études, they would come to the fore demanding appropriate solutions. Thus, a material/composition dialectic had appeared under a hitherto unknown light, justifying the genre étude as such. For Schaeffer in 1953, the application of serial method to concrete material was doubtless contradictory. However, the works of 'Boulez and his friends' were proving that this material could lend itself to abstraction, thus transcending the anecdotal character of the surreal pieces.

> As they went along though, both tendencies, albeit so opposite at the start, finally twined themselves into a garland. In addition to the necessary emulation, it was perhaps useful to put the straitjacket on these new materials for one year or two, so as to demonstrate at least the possibility of submitting them to construction. Thus P. Boulez has created his first étude. Messiaen, who unfortunately stayed somewhat away from the producer,[8] has let this amazing *Timbres-durées* come out; it will certainly remain as simultaneously the greatest success and the greatest failure of this period.
>
> At the same time, the abstracts themselves recognized the thankless character of the materials they had chosen, recommending research into the sonic matter and, even unwillingly, benefiting from the progress achieved in the harvest of material, in its classing, and in the systematic development of new manipulations. So was born, early in 1953, an étude by Michel Philippot, which, as an étude, pleased everybody. The serial construction there was applied to valid materials of which one respected the substance, and with which one played subtly, rediscovering, with an austerity that shall surprise only the neophyte, the immortal characteristics of music: sensibility and sensuality. (Schaeffer 1957^{C}, pp. 19-20)

Within the domain of concrete music, it was possible for those 'two diametrically opposed categories of spirit' to find common ground at the level of the material. A kind of symbiosis in which the concretes would investigate sonority while the abstracts would create œuvres might have appeared as a possible compromise. Nonetheless, the label experimental music intended to do more than bridge over the different approaches to concrete material. Philippe Arthuys' 'Pour commencer...' lays down the purpose of the First International Decade of Experimental Music.

> The *First International Decade of Experimental Music* was held in Paris from 8 to 18 June 1953. The aim of this Decade was to bring together, under the banner of Experimental Music and on the initiative of the Groupe de Recherches de Musique Concrète, all researches that have been done in this direction. It was not at all a Concrete Music festival with a large public, but a workshop of which something was expected to emerge. (Arthuys 1957, p. 8)

But what precisely was expected to emerge? We have seen the Groupe de Recherches de Musique Concrète at an æsthetic and methodological impasse. Schaeffer in turn was already thinking of concrete music as 'the starting point of a more general musical procedure' (cf. quote in pages 15–16). The International Decade of Experimental Music corresponded to the need of a radical reformulation within the concrete group.

> A few years passed. What had appeared to us as an inconsequential excursion proved to be a fertile exploration. What we had taken for an island was perhaps a continent where others might have landed on other shores. We needed to go back to our fundamentals, compare our machines and machinations, recognize the team mates of a necessarily collective adventure and, to these ends, to travel, to correspond with the five parts of the world, with those who know the musical past of this planet, and those who are imagining its future. (Schaeffer 1957^{C}, p. 14)

How this reformulation was expected to materialize, is not made clear in 'Vers une musique expérimentale'. Later, in 'Lettre à Albert Richard', Schaeffer will avow that his intention was 'to realize a synthesis of the different efforts aiming not only at a comparison of methods but also at the establishment of complementary research programmes' (Schaeffer 1957^{B}, p. iv). When 'Lettre à Albert Richard' was reprinted as part of *Machines à communiquer: 1. Genèse des simulacres*, this was rephrased as: 'to contribute towards a synthesis of different efforts, by prompting not only a comparison of methods, but also the establishment of complementary research programmes' (Schaeffer 1970^{B}, p. 190). Schaeffer's view of international developments in electro-acoustic and electronic music is uncomplimentary though.

> Whilst in Cologne or in Bonn, at the confluence of phonetics, acoustics and musicology, one gives birth to disturbing sonic beings, terrible sounds conceived with all possible scientific rigour (which does not make them any more reassuring), under the shadow of American universities, which, as we know, serve as Conservatoire, Faculty and Studio d'Essai, other tapes spin, and other characters bustle about making machines do what the agility of the fingers does no longer know how to; within themselves, they also expect the machine to get there where spirit and invention could not precede it. (Schaeffer 1957^{C}, p. 14)

A few lines below, he becomes even blunter:

> The Germans, hard-working and stubborn, no longer believe in anything but the musical electron. The Americans, dynamic and naïve, put their pianos out of gear and apply to composition (somewhat rashly) the law of probabilities. (Schaeffer 1957^{C}, p. 14)

Getting together stubborn, naïve, and concrete composers is of arguable interest. According to a French historian though, there exists a fundamental difference between the French and the English senses of humour: while Englishmen make fun of someone else by laughing at themselves, Frenchmen laugh at someone else to make fun of themselves.

> It is sometimes touching, and often comical, to see the same successes and failures reward attempts made with diverse means in Paris, New York or Cologne by people who, at least thus far, have not met and are unlikely to have copied each other, to have employed the same procedures, followed the same démarches, or made the same remarks. It is quite interesting anyway that they have undertaken the same tentative efforts, that they have come up against the same deadlocks and, little by little, are publicizing only their contributions and their perhaps divergent methods. (Schaeffer 1957^{C}, p. 17)

Within the concrete group of 1953, composers and researchers were able to find common ground in the choice—deliberate in the researcher's case, circumstantial in the composer's—of a particular material. Schaeffer tried to project this compromise onto the arena of international avant-garde. Thus, concrete music, electronic music, tape music and world music were rallied under the banner of experimental music by the concrete group. In the opening paragraphs of 'Vers une musique expérimentale' Schaeffer outlines their common contender. However, items 6–9 clearly expose his objections to the extension of serial æsthetic to the new instruments, as if, seeking a compromise, Schaeffer could not help pointing out the concessions he was prepared to make:

Given the nonexistence today of an experience which should actually be called the experience of experimental music (some will say: new music, but let us stick to the experience without prejudging the results), the following facts, listed in the order they appear on the scene, must be minimized:

1. The production of sounds by electronic means is of no musical relevance. Such instruments, only just good enough to imitate (but to what end?) classical instruments, must avoid extending their possibilities to the domain where acoustic instruments are powerless: systematic variations of timbres, absolute control of dynamic, and extension of tessituras.

2. The use of prepared or exotic instruments, which now join the classical means for obtaining sounds considered musical, is of no relevance. Apart from the fact that such sounds, of questionable purity, disturb the habits of our ear, we are quite determined not to compose and not to hear any music other than that manufactured with the Occidental *lutherie*, which crystallized one century ago, say at the time of Bach.

3. The means of acceleration, deceleration, superimposition, montage and retrogression which recording techniques afford are totally irrelevant, as are artificial filterings or reverberations: they are engineer's tricks, only just good enough for the sound track of animated cartoons.

4. No more relevant is the creation of complex sonic objects obtained from sounds or noises (musical or otherwise) through the combination of all the aforementioned techniques, which have been systematically practised under the name of *concrete music* and perfected by means of special machines such as the phonogène (chromatic or continuous), the morphophone, the multi-track tape recorder, etc...

5. As to taking into account the tridimensional sonic space where, knowingly or not, one projects any music (live or recorded), this is a minor phenomenon to which one should not attach much importance, be such a phenomenon static—i.e. affecting the origin of recorded sounds—or kinetic—i.e. affecting the possible movement of these sounds in the space they are received.

To these comments on the means of producing sounds, combining them and presenting them to auditors, other negative propositions would have to be added in the interest of comprehensiveness.

6. Music, which is all contained in the symbols of solfège, must not take any account of those sonorities that, being too complex and too new, elude such a system of notation and, for this reason, can be neither adequately laid out on a score that is accessible to traditionally trained musicians nor officially registered in the SACEM.

7. The problem of musical composition itself must be stated only in preconceived

terms. The composer is able to imagine all possible sounds and desirable combinations without resort to sound experimentation. Likewise, he takes their psycho-physiological effects for granted, outside any sensorial experience.

8. In particular, it is through a pure theoretical procedure, rather than through the tentative efforts of experience, that he demands new shapes from the new instruments. The modern composer, writing less and less 'for the instrument', is supported by electronics in his absolute refusal to continue worrying about means for performance: these neither help nor constrain him any longer.

9. Finally, the musical work exists in itself, as unlistened-to, and the auditor must be considered as having no share in the genesis of the work (or at least in its *raison d'être*). He is no more than a witness whose sole limitation is his capacity for adherence or refusal.

I shall not insist on the last four points, which would risk to deepen the misunderstanding of a contingent controversy, although they have been sometimes involved in the talks and discussions of the *First International Decade of Experimental Music*, organized by the *Groupe de Recherches de Musique Concrète de la Radiodiffusion-Télévision Française*. The primary objective of this decade was to highlight the notion of an experimental music, gathering as much information as possible on the subject, and bringing together in Paris those few personalities who have committed themselves to the diverse approaches which could be grouped under this name. The only important thing now, precisely, is to weigh up the various researches, taking the opposite course to an æsthetic debate, which is certainly necessary but untimely: first of all, to record the existence of a music in process of experimentation, acknowledging its tendencies and comparing results. In short, let us begin by applying to researchers themselves the experimental procedure. (Schaeffer 1957^{c}, pp. 11-13)

How are Schaeffer's propositions echoed back by the representatives of electronic music and the 'abstract tendency' of concrete music, that is, Herbert Eimert and Pierre Boulez, respectively? In 'Musique électronique', Eimert (1957) expounds the option for a particular kind of material which is inherent to electronic music. Like Schaeffer, he dismisses the use of new machines to imitate traditional instruments, also observing that 'the virtuosic use of special electronic instruments by any modern symphonic orchestra remains within the framework of the usual manner of playing' (Eimert 1957, p. 45). What is plainly stated by Eimert, is expressed by Schaeffer with all resources of the rhetorical arsenal; Schaeffer's commitment to the æsthetic implications of new material displays a radicalness unknown to Eimert:

How to explain then the state of underdevelopment in which these instruments have remained for almost twenty years? At that time, Martenot, Mager and Trautwein,

> preceded by Mager and many others, had discovered the essentials. Bode's melochord, which today equips certain German studios, and the new models of the Martenot or of the ondioline, simply present in a more convenient manner possibilities formerly glimpsed at. In too convenient a manner, doubtless. These instruments for virtuosi of not only melody but also Klangfarbenmelodie, of ultra-high and infra-low pitches, of the quintuple forte and the sextuple pianissimo, at the start only increase the composer's embarrassment. Instead of destroying note, the last stronghold of traditional music, they put in some more: timbre notes, intensity notes, register notes. 'Musicians, enrich yourselves!', Guizot said. To which the *prix de Rome* replied, as if in the face of the flood: 'What a lot of notes!' (Schaeffer 1957^{C}, p. 16)

Like Schaeffer, Eimert considers sound effects for film and radio as minor artistic forms. Electronic and concrete music share the same aspiration towards musical abstraction. In the words of Eimert: 'It is meaningless to speak of electronic music unless the central processes involved are musical processes, that is, unless all essential decisions concerning form and sound are taken from musical points of view' (Eimert 1957, p. 46). Schaeffer would have no qualms stating the same about concrete music. Even the credo of Schaeffer's is subscribed to by Eimert. Thus, both Schaeffer's 'Vers une musique expérimentale' and Eimert's 'Musique électronique' display as an epigraph the same quotation from Van Gogh: 'I believe one thinks much more sanely when ideas arise from the direct contact with things, than when one starts to look at things with the aim of finding there one idea or another' (Schaeffer 1957^{C}, p. 11, and Eimert 1957, p. 45). However, the incompatibility between concrete and electronic music is implicit in the following paragraphs of Eimert's.

> The fact that this system allows the creation of new musical material that cannot be obtained with classical instruments constitutes a true criterion of electronic music. It could be said, in a general formula that does not bind one to anything, that electronic music starts where instrumental music ceases. From an historical point of view, it is not by chance that means of construction today have been pushed to the limits of the possibilities of realization, and that, precisely at this moment, the new electronic means become available. Thus, there are doubtless real points of contact, particular connections between traditional and electronic musics. Those complicated rhythmic values that can no longer be played by instrumentalists, may be easily represented as length values, that is, in centimetre length. This notwithstanding, it is equally important to learn how to identify and grasp the immanent laws of matter that govern electronic sounds.
>
> We are still quite far from having a detailed knowledge of these laws—let me say, by analogy: the *tonality laws* of electronic music. In such a situation, all one can do is open wide the door onto this new sonic world and, while shaping that world, to operate by analogy with the processes of musical production. (Eimert 1957, p. 49)

Eimert is aware of the possibilities the Cologne studio offers for acoustical research through subtractive and additive syntheses. Furthermore, he recognizes the need for this research, stating that 'there is a kind of *tonality* of electronic music; we do not know its details yet, but it will probably be a tonality of timbres' (Eimert 1957, p. 48). For Eimert though, the introduction of new material does not imply a break with Western musical evolution. In his view, the so called 'tonality laws of electronic music' will emerge, on the one hand, from the analysis of sounds by subtractive and additive syntheses, and, on the other, from the creation of pieces within the framework of Western musical tradition.

If one examines the kind of concerns Pierre Boulez expresses in the article 'Tendances de la musique récente' (Boulez 1957), the frailness of his connection with concrete music becomes evident. Boulez considers the 'musical language' to be in a period of assessment and organization, after destructive researches that abolished the tonal world and the regular metric: on the one hand, complex rhythmic structures combined with very elementary centres of tonal attraction were developed by Stravinsky; the second Viennese school, on the other hand, worked towards the dissolution of tonal attractions thus discovering the series, which was differently explored by Schönberg, Berg and Webern. Boulez stresses the idea that Webern alone was aware of the series as 'a way of giving a structure to the sonic space, of *threading* it somehow' (Boulez 1957, p. 29). He explains: 'Whilst melody remained the fundamental element even in the bosom of polyphony, in the serial system as conceived by Webern it is the polyphonic element itself that becomes the basic element; hence this mode of thinking transcends the notions of verticality and horizontality' (Boulez 1957, p. 31). All the same, he adds, rhythm remained unconnected to the serial language,[9] even in Webern.

Boulez then focuses on the music of Varèse, emphasizing two points: in Varèse, 'the function of the chords is no longer traditionally harmonic, but rather appears as a value of a sonic body[10] calculated in terms of natural harmonics, lower resonances and the diverse tensions necessary to the vitality of this sonic body' (Boulez 1957, p. 29); besides, in Varèse intensity plays a structural role. These two points are summed up by Boulez in what he considers to be Varèse's main preoccupation: acoustics proper. In Boulez's words: 'Considering the acoustic phenomenon as primordial in sonic relations, Varèse applied himself to verifying how it could govern musical construction' (Boulez 1957, p. 30). Varèse's refusal of temperament is also noted by Boulez, as well as his proposal of 'non-octaving scales, repeating themselves according to a *spiral* principle, or, to be clearer, a principle whereby the transposition of sound scales is no longer organized in accord with the octave, but rather in accord with different intervallic functions' (Boulez 1957, p. 30). For Boulez, Cage represents the need to extricate oneself from the limitations of the traditional *luthèrie*, rendered obsolete by the eclipse of the tonal system; hence Cage's interest, shared by Varèse, in percussion. Boulez thinks that, within the domain of

percussion, only rhythm can provide a powerful architectural element, other than timbre relations and acoustic relations between the different categories of instruments (skin, wood, metal).

It is when Boulez comments on Messiaen's *Mode de valeurs et d'intensités* that his own musical conception starts taking shape. For him, this piece materializes 'needs scattered almost anywhere in valid contemporary music' (Boulez 1957, p.31): the notion of an organized universe is applied not only to tessituras but also to durations, intensities and attacks. Boulez believes that, while in Varèse's music intensity plays a structural role due to the preoccupation with acoustics, in *Mode de valeurs et d'intensités* all sonorous elements are part of a formal research. In Messiaen's piece this 'universe' is organized modally; what Boulez has in mind is the serial organization of all planes by means of a single unifying principle. The interesting point is that this total unification has roots 'almost anywhere': from Stravinsky, he takes the rhythmic elaboration; from Webern, not only the series as a way of weaving together the horizontal and the vertical dimensions, but also orchestration as a structural element; from Varèse, the structural role of intensity and the exploitation of the non-tempered universe, the latter also being found in Cage. What is more, Boulez's series stretches its long arm over the definition of scales and the creation of sounds themselves. Schaeffer in turn sees himself as the offspring of Varèse's self-fertilization: 'In the paths we were following, Varèse, the American, was our single great man, and the sole precursor anyway' (Schaeffer 1957^{C}, p.20). However, in the same way as Boulez mentions Cage's *lutherie*, while ignoring his æsthetic, it is the originality of Varèse's *lutherie* that Schaeffer stresses in 'Vers une musique expérimentale'.

It has been seen that for Eimert the introduction of new sounds should lead to the discovery of what he called 'the laws of tonality of electronic music'. By default, the means for this end would be the insertion of such sounds into the atonal æsthetic. Boulez for his part is concerned with the elaboration of a compositional method, or rather with rooting this method 'almost anywhere in valid contemporary music'. For Eimert and Boulez, the new instruments do not imply a radical rupture with the traditional musical system, but rather contribute towards its evolution. New technology here is essentially neutral, a mere means for the advancement of Western musical tradition:

> We are lying in wait for an unheard-of sonic world, rich in possibilities and as yet practically unexplored. The consequences implied by the existence of such a universe are just starting to be perceived. I will note anyway the felicitous coincidence—let us not expect it to be too fortuitous, let us not be surprised by the fact that the musicians who, in different countries, have taken an interest in these researches are linked by an indisputable identity of opinion—the felicitous coincidence occurring in the evolution of musical thinking: this happens to have need of certain means for execution at the

> precise moment when electro-acoustic techniques are able to offer such means. (Boulez 1957, p.34)

Boulez's argumentation deconstructs itself similarly to Eimert's (see quotation in page 23): although 'electronic music starts where instrumental music ceases', a formula which, Eimert wisely observes, does not commit him to anything, 'there are doubtless real points of contact, particular connections between traditional and electronic musics.' No surprise then if Eimert 'opens wide the door onto this new sonic world' for Boulez to step in, sense the void, and step back: for Boulez, musical form (that is, tradition) takes precedence over sonic form. Both Boulez and Eimert seem to suggest that it is not because new sounds are available that new musical forms become possible, but rather because the composer has need of new musical forms that new sounds appear. A mystique of the composer's activity is in operation here; the compositional process itself is beyond question. There would be an evolution of musical forms, independent of ends and means; yet, it is the supreme freedom of the composer that is asserted thereby. For Schaeffer in turn new sounds, whether concrete, electronic, magnetophonic or exotic, are essentially a repository of unimagined musical potentialities. He proposes a renewal of forms through the analysis of material, and a reassessment of ends. One could say, paraphrasing Martin Heidegger, that it is the role of the experimental composer to consider carefully and gather together materials, forms and ends; materials, forms and ends in turn owe thanks to the pondering of the experimental composer for the 'that' and the 'how' of their coming into play for the production of the experimental 'œuvre' (see Heidegger 1954, p.8). Looking at the final paragraphs of 'Vers une musique expérimentale', where Schaeffer exposes what all experimental teams, 'whether electronic, concrete, magnetophonic or serial' have in common, one finds the confirmation of this hypothesis.

> 1. All call into question the notion of instrument. Sound can no longer be characterized by its causal element, it has to be characterized by the effect only. Hence it must be classed according to its particular morphology, rather than according to instrumental provenance. It must be considered in itself. The best proof of this: once the most interesting sonorities produced by the new techniques have been recorded on tape, it is impossible to say how, and by what ensemble of procedures or instruments, they have been produced.
>
> 2. Correlatively, it is necessary to admit that the notion of musical note, so intimately linked to the causal character of the instrument, no longer suffices to account for the sonic object. The definition we give of complex note (a simple sonic object having a beginning, a body and a decay) is already infinitely more general. It is important to realize that, given its acoustical constitution and human manipulation, the traditional instrument, whether exotic or classical, cannot produce anything but notes, in the known restrictive sense. It is therefore natural that the introduction of new sonic objects and

> more complex notes coincides with the introduction of non-acoustic instruments and manipulations that are not directly manual.
>
> 3. The classical relationships between composition and performance, between authors and instrumentalists, also find themselves fundamentally changed. In the new musics, the composer is often his own performer, and the score is simply a shooting script. The creation is achieved once for all, by means of a different partition of responsibilities, which resembles that of the production crews in cinema.
>
> 4. Contact with the public is also different. The concert is no longer a spectacle, at least not in the sense we were used to. The conditions of audition entail new elements, simultaneously physical and physiological, individual and social.
>
> As may be seen, these four major transformations of both the musical phenomenon and its communication are on this side of any problem directly concerning expression and impression.
>
> There is also a lot to be said on these points. A lot will be said and a lot has been said during this Decade. However, in my opinion, it would be much preferable to consider only the aforementioned elements. This would greatly simplify the terribly tangled skein of our problems, certainly allowing all researchers to share, with more lucidity and effectiveness, and with less bitterness, the fruits of their different findings. (Schaeffer 1957^{C}, pp. 26–7)

After the Decade, Schaeffer distanced himself from the Groupe de Recherches de Musique Concrète to direct the foundation and management of Radiodiffusion de la France d'Outremer in Northern Africa. His return to France in 1957 coincided with the publication of *Vers une musique expérimentale*. In 'Lettre à Albert Richard', dated 18 May 1957 and published as an overture to *Vers une musique expérimentale*, Schaeffer renounced to the ideal of syncretizing techniques, and proposed what he then called 'method for research after concrete music'. The following year, he withdrew the term concrete music, so as to detach himself from its æsthetic connotations. Simultaneously, he started defining his work as musical research, and the Groupe de Recherches de Musique Concrète was restructured and rebaptized as Groupe de Recherches Musicales, an altogether different institution, accounting for altogether different aims.

In relation to concrete music, experimental music corresponded to the need to generalize the concrete approach, opening it up to new sounds and techniques, reassessing its principles and defining its method. The creation of concrete pieces had led to the formulation of a number of hypotheses; experimental music implied a shift of priorities: stress was laid on verifying the postulates upon which these pieces were based. However, the method of doing this was still an unknown quantity. Although striving towards the goal of a

synthesis, Pierre Schaeffer's ideal of experimental music was historically placed amid the concrete/electronic controversy, which lasted from 1950 to 1955 (cf. Schaeffer 1966, p. 24).

This controversy has customarily been reduced to the choice between two contrasting kinds of material, each representing a mutually exclusive temperament: the intuitive and the rational. It has gone generally unnoticed that two radically different approaches to technology underlie the concrete/electronic dichotomy: the electronic's, to whom technology was, so to speak, neutral, a mere tool for the perfecting of Western musical tradition, and Schaeffer's, to whom new technology implied new thinking, the calling into question of the whole edifice of Western musical culture. On condition that the affinity between Schaeffer's later thinking and structuralism were proved, one could read the concrete/electronic antagonism in the light of those two opposing *Weltanschauungen* defined by Claude Lévi-Strauss' in the 'Ouverture' to *Le cru et le cuit*: the structural and the serial (Lévi-Strauss 1964). In a critique of Lévi-Strauss' text, Umberto Eco has attempted to demonstrate that these so called *Weltanschauungen* are not in fact mutually exclusive, thus redefining the relation between structuralism and serialism. For Eco, 'each serial technique has to be explicated (as regards effectiveness of communication and as opposed to the techniques it denies) through a structural methodology which accounts for the parameters to which consecrated and innovatory forms alike ultimately refer' (Eco 1968^{B}, p. 318; French translation: p. 56). Thirteen years after the Decade Schaeffer will offer, in *Traité des objets musicaux*, his unfinished account of the musical phenomenon in its universality. It remains to be seen whether or not Schaeffer has committed that mistake Eco pointed out in Lévi-Strauss: 'to take his own private language for a metalanguage' (Eco 1968^{B}, p. 311; French translation: p. 51).

M. Pierret *— Would it be exact and judicious then to incorporate this quarter of a century of your sonorous experimentations into the fabric of a writer's or, if you like, philosopher's thinking? In other words, are these long years of radiophonic and then musical experiences to be put between the quotation marks of two texts: the premonitory* Arts-Relais, *unfinished and unpublished, and, twenty years later, the definitive report,* Traité, *meditated and published?*

P. Schaeffer *— I think it's reasonable to say so. I think that, in both cases, language (its logic, the trace it forms of a continuous thinking, the scaffolding it provides to imagination, similarly to the physicist's equation) has served as notation and trail blazer: turned towards the knowledge acquired, so as to clarify the problematic; turned towards the unknown, so as to conjecture its pattern.* (Pierret 1969, p. 91)

CHAPTER II

Three Fundamental Notions

Having drawn a distinction between research into noises, concrete music, experimental music, and musical research, with particular emphasis on Schaeffer's ideal of an experimental music, we need now to examine some fundamental concepts, before expounding his programme of musical research, or solfège. The notions of acousmatic listening, four levels of listening, and sonic object underpin the 'immense logical architecture'[11] of *Traité des objets musicaux* (Schaeffer 1966).

4. ACOUSMATIC LISTENING.

The word acousmatic is thus defined in the *OED*: 'A professed hearer, a class of scholars under Pythagoras, who listened to his teaching, without inquiring into its inner truths or bases.' Schaeffer refers to the *Larousse*: 'Name given to those disciples of Pythagoras, who, for five years, listened to his lessons from behind a curtain, not seeing him and in the most rigorous silence' (Schaeffer 1966, p.91). According to *Larousse*, when used as an adjective the word acousmatic refers to 'a noise that one hears without seeing the cause from which it originates' (Schaeffer 1966, p.91). Schaeffer unearthed this 'ancient neologism' (cf. Schaeffer 1966, p.90) in order to elaborate on an experience which is characteristic of our times, and whose full consequences he proposes to extract: listening (on the radio, record, the telephone or tape) to sounds whose cause is invisible. For Schaeffer, the main consequences of the acousmatic situation are:

1. The identification of the sound source, which, for traditional musicians and acousticians alike, is an important aspect of sound recognition, must happen without the help of vision. One realizes that much of what seems to be heard is in fact simply seen, and sounds as different as those produced by the strings and the winds may be confused.

2. The repeated audition of sounds whose instrumental sources are masked leads one to neglect source identification, and to get interested in sounds in themselves. Another kind of listening emerges: the listening to sonic shapes, which aims at hearing them better, and at describing them by means of an analysis of perceptions. Schaeffer recognizes that 'the Pythagoras' screen is not enough to divert the curiosity from the causal element, to which we are instinctively, and almost irresistibly attracted' (Schaeffer 1966, pp. 93–4). According to Chion, 'the curiosity about the causes subsists in acousmatic listening (and can be even stirred up by this situation)' (Chion 1983, p. 19). The emphasis the acousmatic situation may lay on the absent sound source is illustrated by a comment of Umberto Eco's: 'Smoke is only a sign of fire to the extent that fire is not actually perceived along with the smoke' (Eco 1979, p. 17). Schaeffer thinks that the repetition of the physical signal, which sound recording makes possible, eventually wears out the curiosity for the invisible source, bringing about a more attentive and refined listening. Thus the richness of the perception is progressively revealed.

3. Exact repetition of sound is a new phenomenon, made possible by new machines; it engenders the awareness of changes in our listening, the so called subjectivity. Schaeffer emphasizes that this 'subjectivity' is not an imperfection or 'woolliness' which would blur the clarity of the physical signal. It is rather a question of new and precise (conscious or unconscious) orientations of listening, which reveal new aspects of sound.

The notion of acousmatic listening clearly points to reduced listening, the listening to a sound in itself, without any reference to its source and significance in a code. Schaeffer introduces the notion of reduced listening within the context of four listening functions.

5. THE FOUR FUNCTIONS OF LISTENING.

The argument begins with a meditation, in the manner of Francis Ponge, upon distinctions of meaning between four French verbs: *écouter*, *ouïr*, *entendre* and *comprendre*. Like Ponge, Schaeffer refers to Littré (see Ponge 1961, pp. 18–19, and Ponge/Sollers 1970, pp. 46–7). Hence, a presentation of this notion in English offers insurmountable difficulties:

> *Entendre*: to direct one's ear towards [that is, to listen to], and hence, to receive sonorous impressions [that is, to hear]. *Entendre* [To hear] noises. I *entends* [hear] people speaking in the room beside, I *entends* [understand] that you have news for me. (Schaeffer 1966, p. 103)

Thus, *entendre* can be translated as to listen to, to hear and to understand. Schaeffer defines *entendre* in opposition[12] to *écouter* and *ouïr*:

> 1. *Entendre/écouter*: *entendre* [to hear] is to be sensitive to sounds; *écouter* [to listen to them] is to lend them an ear so as to *entendre* [hear] them. Sometimes, one does not *entend* [hear], although one *écoute* [listens], and often one *entend* [hears] without *écouter* [listening]. (Schaeffer 1966, p. 103)

The *entendre/écouter* opposition can be therefore consistently rendered as hear/listen. The next opposition, *entendre/ouïr,* can also be translated by the same hear/listen in inverse order, that is, listen/hear. The translation presented between square brackets obviously clashes with the etymological considerations of the text: *entendre* and *ouïr* share their Latin origin, while 'to hear' and 'to listen' are both Germanic; moreover, the defectiveness of the verb *ouïr* is absent from its English equivalent, 'to hear'.

> 2. *Entendre/ouïr*: these two words, though of very different origin, have become perfectly synonymous today. *Ouïr* [Hear] was the proper word, little by little displaced by the figurative word *entendre* [listen]. *Ouïr* [To hear] is to perceive with the ear; *entendre* [to listen] is, properly, to pay attention. Usage alone has given the latter the oblique sense of *ouïr* [to hear]. The only difference now is that *ouïr* [to hear] has become a defective verb, and its use is restricted. When the meaning may be equivocal, one must not hesitate to use *ouïr* [to hear]. Hence this line of Pacuvius on astrologers: 'Better *ouïr* [to hear] them than *écouter* [to listen to] them.' *Entendre* here would be nonsensical. (Schaeffer 1966, p. 103)

Schaeffer then comments on the etymological sense of *entendre,* observing that, originally, *entendre* meant 'to tend towards, and hence, to have the intention, the design of: *"Comment l'entendez-vous?"* [How do you understand it?]' (Schaeffer 1966, p. 103). This points to the third acceptation of *entendre,* which in English translates as 'to understand'. Finally, Schaeffer distinguishes between the verbs *entendre, concevoir,* and *comprendre.*

> 4. *Entendre/concevoir/comprendre: Entendre* [to understand] and *comprendre* [to comprehend] mean to grasp the sense of. This distinguishes them from *concevoir* [to conceive], which signifies to grasp mentally. I *entends* [understand] or *comprends* [comprehend] this sentence, rather than I *conçois* [conceive] it. On the contrary, in Boileau's verse: 'What one *conçoit* [conceives] well, one enunciates well', *entendre* [to understand] or *comprendre* [to comprehend] would be unsuitable. The nuance between *entendre* [to understand] and *comprendre* [to comprehend] is different: the idea of *entendre* [to listen to + to understand] is that of paying attention to, being good at, whilst

> the idea of *comprendre* [to comprehend] is: to grasp. I *entends* [understand] German, that is, I know it, I am good at it. 'I *comprends* [comprehend] German' would say less. On the contrary, I say that I *comprends* [comprehend] a demonstration. (Schaeffer 1966, pp. 103–4)

From these considerations, Schaeffer extracts the following definitions:

> 1. *Écouter* is to lend an ear to, to interest oneself in. I actively direct myself towards someone or something which is described or signalled by a sound.
>
> 2. *Ouïr* is to perceive with the ear. In opposition to *écouter*, which corresponds to the more active attitude, what I *ouïs* is that which is given to my perception.
>
> 3. From *entendre* I shall retain the etymological sense only: 'to have an intention'. What I *entends*, what is evident to me, is a function of this intention.
>
> 4. *Comprendre*, to grasp, has a dual relationship with *écouter* and *entendre*. I *comprends* what I aimed at in my *écoute*, thanks to what I have chosen to *entendre*. But, reciprocally, what I have already *compris* directs my *écoute*, informing what I *entends*. (Schaeffer 1966, p. 104)

These definitions will inform the notion of four listening functions. Within the context of these functions, *écouter*, *ouïr*, *entendre*, and *comprendre* will be respectively translated as *to listen to*, *to hear*, *to listen out for*, and *to comprehend*. Thus, the previous passage will read as follows:

> 1. *To listen to* is to lend an ear to, to interest oneself in. I actively direct myself towards someone or something which is described or signalled by a sound.
>
> 2. *To hear* is to perceive with the ear. In opposition to to listen, which corresponds to the more active attitude, what I hear is that which is given to my perception.
>
> 3. From *to listen out for* I shall retain the [etymological] sense [only]: 'to have an intention'. What I tend towards, what is evident to me, is a function of this intention.
>
> 4. *To comprehend*, to grasp, has a dual relationship with to listen to and to listen out for. I comprehend what I aimed at in my listening, thanks to what I have chosen to listen out for. But, reciprocally, what I have already comprehended directs my listening, informing what I listen out for. (Schaeffer 1966, p. 104)

This translation is obviously not entirely satisfactory, for it is clear from the above definition of *entendre*, where the polysemy of this verb resounds ('What I *entends*...': What I understand, listen out for, tend towards, hear, comprehend...), that Schaeffer is not going to do what he promises: to retain only the etymological meaning of *entendre*. His next step is to make some comments of a phenomenological nature on these activities.

6. HEARING, LISTENING TO, LISTENING OUT FOR, COMPREHENDING.

1. Hearing.

One never stops hearing: the world is always there, offering itself to us, and that world is sonorous, as much as tactile and visual. Silence as such does not exist: in the most absolute silence, our own heartbeats and breaths become audible. An entirely silent world therefore seems unreal: that continuous murmur is part of the feeling of our own duration. As has been seen, Schaeffer conceives of 'to hear' as 'being sensitive to sounds' which reach not only the ear, but also consciousness. He presents three examples which demonstrate that the sounds one hears have an existence for consciousness: we instinctively adapt the volume of our voices to the volume of the background noise; we may be so engrossed in the action of a film as to pay no attention at all to the music which accompanies it, however, when listened to on the radio, this music will evoke, even before we are able to identify it, the same emotions the film aroused; some people who live close to railway stations wake up if the night train does not pass at the usual time. Schaeffer shows that it is always indirectly, through reflection or memory, that one becomes aware of the soundscape:

> I listen to the clock striking the hour. I know this is not the first stroke. Hastily, I mentally reconstitute the first two strokes, which I *had heard*, placing the one I have listened to as the third, even before the fourth stroke sounds. Had I not attempted to know the time, I should actually have ignored that the first two strokes reached my consciousness... Someone is speaking to me, and I think of something else. The person who speaks gets upset and stops talking. I listen to this ominous silence. I manage to snatch from the background noise, before it sinks there forever, the last half of the sentence he has just uttered. With some luck, this will allow me to give a reply, persuading him that the distraction was no more than an illusion. (Schaeffer 1966, p. 105)

2. Listening to.

Schaeffer then assumes that one is listening to this person who speaks, which implies that

one is not listening to the sound of his voice, but rather surrendering to his intention of communicating something, and therefore selecting, from among what is offered to one's hearing, semantic indications to listen to. Schaeffer proposes the following situation: the person who speaks has an accent. At the first meeting, this accent may appear striking, but some time later, meeting the person again, we shall try to ignore it. However, when attempting to recall the conversation spontaneously (evoking an environment etc.) rather than intellectually (recapitulating points and reaching conclusions), not only the things said will come back to us: an accent, a phrasing, and a clearly identifiable voice will also reappear. Schaeffer concludes that this ensemble of features was being heard all the time, even though we may have been incapable of analysing it; and he adds:

> As may be seen, to listen is not necessarily to get interested in a sound. It is even only exceptionally that to listen is to get interested in a sound; to listen is rather to aim at something else through the intermediary of sound. (Schaeffer 1966, p. 106)

Ultimately, the passage through hearing may be ignored, and to listen thus becomes synonymous with to obey ('Listen to your father!') or to believe, as in Pacuvius' sentence (see § 5). According to Schaeffer, 'when I listen to what I am being told, I tend, through words (and beyond a formulation that may be imperfect), towards ideas that I seek to comprehend' (Schaeffer 1966, p. 106). He gives three examples which point to what he calls reduction of listening:

> I am listening to a car. I place it, I assess how far away it is and, eventually, I recognize its make. What do I know about the noise which has provided all this information? The quicker and clearer the information, the poorer my description of the sound will be.
>
> On the contrary, it is precisely to the car noise that I lend an ear if this car is mine and the engine seems to be making 'a funny noise'. All the same, my listening remains utilitarian, for I am trying to infer data concerning the engine condition: given my uncertainty regarding the causes, I am forced first to go through an analysis of the effects.
>
> Finally, I can listen with no aim other than *hearing better*, as I had initially proposed to do. That analysis, which in the previous case was a necessary stage, becomes an aim in itself. Being turned towards the event, I was adhering to my perception, I was using it unconsciously. Now I stand back from it, I stop using it, I am *disinterested*. To listen in this manner is still to aim, through the sound (itself transient), at something other than the sound: a sort of 'sonic nature' taking place in my entire perception. (Schaeffer 1966, pp. 106–7)

3. Listening out for.

When considering listening out for from a phenomenological angle, Schaeffer still places *entendre* in a dual opposition: on the one side *ouïr/entendre*, on the other *écouter/entendre*. So far as possible, *entendre* has been translated as listening out for. This obviously eliminates much ambivalence, turning the English text into a black and white copy of an original which is very nuanced and requires from the reader a great deal of semantic decision-making. It must be said that 3.a. and 3.b. (*ouïr/entendre* and *écouter/entendre*) could perhaps just as well be translated as 'hearing/listening to' and 'hearing/listening out for' respectively; what is important though, is that, in any case, the notion of listening out for will gradually appear as distinct from listening to.

3.a. Hearing/listening out for.

Schaeffer deems it impossible for someone who listens not to make selections from among what is offered to his hearing. There is no background noise unless in an organized ensemble where some noises play this role. Sound may sink into the background, provided one is engrossed with visual perceptions, thoughts or actions. To dismiss the 'impartiality' of listening, he suggests an experiment: what will happen if I do not move, close my eyes, and empty my mind?

> I place the noises, distinguishing for instance those which are near from those which are far, and those coming from the outside from those coming from the inside; inevitably, I start favouring some in relation to others. The clock tick-tock imposes itself, obsessing me and obliterating everything else. In spite of myself, I impose a rhythm upon it: weak beat, strong beat. Powerless to destroy this rhythm, I attempt at least to replace it by another. I start asking myself how I could ever have slept in the same room where this exasperating clock was... but the violent braking of a car in the street is enough to make me forget about the clock. Now, so far as I am aware, my room could well be an island of silence shaken by external rumours. However, I listen to someone knocking on the door, and the ensemble of these changing organizations sinks into the background at once while I open my eyes and stand up to open the door. (Schaeffer 1966, pp. 107–8)

Whence Schaeffer concludes that the sonorous background is charted by fragments, thanks to changes which take place there. These changes may call a paradox to the listener's attention: the more his intention is precise, the more the organization will be definite, and the more it will seem to impose itself from the exterior. Besides, changes themselves are a function of the listener's intention.

> Thus, participating in an informal conversation between various persons, I move from one subject to another, and from one partner to another, not even for one instant suspecting the bizarre confusion of voices, noises, and laughter from where I create an original composition, which is entirely different from the one each of my partners is creating by himself. For any of these compositions to be revealed to me, a tape recorder would be needed. However, as the tape recorder makes no choices, these compositions will be often incomprehensible. (Schaeffer 1966, p. 108)

3.b. Listening to/listening out for.

Schaeffer enlarges on a particular case: one listens in order to hear. This may happen for two reasons: one ignores the source of the sound, and thus needs to go through the sound description; one wants to ignore this origin, focusing exclusively on the perception of the sound itself (reduced listening). The rescuing of a perception from the background to which it had been relegated does not make it display all of its qualities at once: successive selections will continue to be made, and one or another aspect of the perception will be considered in turn.

> Thus, when I look at a house, I place it in the landscape. However, if I continue to be interested in this house, I will examine the stone colour, the material, the architecture, and the detail of a sculpture above the door. Then I return to the landscape, which now I view in terms of the house, noticing that the house has a 'beautiful view'. I see the house again as a whole, as I did in the beginning, but my perception has been enriched by my previous investigations. Furthermore, it is beyond me to look at this house as if it were a rock or a cloud. This is a house, a piece of human work conceived to shelter human beings. It is with reference to this sense that I see and assess the house. My inquiry, like my assessment, will be also different depending on whether my eye is a prospective owner's, an archæologist's, a walker's, or an Eskimo's, that is, an igloo expert's. (Schaeffer 1966, pp. 108–9)

This pattern of perception, when transposed to the realm of sounds, is termed by Schaeffer qualified listening. The diversity of such a listening stems from three factors: a fundamental law of perception, which dictates that the object appear in successive 'sketches', but never entirely be exhausted; the multiplicity of the listener's previous knowledge and experience, which lends different meanings to the object; the variety of directions in which he orientates his listening, his intentions of listening. In order to illustrate the notion of intention of listening, Schaeffer borrows an example from Max Frisch's novel *Homo Faber*:

> 'Every morning I was awoken by a strange noise, half industrial, half musical, a rumour I could not explain and which, rather than loud, was frenetic as chains, metallic,

> monotonous; it was probably a mechanism, but I could not guess what and, afterwards, when I would go for breakfast in the village, it would have stopped and nothing would be seen.'
>
> 'We packed on Sunday... And the strange noise which had woken me up every morning proved to be music, the din of an old marimba, a hammering without timbre, a terrible and totally epileptic music. It was a matter of some feast connected with the full moon. Each morning, before work in the fields, they were training to accompany the dance: five Indians who, with little hammers, furiously knocked on their instrument, a kind of xylophone as long as a table.' (Schaeffer 1966, p. 109)

In both paragraphs, the narrator has heard, but not listened to, the same thing. 'In the first case, he listened to a *noise* whose cause he tried to explain; in the second, being informed about the the causes, he *appraised* a piece of music' (Schaeffer 1966, p. 109). Having managed to qualify listening, he began to listen out for, and then to comprehend, according to a precise signification.

4. Comprehending.

In the example above, it is not directly through sounds that the narrator becomes aware of having listened to music, but rather through vision. Schaeffer says that the narrator comprehended it was a matter of music: one can comprehend the cause of that to which one listens by comparing diverse perceptions or by a complex of deductions. Or else, through listening, it is possible to comprehend something that stands in an indirect relation to that which is listened to: someone notices that the birds have stopped singing, that clouds are low and the heat is oppressive; he thus comprehends that a storm is about to come. To comprehend implies a conscious activity of the mind, which not only accepts a signification, but also abstracts, compares, deduces and relates information from different sources and of various natures. The aim of this activity is either to clarify the initial signification or to extract a complementary one:

> For the housewife, the noise that comes from the room beside and gives her a start is heavy with meaning: it is a noise of a fall or breaking. She listens to it as such. On the other hand, she realizes that her child is no longer with her, and she remembers that the Chinese vase has been placed, quite imprudently, on a table within his reach; she will easily comprehend that the baby has just broken her Chinese vase.
>
> I listen to and I understand what someone tells me, but, picking out contradictions in the story and comparing it with certain facts which furthermore I know, I also comprehend that this person is lying. Suddenly, my aroused suspicion gives a different orientation

> to my listening, and I also comprehend his hesitations, certain breaks in his voice, and 'even glances that you would think were meaningless'. (Schaeffer 1966, p. 110)

Schaeffer organizes these four listening functions in a table, before recapitulating the results of the semantic and phenomenological investigation, and setting out to consider the musical implications of these activities.

IV. COMPREHENDING	I. LISTENING TO
III. LISTENING OUT FOR	II. HEARING

> 1. I listen to what interests me.
>
> 2. I hear, unless I am deaf, sonic events around me, regardless of my activities and interests.
>
> 3. I listen out for according to what interests me, to what I already know, and to what I try to comprehend.
>
> 4. At the conclusion of the listening out for, I comprehend that which I was trying to comprehend, and which was the reason I was listening. (Schaeffer 1966, p. 113)

This summary in amplified by comments aiming at a phenomenology of musical perception:

> 1. Silence, supposedly universal, is disturbed by a sonic *event*. This may be a natural event (a rolling stone, the grating of a weather vane), or for instance the voluntary emission of a sound by an instrumentalist. In any case, what we spontaneously listen to at this level, is the energetic anecdote the sound translates.
>
> 2. Corresponding to the objective event, we find in the auditor the subjective event represented by the *raw perception* of the sound, which is linked on the one hand to the physical nature of this sound, and on the other to general laws of perception. It is reasonable to assume that these laws, roughly speaking, are the same for all human beings (as the Gestaltists' descriptions do).
>
> 3. Once this perception is related to past experiences and prevalent contemporary interests, it gives rise to a *selection* and to an *appraisal*. We say that it has been *qualified*.

> 4. Qualified perceptions are orientated towards a particular form of knowledge, and the individual ultimately comes to *significations*, which are *abstract* in relation to the sonic concrete itself. In general terms, at this level the auditor comprehends a certain *language* of sounds. (Schaeffer 1966, p. 114)

These four terms are involved in Schaeffer's 'communication circuit of sound, from emission to reception' (Schaeffer 1966, p. 113), which is probably an allusion to Ferdinand de Saussure's *circuit de la parole* (Saussure 1916, pp. 27–32). It is important to note that the focus of Schaeffer's and Saussure's inquiries is consciousness, and more precisely, the receiver's consciousness. A critical implication of this fact will be discussed in conclusion. Having condensed conclusions into another succinct scheme, Schaeffer enlarges upon each item.

The first function of listening, listening to, highlights the event; one listens in order to identify the source of the sound, posing the questions: 'What is it?', and 'What has happened?' The auditor does not dwell upon perception itself; instead, he unconsciously uses the sound as an index[13] pointing to some external event. Because of its frequency, spontaneity, and primitiveness, this function seems particularly important: thus, from time immemorial, humans have been warned against danger and guided in their actions. Schaeffer observes that, as a rule, the sound is immediately referred to its origin but, if the indices are ambiguous, a number of comparisons and deductions may be necessary (cf. quote *supra*: 'given my uncertainty regarding the causes, I am forced first to go through an analysis of the effects'). He adds that the scientific curiosity, although involving highly complex data, usually pursues an aim which is fundamentally similar to that of spontaneous event-perception (cf. quote and comment in pages 43–4).

Schaeffer's remarks on the second function of listening, hearing, already sketch the notion of sonic object. He proposes to turn that question, 'What is it?', away from the event which originates the sound, focusing on sound itself, or rather on its perception. This is to say that the perception becomes an object, the object of the inquiry, which implies a dismissal of the opposition between objectivity and subjectivity, a suspension of that duality: external world and perception thereof. Schaeffer names 'raw sonic object' a sound thus perceived (Schaeffer 1966, p. 115). It is in the nature of perception that the objects are given under the form of successive sketches (cf. Sartre 1936, pp. 1–6, and 1940, pp. 3–21). It follows that 'in the sonic object I hear, there is always a *more* to listen to' (Schaeffer 1966, p. 115). The sonic object is therefore an inexhaustible source of perceptual possibilities. In Schaeffer's words: '...at each repetition of a recorded sound, I hear the same object, and I always identify the object as this very specific object, despite the facts that I never listen to it similarly, that from strange it becomes familiar, that a diversity of its aspects are successively perceived, and hence the object is never the same' (Schaeffer

1966, p. 115). One may ask then whence the identity of the sonic object springs. A more precise definition will illuminate this point: 'It (sc. the sonic object) is that which remains identical through the flux of diverse and successive impressions I have of this object, and in relation to my diverse intentions concerning it' (Schaeffer 1966, p. 115). At the level of hearing, the object offers itself as a possibility, a kind of degree zero of perception (see Barthes 1953).

As regards the third function, listening out for, Schaeffer affirms that auditors gathered round a tape recorder will listen to the same sonic object; nevertheless, they will not listen out for the same things. Each auditor selects and assesses different aspects of the object; his listening is biased towards one or another particular aspect, thus giving rise to such and such a qualification of the object. These qualifications vary, as listening does, in connection with each previous experience, and with the orientation of curiosity, at each time, towards this or that new experience. Schaeffer nevertheless ratifies the identity of the sonic object: 'All the same, the unique sonic object, which renders possible such a multiplicity of qualified aspects of the object, remains under the form of, one might say, a halo of perceptions to which the explicit qualifications implicitly refer' (Schaeffer 1966, p. 115). Going back to the example of the house: whilst one focuses on each of the aspects, such as the window or the sculpture above the door (that is, the qualified perception), the perception of the house remains present, and both the window and the sculpture are seen as part of this house.

Commenting on the fourth function, comprehending, Schaeffer observes that a sound can be treated as a sign introducing the auditor into a system of values, and leading him to the consideration of the sense of this sound. The most blatant example is speech. Among the many possible signifying listenings, Schaeffer is of course particularly interested in the musical one. He believes that sonic values can ultimately be separated from their sonic context, which thus would play the role of a medium. It is generally accepted that communication brings about a union of minds. At both extremes of the communication circuit, and at reception in particular, the contingency of the sonic vehicle is discarded in favour of the signifying content. Traditional musical values are no exception: musical signs exist before their sonorous realization, and one strives to perfect the latter with the former in mind, rather than the other way round. This is what allows Schaeffer to speak of abstract significations at this level, as opposed to the material concreteness of level one. He summarizes (see figure 1):

1. LISTENING: —for me: indices; —facing me: exterior events (agent/instrument). Sound *emission.*

2. HEARING: —for me: raw perceptions, sketches of the object; —facing me: raw

sonic object. Sound *reception.*

3. LISTENING OUT FOR: —for me: qualified perceptions; —facing me: qualified sonic object. *Selection* of some particular aspects of sound.

4. COMPREHENDING: —for me: signs; —facing me: values (sense/language). *Emergence* of a sound content, and *reference* to, *comparison* with extrasonorous notions. (Schaeffer 1966, p. 116)

Finally, Schaeffer makes some comments on this scheme:

The division of listening into four functions does not imply a temporal succession; the decoding of a perception is instantaneous, even when the four functions are involved. Although qualified perceptions have been ascribed to sector 3, this qualification is enriched by the tacit reference to the events of sector 1, the values of sector 4, and the sonic detail of the raw sonic object of sector 2. Whether the auditor seeks to decode the meaning of a series of sonic signs, or whether he attempts to decipher sonic indices in terms of events (physical, acoustic or instrumental), he has direct and spontaneous access to objective results at 4 (signs) or at 1 (indices). Nevertheless a different 'short circuit' is involved in each case. In the first, the signs obtained at 4 emerge from the qualified listening at 3 (3→4); in the second, the raw sonic object at 2 is organized in indices at 1 (2→1). Doubts regarding the perception of the final object, in whichever sector this may be, will give rise to an investigation which consists in giving prominence to the partial objects of listening, referring them to one another. Thus, a series of listenings aiming at investigating a particular sector will generate results in the four sectors. The systematic audition of new objects will give rise to important divergences between the various auditors. However, after a large number of repeated listenings, both individual and collective, an agreement is likely to be reached. This is due to the eventual exhaustion of the virtualities of sector 2 (raw sonic object). Thus, a certain intersubjective consensus will ensue on comparison of observations.

Schaeffer's text on the four listening functions follows a very clear pattern, which will be called expansion/condensation. 1) First expansion: lexical considerations on the French verbs *entendre, écouter, ouïr, concevoir,* and *comprendre*; the argument is based on *Littré* (a fact in itself significant) and hinges on the polysemy of the verb *entendre,* which is defined within the context of the paradigmatic oppositions *entendre/écouter, entendre/ouïr* and *entendre/comprendre.* 2) First condensation: the etymological sense of *entendre,* that is, 'to tend towards', is privileged, and specific meanings are ascribed to *ouïr, écouter,* and *comprendre* (*concevoir* is cast aside); this notwithstanding, *entendre* will appear throughout the text within the context of the *entendre/écouter, entendre/ouïr* and *entendre/comprendre*

oppositions, as well as in its etymological acceptation. 3) Second expansion: those paradigmatic oppositions provide the basis for a phenomenological analysis of four listening functions, namely listening to, hearing, listening out for, and comprehending; in the course of this analysis, the notions of reduced listening and intention of listening emerge. 4.a) Second condensation: a table of functions is sketched; listening to, hearing, listening out for, and comprehending, are succinctly defined within a phenomenological framework. 4.b) Expansion of the second condensation: the definitions presented in *4.a* are reworked so as to outline a phenomenology of musical perception. 5) Third expansion: each item of *4.b* is enlarged upon, and what was initially the sketch of a phenomenology of musical perception, becomes the sketch of a phenomenological semiology of musical perception. 6) Third condensation: the results are organized in a table (figure 1). Having summarized his whole argument in this new table, Schaeffer still comments on the actual working of the four listening functions.

From the second table, which adds new material to that sketched in *4.a*, Schaeffer derives four oppositions: abstract/concrete, subjective/objective (or subjective/intersubjective), natural/cultural, and ordinary/proficient. Sectors 3 and 4 (the left quadrants) are considered abstract, whilst sectors 1 and 2 (the right quadrants) are concrete. On the other hand, sectors 1 and 4 (the upper quadrants) are seen as objective (or, more correctly, intersubjective), whilst sectors 2 and 3 (the lower quadrants) are subjective. So far as objectivity and subjectivity are concerned, Schaeffer himself will question this classification (Schaeffer 1966, pp. 316–19). Nonetheless, at this stage, it is licit to state the following: sector 1 (listening to) is concrete and objective; sector 2 (hearing) is concrete and subjective; sector 3 (listening out for) is abstract and subjective; sector 4 (comprehending) is abstract and objective. Schaeffer says in relation to the subjective/objective duality:

> Each one listens out for that which he is able to in sector 3, knowing that the possibility of hearing something pre-exists in sector 2. On the other hand, there are reference signs (sonic and musical) which, being proper to a given civilization, are therefore objectively present in a certain sociological and cultural context. Likewise, within the context of scientific experimentation, corresponding to sectors 2 and 3, one finds observations which are very closely dependent on the observers, and opposed to the ensemble of knowledge to which these observations are referred (4) in order to explain or determine the event (1). (Schaeffer 1966, p. 119)

In other words, listening out for and hearing depend on the subject's intellection and physiology, respectively. Codes and events, on the contrary, have an existence outside the subject. In the second half of this quote, scientific research becomes a metaphor for Schaeffer's notion of listening functions, and the meaning of his musical research is thus hinted at. The scientist has a synthetic perception of a given phenomenon (sector 2,

hearing) whose causes he seeks to explain (sector 1, listening to). One assumes that the ensemble of scientific knowledge (sector 4, comprehending) has not been able to elucidate the phenomenon in question; thus he will have to scrutinize this phenomenon, dwelling upon details that his intuition will point out to him (sector 3, listening out for), and which may be unconnected to that ensemble of knowledge. If he succeeds in explaining the phenomenon, the whole corpus of scientific knowledge will have to be reformulated so as to take into account the new data. As regards the abstract/concrete duality Schaeffer states the following:

> Whether it is a matter of the qualified listening at the subjective level, or of the values and the knowledge that emerge at the collective level, the whole endeavour in sectors 3 and 4 is analytical, and consists in retaining only those *qualities* of the object which will allow it to be compared with other objects, or referred to signifying systems. On the contrary, at 1 and 2, be it a question of all the perceptual virtualities contained in the sonic object, or of all causal references contained in the event, listening turns towards a concrete given, inexhaustible as such, though particular. (Schaeffer 1966, p. 119)

Or else, listening out for and comprehending are selective processes bearing on qualities of the object. On the contrary, listening to and hearing bear on the materiality of the object itself.

Natural listening essentially uses a sound to obtain information about an event; it is universal among humans, and also shared by some animals, whose ear may be finer than ours. This is tantamount to saying that, besides their hearing being 'physically' better, they have a greater facility to deduce from sonorous indices the circumstances which have produced the sonic event (or those which this event may reveal). The focus here is on sector 1 (listening to), and one assumes that sector 2 (hearing) is particularly developed. Schaeffer concludes that what he has defined as concrete functions (listening to and hearing) have some sort of priority, for they are used spontaneously and universally. On the contrary, rather than to the event, one may turn towards explicit conventions (codes such as those of languages, Morse signals, bells or horns), or towards musical conditionings practised by groups within geographic and historic boundaries. Thus, turning away from the sonic event (though still hearing it) and the circumstances concerning its emission, one directs oneself towards the message, the signification, and the values hosted by the sound. Since this listening varies from one group to another, and as even the most intelligent animals, Schaeffer affirms, can only very marginally partake of it (at the expense of an unnatural training), this listening may be considered less universal. Schaeffer calls it cultural. The focus here is on sector 4 (comprehending). There is therefore a correspondence between the abstract/concrete and cultural/natural oppositions, with the particularity that the latter

emphasizes the upper quadrants (comprehending and listening to), that is, the objective functions.

The final opposition Schaeffer derives from the table of four listening functions is that between ordinary listening and proficient listening. By means of this opposition, he stresses differences of competence and quality in listening. Whilst ordinary listening is characterized by a confusion of intentions, 'proficient listening deliberately chooses, among the bulk of things to listen to, that which it wants to listen out for and elucidate' (Schaeffer 1966, p. 121). In ordinary listening one is always open to direct oneself towards one or another dominant perception (natural or cultural), though the ear may be uncultivated. Proficient listening on the other hand, given the intention of listening to this rather than that, and given different trainings and competences, has none of the universality and overall intuition which are among the advantages of ordinary listening. Schaeffer admits that ordinary listening concerns itself very little with sectors 2 (hearing) and 3 (listening out for); instead, it goes at once to the event (1) and to the cultural signification (4), that is, the objective sectors, but the analysis carried out there remains relatively superficial.

> I listen to the high tones of a violin. However, I ignore that, being more musical, I would have listened to a number of details concerning the quality of the violin or of the performance, the correctness of the note played, etc., to which I have no access given my lack of special training. (Schaeffer 1966, p. 121)

This listening may be considered 'subjective', not because one tends towards anything whatsoever, but because neither the hearing nor the ear have been cultivated. This uncultivated ear has nevertheless the capability of opening itself to possibilities which the specialized ear will ignore:

> Let us consider now an acoustician, a musician and... a Far-West Indian. The same horse gallop will be heard by them in very different ways. The acoustician will immediately have an idea of the constitution of the physical signal (frequency band, attenuation caused by the transmission, etc.); the musician will spontaneously analyse rhythmic groups; the Redskin will deduce the danger of a hostile approach, more or less numerous or distant. (Schaeffer 1966, p. 121)

The general tendency is to consider such listenings as more 'objective'. Schaeffer thinks this is correct in so far as they aim at different objects—the sound being only a medium thereof—which are defined in, and referred to sectors 1 (listening to) and 4 (comprehending). Such an objectivity is nevertheless made possible only by a strong contribution of subjectivity, since 'in the consciousness of each of these various auditors, the sonic object,

raw or qualified, is at each time differently perceived or analysed' (Schaeffer 1966, p. 122). This explains usual misunderstandings between experts in different fields: though their ears receive the same physical signal, their perceptual activity, from the auditive sense to the mind, works quite differently. Schaeffer warns against the terms objectivity and subjectivity as applied to proficient and ordinary listenings, respectively: one can also maintain that ordinary listening remains more open to objectiveness, though the individual may be less competent, whilst proficient listening is marked by the individual's intention, though his activity turns towards objects which are much more definite. Thus, in Schaeffer's terms, the proficient/ordinary opposition is parallel with the subjective/objective opposition.

7. THE PHENOMENOLOGICAL STATUS OF THE SONIC OBJECT.

The notion of sonic object was the focus of the first theoretical concerns of concrete music (see Schaeffer 1952^{A}, pp. 143–56, and 1952^{B}). In *Traité des objets musicaux* Schaeffer expounds this notion on three occasions, and within three different frames of reference: in book I, 'Making Music', the sonic object is negatively defined; in book II, 'Listening', it appears in the context of four listening functions as corresponding to a particular intention of listening (see §§ 4 and 6); in book IV, 'Objects and Structures', the sonic object is approached from a philosophical angle. This search for theoretical definition is embedded in the concept of experimental research, which Schaeffer construes as comprising three stages: accidental finding, experience, and explanation. To explain the sonic object, he calls on phenomenology, Gestalt theory, and linguistics: 'Let me choose among the intellectual tools others have spent their lifetimes forging, those suitable to my needs' (Schaeffer 1966, p. 262). Like concrete music and his ideal of an experimental music, Schaeffer's explanation is a *bricolage*. He improvises 'new uses for things originally meant for something else' (Schaeffer and Hodgkinson 1987, p. 5). The rule of *bricolage* is 'to make do with "whatever is at hand"' (Lévi-Strauss 1962, p. 17), investing a new structure with disused remnants of old structures (Genette 1963, p. 37). One saves up by not making it to measure, at the cost of a double operation: analysis, i.e. extraction of various elements from organized ensembles, and synthesis, i.e. organization of these elements into a new ensemble where ultimately they will be entirely detached from their original functions (Genette 1963, p. 37). For Gérard Genette, this procedure is typically structuralist (Genette 1963, p. 37). Schaeffer nevertheless suggests an intrinsic affinity between his own concerns and Edmund Husserl's:

> For years, I have therefore often done phenomenology unknowingly, which is after all better than speaking of phenomenology without practising it. Only afterwards have I recognized that the conception of object postulated by my research had been defined

> by Edmund Husserl with an heroic demand for precision, to which I do not lay claim. (Schaeffer 1966, p. 262)

Husserl distinguishes between science of the natural sort and philosophical science, the former originating from the natural, the latter from the philosophical attitude of mind (Husserl 1950, p. 13). For him, phenomenology denotes a science, a system of scientific disciplines, but it also and above all denotes a method and an attitude of mind, the specifically philosophical attitude of mind, the specifically philosophical method (Husserl 1950, pp. 18–19). Schaeffer found in Husserl's phenomenology a foundation for his critique of *elektronische Musik,* which in *Traité des objets musicaux* appears in the guise of *à priori* music. For Husserl, a 'judgment is *à priori* if the object of the judgment does not have to be given in a perception' (Nakhnikian 1964, p. xii). The term *à priori* music epitomizes the disregard for the perceptual given whereby Schaeffer characterizes the parametric approach. On the contrary, the notion of sonic object implies not only an awareness of the perceived object, but also of the perceptual process which gives this object to perception:

> To put it into a simple and summary fashion, the phenomenologist is in search of a 'pure' or 'reduced' object, the essence of a special thing or of a process, such as seeing. He supposes that the process is unclear and indistinct in its everyday context. In the case of seeing, the 'pure' or 'reduced' phenomenon would be *seeing* plus a *cogitatio,* an act of attention focused upon seeing, to find out what seeing *is.* In the natural, everyday context, there is simply seeing. (Nakhnikian 1964, p. xviii)

Nakhnikian expounds the three steps of the phenomenological method, each of which is a refinement of Descartes' method of doubt (Nakhnikian 1964, pp. xvii–xviii). The first step is phenomenological reduction, the suspension of all beliefs characteristic of the natural attitude (the attitude of common sense and science), which Husserl defines as 'untroubled by the difficulties concerning the possibilities of cognition' (Husserl 1950, p. 1). When one perceives an object, one believes that a physical object is present 'out there'. However, this belief is neither necessarily true nor necessarily false. The phenomenologically reduced state of the given holds in abeyance every such belief. The same happens with mathematical objects. Taking a phenomenological look at a number, one will not include in one's thought of it that this number has an objective, extramental though not physical, existence. Phenomenological reduction is also called bracketing, or ἐποχή (epoché). The second step is eidetic abstraction: in the occasion of the perception of an object one brings oneself to grasp perception as a universal. A universal is the property predicated of all individuals of a certain sort or class, as redness is a universal, predicated of all red objects (cf. Speake ed. 1979, p. 360). The universals that become objects of phenomenological investigation can only be had through actual experience. The phenomenologist 'takes a look' at what is

going on when he is actually seeing something; then he describes what seeing is as such as against *this* occasion of his seeing *that* object. The third step is to discern the manner in which objects of cognition are constituted in cognition. More than simply looking at the reduced phenomena, this requires a careful scrutiny of the manner in which, within cognition, objects are compounded or synthesized according to stable regularities that are not psychological laws of association but are rather the forms of cognitive acts.

What follows will present Schaeffer's concept of sonic object as expounded in book IV of *Traité des objets musicaux*. Schaeffer starts by remarking that the object usually appears in language, classical or colloquial, as a vis-à-vis of the subject: the object of one's concerns, hatred, or studies; an object is any point in the world to which an activity of consciousness is applied. It may be an ideal object, existing in consciousness only, such as a logical proposition, an abstract category, language, or even music when considered independently of its concrete realization. For Husserl, the object is the 'identity centre immanent in each particular actual experience, and nevertheless transcendent in the identity which surpasses these particular experiences' (Husserl quoted by Schaeffer 1966, p.263 from *Logique formelle et logique transcendantale*). The object is immanent in so far as it constitutes an intentional unit corresponding to acts of synthesis; those various actual experiences tend towards and are centred on the object, so much so that one can only account for the structure of one's consciousness by recognizing it as being invariably the 'consciousness of something'. In this connection, the object is contained in consciousness. However, the object is also transcendent in so far as it remains the same throughout the flow of impressions and the diversity of consciousness modes; the perceived object is in no way confusable with its perception.

> Let us begin with an example. I continuously see this table; I turn round it and, as usual, I change position in space; I am conscious all the time of the corporeal existence of one and the same table which, in itself, remains unchanged. Now, the perception of the table does not cease varying; it is a continuous series of changing perceptions. I close my eyes. I do not relate to this table through my other senses. I no longer have any perception of it. I open my eyes and the perception reappears. *The* perception? Let us be more precise. When reappearing, the perception is by no means identical. Only the table is the same: I become conscious of its identity in the synthetic consciousness which links the new perception to remembrance. The perceived thing can be without being perceived, without even a simply potential consciousness of it... the perceived thing can be without changing. As to perception itself, it is what it is: carried along in the ceaseless flow of consciousness and itself ceaselessly flowing. The now of perception never stops becoming a new consciousness which joins the previous one, the consciousness of the has-just-happened (...), simultaneously a new now lightens. For these reasons, not only the perceived thing in general, but also any part, any phase, and any moment supervening this thing, are necessarily transcendent in relation to the

> perception, be it a matter of primary or secondary qualities. The colour of the thing seen cannot in principle be a real moment of the consciousness of colour; the colour appears; however, as it appears, it is possible and *necessary* that this appearance does not cease changing in the course of the experience which legitimates it. The *same* colour appears *in* a varied continuum of colour sketches... This analysis is valid for any sensorial quality and spatial form. One and the same form (corporeally given *as* identical) continually appears to me again *in another way*, in form sketches which are always different. (Husserl quoted by Schaeffer 1966, pp. 263–4 from *Idées directrices pour une phénoménologie*)

An ideal object such as a mathematical theorem is also transcendent in a less particular acceptation, i.e. in so far as it is distinct from the consciousness operations whereby it is formulated and comprehended: rethought on different occasions, it will present itself as the same theorem that one identifies again. However, contrary to a real object, which is perceived as external, the theorem is not particularized in time and space. So much so that the relationship between perception and remembrance will be different, depending on whether it concerns real or ideal objects. 'All clear and explicit remembrance concerning an ideal *species* becomes a perception by dint of a simple and intrinsically possible change of attitude' (Husserl quoted by Schaeffer 1966, p. 264 from *Logique formelle et logique transcendantale*). The word perception obviously assumes here a looser sense, for even the clearest remembrance of a table will not become a perception of this table 'by dint of a simple change of attitude'.

The object transcends not only the diverse moments of the individual experience, but also the whole of this experience; its place is a world which recognizably exists for everyone. 'If I walk towards a mountain, this mountain will appear to me as the same in the course of my approaching it, beyond the multiplicity of my points of view; besides, I shall accept that my fellow traveller walks towards the same mountain, though I may have reason to believe the view he has of it is different from mine' (Schaeffer 1966, pp. 264–5). The consciousness of an objective world implies the consciousness of the other as a subject, in the same way as the evidence of a scientific truth supposes its acknowledgment by a scientific community. Once the object is distinguished from its physical reality and declared relative to the subject, there is a tendency to confuse it with the perception, and therefore consider the object as totally subjective. How could images in perpetual change, points of view which are always partial, and incommunicable impressions become an object of knowledge? Hence Schaeffer's insistence on the transcendence of the object. He points out that, for Husserl, there exist two opposing and complementary attitudes, both of which presuppose a naïve belief in the external world: the realism of the thing in itself and psychologism.

In everyday experience there is no consciousness of the perceptual activity, but simply perception. Awareness is the awareness of the perceived object: 'there is a table there which has such and such a property, and I continually notice its every detail, which was there "beforehand" but I had not yet perceived it, etc.' (Schaeffer 1966, p.265). Two certainties underpin this attitude: the thing is seen in itself, and the thing is external. At a second stage, through reflection, it will emerge that, if the table is external and exists independently of the experience of the table, one does not see the table 'itself': 'There would be on the one hand "something" in the absolute, and on the other the vision I have of it' (Schaeffer 1966, p.265); as perception invariably apprehends one aspect of the object at each time, as it is changing and prone to illusion, it will be considered 'imperfect': the subject is 'subjective', and the object 'in itself' unknowable. At a third stage, one will attempt to explain the perception from the world. The external object then appears as the cause, or at least the source of the subjective impressions. Having a body, a nervous system, etc., one is also part of the world, and the perception then becomes the result of a series of physico-physiological processes. Schaeffer quotes Merleau-Ponty:

> My recent awareness of my gaze as a means of knowledge I now repress, and I treat my eyes as bits of matter. They then take their place in the same objective space in which I am trying to situate the external object and I believe that I am producing the perceived perspective by the projection of the objects on my retina. In the same way I treat my own perceptual history as a result of my relationships with the objective world; my present, which is my point of view on time, becomes one moment of time among all the others, my duration a reflection or abstract aspect of universal time, as my body is a mode of objective space. (...) Thus 'objective' thought (in Kierkegaard's sense) is formed—being that of common sense and of science—which finally causes us to lose contact with perceptual experience, of which it is nevertheless the outcome and the natural sequel. (Merleau-Ponty 1944, pp.70-1, quoted by Schaeffer 1966, p.266)

Schaeffer comments on this quotation:

> Wanting to be lucid, I have made an effort to submit common evidences to criticism. I believed to have distanced myself from the perception: 'What I see as red is not in itself red, blue or green. Red, blue and green result from the action upon my retina, and thence to my brain, of luminous vibrations of different frequencies.' I can even add: 'This explanation does not pretend to absolute truth. It is valid only in the present state of my knowledge, and in relation to my system of thinking, in the same way as the perception of colours I have just experienced was relative to my senses.' I should then believe to have reached the edge of scientific doubt. (Schaeffer 1966, p.266)

Where is the naïveté of this attitude? In that experience is deemed imperfect and called

into question, but the belief in the external world remains unshaken and unexamined. For Schaeffer, as for Husserl and Merleau-Ponty, the elaborated discourse of science is based upon this initial act of faith. Nevertheless, what if perceptual experience had not begun pointing to the existence of this object which science is thus positing as an in-itself ultimately unknowable to perception? Rather than criticize perception, one needs to become conscious of it. This requires that there be no immediate interest in the information perception provides regarding the perceived object. 'In other words, I must *disengage* myself from the world' (Schaeffer 1966, p. 267). The Cartesian act of questioning the existence of the external world implies a positioning in relation to that world, the replacement of a thesis with another. The Husserlian bracketing is the abstention of any such thesis. From the naïve belief to the questioning, one detaches oneself from belief; there is a liberation. Bracketing preserves freedom without shaking the belief. 'We furthermore know that this belief is unshakeable: the most hardened sceptic will stop at the brink of a precipice' (Schaeffer 1966, p. 267). However, rather than guided by that belief, one is conscious of it.

Ceasing to identify oneself with the perceptual experience which posits a transcendent object, one becomes capable of apprehending simultaneously this experience and the object it presents. The transcendence of the object emerges as being constituted in one's experience. The characteristic style of perception, the facts that it never exhausts its object, that it proceeds by sketches, and that it refers back to other experiences which may belie the previous ones, ascribing them to the domain of illusion, are not symptoms of an accidental and regrettable imperfection which would interdict knowledge of the exterior world 'as it is'. This style is the mode itself whereby the world is presented as distinct from the subject, and it is this particular style that allows one to distinguish the perceived object from products of imagination or thinking, to which other structures of consciousness correspond. 'Thus this marvellous correlation between the *phenomenon of cognition* and the *object of cognition* reveals itself everywhere' (Husserl 1950, p. 10). The object is no longer the cause of the perception, it becomes its correlate instead. For Schaeffer's sonic object to exist, there has to be phenomenological reduction. '*I must exclude all that is transcendently posited*' (Husserl 1950, pp. 3–4).

When I listen to a gallop noise on record, the horse or the gallop is the object (in the larger acceptation) which I, like the Pampa Indian, aim at. It is in relation to this object that I hear the sound as an *index*, and it is around this intentional unit that my diverse auditive impressions organize themselves.

When I listen to a discourse, I aim at concepts which are transmitted to me by this intermediary. In relation to these concepts, which are *signifieds*, the sounds I hear are *signifiers*.

> In both cases, there is no sonic object: there is a perception, an aural experience, through which I aim at *another object.* (Schaeffer 1966, p. 268)

The horse is no less present in the recording (without vision) than in the photo (without audition). In other words, the acousmatic situation does not create *ipso facto* a sonic object (see § 4). Although the sonic object displays all essential properties of other kinds of perceived objects, a confusion between perceived object and perception of the object is all the more likely when the object is a sound.

> ...the horse appears to me in a series of diverse and corroborating experiences, which are first aural, then audio-visual and finally tactile; when only sound is concerned, such cross-checks are impossible; besides, the sonic object is framed by a time which I all too easily confuse with the time of my perception, unaware that the time of the object is *constituted* by an act of synthesis, in the absence of which there would be no sonic object, but rather an effluvium of aural impressions; finally, as the sonic object is ephemeral, my experience of it remains unique and without follow-up. (Schaeffer 1966, pp. 268–9)

> The advent of sound-recording has allowed this experience to be repeated. On record or tape, the sonic object appears as identical in the course of the diverse perceptions of it one may have at each listening; it appears as the same object, transcending the diverse individual manners in which various and differently trained observers may experience it (see § 4). This does not mean that the sonic object is the physical signal, which is not sonorous until it has been apprehended by the ear. The physical signal is the object of the physics of the elastic media, and is defined with reference to the perception of specific magnitudes such as displacements, velocities, and pressures. The acoustician has in mind both the signal he measures and the sonic object he hears; he is concerned with two different objects. For him, the exterior world is the source of perception, and the physical signal a starting point; accordingly, audition is a result, and the sonic object a subjective appearance. In reality, it is the sonic object that, being given in perception, points to the signal to be studied and cannot be reconstructed from this signal. So much so that no physical law allows the acoustician to have the faintest idea of a *C, E, G* recorded and mixed on a few centimetres of tape.

The sonic object exists only within the context of a particular listening: the listening to a sound with the exclusive aims of hearing it better and hearing more of it at each listening; the sonic object is therefore the correlate of reduced listening (see §§ 4–6). By way of contrast, it is interesting to see the notion of reduced listening appear within a mystic context.

> A child receives communion. He collects his thoughts, makes silence, and waits for something from himself or his Visitor, something neither ordinary nor excessive, something which may increase the reciprocal feeling of myself to Him, and of Him to myself. Bereft of words, adoration is most often attention, a mobilization of consciousness, before being an intention.
>
> A man concentrates (as taught by emissaries of other civilizations). Without external visitor, without sacrament, without perceptible sign; it is a call on latent forces, the call for the presence, and for this to happen, the stopping we await, the possible albeit improbable stopping of the usual agitation, the background noise of the mind and its never-ending associations. Let us not mention uncertain recipes, idle commentaries, likely misunderstandings...
>
> Finally, an auditor listens to a sound (rather than to a sonorous discourse to put him asleep on his feet, or to a music to make him dream, dance, cry, or laugh). One offers to his listening this piece of sound which is repeated, and to which he applies himself in the same way as he would fix his gaze on a door handle or the horizon line. He receives neither his God nor the flux of his own body, but rather a sign of the external world, whose sonic image takes shape in his consciousness. To consider it, he also needs to pay attention and make silence; to appropriate it, paradoxically, he also needs to cast off everything he previously knew about it; let him discard meanings, indices, and even any suggestions concerning this signal. Listening to it again, now, in a few hours, or in a few days, he will learn more, not only about the object he is considering, but also about the faculties of this subject that he is, and which observes itself observing. In what will this lesson consist precisely? Is he doing musical research? Does he decipher himself? Is he going to ratiocinate, call himself psychologist, musicologist, semiologist? After the inner experience, after the real benefit, paltry specialisms... (Schaeffer 1969^{C}, pp. 211–12)

Most of the time, listening aims at something other than sound: one listens to indices and signs. Thus, when turning towards the sonic object, listening will be initially referential.

> In other words, however interested in the sound itself I may be, at first I shall be incapable of saying anything other than 'it's a horse gallop', 'it's a grating door', 'it's a clarinet *H*', 'it's 920 periods per second', or 'it's Hello, hello'. The greater my ability to interpret sonic indices, the greater my difficulty in listening to objects. The better I comprehend a language, the worse I *hear* it. (Schaeffer 1966, p. 270)

In relation to these referential listenings, listening to the sonic object demands an awakening: 'From which perceptions have I extracted these indices? What has allowed me to recognize this voice? How to describe a gallop on a purely sonorous basis? What exactly have I heard?' (Schaeffer 1966, p. 270). One refers to the aural experience recapturing

impressions, and getting information on the sonic object rather than the horse. All the same, the sonic object exactly coincides in time with the structures and units of the event.

> Listening to a sonic object which originates from a grating door, we may well lose interest in the door and focus on the grating. But the history of the door and that of the grating coincide exactly in time: the coherence of the sonic object is the coherence of the energetic event. In speech, this unity is one of breathing or articulation; in music, it is the unity of the instrumental gesture. *The sonic object is at the meeting point of an acoustic action and an intention of listening.* (Schaeffer 1966, p. 271)

When an arpeggio is played, a musical listening will recognize a pitch structure which can be split into various objects coinciding with the notes. A natural listening in turn will recognize the unity of the instrumental gesture, and according to the same criterion, a musicianly listening, which is energetic, will discern a single sonic object. It is important to note that, for Schaeffer, the adjectives musical and musicianly, as well as the corresponding nouns musicality and musicianship, oppose one another: 'In general terms, *musical* listening or invention refers itself to traditional knowledge, to established and assimilated structures and values which it attempts to recognize or recreate; on the other hand, *musicianly* listening or invention attempts to discover new and interesting phenomena, or to innovate in the facture of sonic objects' (Chion 1983, p. 41; see also § 13 herein). The passage from the object 'note' to the object 'stroke of the bow' corresponds to a change of intention. On the other hand, when a drum roll is played at moderate speed, there may be some hesitation in the definition of the object. Will the roll be recognized as such in its whole, or will it be heard as a succession of percussions, each one to be considered as an object? The passage from the object 'roll' to the object 'succession of percussions' corresponds to a greater or lesser sharpness of attention. 'It is almost the same as if, examining a visual object through a magnifying glass, we discovered complexities invisible to the naked eye' (Schaeffer 1966, p. 272). In this case, both the object and the sonic structure exist at the same level of listening. On the contrary, in the arpeggio, there are two different kinds of object: a musical object heard in connection with musical references, and a sonic object defined in its belonging to structures of sonic event. Schaeffer compares this distinction of levels to that between semantic and phonetic units of linguistics. As will be seen (§ 12) the sonic object as a unit is defined with reference to phonetics, rather than phonology (where semantics is implied); this evidently poses a problem if one wants to use the notion of sonic object in musical analysis.

Before defining the sonic object within a phonetic context (see § 12), Schaeffer presents it within the framework of Gestalt psychology. 'For Gestalt theory, seeing is essentially a phenomenological process in so far as what is "seen" is what appears to the seer rather than what may actually be there' (Speake ed. 1979, p. 131). Schaeffer nevertheless remarks

on the amphibious position of Gestalt psychologists: although refusing to construct the perception artificially from simple sensations meticulously corresponding to stimuli, they immediately re-establish a physical world parallel to, and independent of the perceived world. This physical world is no longer the cause of the perceptual world, but it is still a precondition thereof. Before moving into the domain of Gestalt theory, Schaeffer quotes Lalande:

> According to Lalande's philosophical dictionary, *forms are 'ensembles which constitute autonomous units, show an internal interdependence, and have their own laws.* It follows that the manner of being of each element depends on the structure of the ensemble, and on the laws governing this structure. Neither psychologically nor physiologically does the element exist before the whole... knowledge of the whole and its laws cannot be inferred from the separate knowledge of the parts therein.' (Lalande quoted by Schaeffer 1966, p.273 from *Vocabulaire technique et critique de la philosophie*)

Schaeffer borrows from Gestalt psychology the notion of form. The German term *Gestalt* is usually translated into French as *forme*. Schaeffer nonetheless renders it as structure, since he will need the term *forme* to designate the temporal form of sounds as opposed to their matter (see § 12). If Schaeffer had written in English, he would not have needed to resort to structure: *Gestalt* could have been rendered as form, and the temporal form of the object could have been termed shape.

Schaeffer presents the melody as 'a classical example of form', which cannot be reduced to the succession of its component notes: if the pitch of all notes is modified but the relations between these pitches are preserved, that is, if the melody is transposed, one will have the same melody. On the contrary, the alteration of these relations by the substitution of a single note will turn this melody into another. In fact, rather than a 'classical example of form', Schaeffer is presenting an 'example of classical form', as the different melodic inflexions which may affect a Chopin melody or a Wagnerian Leitmotiv do not turn them into another melody or Leitmotiv. Schaeffer affirms that a note isolated against a background of silence is also a form. Elements are always given as detached units of a complex ensemble; one never perceives anything elementary. The paradox is that the more solid the structure of the ensemble is, the more its elements will seem stable and clearly individualized, and the less they will appear to be conditioned by this structure (see § 6). The melody forms a whole, a structure, of which the notes are parts. Within this whole, they are perceived as simple units, constituent elements. Each note can in turn appear as a structure with an internal organization. The difference between the whole and its elements would therefore seem to be one of complexity: choosing to consider the note as either a part in a whole or an organized whole is choosing between levels of complexity. However, the analysis of the melody into notes and the analysis of the note

into its constituent elements do not happen according to the same criteria. The change of level corresponds to a change of intention (see § 19).

Schaeffer affirms that when one listens to a note or a melody, the note or the melody emerge against a background. This relation corresponds to the relation between what is heard and what is listened to. What is listened to can be compared to a figure, and what is heard—the always relative silence (see § 6)—can be compared to a white page. The ensemble figure/background is also a structure whose elements are indissolubly linked: a figure exists only against a background, and a background is only perceived as such in relation to a figure. This brings to mind that famous Gestalt experiment: black vase against white background, or two white profiles against black background? Still, whilst indissolubly linked, these two elements are antagonistic. 'I can alternately listen to a conversation against a musical background or to music against a background conversation, but never to both at the same time: if I want to listen to the sonorous background, it immediately becomes the figure listened to, simultaneously destroying the previous figure, which thus becomes the background' (Schaeffer 1966, p. 276). The same antagonism exists between the whole and the parts: by listening to each note as an autonomous unit one obliterates the melody.

If the melody is a scale, then the scale will be a perceived (*sensu stricto*) structure. However, any melody with its occasional wrong notes is heard with reference to the scales one has grown familiar with. These scales condition perception without being perceived. They are also a structure, one which is evoked in the abstract; a reference structure. This reference structure 'forms an integral part of a *musical system,* which stands to the melody I am listening to in the same relation the code of good manners stands to the behaviour of the visitor who, at this precise moment, is sitting in my armchair' (Schaeffer 1966, p. 276).

For Schaeffer the terms object and structure fit into each other so well as to become almost synonymous. 'How does it happen that the notion of object, to which this treatise is dedicated, in music be so new or so amazing, while the term *structure* is all the rage?' (Schaeffer 1966, p. 277). Schaeffer answers: 'It is because in fact the term *structure,* used at any turn, ends up meaning nothing at all and drawing a red herring across the trail' (Schaeffer 1966, p. 277). He sees the object/structure pair under three different lights.

On the level of ordinary listening, the level of groups of notes, the object/structure relation is apparently self-evident: notes are component objects of structures. However, the melody is also envisaged as an object identifiable within different contexts; it appears as identical in diverse transpositions and orchestrations. The structure which qualifies the melody is responsible for its permanence. At the second level, the level of individual notes, one observes that: when a note is heard in a melody, only its pitch is retained; a more attentive

listening will nevertheless reveal the internal complexity of the note. 'I will hear unnoticed qualities and maybe even, as Helmholtz did, a "melody" of harmonics whose pitches are referred to my previous experience of "melodies"...' (Schaeffer 1966, p. 277). The note is then being scanned as a not necessarily simple structure, rather than being heard as an object revealed by the melodic structure. By dint of the reference structure, the object 'note' is not resolved according to the same structural schemes that resolve or explain the object 'melody'. On the third level, this melody which was supposedly composed of temperate notes might as well be an Indian motif, a Chinese motif, or a quarter-tone motif. It might be continuous, rather than scalar: a glissando, a melodic arabesque, or a concrete motif (see § 19). These are still recognizable and relatively transposable fragments. It is therefore necessary to identify where these experiences coincide with, and where they diverge from the canonical experience of the melodic phrase, which is concomitant with a reference structure proper to a particular system.

Hence the following question, which will divert Schaeffer's argumentation from phenomenology to linguistics: 'do we face a particular problem relating to music and revolving around the perception of our auditive structures, or a more general problem concerning *structures of perception* themselves, in any sensorial domain whatsoever?' (Schaeffer 1966, p. 278). In the first case, music would be a cloistered domain, and its objects, structures and systems would emerge from the empiricism of musical experiences. In the second case, music would be part of an interdisciplinary research, finding its place amid the domain of structuralist research:

> Saussure, but especially Troubetzkoï and Jakobson with the Prague School, have been the proponents of a démarche enjoying nowadays such a formidable prestige that the term *naturalism*, which opposes it, is regarded as a definitive insult, somewhat as the term 'peasant' when addressed to a dilettante by an ace driver. Though being no more than a dilettante in the subject, I shall venture there with respect and interest anyway : musical research could not be left in such loneliness. It is to be expected that comparisons with linguistics will be able to throw some light on *modes of structuration*, which are in fact general. However, we shall indeed have to revert to the particularity of our soil as well, harbouring furthermore some peasant suspicion towards too universal a panacea. (Schaeffer 1966, p. 278)

Robert Strozier has shown the paradox behind Ferdinand de Saussure's influence on contemporary thought (Strozier 1988). For Strozier, the focus of inquiry in Western thinking has alternated between interiority and exteriority: from Descartes to Edmund Husserl, Charles Sanders Peirce and Saussure, the locus of investigation has been interiority. Between the twenties and forties, a shift towards exteriority was accomplished, leading to such trends as structuralism and deconstruction. Whilst reading Saussure in the light of a

Zeitgeist which is no longer Saussurean (see § 13), Schaeffer reads Husserl in the light of Saussure's (and Husserl's) own *Zeitgeist,* so as to justify philosophically his outbursts of reactive rhetoric against *à priori* music. (Part of the phenomenological appeal may have lain in the fact that, being invested with the armour of *Wissenschaftlichkeit,* phenomenology was all the better equipped to fight the scientificity of *elektronische Musik.*) Strozier considers the history of ideas to be the history of creative misreadings. *Traité des objets musicaux,* with a foot in both camps, is in itself an invitation to a generous misreading.

...The ferula of the professors descended upon us so heavily as to provoke laughter. 'Consequence of destructive individualism...', says one; 'march of humanity towards bestiality', says another. 'Evidently a music of dilettanti, since they write without notes'!... Precisely, Herr Professor, hence its interest; it is written directly with sounds, as cinema is made with images. (...)

The day after, to be completely reassured, it was only necessary to applaud Dr Stoble's reliable declaration: 'Let technicians finally give precedence to composers, and everything will be fine!' (Pierret 1969, p. 103)

CHAPTER III

The Premisses of Typology and Morphology

Chapter I presented the evolution of Schaeffer's work from research into noises to musical research. Chapter II examined three fundamental notions: acousmatic listening, four listening functions, and sonic object. Chapter III will consider notions which are directly involved in Schaeffer's typology and morphology. I shall start by going back to the year 1957, when Schaeffer defined the 'method for research after concrete music', of which the solfège was a stage (§ 8). The 1966 solfège, which became identified with the 'programme of musical research' will be examined in § 9, together with Schaeffer's view of traditional solfège. Section 10 will trace the distinction between typology and morphology back to Schaeffer's prose/translation metaphor. Section 11 will expound the role the notion of instrument has played in Schaeffer's musical research. Section 12 will finally explain what I shall term first morphology, identificatory typology, and second morphology.

8. THE METHOD FOR RESEARCH AFTER CONCRETE MUSIC.

The failure of the Decade's syncretic aims led Schaeffer to sketch, in 1957, what he termed 'method for research after concrete music', comprising three postulates and five methodological rules (cf. Schaeffer 1957^{C}, pp. xi–xvi):

1. Primacy of the ear. Schaeffer wrote: *nihil in intellectu quod prior non fuerat in sensu.* He considered that the most revolutionary element of concrete music had not been the discovery of new machines or sounds, but the discovery, by the ear, of new potentialities. This postulate had two implications: on the positive side, no sound ought to be dismissed, as it was assumed that a new training, similar to that of solfège, was needed; on the negative side, after a certain time the analysis of perceptions should lead to the selection of suitable sounds. Schaeffer noted that the biologist also distinguished, from among chemical substances and physical phenomena, those which were useful and those which were harmful. Schaeffer was aware of the fact that, in the case of sounds, this criterion of suitability implied a value judgment.

2. Return to live acoustic sources. Electronic and synthetic sounds were not to be discarded, but it seemed that the human ear had been conditioned by listening to sounds which had what Schaeffer termed 'a temporal history': attack, body and decay (see § 12). Furthermore, he considered that most sounds evolved, and that this evolution was linked to the presence of a live agent. Thus, although the causal element was to be abstracted, in general terms sounds should be dissymmetrical and relatively heterogeneous. This is another reference to biology: Schaeffer pointed out that dissymmetry and heterogeneity were considered by biologists as distinctive traits of life.

3. Search for a language. According to Schaeffer, the former postulates defined a certain domain of musical structures which were both mechanically feasible and suitable to the ear. It was assumed that, once these structures had an objective existence, they might say something to the researcher's ear. However, the ambition of such structures was to establish a communication on three levels — sensorial, intellectual and emotional — between creator and audience. Again, Schaeffer looked at the world of natural science, mentioning animal language, which was likely to be understood one day. He observed that a language could remain incomprehensible for a long time; the essential thing was that it had a good chance of becoming intelligible.

These three postulates have given rise to five methodological rules:

1. Learning a new solfège. The apprentice of concrete music would have to undergo a systematic listening to sounds, similar to the training of traditional solfège. This new solfège would contain new notions and employ a new vocabulary. Its method had not yet been written; its norms were sketchy. Schaeffer considered it useful to know how the new instruments were made and, more importantly, how to use them, but it would be unnecessary for the composer to master acoustics or electronics. The concrete composer would learn about the new machines in the same way as the traditional composer learned how to play the piano: their aim was to hear better.

2. Creating sounds. The traditional composer used to draw a musical note on the staff, the concrete composer would create his sound concretely. Schaeffer distinguished between the creation of a sound and its transformation. Thus, he advised the beginner not to start with tape-recorders, filters, phonogènes and melochords (instruments to transform sound), but rather with microphones, voices and instruments to make noise. For him, this stage was a true *pons asinorum*. Its importance lay in the fact that the style and the breadth of the musical creations depended on the originality and diversity of the sounds created.

3. Learning procedures (or manipulating machines which should not be confused with musical instruments). In the same way as the abstract act of writing a musical note was

replaced by the concrete creation of the sound, the musical instrument (which in traditional music was responsible for the concrete realization) was replaced by electro-acoustic machines responsible for abstract operations. These machines effected, on signals which were not notated, transformations comparable to those found in a score: transpositions, modulations, juxtapositions, nuances, etc. To learn such procedures was, in a sense, to learn a new musical theory. However, to start from these manipulations would be the same as giving the orchestra a blank score. The musical substance was elsewhere. Schaeffer saw here the second *pons asinorum*.

4. Creating études. Having followed these rules, the student would have developed his hearing, created sounds and learnt how to manipulate machines. The next stage would be the creation of études which Schaeffer compared with instrumental studies, composition studies, and orchestration studies of traditional music: a.) sonority (or character) études would group together sounds having common characters but originating from diverse sources (instrumental studies); b.) assemblage études would be constructed by permutation and juxtaposition of sounds, and so far as possible, they would exclude manipulations (composition studies); c.) manipulation études would focus on transformations of sounds by means of a discerning use of machines (orchestration studies).

5. Work and time. Before any compositional attempt, three years of study would be required: one for solfège, one for creation of sounds, and another for electro-acoustic manipulations.

It will be noted that, whilst in 1957 the solfège is a stage of the 'method for research after concrete music', the 1966 solfège suffers an hypertrophy and becomes identified with the programme of musical research itself.

9. THE FOUR OPERATIONS OF SOLFÈGE.

Schaeffer presents the four operations of solfège in *Traité des objets musicaux* (Schaeffer 1966, pp. 496–8). Michel Chion identifies these four operations with what he terms programme of musical research (Chion 1983, pp. 90–4), which nevertheless comprises five operations. This difference is explained by the fact that Schaeffer's four operations are introduced by a preliminary operation and followed by an epilogue; Chion discards Schaeffer's preliminary operation and presents Schaeffer's epilogue as the fifth operation of the programme of musical research. The embryo of this solfège is Schaeffer's and Moles' 'Esquisse d'un solfège concret' (Schaeffer 1952[A], pp. 201–28; for an English summary see Manning 1985, pp. 29–41). The notion of reference trihedron presented in the early

solfège and Moles' theory of the brick of sensation are formally dismissed in *Traité des objets musicaux.* Chion suggests that the systematism of the earlier solfège was probably due to Moles (Chion 1983, p. 91), and he observes that in 1952 the concepts of reduced listening and sonic object had not yet been fully elaborated; hence ambivalent references to acoustic parameters could not be entirely dispensed with. The 1966 solfège is essentially a perusal of new musical material, the art of training oneself to hear better (cf. Chion 1983, pp. 90–1). Rather than operational, this solfège is descriptive. Schaeffer views it as an indispensable preparatory step to music. New machines here play a specific role; referring back to the notion of relay-arts (see chapter I), one works within the framework of the second stage, where perception is challenged and improved by the new medium.

> What had become of the machines in all this? After having been led into the temptation of taking them for musical instruments, one acknowledged only their strange power to elucidate the sonorous phenomenon. For a while, it would be a question of using them to do *solfège,* that is, to train oneself to hear better, rather than using them to make music. (Schaeffer 1966, p. 62)

Schaeffer's solfège defines itself as opposed to Danhauser's *Théorie de la musique,* written in 1872, of which the 1929 edition was still in use in French musical conservatoires when *Traité des objets musicaux* was written. Schaeffer cites Danhauser's tenets:

> Music is the art of sounds.
>
> It is as easily written and read as the words we pronounce.
>
> In order to read music and comprehend this reading, it is necessary to know the signs by whose means music is written, as well as the laws governing these signs.
>
> The study of these signs and laws is the object of Musical Theory. (Danhauser quoted by Schaeffer 1966, p. 163)

Danhauser is essentially concerned with the signs of musical notation; the object of his Musical Theory is the musical text and its laws (similarly to most of today's semiotics of music). Schaeffer prefers to call these signs 'symbols':

> I shall adopt this term (symbol of solfège), rather than 'sign', because of the inadequacy between musical writing and the musical sign hosted by the actual sonic object. Having made this distinction, musical sign becomes synonymous with musical object. (Schaeffer 1966, p. 321)

The first part of Danhauser's manual deals with 'musical signs', whence the notion of duration emerges: 'The semibreve represents the longest duration; each of the other figures has half the value of the preceding one, and consequently twice the value of the following one' (Danhauser quoted by Schaeffer 1966, p. 163). The second part deals with scales and intervals, defining musical scale as 'the reunion of all sounds perceptible by the ear, from the lowest to the highest pitch, and suitable to be performed by voices or instruments' (Danhauser quoted by Schaeffer 1966, p. 163). Finally, the third part explains 'the genesis of the diatonic scale by reduction to the perfect chord (*C–E–G*) of the third and fifth harmonics of a tonic which is taken as fundamental, and by the addition of two other perfect chords: one (*F–A–C*) whose dominant is the tonic of the original chord, and another (*G–B–D*) whose dominant becomes a new tonic; this makes good Danhauser say that such a disposition "rather than the result of chance, is the result of the natural resonance of sound-producing bodies"' (Schaeffer 1966, p. 163). Schaeffer observes that this comment is printed in small letters, and therefore probably already considered digressive; his commentary focuses on a note attached to that preliminary statement: 'Music is the art of sounds'.

> Sound is a sensation effected on the organ of hearing by the vibratory movement of sound-producing bodies.
>
> Musical sound is distinct from noise by the fact that its pitch can be exactly determined, whilst the musical value of a noise cannot be assessed.
>
> The musical sound has three specific qualities: pitch, intensity and timbre.
>
> Pitch is the result of the greater or lesser number of vibrations produced in a given time: the greater the number of vibrations, the higher the sound.
>
> Intensity, or loudness of sound, depends on the amplitude of the vibrations.
>
> Timbre is that particular quality of sound which makes it impossible to confuse two instruments which are nevertheless producing a sound of the same pitch and intensity. Even the least trained ear will easily distinguish between the timbres of a violin, a trumpet, and an oboe. (Danhauser quoted by Schaeffer 1966, p. 164)

In Schaeffer's opinion, this text, printed in small letters in the end of Danhauser's manual, is so ingrained in the musician's mind that it would not even be necessary to write it. Danhauser provides 'all the stock of knowledge of which the musician disposes, up to and including the *Prix de Rome*' (Schaeffer 1966, p. 164). His teaching is 'this homogenized and guaranteed milk' (Schaeffer 1966, p. 164) which, from infancy, has fed generations of

composers. Schaeffer distils its nutrients: music is entered through notation; pitch (can be sung or played) and timbre (can be recognized) are defined pragmatically; durations are defined metrically; scale tones have an acoustic foundation; the whole thing has a scientific foundation (musical sound is essentially a pitch sensation, pitch depends on the frequency of vibrations, intensity depends on their amplitude). Schaeffer thinks that contemporary music asserts its independence by turning its back on Danhauser's scientific justification of the scale, but does not question the remaining tenets: it is entirely notated from the start, it limits itself to the musical sounds defined by pitch, and it reaffirms that pitch, duration and intensity are linked to the physical values of frequency, time and amplitude, coinciding with the acoustic phenomenon; to this physicists added that which musicians, belatedly, have got used to saying: timbre coincides with the spectrum of frequencies. Schaeffer then presents the four operations of his own solfège.

a) *Preliminaries* (sectors I and II). One plays with diverse sound-producing bodies, experimenting with various factures. Sounds are recorded and (except for the identification sheet, useful in a later stage) *everything* about their origins *is forgotten.*

b) *First operation: typology* (sector 2). One *identifies sonic objects* in any sonic context whatsoever and independently of their sources by applying the articulation/sustenance rule. Then, owing to the presence of criteria that are morphological already, one carries out a *screening* of objects, which will lead to the definition of their *types.*

c) *Second operation: morphology* (sector 3). One compares the *contextures* of those objects identified and classified by typology, which amounts to identifying *component sonic criteria,* simultaneously *qualifying sonic objects* as *structures of these criteria.* The rule of perception adopted is the *shape/matter pair*; it will enable one to determine the *class* of the object in relation to one or another of its morphological criteria.

d) *Third operation: characterology* (again, sectors I and II). Before moving on to the dimensions of criteria, it is useful to remember that no real sound belongs under one criterion only. In order to expose this important aspect of experience, and to realize either the incongruity of the other criteria, or the combinations formed by a bundle of certain criteria, it is necessary to revert to the *particulars of the sounds* one experiences. This return to the sonic concrete acknowledges the *genre of the sound,* with reference to the sound-producing bodies of sector I and the factures of sector II. However, while in traditional music these references were causal, here they are merely indicative, labelling the causality of sounds whose *character will be analysed* with regard to other points.

e) *Fourth operation: musical analysis* (sector 4). Being aware of the inevitable cumbering of experience with incongruous and undesirable criteria, one must carry out comparisons of objects which *host criteria,* for the purpose of exploring *the properties of the perceptual field* vis-à-vis these criteria. Since identification has in principle been granted at the morphological level, one needs to evaluate the site and gauge of different

criteria, i.e. the structures of the perceptual field which may correspond to cardinal or ordinal scales.

f) *Epilogue—synthesis of musical structures. Musical Theory and musical Lutherie of sector I.* Putting the last two operations together: on the one side, one knows the *character of the sounds* and *what sources produce them so*; on the other, one has unravelled structures of criteria perception, despite the incongruity of inapposite criteria. What has not yet been achieved are Syntheses which, on each occasion, will extract a certain music from a certain *lutherie,* or else, will link *a theory of musical structures* to *a practice of timbres and registers.* The instrumental variants of the traditional orchestra, all of which to some extent respond to the timbre/pitch relation, are out of the question; one must create, from a specific kind of instrumental means (tablature), a specific kind of music, based upon a particular fundamental relation. If one mixes everything, heterogeneous tools and discrepant musics, it is because one is setting sights on a generalized, or *polymorphous* music. (Schaeffer 1966, pp. 497–8)

Schaeffer establishes a distinction between sectors numbered in Arabic and Roman numerals in a table called 'programme of musical research' (Schaeffer 1966, p. 369, Chion 1983, p. 171), drawing an elaborate parallel between the traditional system and his own system. This table derives from the table of listening functions (figure 1). Roman numerals correspond to what Schaeffer terms 'traditional listening to sources and codes', whilst Arabic numbers refer to 'reduced listening to sonic and musical objects'. The preliminary operation of solfège takes one back to the early stages of research into noises, when Schaeffer experimented with diverse sound sources which were excited by various means (see § 1). The word 'facture', which has a specific meaning in Schaeffer's terminology (see § 10) is used here with reference to what Chion call its 'secondary acceptation': 'In a secondary acceptation, the term facture designates the intention operating in the instrumental gesture, or still, in traditional and modern musics, the active creation of sound; and by extension, the realization of sounds in the electro-acoustic studio, which includes sound-producing bodies, recording conditions, etc.' (Chion 1983, p. 118).

10. TYPO-MORPHOLOGY AND THE PROSE/TRANSLATION METAPHOR.

The fundamental difference between typology and morphology is one of function. Typology seeks first to identify and isolate sonic objects from a sound continuum, and then to compare and classify them. Morphology seeks to qualify (or describe) the objects. Referring back to the four listening functions, the place of typology is sector 2, hearing, whilst the place of morphology is sector 3, listening out for (see §§ 5 and 6). Within the context of a diachronic approach, it is possible to say that there are three typologies

and three morphologies. There is a preliminary morphology upon which a preliminary typology (concerned with identification) is based; this preliminary typology allows of a more refined morphology, which in turn allows of a more refined typology (concerned with classification), or typology proper, whereon morphology proper is based. Finally, the seven criteria of morphology proper give rise to a third typology, presented in the recapitulatory table of solfège (see figure 7).[14]

It is interesting to observe that typology and morphology (or typo-morphology), which are doubtless the crux of *Traité des objets musicaux* and, at any rate, the only accomplished operations of solfège, mirror the zigzaggy structure of the whole book. It has been shown that Schaeffer uses architecture as a metaphor for music: 'the microstructure informs the macrostructure'. Here the 'microstructure' (typo-morphology) informs and is informed by the 'macrostructure' (*Traité des objets musicaux*): 'This zigzaggy course, in seven jumps called "books" thus proposes to go from a current investigation into the *making* and the *listening* (books I and II) to two meditations, one particularly inspired by physics (III), and the other by philosophy (IV)' (Schaeffer 1966, p. 11).

The notions of typology and morphology are linked to another of Schaeffer's dualisms: that between *thème* and *version*, or prose (composition) and (unseen) translation. Prose composition designates the scholastic exercise which consists in translating a text from one's own language into another; unseen translation designates the scholastic exercise which consists in translating a foreign text into one's own language. Schaeffer's metaphor stresses differences between the traditional composer's and the sound recordist's approaches to sound.[15]

> The composer's démarche strictly conforms to that musical catechism mentioned in § 1,8. Starting from notions and signs he is familiar with, the composer ends up, via performance, with a sonic translation comprehensible to others. This démarche is that of the *prose composition.* If he listens, this happens *before* his musical activity: he inwardly sings the sol-fa, he plays in imagination and, if he is a very good musician, he sight-reads a score in his head without the help of any instrument; he composes likewise. He does not listen, he reads, he 'pre-listens'.
>
> The sound recordist on the other hand has to listen *after* the sonic phenomenon. Details of a score which he does not even need to be able to read are of little import to him. Based on his own listening, he constantly compares the sound image produced by the electro-acoustic chain with the original sonorous phenomenon he is attempting to reproduce; this phenomenon originates from real instruments and exists in true magnitude in the acoustic field. His démarche is that of *the unseen translation.* (Schaeffer 1966, pp. 86–7)

The allusion to musical catechisms refers one back to book I of *Traité des objets musicaux.* For Schaeffer, the experience of instrumental possibilities (or *lutheries*) has led civilizations to the conquest of specific musical domains and to a conditioning of the listening (see § 11).

> Thus, the musical catechism used in the Occident transmits as a definitive acquisition a notional system whose archetype is the musical note, which is easily identifiable according to criteria of pitch, intensity and duration. One composes thanks to these notions, which are considered universal, and to an adequate system of notation: this means that thanks to the symbolism of a writing, one prefigures what the œuvre (which therefore coincides with its score) will be. The score is then entrusted to instruments and instrumentalists; it is played, and the *œuvre,* which was already implicit, readable in the symbols of the text by a professional, becomes explicit, audible, perceptible to the layman. (Schaeffer 1966, p. 50)

Schaeffer transposes the prose/translation metaphor to the solfège démarche. Thus, prose composition is likened to making music, whilst unseen translation is likened to listening to sounds.

> We approached the avenue leading to sonority from two paths, which we have distinguished only afterwards: the prose composition and the unseen translation. To start with, through the practice of the looping groove at our beginnings on the record player (without the looping groove our method would certainly never have come into being), we would take 'something' from a most heterogeneous sound continuum. This surrealist desecration, so far distant from the seriousness of our electronic colleagues, has compelled us to carve out sonority, whilst facing what existed of most disparate and least organizable. Could there be listening rules valid for the ensemble of these carvings? Record-player cuttings thus led to exercises of unseen translation. One could not make head or tail of the noises recorded in the studio, those looping-groove sounds isolated from the middle of a discourse, a noise, singing, or a symphony; they owed their existence to the hazardous moment when the cutter had been lowered. Nevertheless these indefinitely repeated fragments had power.

> Having been extracted from their context, being devoid, and yet still full of meaning, they imprisoned us in their enclosed, engaging, and absurd universe. Probably all deconditionings must go through this: violation, destruction, and meaninglessness. Because furthermore, no matter how great our will to succeed might have been, we were admittedly unlikely to discover as a pure event a splinter of discourse or symphony; such an aborted translation nevertheless incited us to the prose composition.

This prose composition, on the contrary, consisted in intentionally making sonic objects, and has led to another extreme: to use any sonority whatsoever in as many different ways as possible. However, it was necessary to unlearn register games: pieces of sheet

> metal lined up according to size, gauged blocks of wood, and even sterile comparisons of what we inadequately termed 'sound material', when they were actually only sound-producing bodies; wood, iron, liquids, solids, etc. The experience of the looping groove has been useful. According to our research, it actually suggested that 'spare parts' be isolated, and thus finally liberated from registers and *lutheries*, which, by dint of serving sounds, ended up enslaving them. (Schaeffer 1966, pp. 390–1)

Considering the notion of prose composition as applied to the solfège démarche, Schaeffer shows some problems posed by his compositional process:

> We started by collecting sounds, trying various labels on them. It seemed that traditional instrumental sounds themselves should be approachable in a new manner, once our apprenticeship of noises had got under way. Yet, we were collecting noises with a certain circumspection: we observed that interesting sounds did not correspond to the more elaborate sound-producing bodies; it was often the opposite: what resembled the traditional instrument disturbed our quest, and so did noises which were too characteristic. Most of our sound-producing bodies and their products were simple: little objects, vibrating spiral springs, marbles bouncing or rolling inside cups, sand running on membranes, tearing of paper sheets, scarecrow shivers (that metallic paper used to scare birds). Besides, birds themselves were often the temptation of our early days. Being less skilled than Messiaen in notating their singing, and mistrusting the idea itself of notation, we limited ourselves to playing with those emulating instruments, the bird calls.
>
> Between the extreme domains of the orchestra and the bric-a-brac, between sounds with a musical reputation and those dubbed noises, fortunately two transitional zones existed: exotic sounds, considered musical by civilizations other than ours, and vocal sounds, these jacks of all trades, dangerously polyvalent. There was still a fifth partner: the synthetic sound of the electronics experts.
>
> By dint of manipulating such diverse sounds, we reached two results, the first one being that it was necessary to renounce any premature musical classification and, more importantly, the notation we were being urged to find, and without which (so we were told) our research would lead nowhere. On the other hand, for lack of musical criteria, it was also necessary to compare sounds according to those trivial features which, in general terms, they all presented: a beginning, a middle and an end. Certain sounds smoothly moved from one stage to another; others less so. Thus, the idea of a comparative morphology took shape. However, after this decomposition in three parts, namely attack, body and decay, not much could be said about the generality of sounds; it was therefore important to separate them into distinct types; without a preliminary selection, morphologies could be described only in such vague terms as to be of almost no interest. But this selection could not happen otherwise than according to morphological differences. For years on end we have thus hesitated between a hardly

formulated morphology and an undefined typology.

> Vaguely anticipating that it was necessary first to approach from the most general point of view what was the origin of sound *shapes*, we started comparing *factures*. This comparison has become possible once we assumed that it would happen outside any solfège, and outside any causality directly linked to the nature of the sound-producing body, that is, once we decided to forget the respective catechisms of instrument makers and acousticians, practising *reduced listening*, though not yet quite knowing it. (Schaeffer 1966, pp. 392–3)

The term shape is used by Schaeffer in opposition to the term matter: in a sound, matter is that which perpetuates itself without changes throughout the duration of the sound, that which could be isolated if one stopped the sound to listen to what it was at a given moment of the listening; shape represents the trajectory which fashions this matter in the course of the duration, possibly making matter evolve (cf. Chion 1983, p. 116) (see § 12). The secondary acceptation of the word facture has already been mentioned in the end of § 9; in addition, the term facture sometimes refers simply to the preliminary operation of solfège, the creation of sounds by the excitation of sound-producing bodies. Neither definition corresponds to the strict meaning of facture, which Chion expounds in the following terms: '*Facture* is the qualitative perception of the energetic *maintenance* of sonic objects, and has a close relation with this maintenance' (Chion 1983, p. 117). According to him, 'it is therefore possible to say that certain sonic objects "do not have facture", if this facture prolongs itself excessively and unpredictably in the course of duration (sounds which are too long), or if, on the contrary, there is no time for it to be listened to (*impulsions*) (Chion 1983, p. 117).

The problematic posed by the approach of the unseen translation as applied to the solfège démarche is thus presented by Schaeffer:

> If I thus (sc. 'reducedly') listen to a *sonorous ambience* such as that which may be found in the country, where the mill noise is accompanied with some local music — anything from the nowadays rare hurdy-gurdy, to the more likely record player —, by an effort of attention I can distinguish natural sounds sources (a toad, a torrent), mechanical sound sources (a waterwheel, a grating axle, the rotation of a saw plate), human or animal languages (people talking, poultry chirping), and finally the conventionally musical sounds of the record player, to which a toad's *F* sharp could be added, given its remarkable purity.
>
> If I now forget origins and meanings, and consider sounds in themselves only, I can propose a more general classification.

> I can apply a first and roughly musical criterion: greater or lesser stability in tessitura, whether it is a question of pure sounds or noises. The torrent, the waterwheel clatter, and the toad are heard within a specific (and always the same) zone of the register, and it is irrelevant here if this zone can be precisely determined. On the contrary, the saw shares with the spoken voice, the hen cackle, the grating axle, the hurdy-gurdy and the record player, the feature of producing sounds which vary in tessitura.
>
> Applying a second criterion, of phonetic inspiration, I can also say that certain sounds such as the voice are articulated, others less so or not at all. The torrent is inarticulated, as are the hurdy-gurdy drone and the saw after biting into the trunk; on the contrary, the regular grating of the axle, and the biting of the saw into the trunk are articulated, in the same way as vowels are articulated by consonants in language syllables. (Schaeffer 1966, pp. 393–4)

In another fragment Schaeffer clarifies the relationships between, morphology and prose composition on the one hand, and typology and unseen translation on the other.

> Let us now compare our approach by the 'two extremes': morphologies, according to the orientation of the prose composition, and typologies, according to the orientation of the unseen translation.
>
> Morphologies have tended to appear within the domain of the prose composition, in the situation of creating sounds one by one, examining factures and effects at pleasure. The difficulty in generalizing here stems from the fact that when we thus manufacture a sound or sounds for ourselves, we operate in a particular domain on sound-producing bodies arbitrarily chosen, and if we try to qualify the sonic production, it is difficult to detach ourselves from the registers these bodies suggest, and not to echo traditional values and analysis.
>
> The need for a typology, on the contrary, has emerged from the comparison of sound collections, of which only the most general characteristics, and particularly that of articulation followed by sustenance, were retained for identification. The difficulty here is to reach criteria that are sufficiently general, albeit not vague.
>
> These two complementary aspects are due to the fact that morphology tends towards a qualification of sonority, whilst typology answers to the necessity of identifying objects. Morphology receives from typology fragments extracted in the best possible manner from the sound continuum in order to evaluate and class them. One meets again with the pair of functions which, in the traditional system, musicality and sonority shared between themselves, the former being responsible for the identification of musical objects, the latter for the qualification of their content. (Schaeffer 1966, p. 397)

Schaeffer stresses the change his démarche represents in relation to musical habits. 'It will be noticed:'

> 1. That having abandoned any reference to instruments and recognized values, collections of heterogeneous objects are all our stock. The only course left open to us is comparing these objects between themselves, in their contexts and contextures. This activity is that of sound morphology.
>
> 2. Part of the problem is already given as solved, for it is said that one has collections of objects. Though admitting that musicianly inventiveness (a point of departure is certainly necessary) has materially provided a number of heterogeneous objects, it has been necessary, on the one hand, to extract these objects from the continuum they belonged to, and, on the other, to classify them among themselves. If isolated objects have been created, this amounts to the same: rules of sound identification have been implicitly followed. What are these rules? They too can only answer to a preliminary morphological approach. Typology, the art of separating sonic objects, of identifying them and, if possible, making a rough initial selection, has to be based on morphological features.
>
> 3. We have said that we initially rejected musicality, as if, having to unload a truck of its heterogeneous goods, or needing to tidy up our attic, we wanted to have the most general and practical grid of classification, rather than the most specific and refined. This is exact, but stopping at this stage would lead to the worst of misunderstandings. Paradoxically, though very genuinely, it is necessary to add this: as regards sonority, our criteria for selection are *as musical as possible*; we have said that they were tendentious; but this tendency towards musical creation points to an *expansion*, whilst traditional criteria tended to be *specific*.
>
> 4. From where does our inspiration draw its orientation? From the continuation of our previous musical training. Our research does not at all endeavour to cut itself off from tradition. The best innovations are inspired by the predecessors' démarche, which is perhaps our major ambition (including the marvelling of which Oppenheimer spoke). Now, retaining the deepest and the most subtle imprints of our musical training does not necessarily amount to sticking to its attainments. We are acting like the geometer who imagines other geometries thanks to the one he knows, which has already charted the space for him, and which he recognizes as a particular, though central, case in relation to his generalization.
>
> Thus we postulate a *musical perceptual field*, which will be then verified. It may also be said that this notion of field has an important advantage over classical musicality: rather than being based on a property of objects (naïvely conceived as external to consciousness) and hence entirely attached to the particularity of these objects, it is based on those anticipated faculties of synthesis, that aptitude for qualifying objects which is indeed proper to humankind and to the most secret mechanisms of its musical

sensibility.

5. It is therefore a thus generalized *musical intention* as regards heterogeneous sonic objects that defines morphology. We say so in order to show clearly that this intention adds itself to morphology, introducing a tension, a tendency to move on to musicality by some bias. It is indeed a bias, and oblique tension, since anything of culturally, habitually or naturally musical in our intention would irresistibly lead us back to the conventional system. (Schaeffer 1966, pp. 398–9)

The terms context and contexture are used by Schaeffer with reference respectively to the structure where the sonic object appears, and the structure of the sonic object itself. The notion of perceptual field will be explained in § 15.

11. THE TIMBRE OF THE INSTRUMENT THAT DOES NOT EXIST.

What does Schaeffer mean when he says that registers and *lutheries* have served sounds (see quote pp. 68–9)? This question is answered in book I of *Traité des objets musicaux*, 'Making Music': 'we must revert to primitive experience, directly linked to the instinctive practice of the *homo faber*, who probably always and in all precedes the *homo sapiens*' (Schaeffer 1966, p. 42). Schaeffer replaces the mystique of 'rigorous thinking' (see § 3) with a mystique of creative action: the abstract aspect of music does not precede concrete aspects intimately connected with instrumental practice. To demonstrate this, he hypothesizes the birth of music among Neanderthal men.

Would he have found his muse when listening to the hart belling or to the bison bellowing? It is unlikely. One rather imagines him on the *qui vive*, assessing the distance, the direction, and the likelihood of a fruitful hunting. Not for one instant does he linger on or get interested in sound itself, which is instantly obliterated in the interest of the event it signals and the projects it incites to. (Schaeffer 1966, p. 42)

Schaeffer divides the prehistoric man's activities into activities orientated towards survival and activities which are somehow gratuitous, such as races, stretches, simulated fights, testings, free muscular exercising, etc. 'Does prehistoric man not know of a double use of the voice: emission of calling, threatening, or choleric shouts, and trying out what specialists pompously call his phonatory apparatus, the pleasure of shouting at the top of his voice, and also striking on objects, without necessarily dissociating the gesture from its result, the satisfaction of exercising his muscles and the satisfaction of "making noise"?' (Schaeffer 1966, p. 42). Schaeffer thinks that the simultaneous origins of dance, singing,

and music are probably there. For him, both kinds of activities, though essentially different, are always intertwined in practice. Utensils and musical instruments, though gradually differentiated, were originally intimately linked. 'I should not hesitate betting that they were not distinguished in real life, and that the same calabash must have indifferently served music and the soup' (Schaeffer 1966, p. 43).

Music is born at the moment two or three calabashes are put together: the reference to the sound-producing body then becomes pleonastic, and the sounds lose their indexicality (Schaeffer says that 'the signal becomes pleonastic', see Schaeffer 1966, p. 43). Thus, 'sonic objects' emerge, transforming 'the cook into an experimental musician' (Schaeffer 1966, p. 43). Hence the intimate link between discovering music and discovering instrumental possibilities. 'Instrumental activity, the visible and primary cause of any musical phenomenon, offers the particularity of, above all things, tending to efface itself as a material cause' (Schaeffer 1966, p. 43). This happens in two ways.

> The *repetition* of the same causal phenomenon, by saturation of the signal, makes the practical signification of this signal disappear (for instance, *this* objects hits *this* object in *this* manner), and suggests a disinterested activity: it is the passage from utensil to instrument.
>
> In the bosom of causal repetition, the *variation* of *something perceptible* stresses the disinterested character of the activity in relation to the instrument itself, and gives this activity a new interest by creating another kind of event, which will have to be designated as musical. This is the most simple, the most general, and the least preconceived definition of music. (Schaeffer 1966, p. 43)

The variation the instrument allows gives rise to variations, that is, pieces of music. Schaeffer affirms that once one of these pieces is recognized, distinguished from others, and deliberately repeated, there is an *œuvre*, even though a musical language may be still absent. In his opinion, the œuvre precedes the code, and even the objects which compose this œuvre. Schaeffer is actually stressing the fact that rules of instrumental performance, registers, and musical notions will be elaborated in the course of millennia. Within this context, he can legitimately state that the œuvre determines the evolution of the *lutherie*, and hence the sonic objects themselves. On the other hand, Schaeffer also affirms that the evolution of the *lutherie* determines the musical language: 'Be it that the performer's virtuosity has put up with a most primitive *lutherie*, or demanded a constantly improved facture, it is the long experience of instrumental possibilities that has led musical civilizations to the conquest of their particular domains' (Schaeffer 1966, p. 49).

Now, what does Schaeffer mean when he says that registers and *lutheries* ended up enslav-

ing sound (see quote pp. 68–9)? Schaeffer imagines that the calabashes have been covered with a skin: a mechanism is given, and an elaboration of the experience in accordance with various possible behaviours vis-à-vis this mechanism will follow. The prevailing behaviour will engender one kind of music rather than another, that is, particular musical domains: 'by dint of playing his calabashes, our primitive reaches a particular form of virtuosity which *conditions* his music' (Schaeffer 1966, p. 44). Schaeffer distinguishes between what he terms the explicit plays of rhythm and pitch, and the implicit plays of timbres and intensities. 'The discovery of registers is nothing but the art of using the instrumental material available in a particular civilization' (Schaeffer 1966, p. 46). In so far as the playing engenders structures, it shows a tendency towards abstraction; in so far as the playing remains linked to instrumental possibilities, it shows an adhesion to the concrete. 'Depending on instrumental and cultural contexts, the musical production will be mainly concrete, mainly abstract, or just about balanced' (Schaeffer 1966, p. 46). According to the prevailing *lutherie*, Schaeffer outlines three musical domains, each roughly corresponding to a continent: a melodic or harmonic domain (Europe), a rhythmic domain (Africa), and a domain of timbres (Asia).

> Be it a question of strings, membranes, blades, or pipes, of simple or multiple instruments, it is nevertheless evident that instrumental experimentation has been almost entirely concerned with pitch variation. It seems indeed that pitch is the key to the liberating gesture, to the abstractive power whence music springs together with musical possibilities and music making. (Schaeffer 1966, p. 48)

However, despite this fundamental connection between pitch and musicality, Schaeffer wants to liberate the instrument from the tyranny of pitch. For this, he needs to generalize the notion of instrument: 'Any mechanism which allows one to obtain a varied collection of sonic objects — or varied sonic objects — while keeping the permanence of a cause present in one's mind, is a musical instrument in the traditional sense, that is, an experience common to all civilizations' (Schaeffer 1966, p. 51). If the musical qualifying (listening out for) is concerned above all with organizing the variety of sonic objects, one moves within the domain of registers, and within a musical domain defined by structures which correspond to these registers. If qualifying is concerned with objects themselves, their shape and matter (see § 12), one moves towards the external boundaries of Western musical tradition. Schaeffer says about 'gongs, cymbals, cattle bells, and other maracas':

> In fact, rather than a collection of distinct objects which could be ranked according to an abstract quality, these instruments produce stereotyped objects, albeit in various samples, which are differentiated by their concrete characters only. Thus, instrumental practice already reveals the alternation between a *structure* of sounds and the *characters* of a structured sound. (Schaeffer 1966, p. 51)

Chion summarizes the Schaefferian notions of value/character and permanence/variation in the following terms. Values are the distinctive features which emerge when various sonic objects are organized in a structure; they are elements of the abstract musical discourse proper. Those aspects of the object which, rather than being distinctive in the musical structure, constitute the concrete substance of the structure, are grouped under the name of character. The model for the value/character relation is the pitch/timbre pair of traditional music (cf. Chion 1983, p. 70). The value/character pair relates to the permanence/variation pair; according to the permanence/variation pair, any musical structure functions by the variation of certain aspects of sound from an object to another, and this variation is rendered perceptible by the permanence of certain other aspects. Those aspects whose variation is pertinent and forms the abstract musical discourse are termed values; those which guarantee the concrete permanence are termed characters. Accordingly, the law of functioning of musical structures is: permanence of characters, and variation of values. The model for the permanence/variation pair is, again, the pitch/timbre relation as illustrated by a classical melody played on an instrument: timbre grants permanence, whilst pitch varies from note to note (cf. Chion 1983, p. 74).

Schaeffer presents some traditional classifications of instruments. The first one pays tribute to musical abstraction: instruments are divided into instruments of determined pitch, or melodic instruments, and instruments of undetermined pitch, or percussions. As pitch is the dominant value in the traditional system, musical instruments are further divided according to whether they yield predetermined pitches (keyboards) or continuous variation of pitch (the strings, slide instruments). Other classifications refer either to a dominant characteristic related to the material of the sound-producing body (the strings, the woodwind, wind instruments), or to aspects of the mechanism (keyboards, percussions, bows). The first classification is linked to the role of the instrument in an accepted musical system, the other two are linked to details of a given *lutherie*. 'The resources of a musical instrument by far exceed the register possibilities for which it has been conceived' (Schaeffer 1966, p. 52). Furthermore, these resources may go far beyond mechanism limitations. A classification by families, based on *lutherie* procedures is therefore unsuitable to generalized musicality; a musical classification would have to be based on effects rather than causes. The possibilities afforded by sound sources, the variety of playings, and the relationship between instrument and player which the instrument propitiates are important. For abstract and concrete aspects of this relationship to become clear, a universal conception of musical instrument is required.

> We shall say that a musical instrument comprises three elements, of which the first two are essential: the vibrator, which vibrates, and the exciter, which produces the initial vibration or, in the case of sustained sounds, prolongs it; the third element (accessory albeit almost always present) is the resonator, whose function is to add its effects to the

effects of the vibrating body, amplifying, prolonging, or somehow modifying these.

> Thus a violin, a piano, a gong, and a reed pipe can be easily compared. All have a vibrating component: strings for the violin and the piano, membrane or air column for the gong and the reed pipe. For the piano and the gong, the excitation is ephemeral: hammer or drumstick. For the violin and the reed pipe, the excitation is a sustained: bow or breath. Finally, the first two instruments comprise resonators which are so apparent as to hide the whole instrument (the violin and the piano soundboards), whilst the last two do not have resonators. (Schaeffer 1966, pp. 52–3)

This classification may contribute towards a classification of sonic objects themselves (typology): 'a piano note is infinitely closer to a violin pizzicato than to a sustained violin-sound, which is in turn comparable to a sustained sound from the reed pipe' (Schaeffer 1966, p. 53). The similarity between sounds from different instruments may be emphasized by acousmatic listening and subtle electro-acoustic manipulations. Schaeffer establishes a distinction between simple and multiple instruments: once an instrument-maker discovers a sound source, he may choose between 'repeating the same source, multiplying it according to various gauges, or on the contrary, working on the same source, trying to vary the source itself' (Schaeffer 1966, pp. 53–4). The second procedure is the least simple, as it inextricably links vibrator, exciter and resonator.

> Contingencies are likely to force the player not to make use of these variations independently, rather associating them immediately at the level of the æsthetic of the sonic object. Thus a violinist can use the high notes only with precautions, within a limited and precarious register of intensities and timbre. (Schaeffer 1966, p. 54)

This applies above all to the voice, where timbre, pitch and intensity are closely interconnected. Schaeffer enlarges on the piano.

> The piano, which seems one of the simplest (sc. multiple instruments), has required a long and difficult perfecting, precisely because it proposed to vary the collection of vibrators while keeping the collections of percussions and resonators, so far as possible, unchanged. Still, the crudeness of the techniques employed deserves mention, as the strings must be doubled or tripled according to the registers; by listening attentively to the passage from the low to the high register, one realizes there is hardly any possible comparison between the various performances of the same percussion-resonance device. This does not stop the musician speaking of the piano 'timbre' as an entity. The piano timbre is certainly recognizable and, even when racked to pieces, a piano can be identified by a less than well informed auditor. It is nevertheless astonishing that acousticians have been falling into such a trap for so long. Let me state prioristically

> that, rather than *a* timbre, the piano is very likely to have as many *timbres* as notes.
> (Schaeffer 1966, p. 54)

These observations originate in Schaeffer's practical experiments with tape recordings of piano sounds. 'Note on Time Relationships' (Schaeffer 1960) elaborates on what he termed the 'piano law'. Schaeffer noted that the harmonic complexity of piano sounds was greater in the bass, and lesser in the treble, while the attack was steeper in the treble, and less steep in the bass. This was demonstrated by the following experiment: a melody played in the middle register of the piano was recorded on tape, and it was then transposed two octaves above and two octaves below the original melody by means of speeding up and slowing down. The comparison of the tape transpositions with piano transpositions showed that:

> 1. the dynamic slope of the natural notes evolve much more slowly than their multiplication or division, i.e. the natural bass is steeper than the middle register slowed down, while the natural treble is less steep than the middle register speeded up;
>
> 2. the natural bass is much richer than the transposed middle range, while the natural treble is much duller than the transposed middle range.
>
> By analogy, and without being rigid but simply discovering qualitative but most important laws, it can be stated that an instrument like the piano (generator of a family of different but remarkably balanced musical objects) assures this balance by the following laws:
>
> 1. The dynamics, and hence the attacks, vary in direct function of the register.
>
> 2. The harmonic richness of the notes varies in inverse function of the register.
>
> (Both these variations are non-linear.)
>
> 3. In an approximate way: Each note of the piano is in a complex way the equivalent of the neighbouring, by the fact that it is balanced by a sort of law of energy which might be written (by analogy)
>
> $$\textit{Sharpness of attack} \times \textit{Harmonic richness} = \textit{Constant.}$$
>
> (Schaeffer 1960, pp. 59–60)

'In the face of the variety of objects provided by one and the same instrument, the thing which enables us to recognize the instrument at all is the laws relating these variations

to each other' (Schaeffer 1960, p. 59). Schaeffer's analysis of *lutheries* is a means of discovering the relation between the instrument and the families of sounds it may produce. A definition of musical instrument he constantly refers to reads as follows: 'An instrument does not answer to any theoretical definition other than that of permanence/variation' (Schaeffer 1966, p. 51). Whence the question: 'What is the permanent element, common to all sonic objects produced by the same instrument? What are, on the other hand, its possibilities of variation?' (Schaeffer 1966, p. 55). Timbre, which in the beginning of *Traité des objets musicaux* is defined as 'that by which one recognizes that various sounds come from the same instrument' (Schaeffer 1966, p. 55), is held responsible for instrumental permanence. Schaeffer makes an interesting point as regards the etymology of the word *timbre*: the French word originally designated an instrument similar to the snare drum (*tambour à timbre*); according to the *OED*, the word timbre, which is borrowed from the French, originally referred to a small bell, and thence to the 'sound of a bell' (the *Robert* supports Schaeffer, whilst *Littré* gives evidence in favour of both Schaeffer and the *OED*). Schaeffer also mentions another old sense of the word: '"mark of origin" affixed on particular objects to indicate their provenance' (Schaeffer 1966, p. 55).

As to variations, Schaeffer establishes a distinction between abstract variations and concrete variations. Instrumental registers are the source of abstract variations. The word register here has a double meaning: on the one hand, it is 'a *sonic* structure perceptible in the series of objects produced by the instrument' (Schaeffer 1966, p. 55); on the other, it is '*that which produces* the variation of these objects' (Schaeffer 1966, p. 55). Although these two phenomena are obviously related, 'observing that the violin string has been made shorter is one thing, hearing that its notes are higher or lower is another; taking notice of the register the piano keyboard offers is one thing, analysing the character of the notes produced is another' (Schaeffer 1966, pp. 55–6). All instruments have a main register, usually pitch in the elaborate *lutheries*, and secondary registers governing intensity and timbre (which here does not refer to instrumental provenance). Schaeffer considers it useful to study the relationships between the register on the causal level and the sound structures which are perceived by the musical consciousness. On the other hand, instrumental playing is the source of concrete variations, which call on the instrumentalist. Though attentive to rules of playing, he may deliver a variety of objects where facture proper emerges, as in the pianist's *toucher*. Different instrumentalists can produce sounds which, though belonging to the same register and having the same shape (legato, staccato, pizzicato, vibrato), express the instrumentalist's personality, showing his 'sound', or even his 'timbre'. Schaeffer summarizes this triple nature of the instrument:

> We therefore have a triad which henceforth will reign over almost all our analyses. Extracted from the physical world, sound first demands care in its manufacture. Thus, the instrument is studied in itself as a physical device. At the opposite extreme, unless

> one has in mind an æsthetic objective entirely governed by 'musical ideas', this device is meaningless. Finally, the traditional instrument is traditionally operated by an artist, whose presence manifests itself with a certain degree of originality: the score tells him how to use the instrument to produce abstract and concrete effects, whilst leaving him a degree of freedom to express his virtuosity and sensibility.
>
> When a new *lutherie* comes to light, it is instinctively approached in these three manners. When someone wants to build an instrument, he tries to conceive it as having registers that are as rich and numerous as possible, allowing the achievement of the most complex and refined structures, and offering the instrumentalist extended and nuanced performance possibilities. Even before its birth, this is the schedule of conditions that has to be fulfilled by any new instrument, and by the electronic instrument in particular. (Schaeffer 1966, p. 57)

Schaeffer then embarks on a critique of both electronic and concrete *lutheries*. The electronic instrument does not correspond to any of his definitions of musical instrument, as it proposes to synthesize all instruments; it has not only registers, but also a super-register which allows one to move from an instrument to another (similarly to the organ). It is assumed that the instrument can be transcended in the interest of musical structures; timbre thus becomes a characteristic of the musical object (the general colour of the sonic matter, that is, the band of frequencies, each of which has a particular intensity), rather than the perception of the common source of a family of objects. Schaeffer analyses the electronic instrument in terms of that triad: timbre, registers and performance:

> It answers well to the second (sc. criterion), that of *registers*, where it is in fact remarkably rich. The same cannot be said as regards the other two.
>
> To begin with, it is obvious that its playing offers little room for interpretation. Being all predetermined, the objects vary only in one direction, namely abstract values, rather than in the concrete direction of live performance. The human presence is missing, as the vegetal or mineral texture of wood or stone is missing in plastic objects.
>
> As to *timbre*, let me state straightaway that in traditional instruments it appears as resulting from subtle and generally skilfully balanced laws of association between the elements that compose the objects, in accordance with the position of the objects in the register. These laws do not exist for the electronic instrument. One may use all variables independently. Timbre is then reduced to what the ear reveals about the causal identity of all these sounds: synthetic, definite, without any of those accidents, fluctuations, or imprecisions which have been rendered indispensable by a millenary conditioning, and also without those linkages and inevitable dosages along the register.

As may be seen, my critique is not based on principles, but rather on the contingencies

> of our conditioning. Hence it may be accepted or refused. I should easily accept that a training will bring about the possibility of new modes of listening. However, I find it difficult to believe that our ear and our whole musical sense may get used to any disruption whatsoever of their habits; the presence of life, perceptible behind the craftsman's mark, seems indissociable from æsthetic appreciation, and the presence of the instrumental identity too. Once this identity is lost, onto what can one hold as variation takes over permanence in a fatal imbalance? (Schaeffer 1966, pp. 63–4)

In concrete music the notion of instrument is elusive. What is the concrete instrument? 'Is it the sound harvest at the studio, and the intention of collecting sounds from all sources? The practices of recording and working preferably with recorded sounds? The use of special machines to manipulate these sounds, change their speed, filter and mix them?' (Schaeffer 1966, p. 64). Nothing of this corresponds to any of Schaeffer's definitions yet again. By force of habit though, in 1948 he conceived the 'record piano', connecting twelve record players to a keyboard; at that time, Schaeffer designated this piano as 'the most general musical instrument' (see Schaeffer 1950, p. 35; 1952, pp. 15–16; 1966, pp. 64–5):

> Let us suppose that, thanks to the looping-groove technique, sounds from musical instruments have been recorded on twelve records. In each groove a different instrument; on each record a different and, for instance, chromatic pitch. The keyboard would allow one to play with pitches. A device would allow the arm to change groove if need be, hence registering instruments themselves as one does on the organ. (Schaeffer 1966, p. 65)

The idea of the record piano was definitely put aside in 1950. In *Traité des objets musicaux* Schaeffer looks for that triad among filters and modulators:

> In opposition to the possibilities afforded by the electronic instrument, there was no register convenience but, on the contrary, extraordinary *playing* possibilities in relation to both the invention of sonic beings captured by the microphone and the practical post-recording interventions. Finally, if one abstained from any electronic effects, there was evidently no instrumental *timbre* at all, as each object would unequivocally state its own origin. (Schaeffer 1966, p. 65)

Thus, by opposite means, the electronic and the concrete démarches have led to the dismissal of the instrument as a means of musical expression. 'Whilst one of these musics was the by-product of a parameter game, the other was a simple juxtaposition of objects' (Schaeffer 1966, pp. 65–6). Electronic and concrete musics displayed opposing imbalances in relation to the usual instrumental structures; hence they disrupted habits established by

the triad of timbre, registers, and playing. 'This would explain what has seemed so odd thus far: that the ear indifferently perceives as the same fault errors which result from an excess of concreteness and errors which result from an excess of abstraction' (Schaeffer 1966, p. 66). Schaeffer enlarges upon excess of concreteness in particular.

There is an excess of timbre when sounds are slowed down or speeded up so carelessly that the variation states its cause: there is not any dissociation between cause and effect any more, there is no balance between permanence and variation, and hence no instrument. The instrument itself becomes an event detrimental to the musical event. However justifiable in structural terms a fire alarm may be, it always disrupts the musical discourse. If the slowing down and the speeding up affect both the rhythm and the tessitura of this object, the permanence/variation relation seems so rigid that the event sounds like a 'special effect', whether or not it is heard as a fire alarm. Instead of timbre as instrumental permanence, one has the 'timbre of the speeding-up'. When a vocal sound or a piano sound is accelerated with no corresponding rhythmic changes, only spectrum is transposed and, according to acousticians (for whom timbre corresponds to spectrum), timbre remains the same, tessitura alone changes. In fact, 'the piano becomes shrillish, the voice starts quavering and bleating' (Schaeffer 1966, p. 67).

> This happens precisely because the speeding-up does not touch the 'spectral' timbre of the objects, whilst a true musical instrument combines its effects depending on the tessitura, making the composition of the objects vary according to precise and precious laws. Although acousticians define timbre as a quality of each sound, they also customarily mention the timbre of an instrument, implicitly assuming a certain constancy of this quality. In fact, if the timbre of an instrument is recognizable (according to the primitive sense we have established in chapter II, § 4), this is because each object produced by this instrument has a timbre in the physicist's sense, and above all because for each instrument, there exist laws linking these timbres. On the contrary, when an object is speeded up, its physical timbre does not vary, and different samples across the tessitura clearly express this invariance as the *characteristic timbre* of the speeding-up. (Schaeffer 1966, p. 67)

There is an excess of register when registration, rather than modelling the object, indicates the machine; one has again a 'special effect', or a 'timbre'. Schaeffer presents filtering as an example of registration. Synthetically, groups of frequencies are combined to produce an object; analytically, groups of frequencies are extracted from a given object. If filtering is not very refined, it is to filtering that one listens. The operative causality overshadows the variety of the objects thus manufactured. 'The procedure obliterates the object, degrading it, stamping it with its timbre, in the undesirable sense of the word' (Schaeffer 1966, p. 67). Finally, Schaeffer identifies an excess of playing in both electronic and concrete musics.

Had he not said it was obvious that the playing of the electronic instrument offered little room for interpretation (cf. quote pp. 80–1)? 'I am using the word "playing" in its ample sense, transferring to the composer the interpreter's traditional function, as the former pretended to replace the latter' (Schaeffer 1966, p. 68).

> Both an accumulation laden with synthetic sounds and a brutal analysis of natural material lead to the same absence of an economy of means. Too many intentions wear out the object, rendering it shapeless and illegible. (Schaeffer 1966, p. 68)

This notwithstanding, it happened sometimes, in both concrete and electronic musics, that well shaped objects adequately recorded expressed relations of permanence, seemingly coming from the same instrument. In Schaeffer's opinion, this is the only means of giving some coherence to a sequence of sounds which appears across the entire tessitura with the most disparate durations and intensities: thus the contemporary composer often tries, to link sounds by 'something' which, pragmatically, corresponds to instrumental timbre. How is it possible then that, in works where the composer himself cannot explain the causalities of a succession of sounds, things happen as if these sounds came from a particular instrument? 'What is this timbre of an *instrument that does not exist*?' (Schaeffer 1966, p. 68). The point in question is the notion of pseudo-instrument, defined in April 1951 as a solution to the problem posed by the creation of a score for *Orphée* (see § 2):

> *19 April.* I am thinking about the concrete orchestra, of which I seem to have discovered a fundamental law. I have chosen for *Orphée* a number of 'fragments' where matter and shape [see § 12] are interwoven. However, these fragments are the starting point of transformations. If there is a certain 'invariance' of the initial fragment throughout these transformations, this fragment will play the role of a pseudo-instrument. It will appear vertically on the tablature of the concrete orchestra. What are then such invariance criteria? Some sounds have, for instance, an attack that may be characterized by portamento, strain, or opening out (swift transition from piano to forte). If these characteristics remain throughout modulations the sounds undergo, one has sound sources which may play the role of an orchestral instrument. The following laws will be deduced:
>
> 1st) an orchestral element (pseudo-instrument) is recognized by the permanence of a characteristic under various shapes.
>
> 2nd) musical shapes, whether or not they can be written down, are created either by temporal evolution of pseudo-instruments, or by superimposition of pseudo-instruments at a given instant. This evolution may affect all characteristic elements of a given matter (tessitura, dynamic, timbre, note structure, criterion of structure itself), excepting one

> which remains *invariant*, thus defining the identity of the orchestral element to which the shape applies.
>
> 3rd) instrumental techniques, or execution procedures consist in an ensemble of means, whether recognizable to the ear or not, whose causal or operative character must be distinguished. Only effect is relevant to the ear.
>
> There are then two types of score: the operative score, a sort of 'directions for use', and the effect score, which develops on parallel lines the shapes taken by each orchestral element,* and which alone can give an idea of the structure of the work. (Schaeffer 1952[A], pp. 94–5)

Schaeffer's original footnote reads: 'This applies only to one type of music, where the notion of pseudo-instrument is valid. There is a whole musical domain where the notion of pseudo-instrument no longer holds sway' (Schaeffer 1952[A], p. 95).

The essential stages of solfège include not only the identification of a sound amid the sound continuum (identificatory typology), the selection of suitable sounds (classificatory typology), and the description of their properties (morphology proper), but also an operation called characterology. Characterology, the third operation of solfège, concerns itself with 'the principal cases of combinations formed, in the sonic and musical realities, by characteristic *bundles of criteria*, in accordance with the natural acoustic laws which are usually responsible for their combination' (Chion 1983, p. 103).

12. FIRST MORPHOLOGY, IDENTIFICATORY TYPOLOGY, SECOND MORPHOLOGY.

The first typology proposes to identify sounds; it is an operation which 'consists in isolating, or cutting out sonic objects from any sonorous context whatsoever' (Chion, 1983, p. 99). As has been seen in § 10, the identification of a sound amid a sound continuum acousmatically listened to presupposes morphological criteria. According to a most elementary morphology of sounds, a sound has a beginning, a middle, and an end. Users of commercial synthesizers today are familiar with this basic morphology, illustrated on a number of keyboards by the envelope shaper, usually comprising attack, sustain, decay, and release controls.

The quote in pages 70–1, where Schaeffer presents the problems posed by the approach of the unseen translation as applied to the solfège démarche, already introduces criteria for the classification of sounds: the pairs permanence/variation (in tessitura) and articulate-

ness/inarticulateness. According to the permanence/variation pair, the following sounds are permanent: the torrent noise, the waterwheel clatter, and the toad note; the saw, the spoken voices, the cackling hen, the grating axle, the hurdy-gurdy, and the record player produce variable sounds. According to the articulateness/inarticulateness pair, the following sounds are articulated: the toad note, the waterwheel clatter, the grating axle, and the biting of the saw into the trunk; the torrent, the saw after biting into the trunk, and the hurdy-gurdy drone correspond to inarticulated sounds. One is here halfway between identificatory typology and a slightly more refined morphology leading to classificatory typology.

Identificatory typology is solely based on the articulation/sustenance (*articulation/appui*) pair, which allows any sound chain to be split into units, or individual sonic objects. The instrumental gesture, an energetic phenomenon, is therefore at the basis of typo-morphology, and hence of the whole solfège. The articulation/sustenance pair derives from linguistics; in the syllable, 'vowels are articulated by consonants' (cf. quote in page 71). The syllable plays a rather marginal role in linguistics though, since in this science the identification of units happens according to the capability these units have of conveying meaning (someone who listens to a language he does not know at all will hear it in terms of energetic events). The identification of units with reference to meaning is nevertheless out of the question within the framework of Schaeffer's solfège, as the musical code has been razed and is in the process of being rebuilt or, as Schaeffer would probably prefer, discovered. Chion summarizes the articulation/sustenance rule: 'There is *articulation* when there is *"breaking of the sound continuum into distinct and successive energetic events"* (396), as in consonants—and this articulation relates to the sound *maintenance*' (Chion 1983, p. 114) (Chion's bracketed numbers refer to *Traité des objets musicaux*). On the other hand, 'There is *sustenance* when the sound phenomenon prolongs itself like a vowel, and this *sustenance* is linked to the sound *intonation, "that is, to the fact that the sound presents stable or variable pitch"*, or that this pitch is tonic or complex (366)' (Chion 1983, p. 114).

The articulation of the sound, its attack or onset, essentially expresses the kind of energetic input whereby the sound-producing body has been excited, and therefore provides information about the kind of maintenance which is about to follow; on the other hand, during the sustenance of the sound, attention is focused on the sonic matter, its stability or variability, its tonicity or complexity. Here again one is moving towards a more refined morphology. 'In other words, by relating the typology of factures to the morphology of sustenances, and on both sides retaining criteria at the two ends of the object, we provide an indispensable key to sonority; this key is devoid of any refinement, but it shows a musical bias which is as limited and justified as possible' (Schaeffer 1966, p. 366).

The second morphology emerges as Schaeffer moves from identificatory typology towards classificatory typology. The syllabic model, upon which identificatory typology is based, is considered in its suitability for classificatory purposes.

> Let us still recall how linguistic material is classified. With a given sustenance *a*, diverse articulations can be coupled: *pa, sa, ma,* etc. Conversely, with a given articulation *b*, various sustenances can be coupled: *ba, be, bu,* etc. We have then a grid where both criteria combine: in the columns, there are attacks or shapes which give rise to the emission and the nature of sounds; in the rows, there are sustenances, which are relatively independent of attacks. The following table is obtained:

	b	d	f	g	k	l	m	etc.
a	.	.	.	.	.	.	.	.
e	.	.	.	.	.	.	.	.
i	.	.	.	.	.	.	.	.
o	.	.	.	.	.	.	.	.
u	.	.	.	.	.	.	.	.

(Schaeffer 1966, p. 395)

Schaeffer believes that traditional music neglects the energetic factor in favour of instrumental provenance and a distinction between sounds of definite pitch (or tonic sounds) and sounds without a definite pitch; the former are presented by the traditional system as sustained, whilst the latter are presented as originating from percussions. However, the piano offers an example of tonic notes obtained by percussion, and the sound of a quivering cymbal is sustained, though not tonic. Thus, for Schaeffer the energetic classification represents an improvement. Phonetics concentrates on factors such as the colour of the a, o, or i; Schaeffer's classification focuses on the stability or variability of the sustenance in tessitura, and on the fact that some sounds may lack a distinct articulation. The second morphology elaborates on the two basic elements of identificatory typology, namely articulation and sustenance; they give rise to the shape/matter pair of the second morphology. The articulation/sustenance pair accounts for the identification of sonic objects in their contexts; the shape/matter pair accounts for the qualification of sonic objects in their contextures. As has been said in § 10, the matter of a sound is that which can be isolated when one stops this sound to hear what it is at a given moment of the listening; the shape of a sound is the trajectory which fashions this matter, possibly making it evolve. The notions of shape and matter as theoretically independent elements of sonority are directly linked to a machine available in Schaeffer's studio: Springer's Zeitregler. This machine was conceived to solve a prosaic radiophonic problem: 'How to fit into the nineteen minutes available a symphony which lasts twenty?' (Schaeffer 1966, p. 418).

> Springer's machine solves the general question, akin to that raised by Stockhausen's attempt, of condensing or dilating a sonic object which, regarding its shape or matter, remains the same. Let us imagine that it is possible to cut and splice magnetic elements infinitesimally. For instance, let us cut into fragments of one millimetre a tape where a sound of one second has been recorded (that is, 380 millimetres of tape). Let us number these one-millimetre fragments from one to 380. We shall try the following two montages: in one we splice together 1, 3, 5, 7..., that is, all odd numbered fragments (or else, 2, 4, 6, 8..., that is, all even numbered fragments), in the other (which supposes one has a second tape identical to the first and likewise cut) we splice together 1 and 1, then 2 and 2, etc. In the first case, the sound obtained has half the duration of the original; in the second, it has twice this duration. What happens when these two montages are played at the original speed of 38 centimetres per second? Since the elements of the sound *matter* (pitch, harmonic content) are read at the original speed, they seem identical to those of the original recording, even though every other fragment is missing, or each fragment is repeated. However, one of these sounds will be twice shorter, and the other twice longer than the original, that is, the *shape* will have been condensed or dilated; this first procedure therefore affects shape whilst respecting matter. If, on the other hand, we halve the speed at which the shorter tape is played whilst doubling that of the longer one, all sound spectrum will be transposed one octave lower in the former case, and one octave higher in the latter. Then we shall have recovered the original duration of the sound, and hence its shape, but the matter will have been transposed.
> (Schaeffer 1966, pp. 418–19)

Schaeffer relates the discovery and importance of the shape/matter pair in the following terms:

> It was necessary to root morphology somewhere, that is, to decide on some way of comparing sonic objects. Thus typology has been envisioned as both the generalization and the specialization of the articulation/sustenance pair, conceived as the most general law of any sound chain whatsoever. In the mill concert, two criteria were chosen with apparent ease: one of articulation (the emission), another of sustenance (the intonation). Does this not amount already to summarily practising a morphology? The impossibility of deciding on a typology without defining a morphology has already been demonstrated. Thus, it has been necessary to go from one to another in successive approximations. The embryo of a morphology was also necessary.
>
> At this point, fortunately, the perception of duration intervened, so natural as to be hardly remembered, but playing a part in both sonic and musical objects. Let us imagine that it is possible to 'stop' a sound to hear what it is at a given moment of our listening: what we grasp then is what will be termed its *matter*, which is complex, established in tessitura, and in the subtle relationships of the sonic contexture. Listening to the history of this sound, we realize that what was stable for one moment evolves in duration; we recognize a *trajectory which shapes this matter*.

> It is the contexture of an individual object which is thus analysed into shape and matter, but we know that afterwards we shall try to analyse this shape, details of the history in duration, and the composition of the matter at a given instant. Once this exercise has established a method and a terminology, comparisons between objects become easier. One will then discover similar shapes amid sounds of different matter, and comparable matters amid sounds of different shapes.[16] This is the most usual procedure of morphological investigation. (Schaeffer 1966, pp. 399–400)

Reading Schaeffer's 'Introduction à la musique concrète' and *À la recherche d'une musique concrète*, one realizes that the shape/matter opposition underwent a slow crystallization. This is the first appearance of the term matter:

> I was on the wrong track. Rather than musical effects, I was getting dramatic effects. However, if I extract a sonic element, and repeat it with no concern for its *contexture*, making its *matter* vary, I am making it move away from the universe of signification to the universe of form. (Schaeffer 1950, p. 39)

The French word *forme* might have been rendered as 'shape' here, but it is uncertain whether Schaeffer already envisages it within the context of what has been rendered as the shape/matter opposition. The 'universe of form' to which he refers is probably that of musical forms. Comparing this fragment with the reworking it underwent for publication in *À la recherche d'une musique concrète* (when Schaeffer was already distancing himself from musical forms to concentrate on sonic shapes, cf. § 3), one observes that in the 1952 version the word *forme* appears in clear opposition to *matière* (and hence has been rendered as shape), whilst what in 1950 was 'the universe of *forme*' becomes 'the musical phenomenon'; in other words, a specific acceptation of the word *forme* is in the process of taking shape:

> Can such a sequence be considered musical? If I extract any sonic element, and if I repeat it with no concern for its *shape* [*forme*], but making its *matter* vary, I am virtually abolishing this shape [*forme*], which loses its signification; only the variation of matter emerges, and the musical phenomenon therewith. (Schaeffer 1952[4], p. 21)

This comparison demonstrates the slow elaboration of Schaeffer's vocabulary. The fact that *forme* replaces contexture in the rewriting deserves mention, as these terms cannot be confused in Schaeffer's later writing. Another example:

> *2 June.* Where does the disparity of the *Diapason concertino* come from? Not so much from the *matière* itself, for J.-J. Grunenwald's concertante piano replies to sequences

> extracted from an orchestral *matière*. What happens is that concrete manipulations *create formes* which oppose themselves to the usual musical style. (Schaeffer 1952[A], p. 24)

One is left wondering whether *matière* here corresponds to the notion of matter or is a synonym for material. In turn, these *formes* which oppose themselves to the usual musical style are more likely to be sound shapes than musical forms. Schaeffer actually defines *forme* and *matière* clearly in *À la recherche d'une musique concrète*.

> I have used the words matter and shape repeatedly. One may wonder what their precise meaning is. The analogy with visual arts is actually striking already, but this is more than an analogy; it is an exact definition which must satisfy scientific and æsthetic spirits alike. A sonorous phenomenon supposes a certain duration. In the course of this duration, there are 'things which evolve', and things that are the support of this evolution. Hence matter and shape look like two opposing notions, two entities as distinct as a stone is distinct from the geometry to which it is doomed. In the visual arts, space, the pure space of the geometry of shapes, is easily opposed to matter, the impure matter which has a grain, colour, density, and hardness, and which one never stops qualifying. But after all, beyond the qualitative perceptions of our senses, what is this matter, other than space and geometries of structure, now in infinitely small dimensions? A brick, a stone, plaster: if rather than the eyes we use a spectroscope, or the atomist's diagrams, they are still rhythmic spaces, arrangements of numbers and orbits in space. Matter and shape therefore are not so opposed, at least theoretically: space within space, such would be our architectures of matter, except for the fact that their *magnitudes* make any comparison impossible, imparting to them entirely unrelated sensorial, and hence æsthetic, qualities.
>
> What makes visual problems quite clear is the vast gap between these magnitudes. A respectable number of zeros lies between the dimensions of an atom and those of a statue; these differences correspond to Avogadro's number, that is, 23 zeros, more than a milliard to the power of three; they are far from conceivable. On the contrary, in music the periodical phenomena which play the role of 'matter', and which constitute time within the time that composes any sonic shape, are very close to directly perceptible durations: one hears the beating of the 32-foot reed, musical sound appears in the moment we lose track of the number of beats. There exists in music a curious common frontier between matter and shape. Try hitting the air with a lamina vibrating at the rate of ten beats per second, and you will have a rhythmic shape. Double the frequency, and you will start hearing a sound perceived as matter rather than shape. Thus, instead of Avogadro's abyssal 23 zeros, which in the plastic arts separate matter from shape, we have no abyss at all, but rather a dangerous contiguity for confused æsthetic thinking.
>
> Is it surprising then if form problems in music have taken the air of a chemistry of matter, rather than that of a physics of shapes? In fact, any music is established

> primarily on the postulate of resonances, an architecture of frequencies, since frequency is the dominant element which has an algebraic character almost inseparable[17] from the phenomenon itself, so much does this phenomenon derive its importance from algebra. Being thus abstract and stripped of its sensorial context, music has always appeared without its plastic characteristics which today we are forced to give to it.
>
> If, on the contrary, one takes a one-second span and starts distinguishing there those phenomena which correspond to this span from those which correspond to one tenth of a second, the notion of matter and shape appears clearly. Below the tenth of a second — the 'atomic' dimension of sound — there is no perception of shape. Generally, a sonic matter can be perfectly defined by the content of this tenth of a second. The various periodical or pseudo-periodical phenomena produced during this span are likely to be repeated during the infinitesimal intervals which follow. They are somehow predictable. If, for instance, it is the *C* above diapason *A* (440), that is, 1056 periods per second,[18] there will be 105 of these periods per tenth of second, which is largely sufficient for pitch to be identified. Furthermore, timbre will be likewise included, as well as the force of the note. This tenth of a second therefore contains the 'matter' of the violin note. If the violin plays hemidemisemiquavers, there may be many of these in a second; not for this reason does matter change: the sound evolves from top to bottom, it loses power and changes timbre, but usually in a continuous manner, so that one has the impression that this matter has received a shape, whether melodic, rhythmic, or of sound colour.
>
> Briefly, in music, matter and shape are made of the same elements: frequency, intensity, and duration, but these elements present the contradictory appearance of being permanent and varying. In so far as they remain permanent for a brief space of time, they constitute a matter; in so far as they evolve for a space of time only twice as large, they give birth to shapes. Definitely, any sonic phenomenon, music included, can and must be analysed in this way. (Schaeffer 1952[A], pp. 50–2)

The second morphology draws comparisons between shapeless sounds in order to discover criteria of matter. By definition, such sounds have a stable matter, that is, they are fixed in tessitura. The first criterion to emerge is the criterion of mass, which is the foremost matter criterion. It 'corresponds to the *occupation of the pitch field by sound*' (Schaeffer 1966, pp. 401) (for the notion of pitch field see § 16). At one extreme of the mass scale, one finds punctual sounds, that is, sounds which occupy the narrowest possible band of frequency: sine waves; at the other extreme, one finds sounds which occupy the widest possible band of frequency: white noise. Morphology proper will define five gradations between these extremes (see § 16). Second morphology also compares sounds of stable, albeit diverse, matter (such as a sine wave and white noise) in order to identify similarities of shape. Through the recognition of dynamic profiles and the comparison of attacks, a solfège of shapes emerges (see § 17). Before returning to a more detailed morphology, this solfège is expected to give rise to a typological criterion. Schaeffer observes that

'all sounds result from a certain energetic process, the *maintenance*, which manifests *the manner whereby the sound is prolonged in the duration*: if the sound is only ephemeral, there is an *impulsion*; if it is continuously prolonged, there is a *sustained sound*; if it is prolonged by repetition of impulsions, there is a third type of occupation of duration: *iterative maintenance*' (Schaeffer 1966, p. 402). This second morphology is ineffective in the face of evolving sounds, which constitute the vast majority of sounds. Schaeffer says about the evolving sound:

> Logically, our first concern when analysing such a sound ought to be to 'disarticulate' it, until finding elementary sonic objects in the interplay of ruptures and sustenances. According to the tempo of these elements, and also according to the always arbitrary level of the cutting, such sustenances will be more or less complex, their articulations more or less distinct. In any case, these objects generally have profiles of shape and matter. Besides, we do not expect the extreme cases of steady shape and steady matter to provide combinatory data; under these circumstances, they are of no more than little help. This is actually why we usually lack terms for the analysis of our perceptions, even when they display an unquestionable coherence to the ear. It is therefore necessary to return to a formula we have already met with, quitting sonority quite soon without entering musicality too soon: this whereto a *typology* of sonic objects which are more or less 'suitable' to musicality tends. (Schaeffer 1966, pp. 402–3)

Léonard *— Give me further details of the Hydra mechanism.*

The fireman *— The hero strikes with the glaive. The glaive hits a push button concealed in one of the Hydra's necks. If the hero's unskilful, of course...*

Léonard *— He misses the button.*

The fireman *— And the head does not come out.*

Léonard *— Hercules' role is particularly difficult.*

The fireman *— Yes indeed. It requires an artist who's also a fencer and an acrobat, mind you. It's always the problem of the* technician artist. *As for me, I'd rather have a good acrobat who sings reasonably well than a clumsy good singer, but it isn't the opinion of the production. Every man to his own taste.*

Léonard *— Tell me, fireman, I shouldn't like to make myself late, the bell...*

The fireman *— You'll hear it.*

P. Schaeffer — In very bad taste, isn't it?

M. Pierret — ...

(Pierret 1969, p. 100)

CHAPTER IV

Classificatory Typology: 'When the Piping Starts to Sing'

13. THE THREE PAIRS OF CRITERIA OF CLASSIFICATORY TYPOLOGY.

The first morphology, identificatory typology, and the second morphology appear under the heading 'morphology and typology of sonic objects'. Classificatory typology nevertheless comes under 'typology of musical objects'. To what does this distinction between sonority and musicality amount? According to Chion, 'taking traditional music as reference and model, "musicality" corresponds to the *abstract* aspect of the musical work, written and fixed in the score, whilst "sonority" corresponds to the *concrete* part, which may vary at each performance, at each embodiment of the work' (Chion 1983, p. 68). Within this context, Chion identifies the musicality/sonority opposition with the *langue/parole* opposition. 'In the experimental research after a new music, "sonority" designates the jungle of all possible sounds still devoid of a musical function; the point in question then is choosing those *sonic objects* deemed *suitable* to become, in certain contexts, *musical objects* whence "values" are abstracted' (Chion 1983, p. 68). Chion commits the classical mistake of identifying Saussure's notions of *langue* and *parole* with the code and its actualization respectively (cf. Chion 1983, p. 68). The following quote shows that Schaeffer falls into the same trap. As has been pointed out by Robert Strozier (Strozier 1988), the *langue/parole* duality is repeatedly defined in the *Cours de linguistique générale*, and it is only within the context of diachronic linguistics, which in Saussure is largely marginal, that *parole* can be likened to the actualization of the code by the speaking subject.

> We find these different attitudes clearly represented and distinguished in the sciences of language: the grammar, normative, with its prescriptions and interdictions; once one has gone beyond this stage, the separation observed by Ferdinand de Saussure of *langue* and *parole*, or code and behaviour: on one side, the conventions which allow us to comprehend each other; on the other, the particular discourses, effectively pronounced and heard, which refer to this code; finally, the separation of the study of languages according to two perspectives: the study of their evolution within a historical, *diachronic* perspective, and the study of languages in as much as systems at a given

moment of time, from a *synchronic* perspective. (Schaeffer 1966, p. 283)

Referring to the musical text, Schaeffer puts in the following terms the sonority/musicality opposition as illustrated by the traditional system:

> Nevertheless this virtually, albeit authentically sonorous text displays the particularity of embracing an infinite number of potential performances, all sharing the 'musicality' of the score, though having each a 'particular sonority'... I see no better way of defining these two terms. (Schaeffer 1966, p. 319)

However, if *langue* corresponds to musicality, which in turn corresponds to the score, there is here yet another distortion of Saussure's notion: in Saussure, *langue* is an essentially psychic entity, it has nothing to do with writing. The experimental démarche analyses sonority (which Schaeffer likens to timbre in the traditional system, that its, the sound characters), listening out for *'values that escape formal musicality'* (Schaeffer 1966, p. 328). Typology constitutes 'a selection from which sonority will emerge cut into pieces that are labelled according to (musical) types of (sonic) objects' (Schaeffer 1966, p. 371). Identificatory typology identifies sound units; classificatory typology compares these units between themselves, selecting those suitable to achieve the status of musical signs; morphology proper qualifies these units. The paradox here is that the musical objects of classificatory typology do not derive their musical quality from any musical code.

> I cannot overemphasize that the whole approach to sonority hitherto, combining typology and morphology, has been no more than a preliminary to musicality. We have certainly needed time to put it together. All the same, I firmly repeat that the crucial work remains to be done: to pass from the sonic object to the musical object, or else, to determine what is, among the suitable sonic objects, the repertory of musical signs *in posse*. (Schaeffer 1966, p. 475)

The term musicality also appears within another important duality already broached in § 7: musicality/musicianship. Chion defines this duality in the contexts of the prose composition and the unseen translation, that is, the making and the listening; this is how he presents musicality and musicianship in their specific relations to listening:

> Comparing a Stradivarius player with a 'child on the grass', *'who has picked a suitable blade of grass, stretched it between his palms, and is blowing on it'* (339), we might say that it is the child, rather than the violinist, who instigates musicianly listening, diverting us from the references of classical music: *'...rather than listening to the quality of the*

> *Stradivarius sound, which is too musical, we want to listen, in a musicianly manner, to the most crude sonic object; and we shall discover such a listening by practising it.'*
>
> The auditor of the child on the grass *'...will be forced to suffer a collection of sonic objects devoid of musical sense, and hence he will hear them all the better: one hoarser, another shriller; some short, others interminable; some resonant, others grating. The amazing thing is that then he will be practising the best possible musicianly listening'* (340).

Musicianly listening therefore starts from an identificatory attitude: *'it is primarily the listening to factures, the listening of the homo faber, for whom one substitutes oneself in imagination'* (344). Thus it naturally leads to musicianly invention. However, it is also the listening to *'the effects and the overall content of sonority. Actually, this is the first effort of a reduced listening, sonic at this stage, but already turned towards the search for criteria of identification'* (344). In this connection, musicianly listening will guide the choice of the identificatory criteria of typology, which is the first stage of the programme of musical research.

By entirely opening itself to the *'universal symphony'* (332), that *'immense brouhaha'* (332), *musicianly listening* places itself at the start of a new musical démarche. However, in order to lead into music, musicianly listening must limit the field of the objects it studies, focusing on those which are *à priori* 'suitable' (to musicality). One comes to a compromise (partaking of the method of **continual approach**, of which the author of TOM is fond). This compromise consists in a musicianly *'classification of sonic objects which does not deny a musical choice of sonic criteria'* (346). Musicianly listening and musicianly invention do not abandon the reference to the musical past.

Musicianly listening 'therefore suffers a double restriction: on the one hand because one allows it to elucidate only structures of identification, rather than all sonic structures of the object (...), on the other hand because by means of musicianly listening, being informed by this listening, one chooses suitable objects (...). It is through the agency of these two restrictions that musicianly listening "specializes" reduced listening' (348). (Chion 1983, pp. 41–2)

This is how Chion presents the duality musicianly/musical in relation to the prose orientation, that is, on the side of the making:

> The same duality reappears at the level of the *Making*, or the manufacturing of sonic objects where those two complementary aspects, musical invention and musicianly invention, can be distinguished. Musicianly invention nevertheless does not break with the past, notably when it chooses to create objects suitable to facilitate reduced listening and musical research.

> Musicianly invention arranges *'sources in order to create objects'* (345) (concrete pole, pole of factures), whilst musical invention works out *'comparisons in order to create structures'* (345) (abstract pole, pole of values). Both are liable to fall into equivalent traps: for musicianly invention, the trap of *lutherie* and causalities (the temptation to *'confuse sound-producing bodies with the objects they produce'*) (356); for musical invention, the temptation of prematurely evolving structures from values which are not sufficiently based on properties of the objects, making music before having perfected a *'solfège of suitable objects'*. However, they must complement one another, as creation and research (358–9) complement one another, in a permanent toing and froing, from the listening to the making, then back from the making to the listening: *By means of musicianly invention, which is the heir to ancestral ways of making, one will contrive to create sonic objects lending themselves to musical renewal, that is, suitable musical objects. Once such objects have been achieved, one will still contrive, by means of a decontextualized musical listening, to hear them as hosts to intelligible elements of new systems to be deciphered'* (354). (Chion 1983, p. 42)

The initial difficulty classificatory typology faces is the choice of classificatory criteria. Schaeffer exposes it in an allegory, the parable of the attic:

> When we wanted to study a sonic morphology, we needed to choose an exemplary object: a typical object. Wanting to establish a typology, we shall have to evoke morphological characteristics. In order to demonstrate this linkage, let me show how difficult it is to sort out material objects.
>
> The best pedagogic situation, yet the worst for the teacher, is found in the attic: does everything which is piled up there not answer to the notion of object? In this situation, no one would conceive of denying that whatever comes to hand deserves to be put in the right place, unless we do not feel up to it and just give up (which, incidentally, justifies the existence of attics).
>
> Some of these objects have a simple morphology and are easy to classify: planks of different thickness, width, and length; bottles of different capacities. These examples spontaneously come to my mind because, to make the attic test easier, simplicity and measurableness immediately turn up: as may be seen, these objects actually coincide with solids and capacities, that is, they answer to the notion of physical object. However, what is the relation between these planks, some old clothes, wood shavings, and a stuffed bird?
>
> Shall I measure my bird to place it among the planks? Shall I stick a decilitre of wood shavings among my phials? Clearly, physics helps me not, on the contrary. Someone suggests that I arrange the clothes by size: this does not give me the means of placing them in relation to the bird or the bottle. And could I classify a breast-plate, a tail-coat, and bathing trunks all according to size, or else according to the price a second-hand

> dealer would pay for them? Though it is possible to deduce certain criteria of value from the objects, such criteria offer no help in the preliminary selection which must constitute a typology.
>
> It is therefore tempting to give up, observing furthermore that selecting from among any objects whatsoever is not only impossible but perhaps fundamentally useless even. One is aware of the fact that the planks go to the carpenter's, the clothes to the tailor's, and the phials to the pharmacist's; well, the same does not happen with sounds. All sounds go to the musician, and if he refuses one, he must know why: precisely because they come from his *typology*. However, he cannot make a decision unless he has examined a sufficiently vast generality of sounds, so as to know the norms whereby he accepts or rejects them. If, for instance, he takes exclusive account of sounds which can be defined in physical terms, he is like a housewife who keeps in her attic only what can be measured by ruler or in the scales.
>
> Let me pursue this parable for its teachings have not yet been exhausted. Does someone suggest classifying the objects according to material? Those of wood would go together, as would those of fabric, metal, etc. This suggestion is already more realistic than the sizes, but it does not take me very far: shall I stick the iron wire between the forks? a violin among the logs? Should I classify according to destination instead? Or distinguish between manufactured and raw objects? These are better suggestions, for they are already connected with the use of the object, its situation among other objects, and with two intentions which converge thereto: the manufacturer's and the user's. (Schaeffer 1966, pp. 429–30)

Schaeffer spent various years trying different criteria for classificatory typology. He admitted that, necessarily, the choice would be arbitrary to some extent. Various classificatory typologies were possible; some were very good, but none was absolutely imposing. There were convenient typologies; from among these, Schaeffer expected to select a particularly rational one. As has been seen in § 12, being excessively logical and radical to account for the generality of sounds, the shape/matter pair of the second morphology could not provide a key to classification.

> We want to employ sounds chiefly to make music. Let us look for an essentially musical criterion. What do we immediately come across? Pitch, of course. Are we not coming up against that criticism already made about classifying planks by size? Yes and no. We should be committing the same mistake if pitch itself were taken as a criterion. However, simply to mention that an object can be heard according to pitch—regardless of the fact that this pitch is definite and stable (or variable), or multiple and more or less recognizable—amounts to saying that physical objects have one or various spatial dimensions, either fixed or elastic. This procedure does not intend already to organize objects according to value, but simply to ascertain whether or not they present more or less distinct and 'plural' aptitudes for this value. Thus, in relation to *sound mass* [see

§ 12], we have established a typological criterion of stability, and of simple or complex variation; if the mass is stable, the possibility of clear or blurred appraisal of this mass will provide another typological criterion.

Having thus picked out a first criterion related to the (musical) *use* of sounds, let us refer to an essentially musicianly given, so as to find our second criterion, *facture* [see § 10]: the manner whereby energy is imparted and manifests itself in the duration, in close relationship with maintenance. (Schaeffer 1966, pp. 431–2)

Classificatory typology distinguishes four types of mass: tonic mass, where pitch is fixed and identifiable; complex mass, where pitch is fixed but unidentifiable; variable mass (whether tonic or complex), where variation is moderate and organized; and unpredictable mass (whether tonic, complex, or mixed), which varies disorderly and excessively. According to Chion (1983, p. 123), classificatory typology distinguishes three types of facture: continuous facture, which is prolonged and continuous; punctual facture, which is an ephemeral phenomenon, a simple impulsion; iterative facture, which is prolonged by repetition of impulsions. However, the final table of typology (see figure 5) also presents: null factures (whether continuous or iterative), which are not perceived given a temporal span that is either too long (macro-objects) or too short (micro-objects); unpredictable factures (whether continuous or iterative). The second paragraph of the quote in pages 142–3 defines null factures, unpredictable factures and closed shapes as the three distinct factures of classificatory typology. Chion's list is more concerned with maintenance than facture.

The above classification has surreptitiously introduced the second pair of criteria of classificatory typology, namely duration and variation, the former in connection with facture, the latter with mass. 'Contrary to visual objects, sonic objects exist in duration, and not in space: their physical vehicle is essentially an energetic event framed by time' (Schaeffer 1966, p. 244). Schaeffer affirms that his research followed the procedure of acoustics, 'where the perception of duration only little by little appeared as a specific phenomenon' (Schaeffer 1966, p. 244). As acousticians had done before, he started by discarding the problem of time, focusing on pitches and spectra; then he moved on to a study of psychological limits, or thresholds of perception (for physicists, a physical given of the auditory system), where time and duration were implicated; finally, he tackled 'anomalies' between physical data and perception (which he termed anamorphoses), emphasizing relationships between time and duration. 'It seems that we have made a long detour to get to findings which did not require any particular laboratory, and which anyone could have made by attentively comparing the perception of the duration of various sounds with their corresponding physical time' (Schaeffer 1966, p. 244). Schaeffer dismisses both the physicist's and the musician's belief in the existence of a single sort of time: for the former, 'time is a divisible, additive, and chronometrically measurable magnitude' (Schaeffer

1966, p. 245); for the latter, 'a crotchet has the value of two quavers and can be measured by the metronome, this musical chronometer' (Schaeffer 1966, p. 245).

> To underscore the naïveté or the bias of these convictions, and in line with the method adopted in this third book (which will perhaps contradict or at least refine the following book), I shall yet again compare our perceptions and the physical object materialized by the tape. When comparing them closely, we may start our questioning from one or another pole. Comparing sonic objects measured by a certain number of centimetres, we shall listen to the temporal structures they form. On the contrary, starting from the ear, we may gather together our musical experiences of listening to durations, making an effort to comprehend better what the 'time of listening' is. (Schaeffer 1966, p. 245)

For Schaeffer, music has followed the example of physics, devoting its cultural effort to 'normalizing' nature. 'It has been the task of our civilization, whose vocation is the establishment of the intersubjectivity of practices, to domesticate the virgin nature of sound, creating comparable objects' (Schaeffer 1966, p. 245) (the traditional *lutherie* and the traditional solfège are a means to this end). Hence, 'internal durations of the objects and the spaces between them apparently obey the same chronometer' (Schaeffer 1966, p. 245). This holds true for sustained sounds, where quavers and semiquavers get close to the perceptual reality: 'Listening to a run on a flute or violin, or to an arpeggio in the medium of the piano, we shall pay attention to the slightest rhythmic mistake, to the artist's slightest inaccuracy of rhythm: we immediately perceive if he hastens or retains the tempo, if he is nervous, or if his playing is not *perlé*' (Schaeffer 1966, p. 246). Where rhythm prevails, one has simple arithmetic relations (as in consonances).

> However, when considering objects which are less easily comparable than those usually used with a rhythmic intention, there is good reason to question this equivalence between durations and spacings. It will be seen that, if instead of similar objects, primarily made to mark places, we assemble or compare objects conveying different information, then metric time fades in favour of a perception of durations which has an obvious relation with the content of the objects. (Schaeffer 1966, p. 246)

Schaeffer's experiments with anamorphoses of time and duration date from 1959; their results were first published in the paper 'Note on Time Relationships', which appeared the following year in the *Gravesaner Blätter* (see Schaeffer 1960).

> As opposed to such other acoustic and musical phenomena as are veiled in complete obscurity, this particular field of research has the merit of being within grasp of the

> hand, which, armed with a pair of scissors, can cut the sounds' duration, as represented by the equivalent length of magnetic tape, at will. (Schaeffer 1960, p. 51)

So, even if the study of durations could dispense with machines, machines played a pivotal role in the study of temporal anamorphoses. In 1957, Jacques Poullin and Alain Chambure were charged with the oscillographic comparison of initial transients of various sounds. These experiments dealt primarily with the first fifty milliseconds of sounds, a time corresponding to a threshold of perception which was designated as 'the thickness of the present' (cf. Schaeffer 1960, p. 55). Sounds which, perceptually, were undeniably identical, did not give rise to identical graphic representations (see Schaeffer 1960, figures 1–4; 1966, figures 4–5). This confirmed the assumption that 'the first fifty milliseconds of any signal at all create distortions in the ear itself so as to form an *impenetrable mask* to every musical analysis' (Schaeffer 1960, p. 57). It also became clear that the perceived sharpness of attack of piano sounds was not necessarily linked to steepness of attack as graphically displayed in measurements of the physical signal, being rather a function of the decay curve. This was demonstrated by removing first fifty, then one hundred, and finally one hundred and fifty milliseconds from the beginning of an A_4 from the piano: attack was not perceptibly altered by these cuts (it was actually slightly softened). For an A_1, cuts of as much as half a second produced similar results. However, cuts on the decay curve radically changed attack perception. On the other hand, experiments with plucked guitar-strings indicated that the ear operated an overall synthesis of the different phases of the sound duration.

> Some knowledge of Gestalt theory shows that every sound event is perceived as one whole and that the ear makes a synthesis which is the more compressed, the more the causality of it is evident and the æsthetic end of it is classical. For this reason, the pizzicato was a constant riddle to us scientific research workers. It beguiled us into hypothetical graphical representations which more or less rounded off the attack curve. But in reality there is nothing more pointed than the wave-front coming from a string suddenly let go—but the resonant energy momentarily stored and released immediately corrects that impression so that sharpness gives place to an impression of elasticity. It is this elasticity which then appears as the characteristic of the pizzicato, it is this elasticity which softens it, which tinges it psychologically, and which gives the pizzicato a round tone making it appear in the end less hard than keyboard percussion. It will now be clear how far removed these musical interpretations, perfectly correct when viewed psychologically, are from the graphical interpretation. The slope of the piano is far gentler than the beginning of the pizzicato, and the rebound of the latter has quite a different interpretation.

The phenomenon of incompatible *relationships* becomes convincing in this case, which shows not only a blockage of perception as was the case with the piano, but a genuine

> 'time anticipation'; the elasticity of the pizzicato, although being only the second stage of the phenomenon, influences our perception of the beginning. Clearly, numerical interpretation of levels or even slopes leads to musical nonsense. (Schaeffer 1960, p. 61)

Another series of experiments has demonstrated that the ear focuses its attention on the attack. In some cases, sounds whose attack time corresponded to 1/12 of the decay time were heard as having equivalent attack and decay durations. What the ear localized in the instant of attack did not pertain to that instant, but rather originated from a general law of dynamic, an integration phenomenon: 'the ear, far from discriminating among the instants, subjectively projects the whole of the event onto its initial instant' (Schaeffer 1960, p. 53). If the duration of the attack appeared as disproportionate in relation to the time of the attack, this happened because '*musical duration is a direct function of information density*' (Schaeffer 1966, p. 248; 1960, p. 67).

> How to interpret such results? Given the presence of a causality in action (facture), and the importance of evolutions taking place in the sound (variation), the brief instants of attack or maintenance doubly fix the attention: thus the ear gets down to analysing both causes and effects. Once the first event has finished, the ear feels or assumes that all characteristics developing by resonance existed already in the maintenance phase. In the first phase, the effort of attention increases the feeling of event duration, and memory seems to keep a major imprint of this event; the second phase does not demand more than a diffuse attention; curiosity wanes, and the event leaves a minor imprint. (Schaeffer 1966, p. 249)

Schaeffer also made the following observations. When sounds are slowed down, the difference between the active and the passive phases appears lesser as regards information density; time and duration draw closer to each other. When the resonance is cut off from the attack, the ear may somehow 'reconstruct' the resonance, at least when the sound has already been heard; attack is of primary importance in the recognition of sounds. As regards forward and backward play, 'in the former, after a beginning where all information seems to have been given away, the ear switches off and gets bored, whilst in the latter (which begins with resonance), the ear progressively awakes and remains in a kind of suspense waiting for the *dénouement*' (Schaeffer 1966, p. 250; see also Schaeffer 1960, p. 68). Some of the conclusions presented in the *Gravesaner Blätter* concerning experiments with reverse sounds (see Schaeffer 1960, pp. 68–9) are rephrased in *Traité des objets musicaux*:

> 1. *Information density is better distributed.* Attention can be more sustained and gradual. Hence the object appears from a more favourable angle (as regards this particular point, which has nothing to do with pleasantness).

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2. *Listening is more abstract:* both in the resonance phase and in the attack or maintenance phase, musical characteristics of the sound are more clearly perceived: attention becomes more sustained because sound identification (according to the facture) eludes it. This is a kind of 'travesty', an acousmatic curtain drawn on sounds: the reverse sound tends to mask the forward sound.

3. However, such sounds are unfortunately *strange and illogical.* Not only is the ear generally unable to identify the instrumental causality of reverse sounds, but it also immediately recognizes a technique. Unless it undergoes a special training, the ear has difficulty referring such sounds to the usual causes; furthermore, it is disturbed and even scandalized, by an unnatural use of sounds. (Scandal here does not refer to an æsthetic reaction, but rather to a natural repugnance for accepting an energetic phenomenon which does not fade down or whose maintenance systematically 'explodes' after a certain time.)

This strange character has an enormous importance in experimental music. It may be considered as both the salt and danger of a new musicality. One has seen how, at the sensorial level, it can refine listening, but this happens at the cost of a shocking sensation. (Schaeffer 1966, pp. 250–1)

In the case of reverse sounds, listening happens at a different pace and in a different manner. The ear perceives better the harmonic content which the attack masked when it was at the beginning. Sometimes maintenance and resonance, which may appear as two distinct phenomena in a forward sound, appear as a continuous phenomenon in reverse play, and the resonance smoothly becomes a maintenance. Furthermore, as the ear's attention is no longer jerked by the masking of attacks and the little interest of resonances, it becomes more evenly spread not only over the object but also over a whole series of objects. What in forward play was a discontinuous series of objects may become, in reverse play, a sequence of interrelated musical objects; silences between objects, which appeared as breaks, now 'sound' as links. The listening to the objects themselves becomes more subtle, more abstract in a sense, and the harmonic content of each object is better perceived in itself, whilst the diverse harmonic contents of a series of such objects highlight one another. Schaeffer concludes that, if symmetric objects are to be created, this symmetry cannot be based on the physical notion of time, but it has to take account of information density.

So, on the one hand, experiments with temporal thresholds have demonstrated that the ear cannot apprehend details of what it is given in a very brief span, thus perceiving a single event. 'If the duration of the sonic object increases, and if moreover the ear is given some subsequent silence (for "digestion"), it integrates, remembers, and comprehends that which, for being too surprised, it had been unable to analyse' (Schaeffer 1966, p. 253). Hence the notion of a 'fragmented time, or successive "duration takes"—in short, a

discontinuous time of listening' (Schaeffer 1966, p. 253). On the other hand, experiments with anamorphoses have confirmed that 'the ear's attention is concentrated on those instants where the energetic explanation and, in general, the characteristic variations of the object are brought together' (Schaeffer 1966, p. 253). Experiments with reverse sounds have ratified this conclusion. Thus, anamorphoses and reverse play have shown how the ear 'installs itself in different durations, each of which original and holding no direct relation with physical time' (Schaeffer 1966, p. 253). All these experiments were made with brief or medium objects.

In *Traité des objets musicaux* Schaeffer defines four 'temporal zones'. There is a medium zone affording an optimal listening, and varying according to the nature of the object; it favours qualified listening. Rather than closely following the duration of the object, the ear becomes sensitive to overall shape, apprehending internal proportions and relevant details. Since duration does not appear as an essential perceptual value, these objects are somehow beyond duration. When they are played at a faster speed, information density increases and listening becomes less comfortable, since there is less time for analysis of details. When played slower, they appear as under a microscope: the overall panorama gets lost, spilling over 'the sonorous temporal screen, as a slide projection which is larger than the screen it is being projected on' (Schaeffer 1966, p. 254).

> In short, within certain temporal limits, the ear is spontaneously sensitive to a more or less balanced shape, and to a more or less definite content whose trace fits comfortably into a zone of easy memorization (certainly dependent on the nature of the object). Within this zone, the natural curiosity of the ear is not directed towards assessing the duration of the object. (Schaeffer 1966, p. 254)

If the object is excessively long, albeit well shaped, it will not be apprehended in its ensemble. All the ear can do is follow it point by point, as the eye follows a moving mobile. 'In the same way as the screen isolates part of the projection which is too big, a kind of aural screen "slices" the sound, splitting it into assimilable portions' (Schaeffer 1966, p. 254). The perceived duration of these sounds oscillates between two extremes. At one end, they may be too repetitive: the ear recognizes that it has not much to apprehend and gets tired; as attention fades, time seems an indefinite wait. At the other end, these sounds may carry excessive information: the ear has to mobilize continuously, with no time for integration, rest, or recapitulation; the perceived duration then corresponds to the breathlessness of the attention, and one has noise. In either case, no characteristic shape appears; these sounds have no facture.

It will be noticed that classical music simultaneously employs objects fitting into the

> temporal framework of the ear (notes which are clearly outlined as specific sonic entities), and long objects, or sustained notes. These objects, which evolve little, are followed with a more diffuse or a lesser attention; their shapes are not appreciated. They serve as support or linking for other shaped objects. (Schaeffer 1966, p. 255)

The term 'brief objects' refers to objects whose duration is far above the thresholds of temporal differentiation; sounds approximating these thresholds have no appreciable duration in comparison with shaped, long, or even brief objects. The listening to brief sounds focuses on the beginning of the sound; shape is outlined too quickly to be apprehended, unless it has a characteristic content actually determined by the initial features. It is these features (dynamic slopes) that the ear perceives, neglecting the rest. Chion observes that, given their frequent use in traditional music, the ear has got used to brief sounds (cf. Chion 1983, p. 118).

> In short, the 'time of listening' appears under three characteristic forms (excluding the threshold case, which hardly concerns music). One of them consists in following the duration of the object without losing track of the flow of time, as in a moving mobile whose position one constantly assesses. Another, consists in perceiving the overall shape of the object in a temporal screen of optimal memorization. The last one consists in referring this shape to the initial instant by a qualified perception of the attack.
>
> Thus, the ear emerges as a machine integrating time in three diverse manners around this duration of optimal memorization, which of course largely depends on the shape itself of the object, the nature of the information it carries, and the ear's conditioning. (Schaeffer 1966, p. 255)

According to Schaeffer, traditional music primarily uses two kinds of sound: maintained sounds with a flat or widely profiled dynamic, and 'fed' percussions, that is, percussions whose perceived decay is prolonged by a sounding board (piano, harp). In relation to the time of listening, these maintenances correspond to those two extreme cases: sustained sounds, which are perceived at each instant, and percussions, which are referred to the beginning and the decay. As has been seen, the temporal values of maintained sounds can be likened to the spacings between these sounds (a violin minim equals the corresponding rest). If one accepts that the dynamic shapes of percussion sounds are reasonably similar in specific registers of the instrument, it is only the values of the spacings that count; on the other hand, one gets used to the fact that the durations of the objects vary from one register to another; besides, resonances can be cut off by the use of dampers: *lutherie* resources may adapt psychological durations to metrical time. The experimental composer cannot count on artifices of either *lutherie* or performance. Times can be masked by durations which are perceived as extremely variable. 'Generally speaking, one may say

that he (sc. the experimental composer) carries out an instinctive discrimination, opposing to (or enhancing by) one another those three types of object corresponding to the ear's three "times of listening"' (Schaeffer 1966, p. 257). The experimental composer, or the composer of 'generalized music' works with:

a) Widely evolving sounds, demanding a linear listening which regularly progresses in time according to the limited musical information they offer;

b) sounds with 'good shape', where the balances of duration between the various phases of the object play a full part; as these relations elude any metric, they will notably rely on the dynamic asymmetry of the objects, and particularly on oppositions and analogies between maintenance modes;

c) finally, brief percussive sounds, or nearly punctual artificial impulsions, whose 'impact' [see §§ 16 and 17] relies much more on their unusual character than on their dynamic slopes. The ear is forced to 'integrate' such impulsions in the instants which follow. Psychologically then, they are likely to mask subsequent sounds which are too close, or to be masked by these sounds. (Schaeffer 1966, p. 257)

Schaeffer defines the second element of the duration/variation pair as follows:

> On the other hand, we have mentioned variations of shape and mass. But what is a variation, if not something which changes as a function of time? One has *duration a second time*, not anymore in connection with the overall size of the sonic object, but rather in a *relation* resembling velocity; the quotient of distance (that which changes) by duration of change. (Schaeffer 1966, p. 433)

In the same way as the criterion of mass revolves around pitch, which is nevertheless not raised to the status of a musical value, classificatory typology does not treat duration and variation as fundamentals of a musical code. As has been said, they are mentioned with reference to the first pair of typological criteria: mass and facture. One may wish to compare Schaeffer's definition of variation with the idea of changes as expounded in the *I Ching*. According to *The Classic of Change*, change is the back cloth against which permanence is perceived, as much as permanence is the back cloth against which change is perceived. Section 11 has shown the stress Schaeffer's permanence/variation lays on the need for permanence so that variation may be perceived. The *I Ching* recognizes three types of change: cyclic change, evolution, and disorderly change. Cyclic changes are exemplified by the four seasons, the waxing and waning of the moon, the movement of the tides, etc.; evolutions take one from one point to another, from birth to death,

from waxing to waning, from autumn to spring; disorderly change presents no identifiable pattern (compare with the general typology of variations in § 19 and the typo-morphology of allure in § 18).

Before presenting the third pair of typological criteria, Schaeffer expounds the notion of objects in a sheaf, whereby classificatory typology abandons the idea of a physical classification based on independent variables in favour of a selection which is simultaneously psychological and pragmatic; this selection resorts to subtler notions related to musical and musicianly perceptions. The hope of classifying an object once for all in a particular compartment of the table is also left behind. Each object may be placed in a number of compartments, depending on the intention of listening; an 'absolute' typology is deemed illusory.

> If I take as a material object a sheaf of wheat, my intention may be to 'summarize' it, simplifying it, or on the contrary, to analyse it, decomposing it. At a certain moment, it will appear as the good object, the 'happy medium' between what would decompose it and what would integrate it: the sheaf is at an adequate distance from my eye, or it has been suitably placed in relation to my intention. No matter how tenuously someone disagrees, or if my neighbour quibbles, I shall have to admit that this is a group of objects, namely ears. These ears in turn are grain structures, which in turn... etc. But on the contrary, maybe this sheaf belongs to a stack, or has been arbitrarily distinguished in a structure of aligned sheaves, or as a detail in a surface studded with such points, a simple granulation amid vast harvested fields? We have here the two infinities, shared by Pascal and the structuralists, which must not be forgotten when we establish a typology. Once we take a look at an object (in an arbitrary manner), we shall have to expect it to decompose into elements and to blend into an ensemble. In so far as we safeguard its coherence, its unity, it will be classified in a particular compartment of the table. Should we come to distinguish its microstructure, then it will change place, almost certainly ending up in a compartment lodging less simple objects. Should it be blended into a macrostructure, then it will no longer be the isolated object of the previous classification, becoming, in relation to this macrostructure, a simpler element: its personality dissolves; the macrostructure tends to impose as object to be classified. (Schaeffer 1966, pp. 433–4)[19]

A spiccato composed of small impulsions due to the rebounding bow resembles the sheaf. As such, it pertains to a certain compartment of the table. However, if one pays attention to the composing impulsions, it will be differently classified. Likewise, the macrostructure of various bows simultaneously performing the same spiccato or aleatoric spiccati also requires a new classification. Classificatory typology must essentially account for 'objects presenting themselves to musical listening as easily manipulatable, identifiable, and (literally and figuratively) memorable compromises' (Schaeffer 1966, p. 435). The qualities of

this compromise are equilibrium and originality.

According to the example of the sheaf, the central objects of this classification must be neither too elementary nor too structured. If too elementary, they tend to be heard as part of more memorable structures; if too structured, they tend to split into more elementary objects. Duration therefore plays a role in the choice of central objects, as the adjective 'memorable' implies both pregnant shape and adequate duration: these objects must be neither too short nor too long, their durations must correspond to the ear's optimal duration of audition. It is true that short objects tend to sound elementary, whilst long objects invite complexity, but the contrary is equally true: a short object can be very complex, and a long object very simple (what is elementary is not necessarily short, and what is complex is not necessarily long). This would lead to an excessively complex classificatory table. 'Let me simply indicate that we shall qualify the objects as *balanced* or *unbalanced* depending on whether they appear as a good compromise between excessive complexity and excessive simplicity, on whether they come close to structures which, from a perceptual point of view, err through a lack (too elementary) or through an excess (too complex)' (Schaeffer 1966, p. 435).

Duration is directly linked to equilibrium, which in turn is directly linked to originality (a complex structure is necessarily more original than an elementary one). The notion of originality becomes clearer when one compares equally well balanced objects.

> Let us imagine a field of stacks, some of which are true stacks, while others are just cardboard cones or pyramids, or bundles of branches; or else, some are irregular, truncated or hybrid, that is, composed of the aforesaid elements: ears, branches, or rectilinear elements. We shall then have a higher or lower degree of originality at the same degree of equilibrium. The cardboard pyramid will be considered 'redundant', as one of its fragments is enough for us to recall the whole pyramid. It is different with the natural sheaf, unless fluctuations corresponding to the ears are neglected. Roughly speaking, the degree of originality is what surprises expectations. A violin vibrato, which compares in originality with a natural sheaf, is more original than a level electronic sound, but less original than this electronic sound unexpectedly profiled. (Schaeffer 1966, pp. 435–6)

Chion observes: 'Well balanced sounds are *à priori* those which can be *suitable* to musicality, but one must not confuse the notion of balance with the ampler notion of suitability, as the latter relates to an intention of musical use for the objects' (Chion 1983, p. 126).

Classificatory typology is therefore based on three pairs of criteria:

> The first pair is morphological: one follows the facture of the object, and one follows its mass. The second pair is temporal: one considers duration of the object, and variations within this duration, according to the previous criteria. The third pair is structural: one considers the balance of the object which has been chosen among possible structures, and, for this chosen structural level, the greater or lesser degree of originality. (Schaeffer 1966, p.436)

These six criteria would lead to an unmanageable classification if they were not compressed into a bidimensional table. To begin with, the relationships between the first two pairs are simplified: duration is combined with the qualitative perception of the energetic maintenance of the object (facture), and this combination originates the horizontal axis of the classificatory table. To the left, one has continuous maintenances, to the right, iterative maintenances. The central point of this axis is defined by null durations and null maintenance. Round the middle, there are impulsions, objects corresponding to a brief energy instantaneously imparted. Towards the left and the right, factures stretch in duration.

long	←	continuous	←	null	→	discontinuous	→	long
duration		maintenance		duration		maintenance		duration

The combination of mass with variation engenders the vertical axis.

definite pitches

↑

fixed mass

↓

variable mass

These two axes define a four-quadrant diagram (see figure 2). In the middle of the vertical axis one has fixed mass, corresponding to an acceptable balance and sufficient originality of matter. Originality increases from top to bottom. Nothing is less original than an

electronically produced sine wave; the more the mass varies, the more original the sound is, and the more likely to be unbalanced, given its unpredictability and the complexity of its structure. On the vertical line which crosses the very centre of the horizontal axis, one has micro-objects. Although temporally unbalanced and seemingly elementary, they could prove very complex if stretched in time. Close to this centre, there is an equilibrium zone comprising objects which are well balanced, and neither excessively nor insufficiently original. On the borders, there is a vast area of unbalanced objects. In the middle of the horizontal axis of the theoretical table (figure 3), one has briefly imparted energy (pizzicati, impulsions, glottis attacks, etc.), where facture is certainly well defined, but not perceptible as such. To the sides of this zone, there are well shaped, well balanced and sufficiently original factures such as a stroke of the bow or a held note. Further away from the centre, shape dissolves in time; if it remains regular, whether it is a question of a continuously maintained sound (left), or of the uneventful repetition of an impulsion (right), one tends towards null factures. The horizontal axis of classificatory typology defines seven zones where facture and duration appear in characteristic relations, corresponding to various degrees of originality or redundancy as indicated in figure 4,[20] where the Y-axis goes from zero (redundancy) to infinite (total unpredictability). Ultimately, the far right and the far left of the horizontal axis meet.

At both ends of this axis, amid long durations, it is also necessary to find a place for those factures which are prolonged by reiteration (rather than simple lengthening). On the side of continuous sounds, from a well shaped facture such as a stroke of the bow, well balanced in duration, one may get to either the *homogeneous* sound [see § 14] with no facture (a continuous note from the hurdy-gurdy, a synthetic sound imitating an indefinite stroke of the bow), or the *échantillon* [see § 14] with unpredictable facture (irregularly repeated strokes of the bow, as if randomly stringing together sounds), which corresponds to an object endowed with unity solely because its whimsicalness does not hide the causal permanence. Correspondingly, on the side of discontinuous sounds, the well shaped spiccato may also 'dissolve in time' in either way. By impoverishment of facture, it may become mechanical, perfectly iterative, and equivalent to homogeneous sound. Or on the contrary, one may get a more or less aleatoric and confuse reiteration of the same kind of causality (rather than the same cause carrying out its action), producing a number of brief objects with similar factures; thus a series of pizzicati irregularly distributed in time, or of bow impulsions from an ensemble of asynchronous violins, forms a long, unpredictable and excessively original object. Unlike the échantillon, unity here stems from a certain kinship linking countless detail factures, rather than from a transparent causal permanence. Such an object is termed *accumulation* [see § 14]; it is a reiteration which abounds in brief elements, all relatively similar. (Schaeffer 1966, pp. 438–9)

The centre of the vertical axis in figure 3 presents masses which are fixed in tessitura,

such as those produced by gongs, cymbals or bells. Though these sounds are complex, and neither their pitch nor their harmonic content is clear, they correspond to a median originality and to an acceptable balance between what is simpler (harmonic pitch) and what is more complex (masses which evolve in pitch). Above such sounds there are masses with determined pitch (tonic sounds), and at the very top, the absolutely fixed pitches of electronic sounds.

> Below this median type things are less clear. What is a sound of variable mass? What is the nature of this variation? Besides, does variation not imply velocity, and hence yet again the duration of the object, which would have to be introduced, against our will, also along this vertical axis? (Schaeffer 1966, p. 440)

Beyond the zone of well balanced masses, sounds tend to be unclassifiable, or so original as not to answer to the notion of object any more. Instead, they appear as structures of pitch, or of pitch variations, whose *raison d'être* escapes the auditor; they may teem with totally unpredictable events. Two kinds of conditionings may nevertheless give unity to these objects. A slice or 'cell' (see § 14) can be arbitrarily cut from this mass: the brief duration of this cell will help the ear memorize its content, thus conferring an artificial coherence upon this sound, which then becomes justifiable of being classified as an object. Or else, despite variations, the perception of a causal permanence remains, linking the successive instants and defining an object:[21]

> Thus, when the piping starts to sing, the whole hotel is graced with an ensemble of sounds which can be heard as a piece of 'hydraulic music', if one pleases, but which is certainly still more likely to appear as a single object resulting from a well determined aquatic episode, and having a beginning, a middle, and an end. We shall call such sounds 'gross notes' [see § 14]. Gross note and cell, these are the confines of typology, the limits to our exploration of possible cases still belonging to a not entirely subjective characterization. (Schaeffer 1966, p. 441)

The two bottom lines of the typological table house objects which, for being too original or too unbalanced, can hardly be compared with those in the other compartments. This typological sketch outlines three great typological families: well balanced objects, redundant objects, and eccentric sounds.

14. THREE GREAT TYPOLOGICAL FAMILIES: WELL BALANCED OBJECTS, REDUNDANT OBJECTS, ECCENTRIC SOUNDS.

The most suitable objects to musicality are those contained in the nine central compartments of figure 3:

23, 24, 25
33, 34, 35
43, 44, 45

Excluding the central column (which is nevertheless well balanced), these objects are well shaped, i.e. soldered by an undeniable unity of facture, corresponding to the ear's optimal time of memorization. The masses of these nine types are like the masses of orchestral sounds: fixed masses of percussions, determined pitches of sounds which can be written on the stave, glissandi from the strings or from the timpani, etc. 'In typology of sonic objects, the nine types of well balanced sounds are those which show *"a good compromise between excessive structuration and excessive simplicity"*, having a suitable duration, "good shape", and a solid "unity of facture"' (Chion 1983, p. 126). Since Chion accepts that impulsions are not well shaped (Chion 1983, p. 126), one may wonder whether a sound with good shape and a well shaped sound are not the same thing. For him, the term well shaped implies *Gestaltqualität*. All the same, there seems to be some confusion here. Chion affirms that the term notes is often used with reference to well balanced sounds (see Chion 1983, p. 127), but he also says that well shaped sounds are sometimes termed notes, 'because of their similarity with the traditional musical note' (Chion 1983, p. 129). Schaeffer uses the term note with reference to all nine objects.

2) It is possible to distinguish two cases of well shaped sounds:

a) essentially, 'well shaped' sounds proper (in the gestaltist sense of good form), which correspond to *the well balanced sounds of typology less the impulsions.*

b) secondarily, two *eccentric* objects, because though their masses vary excessively, they have a median duration and show temporal unity: the *Gross Note* (W) and the *Cell* (K) [see *infra*].

3) The list of well shaped sounds must not be confused with the list of well balanced sounds. In fact, there are well-shaped well-balanced sounds, as well as unshaped well-balanced sounds (Impulsions) and unbalanced well-shaped sounds (Gross Note and Cell). (Chion 1983, p. 129)

Chion comments on the inclusion of impulsions among well balanced sounds:

> 3) If *impulsions* appear among **well balanced objects,** despite the fact that they do not answer to Schaeffer's criterion of *the ear's optimal time of memorization*' (443), this happens by a kind of adoption, given their current use in traditional music, where our ear has learnt to listen to them. (Chion 1983, p. 127)

Having defined the objects which are suitable to musicality, Schaeffer elaborates on their morphology. In the end, the table of classificatory typology (see figure 5) will discard much of what follows. It has been said that typology distinguishes between three maintenances: no maintenance, continuous maintenance, and iterative maintenance. In the theory of traditional music, performance signs testify to energetic and musical preoccupations. Each of the signs below prescribes a more or less imperative mode of manufacturation, which aims at obtaining a specific effect:

— · *pizz.* *stac.* *trem.*

Maintenance alone cannot be held responsible for all differences of facture: a brief bowed sound from the violin is actually maintained, whilst a low sound from the piano is not; however, the resonant impulsion has a more significant body than the continuous maintenance. Sometimes the instrumental gesture is perceptible, and the sound shape depends on the movement of the arm, or on breathing: the shape may show a live dynamic such as a crescendo or a diminuendo. On the other hand, maintenance alone becomes perceptible in its regularities or fluctuations when it prolongs itself excessively, and sound is no longer perceived as a measured shape; facture disappears. Excessively brief sounds have no facture either. The nine objects suitable to musicality are modelled on traditional musical notes.

First of all, the note which does not include any particular sign, N, corresponds to a well shaped sound, situated between the sustaining $\overline{N}$ and brief sounds; among these, it is necessary to distinguish brief but maintained sounds, which we notate as N' (a violin staccato for instance), from those akin to the pizzicato (brief sound with no maintenance), which we notate as $\dot{N}$. (It must be noticed that we are deliberately moving away from traditional practice, where $\dot{N}$, rather than N', suggests the violin staccato.)

More generally, be it a question of tonic or complex sounds, we keep the apostrophe (') for briefly maintained sounds, and the dot (·) for percussions. However, given the

> important morphological difference between the corresponding objects, it is necessary to distinguish a woodblock percussion from a piano percussion. In the case of the piano, a pause is used to mean that the percussion (·) is joined by the note resonance: $\overset{\frown}{\cdot}$, whilst the use of the (·) alone implies the absence of any resonance; this is the sign of the impulsion or micro-object.
>
> Finally, we designate iterative notes (notes composed of brief repeated sounds as in a spiccato or in a drumstick roll) by the sign (''). Since brief sounds can belong to either the $\dot{N}$ or the N' type, we have two types of shaped iterative notes: (N')'' and ($\dot{N}$)'', that is, the spiccato and the drumstick roll on a non-resonant sound-producing body. (Schaeffer 1966, p. 445)

Ordering non-iterative notes according to their durations, Schaeffer obtains the following series:[22]

$$\dot{N} \qquad N' \qquad N \qquad \overset{\frown}{\dot{N}} \qquad \overline{N}$$

N and $\overline{N}$ give rise to two different pairs on the side of iterations:

(Ṅ)'' corresponds to the shaped roll, and (N')'' to the shaped spiccato, whilst (N̄)'' corresponds to the prolonged roll, and (N')'' to the prolonged spiccato. Schaeffer considers these distinctions as excessively refined for typology, and he simplifies things. $\overline{N}$, (N̄)'' and (N̄')'' are beyond the zone of well balanced objects. Relatively long, but well balanced durations, are represented by N (whether continuous) or N'' (whether discontinuous). The short duration of impulsions is represented by N'. Schaeffer abandons the distinction between N' and $\dot{N}$, as well as the distinction between (N')'' and ($\dot{N}$)'', so that N' encompasses the former two, and N'' the latter two. Given the fact that both the piano sound and a stroke of the bow have a characteristic shape (profiled and memorable) which lessens the importance of maintenance perception, $\overset{\frown}{\dot{N}}$ becomes identified with N. The typology of

well balanced ordinary notes retains three factures: sustainings and shaped resonances N, impulsions N', and shaped iterations N". But what is an ordinary note?

Other than by their factures, well balanced objects are defined by their masses. The mass of ordinary notes N, N', or N" is heard as condensed upon a certain point of tessitura; they have a pitch which corresponds to the traditional definition of musical note. Although the pitch of complex notes X, X', and X" cannot be clearly identified, their mass is fixed in tessitura (even if significant variations of timbre are present, as in the gong and the cymbal). The mass of reasonably varied notes Y, Y', and Y" evolves in tessitura (as do sounds from the Hawaiian guitar and most natural sounds). The table below presents facture criteria on the horizontal axis and mass criteria on the vertical axis.

ordinary note	N	N'	N"
complex note	X	X'	X"
varied note	Y	Y'	Y"

Here are some examples. N: a piano sound, a stroke of the bow on a string instrument. N': a violin pizzicato, a xylophone note. N": a violin spiccato. X: possibly, low sounds from the organ, the piano and the bassoon, the sound of a very fast tremolo produced by padded drumsticks on a cymbal, the sound of a very fast tremolo of the timpani; definitely, the sound produced by a metal brush which grazes a cymbal. X': a cymbal struck and immediately muffled. X": a moderately fast tremolo produced by mallets or drumsticks on a cymbal. Y: a violin glissando, the sound of an hawaiian guitar. Y': a very brief violin glissando. Y": tremolo-glissando of the timpani. Varied notes can be further differentiated according to whether they present tonic mass (Y_n, Y'_n, and $Y"_n$) or complex mass (Y_x, Y'_x, and $Y"_x$). Schaeffer insists on the idea that classification largely depends on the degree of attention paid to maintenance, the context created by other objects, and particular conditions of the listening: 'A classification based on perception presents the interest of stressing and authorizing such shifts, according to context and to the intention of listening to the objects at specific levels of complexity or with reference to specific criteria' (Schaeffer 1966, p. 448).

Figure 4 shows equilibrium as specially connected with facture. Schaeffer obtains redundant objects by temporal dilation of well balanced objects with fixed or varying masses. In connection with objects whose mass is fixed in tessitura, he observes that temporal dilation may be effected by either a voluntary effort of the performer or mechanical means; in the

former case, slight dynamic fluctuations are perceptible. On the side of continuous maintenance one has the drawn-out notes $\overline{N}$ and $\overline{X}$; on the side of discontinuous maintenance, one obtains the unshaped iterations $\overline{N}$" and $\overline{X}$". The symbols H_n and H_x indicate the virtual homogeneity of $\overline{N}$ and $\overline{X}$, whilst Z_n and Z_x indicate the virtual homogeneity of $\overline{N}$" and $\overline{X}$". In the the typological table (figure 5), H_n, H_x, Z_n and Z_x eventually replace $\overline{N}$, $\overline{X}$, $\overline{N}$", and $\overline{X}$".

continuous maintenance	*discontinuous maintenance*
$\overline{N} \rightarrow H_n$	$\overline{N}" \rightarrow Z_n$
$\overline{X} \rightarrow H_x$	$\overline{X}" \rightarrow Z_x$

'In relation to the three pairs of criteria upon which typological classification is based, *Mass/Facture*, *Duration/Variation*, and *Equilibrium/Originality*, homogeneous sounds are easily defined as having a fixed mass, no facture, no variation, no equilibrium and no originality' (Chion 1983, p. 131). Chion presents white noise and a sustaining from the organ as examples of homogeneous sounds. At the level of classificatory typology, such sounds are open to an assessment in terms of mass (tonicity/complexity) and maintenance (continuity/discontinuity). As regards redundant objects of variable mass, Schaeffer poses the following questions:

> How to reconcile the idea of redundant object with with the idea of variation? In other words, how can a varied note such as Y become redundant? When this note dilates in time, the variation, which was considered reasonable at the level of Y types, becomes at least unsurprising, if not totally predictable. It is therefore a question of a relative redundancy. (Schaeffer 1966, p. 449)

A well-shaped harmonic glissando (Y_n) is clearly distinct from a well-shaped complex glissando (Y_x). When Y distends this distinction becomes blurred. An alarm siren, the $\overline{Y}$ prototype, is both varied and redundant, and more noticeable than a homogeneous sound, but it is still tiresome in the monotony of its variation.

> Musically more interesting types are less ordinary: they may present slowly varying melodic-harmonic contextures, intertwining drawn-out N types, or they may display complex X timbres superimposed in a variable manner or slowly evolving. The word varied 'note' is no longer suitable to such rich superimpositions of sounds, which nevertheless are heard as ensembles, since they are not made to be constantly analysed

> and can therefore answer to the notion of object. In our vocabulary, these fusions of slowly evolving sounds are termed *threads* and noted T_n or T_x, depending on whether their contexture is formed mainly by N or X sounds. (Schaeffer 1966, pp. 449–50)

On the side of discontinuous or iterative Y types, one may get the counterpart of $\overline{Y}$, that is $\overline{Y}$", corresponding to the siren indefinitely prolonged in staccato, or one may get the Y' note varying in a lively manner and constantly reiterated, as an interminable tweet-tweet of birds or the regular grating of the mill wheel' (Schaeffer 1966, p. 450). In the second case, one has objects which are termed pedals (Z_y), by analogy with this kind of pianistic or orchestral accompaniment (see figure 6). Finally, a distinction between sinusoidal sounds and sounds of determined pitch with recognizable timbre is considered too subtle for typology, and the final table (figure 5) eliminates the row of pure sounds.

Excessively original, or eccentric sounds, appear in the periphery of the typological table (see figure 3). Excess of originality corresponds to an excess of facture more or less linked to an excess of mass variation, so that dynamic and melodic profiles become tortuous and disorderly. Given the excess of information, eccentric sounds are said to be shapeless, but more correctly, they do not have good shape. Contrary to homogeneous sounds, whose shape is null, their shape swamps perception with complexity and unpredictability. 'In general terms, it (sc. this shape) recounts the history of maintenance always with its dynamic consequences, and often with its melodic and harmonic consequences too; at least, this is what the ear apprehends when it has enough time to evaluate that which the sound manufacturer himself has taken the time to put there' (Schaeffer 1966, p. 452). 'If one of these sounds actually happens to appear in a work, it may steal the auditor's attention; for being too structured, too unpredictable, and generally too cumbersome—always striking—, it stands out and is likely to destroy any "shape" other than its own: rather than remaining as a simple element among others, such objects become the centre of attraction in the structure where they appear' (Schaeffer 1966, p. 452). The study of eccentric sounds considers only those sounds where a certain unity is perceptible, that is, sounds which still qualify as objects.

On the side of continuous maintenances, the unity of an object whose facture is unpredictable (far left of figure 5) may be preserved by the permanence of a cause linking together incoherent elements throughout the diverse phases of the sound event. One has the échantillons, whose masses may be relatively fixed and tonic (E_n), relatively fixed and complex (E_x), reasonably varied (E_y), or unpredictable (E). These sounds are not modulated, articulated, or organized to be heard as a structure or a fragment of musical language, which is another reason for Schaeffer to consider them as objects (cf. Schaeffer 1966, p. 453). An example of échantillon: 'a child grazing a violin string with one finger while clumsily running the bow all over the place' (Schaeffer 1966, p. 453).

On the side of discontinuous maintenances, the unity of an object whose facture is unpredictable (far right of figure 5) may be preserved by 'the similarity of facture between elements of the sound texture, which establishes for the ear a connection between these elements, thus unifying the perception' (Schaeffer 1966, p.453). One has 'jumbles of brief impulsions', which are termed accumulations; their masses may be overall fixed and tonic (A_n), overall fixed and complex (A_x), reasonably varied (A_y), or unpredictable (A). Examples of accumulations: a heap of pebbles being discharged from a dumper, an aviary chirping, or Xenakis' orchestra forming clouds of pizzicati or glissandi, 'though organized according to Poisson's formula or the bell-shaped curve' (Schaeffer 1966, p.453). As has been said in § 13, the extremes of the horizontal axis meet.

> The two cases which I have presented as opposed, at least in my exposition, namely échantillons (persistence of a cause), and accumulations (analogy between multiple causes), are not as far apart as one might initially have thought. In fact, it depends on our desire to listen to the sound of a pebble cascade as coming from a single cause (the tipping lorry) or as composed of brief impulsions due to multiple analogous causes (each pebble falling upon the preceding ones). It is quite certain that a number of sounds can be classified on either side: it is a question of taste, if one may say so. The extreme columns of our table ultimately meet. (Schaeffer 1966, p.454)

On the side of discontinuous maintenances, the two compartments which remain empty in the bottom row will be occupied by types called cell and pedal. The cell (K) is an artificial object whose origin can be traced back to the looping groove technique and random cuttings in the magnetic tape; the cell is directly linked to the emergence of the notion itself of sonic object. The blade determines duration and focus of attention. 'Let us now suppose, on the one hand, that this duration has been chosen in the zone of suitable or memorable durations (thus engendering a sound endowed with an artificial temporal unity), and on the other hand, that our piece of sound has been taken from amid an avalanche of disorderly microsounds: given the temporal unity, the sound thus isolated tends to form an object, specially because its texture, of luxuriant facture and mass variation, shows great originality, and therefore has no difficulty in fulfilling our intention of listening to something' (Schaeffer 1966, p.454). Because of its approximately iterative (or in any case, accumulative) structure, the cell appears in the column of well shaped iterations (see figure 5). It is distinct from an accumulation by its more reasonable duration and better-shaped facture. The pedal, another artificial object, is obtained by cyclic repetition of a cell (indefinitely looping groove). While Z_y corresponds to a redundant pedal, the eccentric pedal is notated P. Schaeffer considers P as the generalization of Z_y: 'whilst Z_y limits itself to repeatedly and clearly putting into action the same sonorous causality, in the pedal of cells one has the general case of what could be termed a *cyclic* sound effect' (Schaeffer 1966, p.455).

Still in the row of unpredictably varying masses, the central compartment is occupied by the fragment φ, which corresponds to cuts of the various well shaped N, X, or Y types in general; usually it is at least original, if not entirely eccentric. As opposed to the impulsion, which obeys a natural energetic logic, the fragment insists on its artificial nature, but it is not necessarily short and may even be almost as long as the original object. Rather than a shortening, what characterizes the fragment is a disruption of the sound history by the introduction of an unexpected ending, or the deletion of the energetic origin (attack), which sometimes is the main responsible for the overall dynamic of the sound. What justifies the presence of φ in the middle of this row is the important role it has played in Schaeffer's musical research: it was the denaturalization of the bell sound by the removal of its attack which allowed him to dissociate the perception of the sound from the perception of its source, thus leading to the notion of reduced listening (see Schaeffer 1950, pp. 35–4, 38–9; 1952^{A}, p. 16, 21–2; 1966 p. 391, 417, 455; § 1 herein). 'Thus, in the same way as the position of the cell among well-shaped iterative notes is not entirely justified (other than by the suitable temporal module of the cut and a certain kinship of structure), the fragment cannot be compared to an impulsion unless by a certain abrupt manner of presenting itself' (Schaeffer 1966, p. 455).

On the side of continuous maintenances, two empty compartments remain in the row of unpredictably varying masses: one in the column of well shaped sustainings, corresponding to the cell on the iterative side; the other in the column of null factures, corresponding to the pedal on the iterative side. In the column of well shaped sustainings, one is looking for a generalization of Y, an object limited in duration and presenting a variation of mass whose details or complexity cannot be followed; this variation of mass must not be too quick though, for then one would have a Y or a Y'. What defines this compartment is slow but multiple variation and coherence of facture. If mass variations were fast and facture incoherent, one would have a cell. 'Here, on the contrary, the object spreads out multiform and ramified variations, in an interlacing of motifs always logically connected: this is a gross note W' (Schaeffer 1966, p. 456). Long sounds from the gong, a bell sound with its successive partials, and 'also new and electro-acoustically produced objects whose complex harmonic and melodic evolution clearly obeys an operating determinism' (Schaeffer 1966, p. 456) are examples of W, besides the singing of the hotel piping (see § 13). If the 'operating determinism' does not lend its logic to the object, the gross note loses its unity and tends toward the échantillon. 'The gross note therefore exists between a reasonably varied note of normal duration, whose structure it complicates by dilation, and the échantillon, whose disorder it simplifies' (Schaeffer 1966, p. 456). For Schaeffer, certain written musical motifs, such as the arpeggio notes Bach adds to a low fundamental (chord of dominant ninth at the beginning of the D minor Toccata and Fugue) are not individually heard, but rather merge into a gross note. In the complementary typology of variations, however, the gross note receives a more strict definition, and Bach's arpeggio

appears as a motif (cf. Chion 1983, p. 133, and § 19 herein).

In the same way as in the column of unshaped iterations P generalizes Z_y, in the column of unshaped sustainings T generalizes T_n and T_x. This thread is formed by slowly evolving clusters of N or X types, which may present irregularities of dynamic and mass, or a slowly emergent rhythmic structure. However, rather than the accumulation of rhythms, it is the evolving permanence of the object that stands out; continuity prevails in melodic-harmonic as in harmonic-dynamic threads. Such threads may be compared in originality to the pedal of cells, whose elements individually considered are totally unpredictable, but whose overall repetition offers no information. Showing the slow evolution of a complex content and a not necessarily regular facture, the mixed thread is relatively predictable, but it conveys some information.

> Such threads are common in traditional symphonic music, once it is observed from a suitable distance. In written music they certainly can be analysed and appear as the result of the combination of various well-defined N, X, or Y objects. It seems nevertheless interesting to characterize them as 'ensemble objects', because for me they prefigure these natural macro-objects for which no score could account, and because they are probably not made to be as distinctly perceived as the details of notation would suggest: instead, the composer seems to ask them to provide a live continuity, a neutral harmonic and melodic basis catering for the unfolding of prominent elements of the discourse. Likewise, the thread of a fabric does not interfere with the motifs of the pattern with an unwelcome originality. (Schaeffer 1966, p. 457)

Schaeffer closes classificatory typology considering the case of unisons, for which he makes no particular provision.

> Should a unison be considered as a simple sustained sound towards which various and similar sound-sources (which a trained ear can discern) actually work, or should it be likened to accumulations instead, highlighting the fact that a number of distinct causes are perceived in the object? One imagines that the answer depends as much on the auditor's intention as on the quality of the unison and the facture of our object. Indeed, if an unison is well performed and if the desire to listen to it as a single note tends to unify it even more, then there is a simple object, for instance an N for violins or voices, though a finer analysis could discern its multiplicity. If the elements are dissimilar, and if our intention of listening insists on this dissimilarity, one tends to perceive an accumulation, though quite simply knowing that the performers play or sing badly the plain N-note the composer has written for them. However, if an orchestra is tuning up, producing *A*s with various dynamic shapes at various octaves, and trimmed with slight glissandi due to the performers' turning the pegs of their violins, rather than a unison, one has a true accumulation of N and Y types. (Schaeffer 1966, p. 458)

The Astrologer *— Time is nothing, work is nothing, hardships are nothing, shortcomings are nothing, mistakes are nothing, stoppages are nothing, but what is more beautiful than anything else: it is perseverance, and the answer:*

Come and see, if I don't complete what I've started! (Schaeffer 1947^{B} quoted by Pierret 1969, p. 128)

CHAPTER V

Third Typology, Morphology Proper, Characterology, Analysis

15. MORPHOLOGY PROPER.

It has been shown in § 10 that typology and morphology are intertwined operations sometimes indistinguishable from one another. The ensemble of procedures which I have termed first morphology, identificatory typology, second morphology, and classificatory typology is expounded in book V of *Traité des objets musicaux*, 'Morphology and Typology of Sonic Objects'; it leads to the establishment of the typological table of figure 5, corresponding to the first operation of solfège (see chapter IV). Book VI of *Traité des objets musicaux* is called 'Solfège of Musical Objects', and one would expect to find there the exposition of the second operation of solfège. However, book VI actually presents morphology proper amidst fragments of characterology and analysis. It has been said that the aim of the first operation of solfège is to identify and classify sounds, establishing types as defined in figure 5, whilst the aim of the second operation is to compare the contexture of the objects, identifying the sonic criteria which compose them, and qualifying these criteria according to classes.

In the contexts of typology and morphology, the notion of criterion appears as a property of the perceived sonic object (cf. Chion 1983, p. 121). Chion observes that, within the framework of typology (whether identificatory or classificatory), these criteria occur in pairs which oppose complementary aspects of sound to one another: the articulation/sustenance pair of identificatory typology is responsible for the segmentation of the sonic chain into units; the mass/facture, the duration/variation, and the equilibrium/originality pairs of classificatory typology 'establish approximative distinctions which allow the principal types of objects to be defined' (Chion 1983, p. 122). It should be added that the shape/matter pair of the second morphology also opposes to one another complementary aspects of sound. Since the three pairs of classificatory criteria are descriptive, Chion considers them as already morphological (cf. Chion 1983, p. 122). The four pairs of typological criteria have been chosen in connection with a musical bias: they are meant to bring out those objects which are suitable to musicality; they are more or less normative and hierarchical. When Chion says that 'morphological criteria are defined as observable characteristics of the sonic object, *"distinctive features"*, or *"properties of the perceived sonic object"* (501)' (Chion 1983, p. 142), he has in mind morphology proper: it is the seven criteria of the third morphology which are expected to emerge as values in the solfège epilogue (synthesis). The diagram that follows outlines the 'zigzaggy route' which leads from the first to the third morphology.

Typo-Morphological Criteria

First Morphology

beginning, middle, end

Identificatory Typology

articulation/sustenance

Second Morphology

shape/matter

Classificatory Typology

mass/facture
duration/variation
equilibrium/originality

Third Morphology

(shape/matter)

mass
harmonic timbre
grain
allure
dynamic
melodic profile
mass profile

16. SOLFÈGE OF HOMOGENEOUS SOUNDS: CRITERIA OF MASS AND HARMONIC TIMBRE.

The shape/matter pair of the second morphology plays a role in the third morphology too: mass and harmonic timbre are studied under the 'Solfège of Homogeneous Sounds'; dynamic is studied under the 'Solfège of Fixed Masses'; grain and allure, which Schaeffer also considers as criteria of matter and shape respectively, appear under the 'Solfège of Maintenance'; melodic profile and mass profile are studied under the 'Solfège of Variations', where reference is also made to variations of grain and allure. Schaeffer notes that homogeneous sounds, which are the most rigorously defined by typology and the easiest to analyse, are also the hardest to find in practice. He includes among homogeneous types some traditionally musical sounds, observing that seldom are natural noises shapeless. White noise is an example of homogeneous sound.

> This is actually a homogeneous sound, the exact opposite of tonic sound (since it occupies all tessitura): each instant of its listening is similar to the previous one, for reasons of statistic order. To a certain extent, these conditions are met by handclaps, waterfalls, the tipping of gravel, and even by agglomerates of any sounds whatsoever, provided their variety is large enough, and their distribution in tessitura and time obeys the laws of chance. The accumulation of all sounds in the world would certainly be white noise, which explains our aversion to such perfect disorder. (Schaeffer 1966, p. 509)

Schaeffer explains the tardive emergence of the mass criterion by the fact that tonic sounds (the main material of traditional music) and white noise (commonly used in electronic music) constitute extreme cases of mass gauge (see *infra*) and, as such, they are not the best suited to express this criterion.

> Some of the most traditional sounds such as tonic ones, despite their nominal pitch undeniably display masses which are not perceived as punctual. Low sounds from the organ for instance, or a sustained note from the double bass or bassoon, when compared to notes from the middle or high registers of the same instruments, or from other instruments which are playing the same tonic, already suggest the term mass, rather than pitch.
>
> A tonic is heard within the framework of the note, but it also saturates the tessitura: the physical references of the spectrum give no indication as to whether our ear can determine a certain *thickness* of the sound, besides the nominal frequency. Let us strike three or four adjacent keys in the medium or high registers of the piano: is the mass of this cluster more or less significant than that of a low sound by itself? Even if

> the answer is uncertain, the question has a sense: mass is a criterion of perception. (Schaeffer 1966, p. 510)

Given the possibility of slicing white noise by filtering, could we not compare the aforementioned sounds to these standards of thickness?' (Schaeffer 1966, p. 510). Differences of genre nevertheless make such comparisons impossible.

> All that which pertains to *linkages* between criteria[23] is actually well known in its principle, but difficult to inventory and classify: one knows that the sound characters of instrumental and 'concrete' sounds evolve in an associate manner, and that this combined evolution contributes towards making the shape of the sound more eloquent and definite: in order to achieve *lifelike* sounds, electronic synthesis must indeed proceed by *associations of criteria evolutions*, since it has been observed that sounds whose parameters evolve independently of one another are badly perceived and seem poorer and more artificial. (Chion 1983, p. 103)

Characterology suffers from Schaeffer's indiscriminate use of the word *caractère*, which, one is inclined to think, sometimes appears simply as a synonym for characteristic. What determines the genre of a sound is a certain combination of criteria defining a character which is easily perceived but hard to analyse. The study of genres by characterology attempts to establish representative cases of criteria combination. 'In general terms, if the *synthesis* of musical objects were possible, it would aim at *producing series of same-genre objects* likely to allow the emergence of a distinctive feature, or *value* among them' (Chion 1983, p. 104). Thus, genre substitutes for instrumental timbre, according to the notion of pseudo-instrument, whose importance has already been exposed (see §§ 2 and 11).

> The usual expression: a sound 'in the genre of', illustrates well this notion of sound *character*. An example—piano, sheet metal, bell, electronic sound...—is not only cited but also generalized; this expression postulates that a certain sound, beyond the particular instance, can present itself as exemplary of a general structure. If I play on the piano clusters of notes giving rise to a thick mass, I shall no longer hear tonics or analyse the chord, but I shall do more than merely assessing the thickness of a more or less blurred interval. Between the *chord*, whose tonics I resolve, and *thickness*, which is the acknowledgement of a blur, I distinguish a texture, a certain organization of mass, as in a bell sound for instance. I can compare sheet metal to low piano by saying: this *texture*[24] that characterizes two sounds which are nevertheless different (as regards tessitura, thickness, etc.) is formed by a thick base topped with a glittering fringe... (whilst in the bell I perceive various nodes [see *infra*] which I vaguely localize): the perception of such relations is possible between sounds belonging to the same *genre*. (Schaeffer 1966, p. 519)

Thus, the definition of thickness scales is hampered by the fact that 'here we perceive a fundamental capped, as it were, with a *thick* timbre, there a cluster of frequencies with no timbre' (Schaeffer 1966, p. 510). Such comparisons 'amount to placing vertebrates on an equal footing with invertebrates' (Schaeffer 1966, p. 510). Mass and harmonic timbre are defined as interdependent criteria.

> I term *mass* that quality whereby sound inscribes itself (*à priori*, in whatever manner) in the pitch field; I term *timbre* the more or less diffuse halo and, in general terms, those subsidiary qualities, all of which seem to be associated with mass and allow its qualification. It is an approximative and totally empirical distinction, which, as will be seen, permits all osmoses. Indeed, my objective is to proceed by methods of approximation, instead of establishing dogmatic categories. (Schaeffer 1966, p. 516)

Chapter IV has shown that classificatory typology combines criteria of mass and variation, thus distinguishing between tonic mass (fixed and identifiable pitch), complex mass (fixed but unidentifiable pitch), variable mass (which, whether tonic or complex, displays reasonable variation), and unpredictable mass (excessive variation). In the third typology (see recapitulatory table of solfège, figure 7) Schaeffer mentions W, K and T as unpredictable-mass types, but he gives no explanation for the exclusion of E, A, P, and φ. Morphology proper designates seven classes of homogeneous mass: pure sound, tonic sound, tonic group, striate sound, nodal group, nodal sound, and white noise. They are presented in figure 7 with their corresponding harmonic timbres.

> The quivering of a cymbal produces a sound which approximates to white noise and is centred on a certain zone of tessitura: such *nodal* sounds have been placed above the compartment of white sounds (6). Symmetrically, tonics from traditional instruments, being less pure than sinusoidal sounds and coloured with a characteristic timbre, have found their place below the compartment of pure frequencies (2). A number of simultaneous cymbal quiverings centred on different zones of tessitura constitutes an agglomerate, whose nodal elements can be isolated: we call this agglomerate a *nodal group* and we have placed it above nodal sounds (5), in the same way as we have placed below single tonics *tonic groups*, whose simplest instance are traditional chords, which can be resolved into component notes (3). Finally, a central compartment has been reserved for ambiguous sounds like gongs, bells, sheet metal, etc., which, according to the sonorous context, are perceived as nodal sounds or groups of nodal sounds, some of which are so narrow as to be heard as tonics, or else, they are perceived as tonic groups more or less distinct and surrounded by a complex halo. These sounds are open to both an evaluation according to traditional intervals, and an assessment according to colour analogies. We call them *striate* sounds. (Schaeffer 1966, pp. 517–18)

Schaeffer presents as paradigms of the seventh class of mass not only white noise, but

also coloured noise, and frequency bands, which poses a problem: what differentiates a frequency band from a node, precisely? 'One speaks of node, or nodal sound, when the mass of a sound consists of a compact and single agglomerate in which no precise pitch can be distinguished (example: a vocal hiss)' (Chion 1983, p. 148).

> 1) One calls 'white noise', 'white sound', 'band', or simply 'noise', a sound whose mass, in principle, contains all frequencies statistically accumulated. This sound can be produced by electronic machines.
>
> 2) One call 'coloured noise' white noise which has been cut by filtering into relatively thick slices. (Chion 1983, p. 149)

The distinction between node and coloured noise remains blurred. Is it a question of bandwidth? of spectral density? The notion of density appear in the solfège of matter, but it concerns harmonic timbre rather than mass (see *infra*), and according to Schaeffer's definition, coloured noises have no timbre.

Figure 9 presents Chion's schematization of Schaeffer's text. The morphology of homogeneous masses gives rise to two questions: 'one concerns the qualification of the criterion of mass in relation to the properties of the perceptual field, the other, the possibility of, if not describing particular cases, at least identifying the main *genres* of sounds in relation to their masses' (Schaeffer 1966, p. 519). In other words, once classes of mass have been established, one needs to define an analysis and a characterology of masses. The characterology of mass is presented by Schaeffer in the succinct terms of the quote in page 124 ('The usual expression...'). In the recapitulatory table of solfège one reads: 'characteristic TEXTURES of mass'. As the characterology of mass does not involve any other criterion, it is restricted to those classes which show layered mass: tonic groups, striate sounds, and nodal groups. Chion is no less vague:

> The author limits himself to indicating that there are *'characteristic textures of mass'*, i.e. characteristic manners in which the sound mass is 'organized' in more or less distended or compact zones, with a certain disposition of thick and thin (or tonic) zones. For instance, *'this texture characterizing two sounds which are nevertheless different (...) is formed by a thick base topped with a glittering fringe'* (519). This is an example of such characteristic structures of mass distribution in tessitura.
>
> It may be said that the problem of the *position* and *instrumentation* of chords in traditional instrumental music corresponds to a problem of *genre*, that is, of mass distribution. One speaks of positions which are relatively fuller or hollower, more or less balanced or unbalanced, etc. (Chion 1983, pp. 146–7)

The next operation to be performed is analysis. Being no more than the sketch of a research project, analysis suffers from the lack of that practical verification which could have led to terminological clarity. The whole analytic project rests upon the notion of perceptual field.

However, the comparison of sonic objects has not yet brought into play the musical ear, from which, by hypothesis, we expect a qualitative (that is, graduated) field of valuation, which I am not going to pretend to rediscover entirely. We have had its practice for a long time, and I am preparing to refine and develop this field, rather than limit it to what convention has offered to its listening.

How are these collections of objects, which have been put together for comparing specific criteria, structured in this natural (though certainly perfected by practical training) field of the ear? Here we find, by force of circumstance, the relation of indetermination between the criterion thus presented to the ear and the perceptual field the ear offers to the criterion. Let us not prematurely enlarge upon this particularly delicate aspect of experience, which always strikes a balance between nature and culture, between innate gifts and the sometimes surprising possibilities of training: this is the objective of the *musical invention* of sector 4.

> This relation of criterion site (or gauge) to perceptual field (or the dimensions of its musical scales) constitutes the results of sector 4, which is absolutely 'analytic', more sensorial than sensible, more scientific than musical, or at least more experimental than artistic.
>
> How to extract practical conclusions for music from all this? How to get to a generalized but perceptible musicality devoid of conventions which may be more artificial, if not more arbitrary than the previous ones? (Schaeffer 1966, pp. 384–5)

'The thesis of the *ear's natural perceptual field*, where sonic objects, their criteria and relations would emerge and be sited according to *natural* laws is one of the main thesis of TOM' (Chion 1983, p. 61). This perceptual field comprises three dimensions (or fields): pitch, duration, and intensity; it is with reference to these three dimensions that morphological criteria (mass, harmonic timbre, grain, allure, dynamic, melodic profile and mass profile) are to be ordered in scales, that musical values are to emerge, and that musical objects are to be assembled into meaningful structures.

> As may be seen, the study of musical objects finally leads to the study of the properties of musical sensibility. One would have expected it. In a situation not lacking in humour, and which I have already pointed out, it is scientific folk who have been happy to concern themselves with our (musical) sensibility, while composers, real

> workaholics, revel only in arrangements of sonic objects 'structured', as they say, without the least concern for our perceptual properties or, for that matter, psycho-acoustic curves. Definitely, criterion and perceptual field establish this relation of indetermination which is so embarrassing to our usual vocabulary. For a sound criterion to be retained, on the one hand it must be suitable and present a musical interest, on the other, there must be in our sensibility a faculty of evaluation, the whole thing always depending on the context where the objects are presented and their own contextures.
>
> It is also necessary to *disconnect* what our musical habits have taught us to link so closely because of the *triple reinforcement* of the pitch value, dominant as *character*, and also dominant as *ordinal* relation, then finally and exceptionally, by its *cardinal* evaluation and 'vectorial' tensions, the only evaluation to be *thus given* to humankind by nature among all perceptions.
>
> In other words, a first faculty of the perceptual field is to be able to compare two objects, finding the same property among them. A second one is to be able to order these values. A third one is to be able to fix the degrees of this scale with more or less precision. One can likewise screen colours with a great deal of precision, but this does not allow one to serialize them, and even less find therein relations of octave or fifth, and for good reason. (Schaeffer 1966, p. 383)

Schaeffer also stresses the need to disconnect morphological criteria from the dimensions the perceptual field offers to their variation, particularly because, in some cases, a criterion is also a dimension of the perceptual field.

> We recognize the paradox of the invariant, mentioned in chapter XXI, § 7. Let us listen to an object as classical as a quite slow violin glissando. Which criterion prevails from beginning to end? Pitch. What varies? Pitch again. In what space does it vary? In the pitch field. These are the two acceptations defined in chapter XXI, § 14 [see quote *supra*]: pitch as a criterion qualifying sound, and pitch as a dimension of the sonic field. This example would not be disturbing unless it were the only one, in which case I should be thanked for sparing the reader from a notion rather than complicating things. Nevertheless the same happens with profile and the rhythm of the pulsations of grain and allure. The loudness of a sound, criterion of intensity, evolves in the field of dynamic, as allure and grain, which are modulations of duration, may evolve in the field of duration. We therefore have three *decouplings* of sound qualities, depending on whether they appear as *criterion of identification* or *dimension of its variation.* But there are more complex criteria where this distinction is more relevant. A *thick sound* in fact presents a distinct criterion (the perception of an original quality) which is so independent of the criterion of *pitch* that it is precisely this criterion of thickness which stops the sound from being heard as tonic. However, if one manages to qualify thickness in turn (which is uncertain), to what, if not the pitch field, will it be referred? If this thickness increases or decreases in the course of duration, or if, remaining constant, it

> moves towards the low or high registers, is it not in the pitch field once again that this variation will have to be sited? (Schaeffer 1966, p. 503)

Analysis aims at defining scales, according to the hypothesis that 'only *scales of criteria* are likely to give rise to abstract relations, rather than dynamic or impressionist ("plastic") relations; this happens because they bring into play not just concrete qualities attached to an element of the objects, but also relations and differences' (Chion 1983, p. 46). Chion observes that scales are not natural, but cultural; on the other hand, the harmonic degrees and intervals which compose these scales are natural, that is, linked to properties of human perception (cf. Chion 1983, p. 47). Hence the balance between nature and culture, the relationship of indetermination. The relation between criterion and perceptual field is also designated as the criterion/dimension relation, and it is one of the four major relations of Schaeffer's musical research, all of which relate to the table of listening functions (see figure 1). 'The *articulation/sustenance* pair underpins the choice of *types*' (Schaeffer 1966, p. 379); it corresponds to the hearing ('sound *reception*'). 'The *shape/matter* pair orientates *sound morphology*' (Schaeffer 1966, p. 379); it corresponds to the listening out for ('*selection* of particular aspects of sound'). 'The *criterion/dimension* pair is the one which finally gives *a sense to the analysis of objects*: the sense of its *musical proportions*' (Schaeffer 1966, p. 379); it corresponds to the comprehending ('emergence of the sound content by *reference to* and *comparison with* extrasonorous notions'). The pair which corresponds to the listening to ('sound emission') is the value/character pair (see § 11).

'Any sonic object therefore occupies each of these three fields in a certain manner, and each of the criteria which characterize an object can be assessed with more or less precision in *site* and *gauge* in relation to each of these dimensions; in other words, according to its *position in the field* (site) and *the space it takes in this field* (gauge)' (Chion 1983, p. 61). The distinction between site and gauge is particularly suitable to the pitch field, and it gives rise to a somewhat cumbersome terminology when applied to the other dimensions (cf. the notions of weight, relief, impact, and module). The pitch field presents the particularity of being double: there are a harmonic field of pitch and a coloured field of pitch.

> When a harmonic sound is perceived, one must imagine that it engages the ear not only in the perception of one degree, but in the perception of the ensemble of degrees of its partials; this structure actually constitutes this kind of perception, whose synthesis is spontaneously carried out. It is easy to imagine that, when a new sound appears, it will fall into the previous grid all the more easily if it displays one of those degrees, or more precisely, if its spectrum leads to a perception which is partially based on the previously perceived structure. In these terms, I am touching on the phenomenon of so called consonance, and the psycho-acoustic correlation between the various sounds of scales. (Schaeffer 1966, p. 522)

Experiments presented in the *Solfège de l'objet sonore* (Schaeffer and Reibel 1967) demonstrate some properties of the coloured field of pitch. In one of these experiments, an X is played at normal speed and then at half speed; according to the norms of the harmonic field of pitch, it should sound one octave below, but it is actually lowered by a semitone. In another experiment, the 'pitch' of white noise is not altered by a change of tape speed. In a third experiment, bands of a given width and different central frequencies are obtained by filtering white noise, and these bands are then played in succession, giving rise to the perception of a 'melody'; however, when bands of the same width are extracted from an N, the result is entirely different: no melody emerges, timbre changes, but a certain texture of mass remains.

The harmonic field of pitch begets cardinal scales, which allow an absolute assessment of degrees and intervals, whilst the coloured field of pitch begets ordinal scales ('colour scales'), which give rise to a relative assessment of degrees. In the pitch field, whether harmonic or coloured, site is termed tessitura, and gauge is termed écart. The site of a mass in the harmonic field of pitch corresponds to its pitch degree: 'since the Occidental ear perceives about 12 semitones per octave over more or less seven octaves, one has a minimum of 84 clearly distinct degrees' (Chion 1983, p. 147). Because the spectrum of tonic sounds is heard as a timbre, the assessment of gauges in the harmonic field of pitch refers to intervals between distinct sounds. For mass species in the coloured field of pitch, 'the ear perceives differences of site and gauge of complex masses with the same sharpness the eye perceives different colours, but it is incapable of "scaling" them' (Chion 1983, p. 148). Schaeffer proposes nine registers of site: infralow, very low, low, medium low, diapason, medium high, high, very high, ultrahigh. As regards gauges in the coloured field of pitch, he simply mentions the perception of thickness. Chion suggests a scale: 'very thin, thin, medium, thick, very thick, etc.' (Chion 1983, p. 148).

The criterion of mass is also evaluated in the fields of intensity and duration. In the former, site is termed weight, and gauge is termed relief. Chion points out numerous inconsistencies in Schaeffer's use of these terms (see Chion 1983, pp. 109–11). Schaeffer proposes the following weight scale: *ppp*, *pp*, *p*, *mf*, *f*, *ff*, *fff*. 'The relief of a criterion corresponds to the manner in which it occupies the intensity field' (Chion 1983, p. 110). Relief implies a variation, a movement from a certain site to another, a loss or an increase of weight; one is therefore beyond the boundaries of homogeneous sounds. In the recapitulatory table of solfège, Schaeffer refers to the notion of 'profile of mass texture' (see figure 7).

Finally, the criterion of mass is assessed in the field of duration, where site is termed impact (see § 17), and gauge is termed module. As matter is sound in a timeless state, one is again moving beyond the boundaries of homogeneous sounds. Chion points out blatant contradictions in Schaeffer's use of the term impact (see Chion 1983, p. 110–11). In the

recapitulatory table of solfège, the compartment where mass impact would be analysed remains empty. Module is another slippery term.

> 1) Module is a 'duration gauge', that is, a duration value. More precisely, for criteria such as grain or allure, which are defined by oscillation or periodic and frequent unevenness, *module* corresponds to an assessment of the relation between the amplitude of the oscillation and its 'velocity'. It may also designate the speed of oscillation of this criterion (number of pulsations in the duration).
>
> The notion of module therefore serves to express diverse dimensions of which the only common trait is that they concern *duration*: duration of existence, or duration of variation for criteria attached to periodic (allure) or aperiodic (melodic profile, mass profile) variation. (Chion 1983, pp. 111–12)

Module scales will be presented in connection with the criteria to which they are applicable, that is, dynamic, melodic profile, mass profile, and particularly, grain and allure. In connection with homogeneous masses, Schaeffer limits himself to noting, in the recapitulatory table of solfège, 'threshold of mass recognition for brief sounds'; module here simply means duration of existence.

Chion terms the criterion of harmonic timbre a 'satellite' of the mass criterion (cf. Chion 1983, p. 149). The 'law of the piano' (see § 11) reconciles the paradox according to which an instrument has a timbre while each of the various objects it delivers has a particular timbre. When defined as reference to causality (indexicality), timbre points to ordinary listening. For music to exist, the sound-producing body has to be obliterated by repetition and variation (see § 11). The musician speaks of the timbre of a sound without reference to a specific instrument, saying that a certain note has a good or a bad timbre.

> However, when defined in these terms, the timbre of an object is nothing but its sonic shape and matter, its complete description within the limits of the sounds that a given instrument can produce, and considering all variations of facture that this instrument allows. The word *timbre* used in connection with the object does not offer any new resource for the description of the object in itself, as it merely refers to the subtlest analysis of the qualified perceptions one has of this object. (Schaeffer 1966, p. 232)

The musician's notion of timbre is a question of listening out for those qualities of sound which play a subsidiary role in the musical code; the vocabulary thereof exists in a limbo of 'subjective' definitions. Now, 'as there is hardly thinking without verbal formulation, there is little chance for the auditor to think of this sound at all without implicit resort to

words and ideas' (Schaeffer 1966, p.482). 'Psychologists such as G.A. Miller, who have studied the learning processes, show that *abstractions* (precisely what leads to solfèges and the assessment of the qualities of objects) are mostly products of society' (Schaeffer 1966, p.477):

> A man who lived his entire life alone would not react differently to different colors; nothing in his contact with the automatic *reinforcements* of the physical world would reward him for abstracting the concept of color. (Curiously enough, a solitary man would have no vocabulary about himself, for the concept of self is a social phenomenon.) Some native tribes are known to have no names for part of the visible spectrum, yet they are able to see these colors. Their culture does not *reinforce* them differentially for making the distinction. On the other hand, things intimately related to the daily work and acquisition of food are meticulously discriminated because such abstractions are *reinforced*. When husbandry and hunting were more important to the average man, English distinguished among 'herd', 'flock', 'bevy', 'school', 'brood', 'drove', 'covey', 'swarm', and 'pack'. Today these distinctions are relics and could all be replaced by 'group'. Modern English, however, is careful to distinguish among terms closely related to modern life; for example, the distinctions among 'car', 'coupé', 'sedan', 'taxi', 'bus', 'roadster', 'convertible', 'automobile', 'truck', 'racer', and 'station wagon' are perfectly clear. (Miller 1951, p.168, quoted by Schaeffer 1966, pp.477–8, from the French translation.)

Hence the importance collective communication of aural experiences acquires in Schaeffer's musical research. For him, the creation of a musical language depends on the creation of a vocabulary to describe sounds. It is only in this manner that sector 3 (the listening out for) can become operative; he calls this vocabulary a metalanguage. Schaeffer's metalanguage speaks the object rather than the language.

> The notion of a metalanguage has thus emerged, which is something different from a pedagogy or an explicative critique: it is an organic need, attached to an art, of possessing an adequate terminology resulting from a realistic analysis of what is distinctive or perceptible in the objects this art employs. Objects assembled at the higher level form indeed an original language which can dispense with comments or elucidate itself. Things are different two steps below, at the level of the elements which constitute the objects. The description of these elements and the determining of their functions, at this level at least, demand a vocabulary. (Schaeffer 1966, p.481)

The characteristics of language proper, its binary oppositions, define Schaeffer's metalanguage, but he also ascribes to the musical language itself what are in fact the characteristics of the language which speaks this so called musical language: 'It is doubtless because,

as an *Élève-Maître* at the Conservatoire, he (sc. Michel Chion) has heard me ceaselessly going back over the same key words (value and character, sonority and musicality, permanence and variation, which sing always in duo), that he was one of the first to comprehend the strange musical dualism upon which all music is based (alas, this escapes most of our contemporaries)' (Schaeffer 1983[A], p. 9).

> Language, according to Benveniste, is the only semiotic system capable of *interpreting* another semiotic system (though undoubtedly there exist limit works in the course of which a system feigns self-interpretation—*The Art of the Fugue*). How then does language manage when it has to interpret music? Alas, it seems, very badly. (Barthes 1972[A], p. 179)

Schaeffer's structuralist flirt appears here, as in many passages of *Traité des objets musicaux*. (Would it be a question of *Zeitgeist*, as the following quote suggests?) Roland Barthes observes apropos the structuring of *Elements of Semiology*:

> It will be seen that these headings appear in dichotomic form; the reader will also notice that the binary classification of concepts seems frequent in structural thought, as if the metalanguage of the linguist reproduced, like a mirror, the binary structure of the system it is describing; and we shall point out, as the occasion arises, that it would probably be very instructive to study the pre-eminence of binary classification in the discourse of contemporary social sciences. The taxonomy of these sciences, if it were well known, would undoubtedly provide a great deal of information on what might be called the field of intellectual imagination in our time. (Barthes 1964[A], p. 80)

Schaeffer alludes to the musician's analogical vocabulary for timbre description:

> Would other means exist, less laborious and more direct, of approaching the description of sonority and musicality? Resorting to analogy for instance, as we do daily when speaking of sounds. What do we say about a voice for instance? That it is 'harsh', 'piercing', 'screechy', 'sharp', 'dull', 'lifeless', 'bitter', 'tense', 'flat', 'metallic'... Adjectives referring to a 'voice colour' are a little less trivial: 'colourful', 'clear', 'dark', 'colourless'... Then come tautologies: 'timbred', 'timbreless'..., metaphors: 'tubby', 'brassy', 'incisive'..., images borrowed from physics: 'warm', 'cold'..., from the dimensions: 'big', 'small', 'tiny', 'thin', etc. (Schaeffer 1966, p. 506)

For Schaeffer, this analogical terminology translates the impossibility of describing an object in itself, outside any structure: 'If we refuse to refer this sound, this voice, to other

sonic objects, the only solution is to look for references elsewhere, in other domains of perception or thought: vision, the kinæsthetic sense, touch, etc.' (Schaeffer 1966, p. 506). Schaeffer does not reject this vocabulary, but he makes a distinction: 'to speak *about* sound (analogy), or to speak *on* sound itself, by comparison (collections, structures and scales)' (Schaeffer 1966, p. 507). The physicist also uses analogies such as shape, amplitude, pitch, volume, and density, but he isolates these notions from the objects as absolute qualities or quantities. 'Next, he draws comparisons between sounds as we do: by establishing curves and taking measurements, he is also forming analytical structures which aim at standardizing a perception as simplified as possible...' (Schaeffer 1966, p. 507). Amid what he calls 'the verbal fireworks of analogic, artistic and physical terms' (Schaeffer 1966, p. 507), Schaeffer identifies three of the four operations of his solfège:

> 1. We certainly do not find typological terms, as these correspond to an abstraction of sonority which is entirely artificial. On the contrary, we have supplied typology with analogies of our own choice: cell, échantillon, accumulation, etc.
>
> 2. Round, harsh, big, small, tiny, and thin are all morphological terms, as well as tense and flat. They designate both shapes and 'factures', which are qualified as incisive, emphatic, piercing, etc.
>
> 3. Metallic, brassy and screechy, like the 'timbred/timbreless' tautology, evoke genres of sound, insisting on the instrumental allusion.
>
> 4. Clear and dark, like warm and cold, are obviously analogies which, as in sector 4, seek an equivalent of musical dimensions in registers of colour or temperature. The physicist's 'pitch' and 'level' are also space analogies; intensity and strength are kinæsthetic analogies. (Schaeffer 1966, p. 507)

If morphology proper scrutinizes timbre, discerning under this word specific qualities, and creating a vocabulary to discuss and assess these qualities, what role does the word timbre play when it enters the morphological vocabulary coupled with the adjective harmonic? 'The notion of timbre seems to be the least favourable to abstraction, since it actually designates this qualitative residue which remains at the bottom of the psycho-acoustician's test tube after he has decomposed the sound in three quantitatively measurable parameters: frequency, amplitude, and duration' (Chion 1983, pp. 51–2). Within the context of morphology proper, Schaeffer defines harmonic timbre as 'the more or less diffuse halo and, in general terms, those subsidiary qualities, all of which seem to be associated with mass and allow its qualification' (Schaeffer 1966, p. 516). The qualifier 'harmonic' points to the fact that the notion of timbre, in this case, is confined to the matter of sound, neglecting attack and dynamic profile. It must be noted that, according to Schaeffer's definition,

both harmonic and inharmonic sounds have harmonic timbre. Being restricted to matter, and being the remainder of mass analysis, the notion of harmonic timbre reproduces, within Schaeffer's system, the conception of timbre he criticizes in the traditional system. Schaeffer envisages three main relationships between mass and harmonic timbre:

> — in the case of traditional tonic sounds, pitch is naturally distinguished from timbre: one encounters tradition *en passant*;
>
> — in the case of pure sounds, the analogies chosen to designate those subsidiary qualities we have previously mentioned: volume and density are linked to mass;
>
> — in most cases: non-tonic sounds, mass is less simple to perceive, but *what we do not identify* as an integral part of mass is still a timbre, whatever the auditor's training or the sound context. In fact, the auditor can make a distinction between mass and timbre in various ways, according to his ability, attention, and also according to the environment of the object in question. For instance, a bell will be sited at a different pitch degree (mass evaluation) depending on whether it is assimilated to one tonic or another; or else, it will seem to be composed of tonic or complex sounds (no definite pitch), according to the auditor's aptitude for extricating sound agglomerates. Similarly, a homogeneous sound from a sheet metal may seem a confused mass, or on the contrary, a superimposition of tonic or blurred components, the whole perhaps topped with a high harmonic having its own timbre... (Schaeffer 1966, pp. 516–17)

According to the paragraph *supra*, for tonic sounds, harmonic timbre corresponds to the perception of the harmonic spectrum, whilst for non-tonic sounds, harmonic timbre corresponds to what remains to be said about sound matter after an exhaustive analysis of mass. What are volume and density? Schaeffer proposes to resurrect certain works by physicists on properties of pure sounds other than pitch, intensity and duration. These physicists 'admit the existence of subsidiary qualities, owing to the fact that the properties of perception depend on the characteristics of the receiving system as much as on the stimulus: such properties are therefore objective, but they tend to withstand experimentation, given the imprecision of analogies and the unavoidable conditioning of the auditors who may be asked about them' (Schaeffer 1966, p. 512). Schaeffer summarizes these properties:

> 1. Sound force (intensity), rising with level (decibels or phons) and, at the same level, varying in a complex way with frequency (Fletcher curves);
>
> 2. Pitch, rising with frequency and perceptibly affected, though to a lesser degree, by level;
>
> 3. Volume, augmenting with level and, at a particular level, decreasing as frequency

augments;[25]

4. Density, rising with both frequency and level. (Schaeffer 1966, p. 512–13)

This means that, at a given intensity, a low sine wave will be considered more voluminous and less dense than a high one. For both waves to appear as having the same density, the intensity of the lower wave must be greater than that of the higher one; for them to have the same volume (not to be confused with loudness), the higher sine wave must have a greater intensity that the lower sine wave. Schaeffer questions these analogies, which, unlike pitch and intensity, have no solid tradition: 'what characterizes the notion of volume in relation to density, and how to disconnect so easily these perceptions from intensity?' (Schaeffer 1966, p. 514). The third typology distinguishes two types of harmonic timbre.

> Two cases: either the sound mass is one and global, and then harmonic timbre is likewise global.
>
> Or this mass is perceived as subdivided into various layers (which may be tonic, as in the case of tonic groups), and then there will be a different harmonic timbre for each of these layers. (Chion 1983, p. 150)

In other words, the harmonic timbres of pure sounds, tonic masses, nodes, and frequency bands constitute one type of harmonic timbre; the harmonic timbres of tonic groups and nodal groups constitute another type of harmonic timbre; the borderline case of striate masses in turn may display either type of harmonic timbre. Classes of harmonic timbre are presented as complementary to classes of mass (see figures 7 and 8):

> For masses of classes 1 and 7 (pure frequencies and frequency bands): no timbre. For the tonic masses of class 2: a 'tonic' timbre. It has been said that, for nodes (classes 5 and 6), timbre constitutes the 'remainder' of sound, that which is not described as mass and is often susceptible of subsequent analysis (complex timbre): it can therefore harbour badly perceived striæ, unless the node is perfectly fused, as in a cymbal, and timbre then is inseparable from this node: such timbre might be termed merged or 'continuous'. For a sound which is itself striate, the perception of timbre may correspond to the halo, which is not analysed: this halo may also present striæ, or else a continuous timbre, depending on how far the analysis is pursued and how well fused the masses are. Finally, a group of tonics may display a continuous and even harmonic timbre, depending on the contexture of both the chord and its instruments. (Schaeffer 1966, pp. 524–5)

For Chion (see Chion 1983, p. 150), the notions of continuous harmonic timbre and dis-

continuous harmonic timbre indicate whether timbre is separable or inseparable from mass. According to figure 8, pure sounds, as well as white and coloured noises, have no timbre; tonic sounds have tonic timbre; tonic groups have striate tonic timbre or continuous timbre; striate sounds, nodal groups, and nodal sounds have either continuous or complex timbre. This does not contradict the paragraph *supra*, and is repeated by Chion:

> — In the case of pure sounds and white noises, that is to say, in the extreme cases, harmonic timbre is considered *'null'*, either because it does not exist at all (sounds with no harmonics), or because mass covers all pitch field and does not leave any space for timbre! (white noise);
>
> — the harmonic timbre of tonic sounds is termed *'tonic'*;
>
> — the harmonic timbre of tonic groups is termed *'striate tonic'* or *'continuous'*;
>
> — the harmonic timbres of striate sounds, nodal groups, and nodal sounds are termed either *complex* or *continuous*. (Chion 1983, p. 150)

When used in the compound 'tonic harmonic timbre', the term 'tonic' replaces 'harmonic' in its more usual acceptation (as in the harmonic/inharmonic opposition). It has been seen that the term 'harmonic timbre' refers to the perception of any spectrum (whether harmonic or inharmonic), at the exclusion of frequency bands and white or coloured noises (whose spectrum becomes identified with mass, which occupies a higher place in the morphological hierarchy). It follows that a tonic group necessarily displays a harmonic timbre. So, what does Schaeffer mean when he says that tonic groups may present 'a continuous, and even harmonic timbre'? Does the adjective 'harmonic' here acquire its traditional sense?

Comparing these morphologies of harmonic timbres with that presented in the recapitulatory table of solfège, one faces hardly conciliable contradictions. So far as pure sounds, tonic sounds, and white and coloured noises are concerned, there is no discrepancy: they are always presented as having, respectively, null harmonic timbre, tonic harmonic timbre, and null harmonic timbre. Problems arise with tonic groups, striate sounds, nodal groups, and nodal sounds. Tonic groups 'may display a continuous and even harmonic [tonic?] timbre' according to Schaeffer's paragraph *supra*; they may have a striate tonic timbre or a continuous timbre according to the table of figure 8; they have a continuous harmonic timbre according to the recapitulatory table of solfège. According to Schaeffer's paragraph *supra*, in striate sounds 'the perception of timbre may correspond to the halo, which is not analysed', and 'this halo may also present striæ, or else a continuous timbre' ('depending on how far the analysis is pursued and on how well fused the masses are'); according to the table of figure 8, the harmonic timbre of striate sounds is either complex or con-

tinuous; according to the recapitulatory table of solfège, the harmonic timbre of striate sounds is either striate or continuous. As regards nodes and nodal groups, Schaeffer's paragraph *supra* states that timbre constitutes 'the "remainder" of sound, that which is not described as mass and is often susceptible of subsequent analysis (complex timbre): it can therefore harbour badly perceived striæ, unless the node is perfectly fused, as in a cymbal, and timbre then is inseparable from this node: such timbre might be termed merged or "continuous" '; in the table of figure 8, nodes and nodal groups appear as having either a complex or a continuous harmonic timbre. One might infer that a striate harmonic timbre is a particular kind of complex harmonic timbre. However, how to explain the fact that, in the recapitulatory table of solfège, nodes appear as having, invariably, a complex harmonic timbre, whilst nodal groups may have either a continuous or a striate timbre? Moreover, should provision not be made for cases such as pink noise? Does one not perceive pink and white noises as two different 'noise timbres'? This question has concerned neither Chion nor Schaeffer. The latter indifferently uses the phrases 'white or coloured noises', 'frequency band', or simply 'band' to characterize the seventh class of mass. The solfège of masses nevertheless provides no tools for distinguishing a white from a pink mass, other than terming then white noise and pink noise. This distinction is therefore the remainder of an analysis of mass, and hence it is a question of harmonic timbre; on the other hand, frequency bands and coloured noises, by definition, have no harmonic timbre... This is how Schaeffer presents the characterology of harmonic timbres:

> Nevertheless, timbre remains independent of mass in certain cases and within certain limits. If a violin produces a note, and then two or three notes close to each other, it is really mass that becomes thicker, with no apparent change in timbre; neither does timbre appear to change when the violinist plays double-stops. By contrast, it suffices to mention the techniques of harmonics and unisons to highlight timbre variations which are both refined and evident. To mention, in addition, the differences of timbre between an open string, a vibrato and a harmonic, obviously means to consider the various characters of the violin timbre. All one can do here is to cite its evidence.
>
> Is it possible to continue the study of characters, given the acoustic correlations? Would it be possible to salvage certain works of physics in this respect? We certainly could, in this precise point of the exposition: the characterology of objects. Some of their results could be spadework for the solution of *lutherie* problems; but often too many variables seem to come into play, so that in the end the quite spontaneous judgement of the ear will be preferred to laborious syntheses. The sole well founded characterology of timbres concerns music only incidentally: it deals with phonetic objects, vocalic or consonantal; still, it is necessary to note that the analysis and synthesis of formants, now possible, aims at identifying consonants and vowels, rather than qualifying them. They refer much more to the distinctive features of phonetic sounds than to their features of sonority and diction. They only touch on musicality in a marginal way. (Schaeffer 1966, p. 525)

In the recapitulatory table of solfège, characterology limits itself to this note: 'Character of the sound-producing body: hollow/full, round/pointed, brassy/dull'. Schaeffer observes that the definition of species of harmonic timbre cannot be based upon the definition of mass species, despite the relation of interdependence between these criteria.

> In traditional music, timbres do not have the fundamental structural role which is devolved upon pitch, and on the other hand the perception of timbre has almost always been referred to the causal origin, and even sought after as such, certainly for a better elucidation of polyphonies. If it happens that in contemporary music one may offer a fundamental role to timbre, this is because it seems possible to go against nature, by refining perceptions, and against society, by renouncing usages. (Schaeffer 1966, p. 526)

Schaeffer notes that perceptions of harmonic timbre have not been inventoried; one could speak of the width or narrowness, of the richness or poverty, of the brilliance or opacity of a harmonic timbre, but for this vocabulary to become fully operational, it would have to quit the domain of vague analogies: the higher a sound, the brighter it appears, however, it is known that a low note contains high harmonics, it is rich and bright, whilst a high note contains almost none, it is poor and opaque.

> After such comparisons, our auditors shall actually admit that their terminology needs revision; the low note is relatively clearer than the high one. They will have learnt how to separate the perception of the tonic, whether dark or clear, from the harmonic halo, whether clear or dark. (Schaeffer 1966, pp. 526–7)

Schaeffer gives another example of how training may change perception of harmonic timbre:

> The second example is traditional enough: an auditor who is not a musician will perceive a piano chord as a single musical object. He knows very well that this is a chord, and he recognizes in this chord a certain contexture of mass, but he is unable to resolve it... It is very easy for a solfège beginner to make this out: *'C, E, G, B'*, he says. Nevertheless, if he hears the same chord with its notes divided between various instruments, then his training immediately proves inadequate: perhaps he is still able to identify the notes, but he will not succeed in recognizing the timbres. A very good musician is likely to do no better if timbres have fused and, incidentally, this is desirable: one ought to speak then of the timbre of this chord. One sees the range of trainings in the very bosom of traditional musical society. Thus, the qualification of harmonic timbre in the field of pitch demands extreme caution. (Schaeffer 1966, p. 527)

The recapitulatory table of solfège defines two sites (dark and clear) and two gauges (narrow and wide) for harmonic timbre in the field of pitch. Schaeffer adds that 'these terms will not be elucidated until a good deal of research is carried out' (Schaeffer 1966, p. 527). Chion observes that these adjectives can be combined in pairs: dark-narrow, dark-wide, clear-narrow, and clear-wide; this is expressed in the recapitulatory table by the following diagram:

	narrow	wide
dark	1	2
clear	3	4

The weight of harmonic timbre is defined in relation to the mass as being either rich or poor. The following paragraph presents the assessment of harmonic timbre in the field of intensity.

> Finally, timbre can also be considered in the field of intensities; here it is a question of its brilliance or richness in relation to the intensity of the tonic. However, it is known that sounds with no harmonics also present the subsidiary qualities of volume and density: should these qualities be linked to mass, or should one say that they constitute a timbre, that is, 'the remainder of perception', when even spectrum is missing? Would the complementary volume and density then be the counterpart of what is perceived in colour and degree? One gets lost in conjectures. (Schaeffer 1966, p. 527)

The weight and relief of harmonic timbre in the field of intensity are expressed in the recapitulatory table by a diagram similar to that used for tessitura and écart:

	dens.?	vol.?
poor	1	2
rich	3	4

It is well known to sound producers that the boosting of certain frequencies may bring a

sound to the foreground; this may justify Schaeffer's definition of richness and poorness as sites of harmonic timbre in the intensity field. However, how to understand volume and density as gauges of harmonic timbre in this field? Chion affirms that these qualities here apply to 'all kinds of harmonic timbre' (Chion 1983, p. 151). All the same, the terms remain undefined. It is moreover hard to figure out the relationship between volume and density as gauges of harmonic timbre in the intensity field and the notion itself of relief as expounded with regard to the dynamic criterion (see § 17).

Assessing the impact (see § 17) of harmonic timbre, Schaeffer states in the recapitulatory table of solfège: 'variation of width, colour, richness; numbers 1 to 9'. In Chion's words: 'during the unfolding of a sound, harmonic timbre may vary in width, colour, and richness, according to a progression which one can number from 1 to 9' (Chion 1983, p. 151). Assessing the module of harmonic timbre, Schaeffer notes in the recapitulatory table of solfège: 'threshold of timbre recognition for brief sounds'; again, module has become synonymous with duration of existence.

17. SOLFÈGE OF FIXED MASSES: DYNAMIC CRITERION.

Schaeffer terms dynamic of a sound the variation of intensity in the course of its duration (cf. Schaeffer 1966, p. 54). The study of dynamic, the main criterion of shape, is made with reference to '*shaped* sounds with *fixed mass*, that is, sounds whose matter answers to the criterion of homogeneity, if one abstracts their dynamic' (Schaeffer 1966, p. 529). One is moving within the boundaries of a particular area of the note zone. The area in question excludes Y, Y', and Y", as their mass varies in tessitura. 'We shall attempt to listen with the same ear to pure, tonic, or thick sounds, whether blurred or striate, provided they are comparable in shape' (Schaeffer 1966, p. 529). In the same way as Saussure dissociates linguistic sounds from their written representation, Schaeffer does not link the idea of note to the idea of notation.

> In addition to pitch, duration and nuance, which are explicitly specified on paper, what defines a score note when performed is a certain dynamic curve this note draws on the sound space. It comprises a beginning, a body and a decay; this elementary morphology has already been described. In a traditional score the dynamic aspect is generally neglected; the idea of note goes without saying. At the very most, one finds some performance signs: staccato, legato, etc., which are instructions to the instrumentalist, rather than formal elements of the composition. Nonetheless, the score also affords an entire system of signs which establishes between the notes a network of indications concerning dynamics and maintenances: slurs encompassing a series of successive notes, crescendi, etc. In conjunction with this, there are generic nuances: *pp*, *mf*, etc., whose articulations sometimes require specific and precise dynamics: sforzando, forte-

> piano... In general terms, the ensemble of these indications contributes towards situating the particular nuance of the note in the context of an overall expressive dynamic, and ultimately, despite a somewhat unexplicit approach, each note of a traditional score represents a specific *temporal shape*, rather than any shape whatsoever: its own life must become integrated into the rest of the composition, contributing in a precise manner towards the general musical effect. I have therefore reason to generalize the notion of note, applying it to any dynamic shape identifiable as such. (Schaeffer 1966, pp. 529–30)

Schaeffer considers the dynamic question as relatively simpler than the question of mass; the dynamic criterion exists in the temporal dimension, and 'temporal correlations between physical object and sonic object have an irrefutable basis, the magnetic tape, and also a relatively accessible means of description: the sonogram' (Schaeffer 1966, p. 530). Before exposing the plan of the solfège as applied to dynamic, Schaeffer recapitulates his analyses of duration and maintenance.

> In chapter XIV I have distinguished between three zones of the ear's sensitivity to duration: in the first, extremely brief sounds are perceived as impulsions (we have seen that what is most important here are the 'initial conditions' of sound evolution, and particularly the initial dynamic slope); on the contrary, in the third zone a very long sound is followed by the auditor from moment to moment as a kind of sonic mobile, with the ear adding up the information which is progressively accumulated; finally, I have placed in the intermediate zone those sounds which take up the ear's optimal duration of memorization. Within the context of this last zone, however slightly 'coherent and interesting' (no excess, no flatness) the shape may be, the sound is easily apprehended, leaving upon the memory an imprint whose value and legibility will be enshrined, which does not happen in the other two cases.
>
> This inclines me to take into account a general criterion of duration, distinguishing: anamorphosed sounds (where attack predominates), sounds having a shape (the word profile will also be used), and long sounds with poor shape. Moreover, in connection with these general facts of the perception of durations, we have seen that typology summarily distinguished null factures (homogeneous sounds, either continuous or iterative), unpredictable factures (accumulations and échantillons), and 'closed' shapes. My division of shapes into *classes* will take all these considerations into account.
>
> In chapters XII and XIII I have also spoken about the relations between instrumental timbre and attacks: for sounds where these relations predominate (resonant sounds in particular), it actually seems that they ought to provide the basis for classing shapes. It will be seen that they are used, in general terms, to define the *genre* of sounds as regards their *dynamic timbre*.
>
> Finally, *dynamic species* of sounds remain to be defined. To this end, I propose the

> reference frames of intensity and depth of the *model of profiles*. (Schaeffer 1966, pp. 530–1)

One would therefore think that the study of dynamic will follow the general plan of the solfège. However, given their importance, the solfège of the dynamic criterion begins with a study of attacks. This study concerns the relationship between the attack of a sound and its dynamic and harmonic profiles; it defines a characterology. Dynamic profile is sometimes dependent on sound genre; 'in particular, for purely physical reasons, profile is often entirely predetermined by attack itself (all percussion-resonance sounds)' (Schaeffer 1966, p. 531). The following quote refers to figure 10.

> Let us now analyse more closely the criterion of attack, which in traditional music is so intimately linked to the instrumental *genre* of the sound. Provision will be made for seven compartments, which should be enough to delimit the various attacks without going into too much detail. Moving from the *harshest* to the absolutely *null*, in the first compartment of this classification we have placed attacks which are termed *abrupt* (plectrum instruments and woodblocks), and in the last, imperceptible attacks (sounds whose intensity establishes itself very gradually).
>
> Midway, in compartment 4, we have placed *flat* attacks such as those of the harmonium and, actually, all homogeneous sounds; it is a question of sounds which instantly have their definitive intensity. Let me note that, as has been mentioned in book III, these sounds give rise to a *pseudo-attack* under the form of a very brief white noise corresponding to the sudden burst of the energy inside the ear. Since our classification is musical, that is, since it must account for the effect and not for the physical cause, we place in the compartment of flat attacks all attacks which include light mordents of whatever origin: rosin of the bow, tonguing of the winds, as well as the pseudo-attack due to the cut of the razor blade.
>
> In compartments 2 and 6, counterbalancing each other, we have respectively placed *steep* attacks and *progressive* or *sforzando* attacks. I shall observe that perceptions should not be expected to be as 'symmetrical' as our compartments or sonographic lines even. On one side we have sounds whose intensity establishes itself very quickly, though not instantaneously, and which are generally sustained; this last character prevails over attack character, and the attack then plays a secondary role: attention is directed to the whole of the sound. On the contrary, a steep attack, whose prototype is that of the piano, focuses the listening on the beginning of the sound: in this case, as we have seen, a temporal anamorphosis occurs, and the character of the attack is dominant in relation to the character of the sound body.
>
> A compartment remains to be filled on either side of pseudo-attacks. Between these and the sforzando attack, we place those giving the impression of a musically softened sound which nonetheless seems to establish itself instantaneously: such sounds are achieved

> in practice by taking precautions when the sonic energy is triggered off. Between the mordent of the rosin and the sforzando, between the attack of the glottis and the quick but progressive input, there is a number of sounds which are produced with tact, and have neither an apparent profile nor a parasitic noise or a voluntary mordent. We then speak of *mellow* attacks.
>
> At first sight, compartment 3 is difficult to fill. We have placed there attacks which can be qualified as *soft*. As we shall see in the next section, they may be considered as a combination of the first two genres. A guitar string would normally give rise to an abrupt attack like that of the mandolin, however, apart from the fact that the string is more gently plucked (by the thick of the finger rather than the plectrum), a relevant resonance relays the initial impulsion; the dynamic seems to rebound, and its slope may become less steep than that of the piano: we then say that the guitar sound presents a *soft* attack, as all elastic pizzicati followed by resonance reinforcements do.
>
> This very approximative classification is far from accounting with precision for all instrumental cases. It serves as a frame of reference. A percussion from the timpani, the gong, or the cymbal will be classified in compartments 3, 2 or 1, depending on the stiffness of the mallet and on the relative importance of the resonance: the woodblock percussion is classified in compartment 1, the guitar pizzicato in 3, and in 2 we have those instruments where shock and resonance are perceptibly balanced: harp, vibraphone, and piano. It will be noted that percussions reiterated by means of felted mallets which progressively excite sound-producing bodies (tremoli of the timpani, of the cymbal, etc.) correspond to those attacks located on the right side of our table (compartments 5, 6 and 7). (Schaeffer 1966, pp. 532–4)

These considerations on dynamic genres lead to the definition of two dynamic classes.

> The previous classification allows us to reach a better understanding of profiles. According to attack genre, dynamic profile is either determined by this attack or liberated from it by the maintenance which follows. For percussion-resonance sounds, resonance profile cannot really be perceived in itself unless one manages to extricate it from its determinism in one way or another. The second case encompasses most sustained sounds: attack and body of the sound then have relatively independent dynamics.
>
> We have also seen that certain dynamic profiles are linked to a relatively minor (albeit perceptible) variation of mass. In fact, as I have already said in chapters XII and XIII, this is the case with most percussion-resonance sounds and, in particular, with the sound of the piano in its middle and high registers, where harmonic content loses various components as resonance fades away. In general, we shall speak then of *linked* harmonic and dynamic profiles. Conversely, these profiles can be relatively more *independent* in cases where the sound body is manufactured, by the instrumentalist or the experimental musician, more or less independently of the attack.

> In view of these considerations, I shall divide shapes into two classes: 1. profiles which are determined by attack and, in general, linked to a harmonic profile (particularly in the phenomenon of double attack); 2. profiles which are not determined by the attack and, in most cases, not linked to a harmonic profile. (Schaeffer 1966, p. 535)

The first dynamic class comprises attack genres 1, 2, and 3. 'Experience shows that in this case, as resonance develops, there is usually an evolution of harmonic content which is beyond the instrumentalist's control: whether it is a question of striking a bell or a piano keyboard, of plucking with a plectrum the strings of a mandolin or harpsichord, whether it is a question of a violin pizzicato or of a timpani percussion, there is in fact only one means of intervention: the instrumentalist puts a greater or lesser energy into the striking, he stretches the string more or less with the plectrum' (Schaeffer 1966, pp. 535–6). Schaeffer designates this dynamic class as the class of resonant attacks or anamorphosed dynamics, which he divides into two subclasses: simple attacks and double attacks. The prototype of simple attack is the piano in its low and medium registers.

> In chapter XII we have seen that, however preoccupied pianists may be with the weight of the forearm and the suppleness of the wrist, it is definitely the sole force of percussion which determines the force of attack, and hence resonance duration on the one hand, and initial harmonic content together with its evolution on the other. It will be noted that this initial harmonic content remains perceptually the same for the whole duration of the note in the low register of the piano. Is it still possible to speak of linked harmonic and dynamic profiles then? Yes, in so far as it is still the force of percussion—hence the attack—that determines what this constant harmonic content of the note will be. A mellower attack gives rise to a poorer timbre; conversely, a vigorous attack makes timbre become brilliant. This is why, over the extension of the whole keyboard, pianists have at their disposal the possibility of determining the timbre of each note according to the force of their playing; although their action involves no more than *one single degree of freedom*, they calculate it so as to attain *at the same time nuance level, dynamic timbre* and *harmonic timbre*, which are *indissolubly linked* at each emission of a note. It is therefore a total fallacy to believe that, on the piano, one can keep the same timbre while changing nuance, and vice-versa. On the contrary, there exists for each note a wide range of nuance-timbre pairs, at each time associated with a certain force of attack. Let me finally observe that, regarding the piano as well as all instruments where it is possible to stop resonance at any point in time, the musician has at his disposal an additional possibility of intervention on the note decay; from this perspective though, it is duration (and not profile) that is no longer entirely determined by the attack. (Schaeffer 1966, p. 536)

The second subclass of profiles which are determined by the attack is that of double attacks. Schaeffer designates it as the general case; this subclass encompasses the subclass to which

it is opposed (simple attacks). 'In comparison with the general case of percussions, the piano actually presents the particularity of balancing percussion shock and resonance, which therefore are not heard as distinct entities, at least in the low and medium registers' (Schaeffer 1966, pp. 536–8). The further up one moves along the piano keyboard, the lesser the relative importance of the resonance. Schaeffer considers high notes from the piano as prototypical of percussions in general.

> If the surfaces which come into contact are hard, the shock produces an initial sound, a quickly deadened noise (abrupt decay) whose particular colour and timbre depend on these surfaces as well as on the force of the blow. Resonance in turn establishes itself, and its timbre depends on the nature of the resonator (piano soundboard, gong, membrane, taut string, sheet metal) as well as on the force with which this resonator is excited. The shock-resonance ensemble produces a double sound, where each component has its own law of extinction, its own timbre and level. There is duality of harmonic and dynamic profiles. (Schaeffer 1966, p. 538)

This subclass is further divided by Schaeffer. A) Shock is more significant than resonance profile, as in the woodblock, which is characteristic of abrupt and dry attacks with double timbre. B) The attack is abrupt but does not contribute a particular timbre and is furthermore immediately relayed by the resonance, as in the pizzicato; though less intense than attack, resonance is richer, and the overall perception balances resonance and attack. C) Shock is suitably felted, and resonance is greatly reinforced; the extreme case here is that of the medium and low registers of the piano, where shock is practically masked by resonance.

> In sounds from the vibraphone or the high register of the piano, the ear easily distinguishes shock from resonance. These sounds therefore physically belong to case *b*, with a shock which is absent from the pizzicato. Yet what interests musical perception is above all, or even exclusively, resonance: psychologically, one skates over the shock in *c*, as a particular intention of listening obliterates it; accordingly, a more objective intention of listening would reinstate it.
>
> These different cases may be represented by the superimposition of the two profiles: shock profile, always abrupt, and resonance profile, which is disproportionate in the woodblock, but balanced in the pizzicato or vibraphone, and apparently dominant—that is, blurring the attack—in the low register of the piano (see figure 38). (Schaeffer 1966, p. 538)

Comparing this distinction between four attack profiles (figure 11) with the characterology of attacks (figure10), one realizes that those four attack profiles correspond to attack genres

1 to 3, with the particularity that genre 2 (steep attacks) has been split into subclasses 1 and 2 (or into two subdivisions of the third division of subclass 2). The second dynamic class, that of profiles which are not determined by the attack, includes genres 4, 5, 6, and 7, whose maintenance allows the instrumentalist to disconnect attack from sound body. In extreme circumstances, they will be totally independent of each other.

> In this case, what happens to harmonic evolution in relation to dynamic profile? One can admit that, in general, they are quite dependent, even though the instrumentalist or singer may strive to control the sound continuously, so as to preserve the same timbre during a crescendo or decrescendo. In electronic music, composers have made abundant use of the possibilities the electronic studio offered for the creation of 'sonic pastes' presenting masses which were absolutely steady, and whose intensity could vary from a *pp* to the most deafening *ff*. Yet, it is necessary to observe that such sounds are often unpleasant, rather than unfamiliar; this happens because in classical *lutherie*, harmonic and dynamic profiles are seldom so independent; a singer gradually *timbres* sound as the held note unfolds, and so does the violinist; the average auditor is conditioned to this close association. One is therefore surprised when listening to electronic sounds which display precisely the opposite relation: colour becoming brighter as intensity decreases. The auditor is then shocked by what is unusual, not to say 'against nature', in these sounds. (Schaeffer 1966, p.539)

Schaeffer affirms that, in sustained sounds, the link between dynamic profile and harmonic profile results from the ear's habituation to music making, which is in turn subject to the laws of maintenance that govern sound-producing bodies. For sounds whose profile is not determined by the attack, the instrumentalist remains relatively free to choose and model harmonic content and dynamic profile as he pleases.

Thus far the word class has been used in connection with profiles which are determined by attack and profiles which are not determined by attack. At this point in Schaeffer's exposition though, the word class appears as defining two cases of what had been termed the class of profiles which are not determined by attack: 'I shall range the objects concerned here in the class of *profiles* if their dynamic shape presents some relief, and in the class of *amorphous sounds* if profile tends towards the regularity of homogeneous sounds' (Schaeffer 1966, p.539). In the recapitulatory table of solfège, the morphology of dynamic defines three classes: anamorphosed sounds (shock/resonance), profiles (crescendo, decrescendo, delta, hollow), and amorphous[26] sounds (flat, mordent). The class of anamorphosed sounds corresponds to what had been defined as the class of profiles determined by the attack, comprising subclass 1 (simple attack), and subclass 2 (double attack) with its subdivisions (prevalent shock, shock/resonance balance, prevalent resonance); the classes of profiles and amorphous sounds are subdivisions of what had been hitherto defined as the class of profiles which are not determined by the attack.

The analysis of the dynamic criterion makes no reference to the pitch field. Chion remarks: 'nothing to note, as the relationship between the dynamic of a sound and its mass is infinitely complex and offers an excessively large number of linkage possibilities' (Chion 1983, p. 156). Before assessing the dynamic criterion in the field of intensity, Schaeffer introduces what he terms the notion of 'mass profile'. In fact, he is speaking about the dynamic profile of mass (see § 19 for mass profile proper). Chion explains it:

> In a secondary sense, the expression *mass profile* designates something entirely different: the ensemble of component intensities of the sound spectrum perceived simultaneously, rather than successively (542). It is therefore a kind of instantaneous profile, a vertical profile. (Chion 1983, p. 165)

It would be easier to make sense of the following quote if, in the first sentence, 'pitch field' were replaced with 'intensity field'.

> I could have already mentioned it (sc. mass profile) in connection with the site of mass in the pitch field. The *profile of mass* is formed by the ensemble of (perceived) intensities of the various components of the sound spectrum. It corresponds to a more or less general or detailed perception of these components, and therefore can be inferred only very approximately from the acoustic spectrum and Fletcher curves. Wegel and Lane (1924) actually show that 'prolonged sounds which are sufficiently intense mask high notes over more than an octave above them, but do not mask lower sounds at all'. Winckel says that the presence 'of an intense pure sound with long duration and having the frequency of 800 hertz (around G_5) raises the pitch of neighbouring notes over the range of a fifth by nearly 7%, that is, a semitone. This discrepancy can still amount to 6% for a sound of 500 hertz (near B_4)'. Let me still mention that, at the same level (decibels), sounds of different frequencies may have very different intensities (sones), as Fletcher curves show. The perception of the dynamic profile of mass must therefore form the subject of a specific research having its references in perception itself, and devoted to the discovery of characters attached to the *genre* of sounds; such characters cannot be predicted from *à priori* considerations. (Schaeffer 1966, pp. 542–3)

Siting the dynamic criterion in the intensity field, Schaeffer defines weight.

> The notion of weight can be deduced from the foregoing considerations by observing that it is impossible to speak about the intensity of a mass, even in steady state, without making reference to its context. I call *weight* the intensity of a given sound in relation to one or various sounds. There are two kinds of comparisons: those possible between sounds belonging to the register of a same instrument when the respective weight of its notes is assessed, and those possible in relation to a *standard sound* which

> serves as reference for all possible sounds; one has then conditions of experimentation leading to a generalization of Fletcher curves. Such comparisons, quite apart from their inherent difficulty, scarcely have any musical use, so far as in traditional music one is always within particular instrumental contexts and, in experimental music, one ought to compare only those dynamic structures formed by objects of the same *genre*. (Schaeffer 1966, p. 543)

Schaeffer then makes some general comments on nuances.

> It seems that the majority of nuances are found less in the force than in the weakness of sound. The subjective scale of sonority in terms of decibels shows that, for C_5, half of the nuance range (from *ppp* to *mf*) has been covered once the physical level (decibels) of the sound has varied by a quarter of its value. It is possible to say that, for each side of the mezzo-forte, there is a 'law' of nuance in terms of level in decibels: one is linear and moves towards the forti; the other moves faster towards the piani. These findings will not surprise musicians, who know the subtlety and effectiveness of pianissimi in music; in other words, for soft sounds, the ear is placed in better conditions of sensitivity and attention. Anyway, it is important to remember that the scale of nuances remains above all a specifically musical perception whose criteria depend on the context; such criteria specialize these generic indications provided by physical measures whose general sense they do not contradict. (Schaeffer 1966, pp. 543–4)

The point in question is the weight of homogeneous masses. Schaeffer's exposition now reverts to analysis of harmonic timbre, as he chooses to expound relief of harmonic timbre under the dynamic criterion. In the context of this work, this notion has been expounded under the solfège of harmonic timbre (see § 16). The solfège of dynamic presents mass weight as a function of mass module:

> The relative intensity (weight) of a permanent sound depends on its duration and profile. At one extreme, the ear does not analyse the mode of appearance and disappearance of energy (brief sounds), whilst at the other, it gets tired (long sounds). Besides, loud sounds either force the ear to adapt, or they weary it; this translates into a drop in apparent intensity which also affects subsequent sounds for a certain period. Von Bekesy has demonstrated that a sound which follows a loud and long sound of the same pitch after a silence of one and a half seconds is perceived as less loud (by about 5 sones).
>
> Independently of these phenomena, the dynamic profile indubitably introduces a perception of nuances which differs from that corresponding to steady states. The intensity of a note from the piano, or of a pizzicato, is assessed differently from that of a sound

> maintained by blowing or bowing. There is an anamorphosis in the perception of intensities, as in temporal localization. (Schaeffer 1966, p. 545)

Chion alludes to some factors which affect weight: '*masking effects, effects of reference to the sound agent* (though lower in decibels than a piccolo pianissimo, a violin "fortissimo" is perceived as louder); and also *perceptual phenomenon of emergence of a variation within a homogeneous brouhaha,* even if this brouhaha has a greater "weight" (for instance, a cat's weak mewing emerging from a hubbub)' (Chion 1983, p. 110). This emergence phenomenon is termed impact, and corresponds to site in the field of duration, but it also involves relief (intensity gauge).

> It is therefore necessary to consider, as a complement to the perception of *weight,* the fact that this perception is more or less anamorphosed or localized at a certain instant of duration; that is to say, it is necessary to consider the *impact* of sounds, corresponding less to their intensity than to the nature and velocity of their variations. Let me give three examples of these effects I group under the name of *impact.* The first one belongs to everyday experience. In a sonorous context of great intensity, provided the ear is not physiologically saturated, what we perceive best are sounds which vary quickly enough to realize what I call *impact.* For instance, the mewing of a cat, which has a low level, will nevertheless emerge from a hubbub. It is therefore a question of *relief of the variation* in relation to duration. Second example: the surprise of the acousmatic auditor who listens on record to unexpected noises and inopportune coughs which he had not noticed in direct audition. This fact has already been partially explained by saying that, at the concert, this information was neglected. However, what interests me here is that these anecdotal noises are all the more inopportune since they are constituted by rapid shapes. Finally, rooms that fall silent before the first bars of a concert show the same phenomenon: the slightest creak of a chair, a snapping string, and a falling drumstick, all are disproportionally noticeable given the tension of silence: the reference level is then exceptional. What I call *impact* therefore musters everything that weight neglected. (Schaeffer 1966, pp. 545–6)

Impact is measured by comparing variation relief to temporal module.

	slow	mod.	fast
minor	1	2	3
med.	4	5	6
major	7	8	9

'For the dynamic criterion, the number 7 will qualify an important but very progressive dynamic evolution; for melodic profile, the number 6 corresponds to a medium écart of variation in a fast speed of variation' (Chion 1983, p. 111). The word écart therefore does not refer solely to gauges in the field of pitch.

> 1) One calls *écart* either the space which a criterion occupies in the field of pitch (its 'thickness' in relation to the pitch field), or the gauge of its variation in the same field, that is, the importance of the covered tessitura. For instance, the vibrato of a singer who 'vibrates too much' has a major écart.
>
> 2) The notion of *écart* therefore concerns not only the criteria of mass and harmonic timbre, but also those three criteria characterized by variations in the pitch field: *allure*, *melodic profile*, and *mass profile* (and even *grain*). (Chion 1983, p. 109)

In a more general sense, 'écart designates the amplitude of any difference or variation whatsoever in any perceptual field whatsoever' (Chion 1983, p. 109); for instance: the écart of intensity between two sounds. As regards the gauging of the dynamic criterion in the duration field, yet again module corresponds to duration of existence, brief, measured, or long (see figure 10).

18. SOLFÈGE OF MAINTENANCE: GRAIN AND ALLURE.

'I have already mentioned maintenance as a morpho-typological criterion which allowed identification of objects and underpinned their unity: null, continuous, or iterative maintenance' (Schaeffer 1966, p. 547). The solfège of maintenance, however, 'is rather a question of maintenance characters, of maintenance "manner", which implies the manner of the energetic agent' (Schaeffer 1966, p. 547). It opens with a metaphor:

> I have mentioned that a collection of objects could be examined otherwise than for the sake of the shapes it presents. This is what happens for instance when I say, about a number of figures, that some are printed, others drawn, by hand or with a rule, with a soft-lead or hard-lead pencil, a needle-pointed tracing wheel, or a dripping brush... The interplay of figure shapes is out of the question here. What is holding my attention is the diversity of factures and, more precisely, the variations of line 'maintenance' from one drawing to another. It is easy to transpose this example to to the auditive domain. (Schaeffer 1966, p. 547)

The inclusion of grain amid matter criteria evinces the relationship between Schaeffer's theoretical construct and technology. Physically, sound is vibration, which can only exist

in the flow of time: 'only by the form, the pattern, can words or music reach the stillness...' (Eliot 1944, p. 12). It is possible to conceive of a sound which does not vary and say that this sound exists as sheer matter waiting for time to shape it; this shaping of matter by time will *express* the flow of time, and rescue matter from its timelessness. Today, in an amount of time infinitesimally smaller than that minimum necessary for the obliteration of shapes (and for grain to exist), the computer can gather information on the spectrum of a sound, its component partials and their level; it can then resynthesize this sound, presenting it in the flow of time, and yet as sheer matter, that is, endowed with all perceptual qualities of this timeless state where no sound exists. Were such means of analysis and synthesis available to Schaeffer, would grain have been included among matter criteria? would homogeneity have been defined in stricter terms?

'However, I have preferred to reserve a special chapter for the solfège of allure and grain, considering that, whilst mass and dynamic profile originate in the *abstract* pole of the object, that is, its effects, the perceptions of grain and allure, on the contrary, reveal the *concrete* pole of the objects, closely linked to the energetic history, which recounts the genesis of *each instant of the sound*' (Schaeffer 1966, pp. 547–8). They 'tend to present themselves as grouping two borderline cases of dynamic perceptions and mass perceptions, at the meeting point of shape criteria and matter criteria' (Schaeffer 1966, p. 548).

A homogeneous sound may show a microstructure which generally originates from maintenances such as those of a bow, a reed, or even a mallet roll. This property of *the sonic matter* evokes the *grain* of a fabric or mineral.

Watching the movement of a bow filmed in slow motion, one actually notices that even in the most limpid note, irrespective of how well 'held' the bow is, it really produces a succession of attacks whose backlashes are more or less spaced and regular. Likewise, the bassoon reed emits as many 'noises' as beatings, and one is in a zone where two sensations related to the same phenomenon merge: perception of pitches, by integration of beatings, and perception of beating, by differentiation of shocks. Finally, a quivering cymbal, though left to itself, 'crawls' with sounds, and the resulting impression is also similar to grain.

One can assess here the importance of a musical analysis which, under the same perceptual rubric, groups three phenomena that are physically so different; at the level of the causes, there is nothing in common between the grain of the bowed sound and the grain of the cymbal sound: the former is purely dynamic, the latter is purely harmonic; the bassoon grain on the other hand corresponds to one of those two simultaneous albeit qualitatively distinct perceptions of the same periodic phenomenon (the other is pitch). The notion of grain, though disparate as regards its physical origin, sums up all these aspects of the same genre of perception. (Schaeffer 1966, p. 548)

Grain morphology is expounded after characterology and analysis. Schaeffer starts with typology.

> As to grains, this criterion is so concrete that one immediately thinks of analogies which seem justified. To say that a sound is rugged or mat, velvety or limpid, is to compare it to a stone, a skin, velvet or flowing water. At the level of microstructures, analogy seems to have a much more solid foundation, although it refers to perceptions which have no tactile or visual connection. There must be a reason for everyday language to compare perceptions thus spontaneously and convincingly: in this case, the issue is not the objects themselves of vision or audition, but their organization. On this level, it is the structural face of the object that is perceived: it is immaterial whether the object is a sound or an image, since one perceives the same organization under two forms. (Schaeffer 1966, pp. 550–1)

The typology of grains distinguishes three main types, which may give rise to combinations: grains of resonance, rub, and iteration. Schaeffer expounds the relation between these types and the three types of maintenance which underpin classificatory typology: null, sustained, and iterative.

> Let us call on everyday musical experience. As examples of null maintenance, we could take a string pizzicato, a piano note and a gong or cymbal stroke. The pizzicato presents no perceptible grain. In the low notes of the piano, however, one perceives a scintillation which, in certain pianos, evokes a variegated dust. As to the cymbal sound, besides its mass and harmonic timbre, it gives rise to a kind of rapid pricking sensation. These are *resonance grains*, or scintillations, akin to harmonic timbre, of which they are a generic character.
>
> To classify grains which correspond to the other two modes of maintenance (sustained and iterative), it will be necessary to shuffle a bit *lutherie* distinctions. Indeed, so far as maintenance is concerned, the listener sees no great difference between the beating of a bassoon reed in the low notes, and a bongo roll produced by hard drumsticks. On the contrary, both of these sounds are very distinct from the sound of a bow which, rubbing the string, actually imparts a totally aleatoric microdynamic to it.
>
> We therefore have two types of grain, depending on whether maintenance is really iterative (and relatively regular), or happens by rubbing, being then much more sustained, much denser (and in fact irregular, since its seeming regularity is simply an obedience to statistic laws).
>
> Wind instruments are divided then into two categories, depending on maintenance type: a flute sound for instance presents a very perceptible rub grain due to the air; it may be compared to the bow rub. Reeds in turn beat, 'crenellating' the dynamic. Likewise,

> a voice in its very low register produces, rather than a rub grain, a succession of intermissions and admissions of air: the glottis in this case is similar to a beating reed, and its crenellated grain is similar to the grain of a low sound from the bassoon. (Schaeffer 1966, pp. 551–2)

The type termed resonance grain corresponds to null maintenances; it defines the harmonic genre. The type termed rub grain corresponds to the sustainings of the flute and bowed strings (but excludes reeds); it defines the compact genre. The type termed iteration grain corresponds to iterative maintenances (but includes reeds); it defines the discontinuous genre. These three genres may combine.

> Where shall we place, for instance, the grain which results from a rub against a rough surface? There is the perception of the actual rubbing, mixed with the iteration of micronoises due to asperities. This leads to a table of main mixed genres, which combines in pairs those types; in more complex cases, one will carry on with this analysis, distinguishing the contributions and proportions of the three typical components (see figure 39) [refer to figure 12].
>
> How to classify the noise of a cart moving on cobble-stones? The wheels make a grinding sound (rub) and hit irregularities (striking); these shocks excite the cart (resonance). A *vrombissement* [buzzing] is explained by its first two letters: a rubbing 'v' and a beating 'r'. A marble rolling on a gong mixes three types of grain: rub and micronoises, everything intimately enfolded in a glitter of resonance. The terminology of our table evokes that of the Italian *bruiteurs*, precursors of this somewhat too anecdotal part of solfège. Though concerned with the dramatic result of the sound effects, it is clear that they must have instinctively attempted the act of generalization, which properly belongs to the musical domain.
>
> The reduction of grain to six main genres certainly does dot exhaust the ear's possibilities of appreciation; distinctions within each genre are possible; thus, one may find regular scintillations (as in a low note from the piano) or aleatoric scintillations (as in a cymbal sound). Other sounds may present progressive or varied scintillation. Friction rubs will be distinguished from 'æolian' rubs (wind, breath). As to strikings, it is necessary to distinguish those which are regular or aleatoric, rhythmic or progressive, those which evolve, and thus become denser or swell, giving rise to variations of relative weight and of module (compartments 68 and 69 of chapter 34, §3, general table) [refer to figure 7]. (Schaeffer 1966, pp. 552–3)

According to the recapitulatory table of solfège, the typology of grain also makes provision for mixed types. However, Schaeffer repeatedly uses the term type in connection with the three genres of unmixed grain, as the following quote demonstrates (see also the first paragraph of the quote *supra*).

> Pure *types* correspond to resonance, rub, and iteration: *harmonic* grains, *compact* grains, and *discontinuous* grains, respectively. However, these types of maintenance in practice are superimposed and combined. What are the main combinations which constitute *genres* of grain? (Schaeffer 1966, p. 552)

In the text of *Traité des objets musicaux* (as opposed to the recapitulatory table of solfège), the word type tends to be used with reference to pure types or pure genres, whilst the word genre tends to refer to mixed genres. Schaeffer comments on mixed genres:

> When considering mixed grains, the auditor likewise separates the objects which host grains; these grains then become distinctive criteria, even for objects which are inextricably combined in the pitch field; this analysis applies to the marble rolling on a gong, in which case one clearly distinguishes the marble (discontinuous grain) from the gong (resonance grain); it is an analysis of this kind which allows distinct musical notes to be recognized amid instrumental harmonic pastes.
>
> A similar phenomenon often facilitates analysis of contexture when one is considering sounds which are much more complex: in fact, a particular nodal sound will be distinguished by its grain. Thus, grain is the sound signature, the index, now coarse, now subtle, which helps identification. (Schaeffer 1966, p. 554–5)

Grain analysis is expounded in sketchy terms.

> But how does this criterion, hybrid between shape and matter, present itself in this field (sc. the musical field)? Does grain have, in its own way, a kind of mass and intensity? What is its relation with durations? Let us summarily explore this virgin territory.
>
> The most elementary qualification concerns *dynamic texture* of grain: this texture can be more or less dense. On the other hand, if grain is distinct from mass, one may say that it can be a question of its *weight*, in a relation between mass and 'background noise'. For instance, this relation is very noticeable in high tones from the violin, which are accompanied by a true fringe of white noise, whose æsthetic or inæsthetic aspect depends less on the level than on the quality of the grain. It is nevertheless necessary to admit that this case is a little arguable, as grain can only exist 'in' a sound, since it constitutes a property of the sonic matter itself; once one has objects where grain seems to 'detach itself' from the sound body, one is entitled to carry on with analysis, decomposing the sound into two distinct objects. This is done by the auditor who hears grain as noise in a musical note (high tones from the violin plus bow rub). Taken to extremes, this decomposition leads one to qualify grain similarly to mass, which is presented, under all reservations, in compartments 64 and 65, and 66 and 67, of the general table [refer to figure 7]. (Schaeffer 1966, p. 554)

According to the recapitulatory table, a grain whose mass or harmonic timbre is assessed will have its tessitura qualified in terms of grain colour, whilst its écart will be qualified in terms of grain thickness. In the intensity field, the weight of grain is defined in relation to mass, but no scale is proposed; its relief refers to the notion of dynamic texture of grain, scaled as minor, medium or major. Though the quote *supra* states that the dynamic texture of grain can be assessed in terms of density, density criteria actually appear in the module compartment. This is Chion's exposition of grain analysis:

> *α) Pitch field:*
>
> — *site* and *gauge*: if in a tonic musical sound grain is heard as a separate noise, which one evaluates by isolating it from the sonic mass proper, then the mass or timbre of this grain may be *sited* as having a certain *'colour'* (site), and the grain may be *gauged* as having a certain *'thickness'*.
>
> *β) Intensity field:*
>
> — *site*: likewise, if grain is heard as separate from mass, one may speak of its relative *weight* in comparison with this mass (relative site in intensity);
>
> — *gauge*: intensity gauge, or relief, corresponds here to the *amplitude* of the (very fast) dynamic oscillation which characterizes grain; this relief can be evaluated according to a scale having three degrees: minor, medium, and major.
>
> (It must be added that the species indicated here for the fields of pitch and intensity are given under all reservations.)
>
> *γ) Field of duration:*
>
> — *module* (duration in absolute value): there are three modules, or else three velocities, from fast to slow: *dense, adjusted, slack*;
>
> — *impact*: combining these three modules (horizontal entry) with the reliefs of intensity, corresponding to amplitude of intensity variation (vertical entry), one obtains a table which has nine compartments, and whose nine digits allow one to trace the profile of a grain variation in the course of the sound history.
>
> Example: 1–6–8 reads: passage from a dense grain of minor relief to a slower grain of greater relief, and thence to a grain of intermediary velocity but very pronounced dynamic oscillation. (Chion 1983, p. 154)

The notion of harmonic texture of grain therefore corresponds to the relation between the

gauges of intensity (relief) and duration (module). Impact in turn is defined by variation of dynamic texture. The recapitulatory table of solfège presents a grid similar to that used for the assessment of dynamic impact, but whilst the grid for dynamic impact appears in the impact compartment of this table, the grid for grain impact appears in the module compartment.

	dense	adjust.	slack
minor	1	2	3
med.	4	5	6
major	7	8	9

There are nine classes of grain, which fundamentally correspond to three modules (slack, adjusted, dense) for each grain type. Resonance grains are classed as shivering, teeming, or limpid; rub grains are classed as rugged, mat, or smooth; iteration grains are classed as coarse, neat, or fine. 'In fact, saying that a grain is mat or rugged, amounts to saying that it has a greater or lesser density, mentioning furthermore a quality linked to sound matter, which distinguishes one mass from another' (Schaeffer 1966, p. 555).

Schaeffer expounds the perception of allure in the following terms:

> It is known that the dynamic profile of an object is the envelope of dynamic variations of the sound in the course of its duration, as representable by a curve. It is easy to observe that, whilst certain profiles are characteristic of the instrument (slope of the piano sound, of the guitar pizzicato, etc.), others are characteristic of maintenance, and even of the instrumentalist's maintenance style: violin vibrati, intentional, and singer's vibrati, more or less unintentional. An *allure* such as a vibrato, which is characteristic of the maintenance, can join the overall profile, which is often characteristic of the sound-producing body.
>
> What distinguishes allure from dynamic *profile*? The fact that the latter characterizes the *object*, neglecting maintenance. Does this sound fade away quickly, has it got a steep attack, or does its energetic unfolding make it into a held sound? It is morphology that distinguishes this profile, in a first-order energetic perception. However, maintenance also expresses itself by a *maintenance law*, which corresponds merely to a second-order characterization of the object.
>
> One sees that allures are closer to dynamic criteria than to criteria of mass. However,

> allure is not exclusively a dynamic criterion; the more or less regular fluctuations whereby it manifests itself also effect pitch variations (vibrato of string instruments, of singers...), harmonic timbre... It is possible to say that allure combines multiple factors (in variable proportions, according to maintenance type), of which the most important are directly connected with dynamic and pitch.
>
> Allure therefore provides one indication among others about the history of energy in the course of duration; these indications are finally perceived in three different ways:
>
> *a*) *first-order* indications focusing on overall shapes: the *intensity site* to which musicians allude when they speak of *nuances*, and the *contours* which I have termed *dynamic profile*.
>
> *b*) indications which could be considered as *second-order* indications, in so far as we perceive *details of profile* as oscillations occurring at the rate of, for instance, a few per second: it is the *allure* of the sound.
>
> *c*) finally, third-order indications, which appear as perceptions of *matter* (though sometimes they are actually dynamic structures) integrated under the form of *grain*, which therefore represents a mutation of allure perceptions when allure becomes denser. (Schaeffer 1966, pp. 549–50)

Considered as merely a profile scallop or a detail of a shape, allure would not deserve a place among morphological criteria. Its significance resides in revealing 'the energetic agent's manner of being and, in very general terms, whether this agent is alive: life in fact manifests itself by a typical fluctuation' (Schaeffer 1966, p. 550). Such minimal indices of facture may be more important than obvious dynamic embroideries.

> The grain quality, attached to sonic matter, evoked the surface of a material object and the tactile sense. Accordingly, the criterion of allure, which is connected to shape, evokes the agent's dynamism and the kinæsthetic sense; it allows one to assess the liveliness and the energy proper to the object. The violin is a particularly eloquent example in this respect. Our listening judges by its results the action of the right hand, the wrist which handles the bow; it is according to grain that the resulting sound will be qualified as beautiful, full, screechy, or pale. Besides, the action of the left hand, that trembling finger on the fingerboard, that vibrato, reveals its tangible presence through an allure, which in turn may be qualified independently of profile or mass: it will be *wide, dense, ample, tiny,* or else *generous, brilliant,* but never *irregular* or *mechanical.* Should it disappear, then our listening to the right hand becomes more attentive, still recognizing the player by inevitable sound fluctuations, which are another form of allure (has the vibrato not been made precisely to compensate for and overcome the mechanical uncertainty of the player amid the thrill of life?). On the contrary, if a hurdy-gurdy

> produces its naïve tremoli, prior to any musical qualification the ear identifies the allure: this is a machine.
>
> Here is a very general query of humankind's in the presence of any object, whether musical or not: 'natural or artificial? craftsman or machine? wood or plastic?' As regards the musical object, it is allure that allows one to answer. In the allure, perception follows closely anything which may reveal the presence of differentiation, of life.
>
> What appeared as simply a second-order dynamic aspect is therefore related to a fundamental question. We immediately distinguish a very regular vibrato, realized by a violinist, from a machine vibrato: so far as shape is concerned, the difference between them is not great. However minimal this difference may be, it is instantly apprehended and decoded by a perception which tries to know whether the event, which depends on natural laws, is totally predictable, obeys a human intention, or is entirely dependent on chance. Let us not suppose that this quest exceeds the powers of the ear: in domains where it is thus guided by the ancestral training of indice decoding, the ear is capable of grasping very easily indications of second or third order, and it shows an extraordinary ability to gather, from the smallest sonic fragment, information on the human or mechanical origin of this fragment, and on its predictable or aleatoric character.
>
> That allure which balances a disorder of small events, the characteristic *fluctuation* of the live agent, constitutes a central class or type among maintenance styles. On its sides we shall place: to the right, the predictability of mechanical *order*; to the left, the unpredictability of chance, or *disorder*.[27]
>
> What professional sound-effects men (in radio, theatre, etc.) try, precisely, is tricking the auditor about provenance. Thus, they imitate the whining of the wind in the woods, a locomotive, or footsteps on gravel. If the technician has no exact intuition of allures, his artifice fails; one recognizes nature, humankind, and machines by allure, even more than, or as much as by the content of the sound chains they produce.
>
> According to our definition, allure, which affects not only profile but indirectly also matter by very slight oscillations of the character ensemble, presents itself as a powerful means of identification. As with grain, the point in question is not the recognition of an anecdotal causality — 'who or what in particular has produced this sound?' — but rather the answer to a more general query which ranges allure from redundancy to disorder. (Schaeffer 1966, pp. 556–7)

Typology and morphology of allure are merged in a typo-morphology, which is sketched in the fourth paragraph of the quote *supra*. Schaeffer refers to class *or* type of allure. In fact, there is a typology of allures, which defines mechanical, live, and natural types, and there is a morphology of allures which is defined by the combination of typological criteria (allure of the agent), with a distinction between orderly, fluctuant, and disorderly allures (allure of

shape). Thus, one has a partition of functions similar to that which occurs in the solfège of grain, where the third typology names a physical process (resonance, rub, iteration), whilst characterology qualifies the resulting perception (harmonic, compact, discontinuous). In the solfège of allure, the third typology names the mode of being of sources, (mechanical, alive, natural), whilst morphology establishes distinctions between the behaviour of these sources (orderly, fluctuant, disorderly).

One is therefore inclined to classify allures according to the inductions to which their perception tends (allure of the agent), as well as according to the examination of the effects of these allures (allure of shape).

For this classification I propose a table with nine compartments (see figure 40) [refer to figure 13], where 'normal' allures appear along the diagonal line: normally, a *mechanical* maintenance is regular, a *live* maintenance is fluctuant, and a *natural* maintenance is disorderly. Compartments on either side of the diagonal correspond to other allures, such as those which, in a disorderly phenomenon, distinguish human action from mechanical action. Thus, one does one's best to efface any difference between real thunder and backstage thunder; one seeks to characterize the allure which directs the backstage shaking of sheet metal by stripping this shaking of anything likely to betray human or mechanical intervention, thereby giving the illusion of a natural disorder.

> Let me stick to what is directly connected with our objective: as music is communication, the auditor naturally expects the message to come from another human being, but within certain limits he accepts his partner's use of machines. It is difficult to put up with electronic sounds, but the piano is a machine, and the organ too; the violin is more responsive. By convention, one tolerates from the violin a noise and fluctuations which would make another instrument unbearable. Only usage arbitrates between innovation and conditioning. This frontier remains disputable and mobile. (Schaeffer 1966, pp. 557–8)

The typo-morphology of allure is presented in the recapitulatory table of solfège according to the standard ninefold table.

	order	fluct.	disord.
mech.	1	2	3
live	4	5	6
natur.	7	8	9

What are those mixed types of allure mentioned in the recapitulatory table?

> In the concrete, maintenance can be simultaneously orderly and fluctuant, associating a mechanism to the presence of life. As has been said, the vibrato essentially bespeaks life, but it also depends on mechanical causalities; hence, it may be regular, symmetrical, and obey a 'pendular' law, or it may be asymmetrical, originating from a relaxation oscillation or, finally, from an iteration. (Schaeffer 1966, pp. 558–9)[28]

Schaeffer stresses the plurality of phenomena grouped under allure.

> The term 'allure' is therefore a manner of envisaging sounds under this aspect which, again, summarizes quite a few causalities in very different cases: accumulation of percussions, variations of pitch and intensity in a vibrato, cyclic repetition of a loop. In all these cases, one assesses maintenance law similarly, immediately qualifying its regularity, irregularity, or progression (itself regular or irregular) according to the contraction and dilation of pulsations, accompanied by variations in the regime of the pulsations.
>
> One could speak of the particular allure of an object, as well as of the allure which is characteristic of a collection of objects, such as that of a set of bells, or a vibraphone keyboard. When a collection of sounds presents a maintenance incident, this singular point will also characterize allure. Thus, particular circumstances of maintenance, the linkages it imposes on all values, sometimes demand the term 'allure' before a more abstract analysis is carried out. This amounts to backtracking to pure causality though; it is advisable to exhaust first-order linkages first, the linkages of dynamic profile, which have been studied in the previous chapter. (Schaeffer 1966, p. 559)

The characterology of allure is presented in the recapitulatory table of solfège in the following terms:

regular cyclic
vibrato
progressive
irregular
steep, cushioned fall
incidental

To this, Chion adds a word and punctuation: '*Regular* (allure) *cyclic vibrato; progressive; irregular; steep, cushioned fall; incidental*' (Chion 1983, p. 161). He observes that these

genres are ordered from regularity to irregularity. The translation of the recapitulatory table presented here (figure 7) recasts Chion's version.

Regular allure:
cyclic vibrato;
Progressive;
Irregular:
steep or cushioned fall;
Incidental.

Schaeffer presents the analysis of allure in very summary terms.

> Although it is usual to say 'allure' of a sound in a very general sense, in the last analysis I shall not retain such a large acceptation. This differential of dynamic must be distinguished from dynamic itself, even more easily than grain has been distinguished from matter. It is also possible to gauge allure as differential of the central pitch of the sound (amplitude in tessitura of the vibrato). Thus delimited, allure affects, with its oscillations, criteria of pitch and intensity; it also emerges in duration, either by its module (number of pulsations in duration), or by the variations of its regime.
>
> I shall limit myself to a summary analysis of these three cases. There is no site for allure in intensity and pitch, since it is just a differential whose relief is shown in columns 5 and 7 of the recapitulatory table of chapter XXXIV [refer to figure 7], where allure is briefly charted as minor, medium, or major; these gauges evaluate the 'hollow' presented by the pitch scallop or the intensity scallop in relation to the pitch or the weight of the sound. Evidently, I link columns 5 and 7 to the the last column of duration, so as to find there the common module of pulsation frequency.
>
> If allure varies, we shall compare the importance of this variation to its velocity of evolution in a summary table which has nine compartments and is shown in columns 8 and 9 (it will reappear in the next chapter for all kinds of variation) [see § 19]: it combines three gauge indications with three module indications, thus allowing one roughly to define, by means of three numbers, the stages of an evolution which for instance will have three phases: initial: medium and dense (4); middle: major and adjusted (8); final: minor and slack (3). (Schaeffer 1966, pp. 559–60)

Although Schaeffer says that there is no site for allure in intensity, column six of the recapitulatory table shows this comment: 'relative weight: allure/dynamic'. When Schaeffer affirms that allure is a differential 'whose relief is shown in columns 5 and 7 of the

recapitulatory table', he is using the term relief where 'relief and écart' would be more appropriate. The recapitulatory table corrects this equivocation. Chion comments on the table in the module compartment of the recapitulatory table:

> No matter how it is read, this table lends itself to two types of use:
>
> — *Case of an allure that does not vary in the course of the sound: 'the criterion is regular and has a fixed value'* (590), which is evaluated according to the module table.
>
> — *Case of an allure which varies in the course of the sound:* one then uses various of the table numbers to trace the history of these variations in duration. (Chion 1983, p. 162)

Allure module is defined by a combination of density criteria (dense, adjusted, slack) with écart or relief criteria (minor, medium, major), whilst impact is defined by module variation.

19. SOLFÈGE OF VARIATIONS: MELODIC PROFILE AND MASS PROFILE.

It has been seen in § 11 that, for Schaeffer, music was born when the primitive put two or three calabashes together: the repetition of causality made reference to the source redundant, and listening then focused on variations from one sound to another. Schaeffer opens the solfège of variations hypothesizing another genesis, which he describes as more poetic: the birth of music within the contexture of a single object. It will be noticed that the single objects in the quote which follows could all be defined as échantillons, the unity of which is based on the perception of a common causality.

> Let us imagine that, in the confusion which is the chaos of natural sounds, our primitive gets less attentive to indices for one moment. Why would he, ever so watchful, behave like this? Because one of these noises, trotting out the same cause, gives rise to a variation of effects he does not need to worry about: it is the wind that moans louder or in a higher tone, it is the wave that phrases more vigorously its raids, it is the pebble that bounces, and whose shocks move away with increasing echo reverberation. If this evolution of sonic indices were a source of information, he would listen to it as such. It is not so, because the wind is always the wind, the sea always starts again, and the distant fall of the pebble presents no interest at all; he listens to something else: this residue is music. When effects vary and the cause is annulled, then the sonic object arises, and is about to become musical.
>
> When much later, in the bosom of a crystallized civilization where musicality is in

> place and the ear conditioned, a new primitive puts on the record player the chaos of recorded sounds, there are only too many reasons for content—nature and culture—to be deciphered, according to one or another of the various codes available. If the record player oscillates around its average speed, or if this speed changes gradually or by 'chromatic' steps, there he goes, rediscovering that ancient (albeit quite conventional) experience; though annoyed by the wow or the harmonic progression the phonogène is effecting on whatever has been recorded, this phenomenon deserves his attention, as it opens the doors of the musical domain: that of a variation which obliterates content. (Schaeffer 1966, pp. 561–2)

One musical genesis then focuses on 'the discovery of sound-producing bodies, each of which produces an object which is immediately referred to structures' (Schaeffer 1966, p. 562). In the other, musicality no longer arises from a discontinuous structure 'originating in distinct bodies which allow easy identification of objects, but rather from a continuous movement which comes from the object itself, revealing a shape, and comparing this shape to the "dimensions" of the perceptual field' (Schaeffer 1966, p. 562). As reference structures have evolved within the context of discontinuity (collections of musical objects), the listening to individual objects is less cultural than the listening to musical structures. Structures rest upon a variation and may appear in discontinuous configurations (series of objects), or in the continuity of one single object (cf. Schaeffer 1966, p. 562). However, discontinuous scales are unsuitable to account for the perception and manipulation of individual objects.

> One would be tempted to study for instance a glissando according to traditional pitches, thus referring its value to a discontinuous scale: it would occupy the interval of a sixth for instance. This is a physical procedure though. A glissando occupies pitch in a singular manner: it is an original perception which has little to do with the interval indicated on the score: the glissando is the criterion of a *new musical object*, and it is in every respect different from the nominal interval indicated by the symbols of solfège. (Schaeffer 1966, p. 562)

Since references to the scale, melody, and harmonic relations are inevitable, it is important to understand how these two elements fit together: scalar structures of musical objects on the one hand, and musical variations in the bosom of objects (continuous musical structures) on the other. Musicians often refer the perception of continuity to the perception of discontinuity. Schaeffer adds that, though physicists do the same sometimes, they have been the first to distinguish 'two scales of sensibility, or different structures, depending on whether one hears discontinuous harmonic pitches (interval scale) or continuous trajectories (mel scale)' (Schaeffer 1966, p. 563).

> A more striking example of disparity has been given in book III, in connection with anamorphoses: the dynamic variation of a piano note is not perceived as a variation of level, but rather as another sound quality: attack. An even more convincing example: if I introduce variations in the spacing between successive shocks, what physical law will let me predict what shall happen? I simply expect a variation from slow to fast, according to a criterion of rhythm. However, this extrapolation soon looses its validity. Rhythm, which had become fast, changes its sense for perception: it is perceived as allure or grain. Then comes a zone where, again, one perceives a variation of the grain criterion, from wide to dense. When grain becomes 'velvety', there is yet another perception (which I have grouped under grain though, so as not to dissipate our analysis). In the meantime, another perception has appeared: pitch; no rhythm theory could have predicted it. The example of the bassoon has already been cited in order to highlight not only this passage from one perception to another during the variation of the same physical parameter (frequency of movement), but also the coexistence of perceptions: this same causal parameter is simultaneously perceived in two different manners, according to two distinct criteria of discontinuity and continuity: grain and pitch. (Schaeffer 1966, p. 563)

Schaeffer sees two main obstacles to the comprehension of musicality. One is the belief in the physical parameter: 'While a univocal physical law may well link an incident parameter to a resulting effect (and a number may unequivocally define magnitudes such as frequency or dynamic), the faculties of our ear are at liberty to make us hear this or that as we (humans) please, rather than as the logic of the incident parameter, its continuity for instance, would like' (Schaeffer 1966, p. 564). The other obstacle is the difficulty in understanding the duality of approaches: discontinuity and continuity. Schaeffer summarizes their relationships:

DISCONTINUITY	CONTINUITY
Frequencies:	
a) harmonic spectrum, heard as tonic (pitch)	a) band spectrum or complex spectrum, heard as colour (thickness)
b) between two tonics: relation of (harmonic) interval	b) trajectory in tessitura (glissandi): melodic relation (mels)
Level:	
a) constant level (homogeneous sounds), heard in nuances (intensity)	a) slow or fast dynamic trajectories: profiles or anamorphoses
b) between two homogeneous sounds: dynamic écart (weight)	b) between two shaped sounds: dynamic relation (impact)

Time:

a) attack spacing (rhythm), linking up with...

a) ...regular repetition of impulsions (from a few tens per second upwards): pitch sensation

b) fast pulsations: allure, linking up with...

b) ...even faster pulsations (beyond the ear's discriminatory power): grain

Discontinuity is made of the continuity of its component parts (batches of frequency, of dynamics, pulsations), and it is perceived by the cohesion of its elements: pitch sensation, rather than distinction between 440 rhythmic pulsations, velvetiness of a grain, rather than perception of a string shaken by a bow, impact of an attack, rather than detail of sound decay. Continuity is the reverse side of discontinuity. The approach to musicality by the route of varying objects is based on drastic alterations of natural orders of magnitude.

> There are two ways of doing this: with the help of machines which are not affected by magnitude orders, one may have insights into what happens physically; being sufficiently informed, our ear can make an effort to hear what natural listening had masked. Or else, we may transpose shapes *to a higher level of duration.* Attack, anamorphosed, unfolds as profile. A very low frequency starts fluctuating and beating as a semiquaver. The glissando flaunts itself, differently from a scale, or similarly to a scale which were so drawn out that its degrees would fuse. (Schaeffer 1966, pp. 565–6)

In this manner, one discovers perceptions of the same order as the perceptions of discontinuity, but different from them.

> At a certain level of the phenomenon, the object (isolated and coherent) was a fused structure of continuous elements which were not distinctly perceived. In itself, it was not perceived as a structure, but rather as an object taken in a structure of higher level: a discontinuous structure. Has this object been dilated (or fused with other objects) to such an extent that this same (continuous) structure now emerges in the framework of normal durations of perception? All previous lower register of perceptions (masked and unconscious) comes to the fore; the perceptions of the superior level disappear, they dissolve given the absence of structure: the object is in itself its structure of perception. If by any chance this object is composed of discontinuous elements, these elements in turn progressively take charge of the previous register of perceptions. (Schaeffer 1966, p. 566)

Before defining a general typology of variations, Schaeffer recapitulates the solfège route.

> We have chosen to enter musical analysis through the study of the simplest deponent cases. Homogeneous sounds have given us access to the study of fixed masses; then these fixed masses, now shaped in duration, have introduced us to the solfège of dynamic shapes. However, to account for the most usual experimental datum, we have had to associate simple variations of harmonic timbre (linked profiles) with dynamic profile, though remaining within the framework of the solfège of shaped sounds with fixed mass. It is easy to imagine that, in view of variations, sooner or later this frame will be broken, since the ear will stop perceiving as an original given the fixedness of a mass or the general profile of a shape. The 'fortified zone' of the solfège of variations begins here. (Schaeffer 1966, pp. 566–7)

The typology of variations is based on Schaeffer's studies of durations and information density.

> More precisely, appropriating considerations already made in the first typological chapter, one may say that variations touch our ear in three manners: they may be slow enough for us to refer our perceptions to fixed discontinuous values (variations of one of the previous criteria), they may be relatively fast and show an original criterion of variation in a 'characteristic form', or they may be too fast to be followed, and the shape, visible in a sonogram, will be anamorphosed. Such can be these *mutations of perception*: *variation criteria*. A singer's held note has an almost null profile, though its slight inflexions of nuance are perfectly perceived; not for this reason do they spoil the almost homogeneous character of the sound. A stroke of the bow on the violin may present a clear variation of intensity perceived as an 'envelope': this is the median case of dynamic shapes; finally, a piano sound corresponds to a new type of perception, given the rapidity of its (dynamic) variation: that of percussion-resonance anamorphosed sounds.
>
> Density of information therefore constitutes the first criterion of our typology of variations. In the first case, we shall speak of slow *trajectory* of sound in a given dimension—mass or intensity, for instance; in the second case, that of medium variations, there will be *profiles* (whose prototype is dynamic profile, mentioned in the solfège of shapes); finally in the third case, for fast variations, one will simply speak of *anamorphoses* (the perception of percussion-resonance is a model as regards dynamic variations; the very fast glissando, heard as the lash of a whip, is another example of anamorphosis). (Schaeffer 1966, p. 567)

The information Schaeffer is speaking about 'is all tainted with the subjective curiosity linked to event decoding, and it may be more prominent in subtle variations (singer) than in important dynamic écarts (piano)' (Schaeffer 1966, p. 568). 'The former comes under the tightrope walker's suspense, the latter fall within an *assured prediction*' (Schaeffer 1966, p. 568).

> One also sees that the median case (shaped stroke of the bow) oscillates between two more distinct extremes. In one case one pays attention throughout the duration of the sound, and one therefore knows what one is 'keeping an ear on' (one does indeed say that one is 'keeping an eye on' something that moves); in the other case, sound impact is received at the beginning of the sound. The median cases are situated between the other two, and they borrow from both. One suspects that, in the first case, there will be fused perceptions linking discontinuity criteria together in a temporal continuity, whilst in the extreme case, other criteria will be perceived. This can only be discovered by means of experimental material. The first case therefore suggests a morphology of profiles, the last case suggests a temporal anamorphosis of perceptions.[29]

We have thus found the first criterion of the typology of variations: information density. We need another one to clarify a little the character of what varies. We have three modules of information density, but what information? Since we went for abstraction straightaway, let us move to the concrete side: facture of variation.

> We can also make three very general distinctions here. It may be a question of a variation perceived as no more than the imperfection of a sought-after stability; we have already mentioned this genre of *fluctuation*. It may be a question of progressive *evolution*. Finally, it may be a question of *modulation*, that is, an evolution by levels, which already outlines a scalar structure. (Schaeffer 1966, p. 568)

The following table outlines the general typology of variations.

	Facture type		
Information density	Fluctuation	Evolution	Modulation
minor (trajectory)	1	2	3
medium (profile)	4	5	6
major (anamorphoses)	7	8	9

The study of variations poses a methodological problem.

> It would be certainly convenient to proceed step by step, studying sounds with no dynamic profile whose mass could be considered fixed. Then displacements of this mass in the pitch field would be selectively studied: melodic trajectories, melodic profiles, and melodic anamorphoses. Afterwards, taking sounds with neither melodic

> variation nor dynamic, one would consider those which present mass variations. This is possible in certain particular cases. In fact, once one approaches varied sounds, it is very clear that everything is given at once, that melodic variations are linked to dynamic variations, and that it is very hard to isolate mass variations which do not include any melodic profile. In the end, a study based on deponent cases can bring some results, but only in a very limited scale, as these results cannot be extrapolated without the risk of errors.
>
> It is therefore without much conviction, and rather as an exercise of method and plan of research, that I undertake to present typical variations, given the impossibility of tackling everything at once. By hypothesis, I shall therefore separate 'figure cases' corresponding, if not to the 'purity' of an isolated variation, at least to its 'dominance'. Then it will be a question of making use of a principal type to cast light on other cases, always expecting surprises, both in the recombination of contextures and in the reaction of contexts. (Schaeffer 1966, p. 569)

The solfège of variations tackles melodic variations, mass variations, and variations of allure and grain.

> Our general typology of variations will obviously apply to each of these four cases. First we shall have to be more specific about the two bottom lines of that typology briefly outlined in chapter XXIV [see § 13]. The morphological aspect applies to variations where trajectories and profiles are not disturbed by an excessive density of information. Otherwise, we shall find new perceptions through the experimental expedient of 'genres of sound' consisting of these perceptions. So far as our extrapolation of discontinuity holds good, we may speak of melodic profiles or mass profiles. Once we listen differently and to a different thing, we can only name the new objects which are given by experience. It is precisely here that variation criteria appear, intimately linked and forming original configurations. Cases of species, already hard to site and gauge in the simplest sounds, no doubt become even harder now. Because a variation criterion in turn may vary. This is actually the general case. A mass profile or a melodic profile can speed up, slow down, fluctuate, or modulate in the course of its duration. These variations (to the power of two...) can then be assessed for the sake of their importance in the bosom of the same perception by a second-order analysis, where density of information will necessarily appear again: major, medium, or minor écart (of the property concerned), referred to a slow, moderate, or fast velocity of variation. Aware of the fact that the previous chapters have already mentioned these general principles, we shall apply them to criteria of mass variation and maintenance variation. (Schaeffer 1966, pp. 569–70)

Schaeffer starts the typology of melodic variations by observing that $\overline{Y}$, Y, and Y' correspond to three status of information: slow, moderate, and fast.

> Considering the glissando, a most simple example which outlines various other developments of melodic evolution, one will say that, under its first form ($\overline{Y}$), it is not perceived as such, but rather as a continuous gradation of pitches; in the second case (Y), it corresponds to a shape in tessitura, a suitably reassembled and memorized movement; in the third case (Y') it corresponds to the anamorphosis, which transforms the perception into a crack, a lash of the whip (a bird tweet-tweet for instance). (Schaeffer 1966, p. 570)

Schaeffer relates $\overline{Y}$, Y, and Y' to 'derived types, corresponding to much more complex amalgams which one wishes to put together for diverse reasons connected with either manufacture (single causality) or use (ensemble function)' (Schaeffer 1966, p. 570).

	Fluctuation	Evolution	Modulation
Trajectory $\overline{Y}$	T_z	T_y	(slow) T_x
Profile Y		W	M
Impulsion Y'			(fast) K

Chion observes:

> The complementary typology of variations starts by envisaging new distinctions between 'fluctuant' threads T_z, evolving threads T_y, and modulating (evolving in stages) threads T_x, but it ultimately ranges the general case of the Thread T among objects *varying slowly in a progressive and continuous manner* ('trajectory' type of variation). (Chion 1983, p. 134)

Schaeffer's comments on the table of melodic variations are a reassessment of classificatory typology, out of which two new types emerge: the group and the motif.

> Though long, the gross note W combines linked profiles; the cell K groups disparate and necessarily scalar impulsions; being equivalent to the gross note, the motif M reveals an artificial organization. It is impossible to enlarge upon these unpredictable morphologies. On the other hand, I shall have to go back over the Y note, whose profile is 'reasonable', in order to stress the fact that tradition had already considered it.

> Meanwhile, I need to complete somewhat the typology of chapter XXVI [eccentric sounds, see § 14]; it accounted only for fixed masses or simple evolution of mass (line of Y notes), rejecting unpredictable variations which were placed in the fourth row. What were this simple variation and these unpredictable variations? Have our 'fixed masses' not allowed for some fluctuation already? On the other hand, our variable masses touched only on generally coherent evolutions due to the determinism of a causality, and going from the very simple sonic object Y to the gross note W. Now we have to account for a variation of the type 'modulation', a scalar variation which originates more often from an author's intention than from instrumental causality. Somewhat rashly, I have said in chapter XXVIII, § 7, that, being a study of material, our solfège of the object should discard authors' intentions, so far as possible. Now it is time to say that this is not always so easy, for two reasons or in two cases. The first case, which happens in classical music, presents visibly modulated and easily decomposable objects, but one may wish to consider the ensemble structure. We therefore need a term to designate them: they are *groups* of notes. The second case is found in new musics, beyond the notion of note. In so far as there are notes, by which I mean instrumental notes, one knows what one is talking about. Once there are new sonic objects more or less distinct or fused merging with each other, one is at a loss for words. It does not matter whether they are *objets d'auteur*, deliberately manufactured or chosen amid a varied range of samples; they are already too particular to form part of a general material: I have said that they would be termed *motifs*. This could be seen as the condemnation of a system where any object would be so original that there would be no possible common ground. It is not actually so. It is rather a question of a new style of musical perception, a continuous style now, which fuses in a single object those criteria that used to be scattered between notes. There is no reason for alarm if, in the eyes of typology, these objects seem too original. This means that they are already musical motifs, be it that an object has been deliberately modelled or modulated in this manner, be it that a naturally generated evolution or modulation has been chosen for the sake of its originality.
>
> In brief, the evolution-modulation pair is applicable in two contexts: the purely morphological context of a transition between continuity and discontinuity, and the context, now musical, of the perception of an intention, the recognition of an originality, whether it is a question of natural evolution (gross note W) or artificial modulation (motif M). (Schaeffer 1966, pp. 571–2)

Thus, 'to complete the panoply of classificatory terms' (Schaeffer 1966, p. 572), Schaeffer adds the definitions of group (G) and motif (M) to typology, and he reminds the reader that 'the *thread* T is synonymous with slow evolution of not very differentiated structures, while the *pedal* P may effect, also slowly, the evolution of structures as organized as groups' (Schaeffer 1966, p. 572). The typology of melodic variations gives rise to a new typological grouping. Schaeffer observes that the material of traditional music is found where rows 'a' and 'c' meet columns one, three, and five, whilst the other configurations

present the material of generalized music.

Variation shape:	*Trajectory*	*Profile*	*Anamorphosis*
Variation speed	slow	moderate	fast

Variation facture:	1	2	3	4	5	6
a) Fluctuation	$\overline{N}$	$\overline{X}$	N	X	N'	X'
b) Evolution	$\overline{Y}$	T	Y	W	Y'	W'
c) Modulation	$\overline{G}$	P	G	M	G'	K

When this table is presented in the solfège recapitulation as defining the typology of melodic profiles, W' disappears from the compartment of anamorphosed evolutions, whilst G' disappears from the compartment of anamorphosed modulations:[30]

	Traj.	Prof.	Anam.
Fluct.	$\overline{N}$, $\overline{X}$	N, X	N', X'
Evol.	$\overline{Y}$, T	Y, W	Y'
Mod.	$\overline{G}$, P	G, M	K

Schaeffer then embarks on a digression on the neumes of Gregorian chant. In his view, they demonstrate that, 'for various centuries, *the musical unit* was the *varied musical object*, rather than its decomposition into notes' (Schaeffer 1966, p. 573). The neume expresses 'the movement, the continuity of figures, rather than the discontinuity of the values' (Schaeffer 1966, p. 573). Neumes retain 'a certain sensibility to reality, and a certain inspiration linked to the direct implication of the senses in the symbols of notation' (Schaeffer 1966, p. 573), which got lost when a notation of results replaced them. The morphology of melodic variations derives from the podatus, the torculus, the clivis, and the porrectus of neumatic notation. Their dynamic inflexions are presented in the solfège recapitulation, where Schaeffer observes that it applies to varied notes only. The characterology of melodic variations is presented in very vague terms, and neither the recapitulatory table nor Chion are any more specific about it.

> In the music of Western tradition, melodic variation is generally misplaced: like the Hawaiian guitar, the portamento is in dubious taste — at least for our ears. It is actually in primitive or exotic musics that this genre of sounds, deliberately varied in tessitura, is found: *traînages* due to a lack of tension in the strings, which thus produce sounds whose body is consistently lower than the attack; progressive rises of Japanese instrumental ensembles (Noh psalmodies); 'kittenish' ways of Indian musics which play with pitch in a ballet of erotic-mystic approaches and invitations. So far as an evaluation of possible *genres* of melodic variations is concerned, I shall stop here. (Schaeffer 1966, p. 574)

For species of melodic variations in general, Schaeffer proposes a table which has already been used many times in one form or another: three velocities of variation (slow, moderate, and fast) combine with three melodic écarts (minor, medium, and major). He adds that 'melodic profile can span the whole duration of a sound or only part of it' (Schaeffer 1966, p. 575).

	Slow	Mod.	Fast
minor	1	2	3
med.	4	5	6
major	7	8	9

Chion thinks that the solfège recapitulation presents this assessment in a cumbersome manner.

> — because, on the one hand the columns of the pitch field have been linked by arrows to the columns of the duration field (it must be understood that these arrows *cross* the columns of the intensity field, which is nevertheless not directly concerned);
>
> — on the other hand, the column dedicated to duration module carries the enigmatic mention: 'partial or total', which certainly means that melodic variation (or melodic profile) may affect only part of the sonic object (beginning, body, decay) or the whole of its history. (Chion 1983, p. 164)

Although Chion affirms that the arrows linking écart to the duration field do not directly concern the intensity field, Schaeffer writes across the compartments of weight and relief:

'link of melodic profile to dynamic profile'. As regards the site of melodic profile in the pitch field, the recapitulatory table of solfège refers one to the criterion of mass.

In the single page Schaeffer dedicates to the study of mass variations, he seems to absent himself from his own writing.

> There has been very little exploration of the previous domain, and even less of this one. Electronic music thought it could approach it *à priori,* whilst electro-acoustic musics have approached it empirically. One can hardly extract any conclusions, given the confusion which reigns over notions and uses. The interest of such a study is nevertheless palpable, and will probably open more avenues than the study of melodic variations. (Schaeffer 1966, p. 575)

The distinction between mass profile and variations of harmonic timbre is as blurred as the distinction between mass and harmonic timbre. Aural training plays a large role here. The text of *Traité des objets musicaux* presents instances of what the solfège recapitulation defines as the morphology of mass profiles.

> I have already given examples of inversion of harmonic profile: we know how to enrich it, despite the fact that it usually becomes poorer in the course of the sound. However, these facile touching-ups at the potentiometer by mean of filters tend to 'sculpt' mass itself incidentally only, whether electronically or by electro-acoustic manipulation.
>
> Examples: a tonic sound may turn into a thick sound, or on the contrary, a resonant sound rich in harmonics or partials and relatively thick may be gradually reduced to a tonic. Let me note yet again that, being conditioned by traditional listening, we risk to hear only timbre evolutions; a better informed ear will perceive mass evolution, independent of or linked to timbre evolution. (Schaeffer 1966, pp. 575–6)

The solfège recapitulation defines the following classes: swelling, delta, thinning, and hollowed. The text of *Traité des objets musicaux* hints at what the recapitulatory table presents as the typology of mass profiles:

> The distinction between evolution and modulation is also valid here. For an uninformed perception, the progressive arpeggio of the organ, already mentioned, is in fact a varied agglomerate of thick low sounds. Within a typological context, it is close to a gross note, but its scalar variation organizes its structure, and in the end we actually perceive a mass variation forming a motif. Many figures of modern music, employing this genre of mass effect (sound blocks from the piano and other instruments), are answerable to

> this analysis which we have announced in chapter 21, §§ 12 and 15: *the fundamental variation/texture relation.* (Schaeffer 1966, p. 576)

The typology of mass variations refers to fluctuations, evolutions and modulations between pairs of types. Under the general heading of typological evolution, the solfège recapitulation presents fluctuations X/N or N/X, evolutions Y/W or W/Y, and modulations G/W or W/G. The characterology of mass profile limits itself to this note: 'Characteristic evolution of mass and harmonic timbre'. The site of mass profile in the pitch field gives occasion to this comment: 'effect on tessitura or on colour (mass and harmonic timbre)'. The analysis of mass profile happens along the lines of the analysis of melodic profile. The only differences are that, on the one hand, 'melodic écart' becomes 'écart of interval or thickness'; on the other hand, 'link between melodic profile and dynamic profile' becomes 'link between mass profile and dynamic profile'. Finally, Schaeffer comments on maintenance variations.

> The violinist who lets his instrument resound after a stroke of the bow produces a sound which is initially maintained by rub and affected by an appreciable allure, and then prolonged by resonance: we are so used to this genre of sound that the changes in grain and allure are considered entirely natural. We tend to be surprised by less usual or more complicated sounds. Let us listen to the long grating of a door. Besides dynamic profile and melodic profile or mass profile, we obviously have various successive grains: rough in the beginning of the sound, smooth if the movement is faster, and grain may go down the gauge scale to the point of being finally heard as iterations or distinct shocks, provided the door opener shows enough skill in the final ritardando. If the reader thinks that this trivial example is far removed from music, he will remember that the same happens in the orchestra when the long final chords of a symphony are made more sonorous: the cymbal tremolo offers not only a dynamic crescendo, but also an increasingly intense scintillation, that is, the greatest grain variation.
>
> What do grain variations consist in? In passing from rub to iteration or resonance; a typical variation of allure consists in passing from a live maintenance to mechanical or disorderly maintenance. (Schaeffer 1966, pp. 576–7)

The solfège of variations closes with comments on structures of variations, where Schaeffer points to the limitations of the solfège.

> Contemplating the generality of sounds, one is compelled to imagine sonic situations extending beyond the previous sketches, even though these sketches have striven to define a first and a second degrees of variation. In a cell of hazardous brief sounds, as in a trite 'échantillon' resulting from an unskilful scratching by a bow, there are more sounds, more objects than we can describe. (Schaeffer 1966, p. 577)

Schaeffer then reminds the reader of 'the old precept of Gestalt: a strong form draws its power from the sharpness of its elements (and vice versa)' (Schaeffer 1966, p.577). The final paragraphs on variations evince the fundamental paradox behind Schaeffer's démarche.

> What are, in the concrete, these structures of variations, of varied objects? Simply, structures of glissandi, of variable masses, or of variously inflected profiles. What is the error to avoid? To believe that it is by a first-order variation, at the level of the varied criterion, that one will be able to foresee the organization of the structure at a superior level. It is rather the opposite, and this is indeed the terminal point of our démarche. The manufacturation of varied objects must be considered experimental, and the approximations attempted in this list of 'deponent' variations, which do not automatically recombine, are of little importance. The perceptual sanction will be actually given later by the superior level of structures (certainly unconventional, but also unpremeditated and uncalculated) formed by experimental assemblages of objects. Not only will one hear whether such structures have a sense, but it is these structures in turn that will give rise to the dominant value of their component objects. These objects were previously in the state of material whose character, a bundle of sonic criteria of variations notably, was analysed. Then, it was according to the attention we directed to them, that one or another object appeared as interesting or potentially musical. However, if by any chance the otherwise disparate collection *takes itself as a structure*, musicality appears, according to the famous permanence-variation relation, which underpins the musicality of the structure, linked to the musicality of the component objects. What is this element of permanence (of the object) which varies (in structure)? In this chapter, the variation criterion itself has granted permanence.
>
> This notion, perhaps complicated to understand or expound, is nevertheless quite evident to the ear. A structure of glissandi makes appear as permanent the criterion 'glissando', and it gives its (musical) sense to a variation of glissandi: a variation of variations. The mathematical formulation is visibly misleading in its complication because, though rationally exact, it does not answer to the simplicity of musical experience. For the ear, a glissando is no more complex than a frequency; it is rather less complex. A piano note has no varying character, as it is primarily a dynamic shape evolving in duration.
>
> Having said that, the solfège stops. Music starts. Indeed, the passage from object to structure, or the sense the structure gives to the object, is the true birth of musicality. In traditional music this is called Musical Theory, which is essentially the theory of scales. I have said that we could not go that far. (Schaeffer 1966, pp.578–9)

P. Schaeffer *— Ah, Berio! As people say about a sportsman or a mathematician, 'He's on the ball'. Composer, conductor, manager of his Kathy [* sic*] Barberian, he feels so at ease everywhere! What talent he's got! But what a lot of notes, what a lot of procedures just invented and already abandoned, what a lot of gratuitous virtuosity! What do you expect, for me this sounds fin de siècle! It's Byzantium.* (Pierret 1969, p. 23)

CONCLUSION: BY READING

In Cage, any possible contradiction between the perceptual qualities of individual sounds and the musical structures to which they belong becomes an exercise of transcendence and engenders both art and philosophy. In Boulez the musical structure takes precedence of individual sounds, and technology becomes a tool for the perfecting of Western musical tradition. Given his previous work in broadcasting, Schaeffer was better prepared than Boulez to foresee the implications of new technology, but he suffered from a chronic æsthetic conservatism. Schaeffer was perfectly able to exploit contradictions between material and structure and to create musical structures appropriate to the dramatic character of the material. Nevertheless, he chose to purify the material from its drama, using technology as a tool for discovering new perceptual possibilities, which in turn would lead to new possibilities of structuration untainted by what he saw as the decadentism of contemporary music. Why has the *Traité des structures musicales* never been written?

In *Writing Degree Zero,* Roland Barthes writes apropos revolution:

> There is therefore in every present mode of writing a double postulation: there is the impetus of a break and the impetus of a coming to power, there is the very shape of every revolutionary situation, the fundamental ambiguity of which is that Revolution must of necessity borrow, from what it wants to destroy, the very image of what it wants to possess. Like modern art in its entirety, literary writing carries at the same time the alienation of History and the dream of History; as a Necessity, it testifies to the division of languages which is inseparable from the division of classes; as Freedom, it is the consciousness of this division and the very effort which seeks to surmount it. Feeling permanently guilty of its own solitude, it is none the less an imagination eagerly desiring a felicity of words, it hastens towards a dreamed-of language whose freshness, by a kind of ideal anticipation, might portray the perfection of some new Adamic world where language would no longer be alienated. The proliferation of modes of writing brings a new Literature into being in so far as the latter invents its language only in order to be a project: Literature becomes the Utopia of language. (Barthes 1953, pp. 72–3)

Although acknowledging the plurality of what can be termed, after Barthes, 'modes of

composing', Schaeffer has not looked into it, and it might be said that the solfège gets round the problem: musicality is quality without substantiation. This singular substantivated adjective corresponds to a pluralized substantive with no concrete substance: musics. A radical step would be to dissociate musicality from structuration, listening to music at the level of *objets trouvés*. Why create for new sounds a listening system as the image of and rebellion against tradition?

The notion of reduced listening, this 'listening degree zero', is not actually listening, but listening plus something else. This something else is presented as intrinsic to phenomenology, but it also includes the hoping for a universal or generalized *langue*, which would engender a conviviality of polymorphous *paroles*. (No classes, no boundaries, or the acceptance of all classes and all boundaries?) Schaeffer envisaged reduced listening as a preliminary exercise which would liberate sound at the cost of constraining the listening. Should his Utopia of language come to pass, then sound would be constrained anew, and listening liberated. As soon as even the most general morphology defines criteria for the listening, one has established reference structures, however generalized. The use of the word generalized is in itself significant, as it suggests a circle whose radius has been increased; this increase is measured in relation to the centre. Schaeffer did not give any serious thought to world music, not even in connection with its materials, and the use of the qualifier exotic suffices to define his Eurocentrism. He thought that the reference frames he proposed for listening, though musically biased, would be as universal as possible, which would have been achieved through the oblique route of musicianship. Thus, musicianship has taken over musicality only to serve it better. But if musicianship is universal, this is by dint of a fiction writer's recreation of a prehistory which might have been.

Traité des objets musicaux was written in fifteen years (cf. Pierret 1969, p.97), probably between the years 1950 and 65. One can follow two movements there: on the one hand, the text itself becomes a perpetual evasion from a tradition whose fringes (musicianship, sonority, facture, grain, allure) Schaeffer inhabits; on the other, the man himself takes refuge in Bach, taking his distance vis-à-vis the music of his contemporaries. The comparison of Schaeffer's 1953 reference to Varèse (Schaeffer 1957^{C}, p.20) — 'In the paths we were following, Varèse, the American, had long been our only big man and the single precursor anyway' — with references made in 1969, testifies to a certain change of mind, which evinces that second movement:

> **P. Schaeffer** — Could I possibly say bad things about Varèse when everybody is celebrating him? The character was certainly likeable, I loved the man. Civility required that people said he was a precursor, the inevitable point of transition between yesterday's music and today's music, tarara tarara; well, I've said it. Yes, it's true, Varèse's work has importance and interest...

M. Pierret — But?

P. Schaeffer — But afterwards, listening to all his works, I had a feeling of deep helplessness. I said to myself: 'It's a questionable music, a wrecked music, a shaking pilotis — maybe a necessary one, since it has allowed the young generations to step across.' We grope along these 'deserts' towards a future with no certainties... Varèse has lived through all misunderstandings of new music, creating sonic objects beyond notation. It's not just because he put alarm bells in the orchestra that he's a precursor. Satie had actually put a typewriter there, but apart from that, Satie always did do, re, mi, fa, sol. On the contrary, Varèse makes the orchestra say something different from what people have usually made it say. He extracts 'wild sounds' from old-fashioned instruments. Perhaps fifty years and a whole education of listening have been necessary for his music to start being properly *listened to*. He's needed genius, and all the courage of the initiator. Let's leave him with this glory he deserves. But why should people say the œuvre is accomplished and insist it's a masterpiece? I particularly find it cruel sometimes, Varèse's music... (Pierret 1969, pp. 21–2)

Baudelaire's reiteration of the abyss image can be seen as an expression of his impulse towards God and a statement of his deep religiousness. Schaeffer wanted to make old-fashioned music with new sounds. Contrary to Baudelaire, who revived dying forms with new subject matter, Schaeffer attempted to extract new musical forms from new sounds, but he hoped these forms, sidestepping the twilight of tonality, would be the logical continuation of classical tradition, of which they were to be 'the rightful heir' (to borrow Denis Smalley's phrase). Rather than accepting the contradictions between concrete material and classical form, rather than exploring these contradictions in the interest of the œuvre (as Baudelaire did), Schaeffer set out to domesticate locomotive sounds. For this, he first needed to liberate them. Alas, 'how much I prefer them in their raw state than in the sate of vague composition (decomposition) where I have painstakingly finished in isolating eight pseudo-bars of a pseudo-rhythm...' (Schaeffer 1952^{A}, p. 20).

When elaborating on the notion of musical revolution, Schaeffer has usually found his metaphors in science.

New elements at first appear as a musical mistake or musical nonsense. Their contemporaries frenetically reject them, but fifty year later they fit into the evolution with harmonious continuity. This historical comparison is not entirely valid though. The experimental music we are engaged in goes far beyond the conquest of a new dissonance or even the refusal of the scale. Its démarche recalls other contemporary démarches, all of which are marked in their evolution with what mathematicians call a singular point; the curve follows in a new direction, rather than in an increasingly steep slope. It certainly falls to this or that category of spirits to cling to the change of direction above all and insist on the newness: new music, or even no longer any music at all — a

> new art of sounds, to be differently named. On the contrary, other spirits, bolder in a sense, assimilate the singular point and think that, enriched with new elements and, more important, considered anew, it remains within the musical domain. (Schaeffer 1957^{C}, p. 22)

The revolutionary element of Schaeffer's research lies in acknowledging the æsthetic implications of technology and in shifting priorities: technology is factually used to refine perception. Schaeffer thus contributes to undermine the popular view according to which technology is neutral (see Machover 1984, pp. 1–2 on the neutrality of musical technology at IRCAM). 'But we are delivered over to it (sc. technology) in the worst possible way when we regard it as something neutral; for this conception of it, to which today we particularly like to do homage, makes us utterly blind to the essence of technology' (Heidegger 1954, p. 4). The reactionary element of Schaeffer's research is that he equates tradition with classicism, that he does not distance himself from this tradition, and believes the introduction of new material will bring a new classicism into bloom. This notwithstanding, typo-morphology is by no means an æsthetic platform or pogrom, nor is it tomorrow's musical *langue*. Schaeffer's solfège is a *wissenschaftlich* method.

Although this solfège does not trouble its head about musical structures, the objects typo-morphology studies reveal themselves as structures of criteria, which points to the most problematic of the solfège operations: characterology. If the notion of musicality is to remain linked to the notion of sound structuration, and if Schaeffer's solfège is to provide the key to musicality, then this key will have to be found within the domain of characterology. As has been seen, this operation is presented in a very unsatisfactory manner. It might be said that Schaeffer lacked the technology he needed. It must be said that, since characterology is expected to study relationships between criteria, it makes no sense to present it under one particular criterion as Schaeffer does. On the other hand, when distinct criteria are sited and gauged in the perceptual fields, the solfège seems to take one close to a true characterology, which is again hampered by its cumbersome formulation.

Because of its toings and froings in relation to Western tradition, and also because of the narrow-mindedness with which it construes this tradition, Schaeffer's solfège cannot offer itself as the musical materialization of Roland Barthes' semiological challenge. It has nevertheless an important contribution to make in the field of musical semiotics, or at least (and maybe more importantly) in semiotics of sound.

Beyond semiotics, there is another realm where Schaeffer has done spadework, not least for his attempt to distance himself vis-à-vis particular æsthetics. I am referring to the creation of digital systems for musical synthesis and composition. The whole research carried out by Schaeffer into the role the notion of instrument has played in music (summarily expounded

here in § 11) is invaluable. I have pointed out the paradox whereby classificatory typology selects sounds which are suitable to musicality when a musical *langue* does not exist or has been abolished by deconditioning (rather than by division of classes). Is this not the paradox every digital *luthier* comes face to face with?

Because it could represent the beginning of a rescue operation, bringing the mainstream of today's musical thinking into contact with Schaeffer's thinking, Claude Cadoz's opening article in IRCAM's *Le timbre, métaphore pour la composition* (Cadoz 1991) could prove to be a landmark. In turn, Nattiez's latest book (Nattiez 1990^{A}) devotes considerable space to Schaeffer, and it is certainly not by coincidence that the preface: 'This book is based upon a hypothesis that I shall immediately state: the musical work is not merely what we used to call the "text"' (Nattiez 1990^{A}, p. ix).

In a personal communication, Dieter Schnebel has expressed the view that there is today a *Wiederentdeckung*. The main hindrance to this *Wiederentdeckung* comes from the extraordinary difficulty posed by *Traité des objets musicaux*. I have spoken of the literary quality of Schaeffer's writing. I must now say that, more often than not, this literary quality is misplaced, which has been noted by Marc Pierret:

> **M. Pierret** — Let's get to the heart of the matter straightaway, as Morin would have said. I don't want to hide from you my suspicion you're first an author. Even worse in your case, a literary author...
>
> **P. Schaeffer** — Oh!
>
> **M. Pierret** — Let's say an author of texts that show no similarity with each other, but are all marked with a concern for style, which is after all paradoxical when we know your contempt for the genre Artist, Great Literature, etc. (Pierret 1969, p. 87)

The tradition of French *moralistes* such as Montaigne, Pascal, La Rochefoucauld, La Bruyère and Vauvenargues, finds its way through Schaeffer's text. 'Of course one can read La Bruyère in a spirit of confirmation, searching for and looking into, as in any *moraliste*, the maxim that will account, in a perfect form, for *that* wound we have just received from mankind' (Barthes 1964^{B}, p. 223; English translation p. 223). One can read Pierre Schaeffer in like manner.

> In what he writes, there are two texts. Text I is reactive, moved by indignations, fears, unspoken rejoinders, minor paranoias, defenses, scenes. Text II is active, moved by pleasure. But as it is written, corrected, accommodated to the fiction of Style, Text I

> becomes active too, whereupon it loses its reactive skin, which subsists only in patches (mere parentheses). (Barthes 1975, p. 47; English translation p. 43)

The fiction of Schaeffer's style condones the reactive skin; but isolated words become pleasure's shelter. The active text in Schaeffer is condensed in words he sprinkles on the prattle of the text, 'that foam of language which forms by the effect of a simple need of writing' (Barthes 1973, p. 11–12; English translation p. 4). Terms such as allure, grain, échantillon, écart, sonic object, and the like, glisten sensuously on the page, catch the reader's eye, and bedazzle him; terms like morphology, typology, concrete music, and shape/matter are palimpests whose semantic layers reveal the diachrony of Schaeffer's research. My reading has followed two paths. There has been an initial struggle to circumscribe the word, establishing distinctions between the various morphologies, between each of the listening functions, and so on. Then, beyond inconsistencies, I have attempted to construe morphology as that common element which links the various morphologies together under a common designation; I have successively ascribed to *écouter, ouïr, entendre,* or *comprendre,* at each of its appearances, the meaning of those elements of the paradigm (i.e. the other three verbs) which were not actually there; at each appearance of the word timbre I have construed it according to each of its definitions, one after the other; I have read *caractère* as character and/or characteristic; I have read 'shape' as both (and/or either) 'form' and (or) 'shape', and I have read 'matter' as either (or/and both) 'matter' or (and) 'material'. The solfège autopsy reads as follows.

> The word inflates, opening itself up extravagantly to an unreasonable range of meaning. The binary-opposition machinery keeps engendering writing but no longer makes sense. The text refuses to write itself off. One fades it out. ('The text of pleasure is a sanctioned Babel'...) (Barthes 1973, p. 10; English translation p. 4).

In John Cage's obituary (*The Independent,* 14 August 1992), Paul Driver reports what Cage said at the time of his seventieth birthday.

> In Buddhism, two Coca-Cola bottles are both, separately, seen as the centre of the world. A different light strikes them when you look. It's not that my work is about that realisation. The 20th century is all about seeing things that way.

We need Pierre Schaeffer's work today, as a Coca-Cola bottle needs its matching piece.

Shincliffe Hall, 6 September 1992

ADDENDUM

'Musicology and Linguistics'

The lecture which G. Becking, Professor of musicology at the German University of Prague, gave not long ago in the Prague Linguistic Circle belongs to the major events of Prague academic life in recent times. The parallel between the fundamental problems of phonology and those of modern musicology had already been stressed in the course of the phonetics congress which took place in Amsterdam last July, when Becking lectured on the musicality of Serbo-Croat folk-epics, and J. van Ginneken, chairman of the congress, gave the inaugural talk. However, the full scope of this connection did not come to light until the lecture I was referring to took place. With clarity and a great many examples standing to a layman's reason even, this researcher has outlined a convincing comparative description of musicology and phonology.

A native African plays a tune on his bamboo flute. The European musician will have great difficulty in reproducing the exotic melody faithfully. When he finally succeeds in identifying pitches, he is convinced of having accurately accounted for the piece of music. The native protests though, for the European has not paid enough attention to the timbre of the tones. The native then plays the same tune on another flute. The European believes it is another melody, since pitches have completely changed in compliance with the dissimilar construction of the new instrument. But the native swears it is the same piece. Herein lies the difference: whilst for the African the likeness of timbre is vital, for the European the issue is pitch. What is important in music is not the natural given, it is not sounds as executed, but their intention. The Native and the European listen to the same sound, whereby they intend quite different things, for this sound is comprehended in connection with two different musical systems; sound in music functions as a 'system-sound': executions may diverge, as the acoustician can accurately determine, but for music, the essential thing is that the piece must be recognized as identical. There exists between a musical value and its materialization precisely the same relation as there is in language between a phoneme and the sounds which represent the intended phoneme in speech.

The difference between the neumes of the Middle Ages and modern notes is not a mere discrepancy of writing; it reflects the crucial distinction between two musical systems: Gregorian chant, in diametric opposition to modern European music, is not concerned with the pitch, but rather with the movement of sounds. The intimate connection between the phonological structure of a language and its corresponding writing, which has been specifically tackled by N.S. Trubetzkoys and A. Artymovyčs in their Circle talks, provides a close parallel.

Becking attempts to establish a typology of musical systems. He distinguishes 'unidimensional systems', where only the number of scale degrees is relevant, from 'bidimensional systems', which sustain the principle of intrinsic affinity of the sonic material, 'tridimensional systems', which are defined by harmonic functions, and finally 'four-dimensional systems', where the individual tone also represents the function of its chord in the harmonic system of tonality. The regularity of this system structure recalls the typology of the phonological system. The scholar gives instances: for the first type, the music of the Montenegrin guslari; for the second, a Balinese symphony; for the third, a piece of English church-music from the fourteenth century; and for the fourth, a Venetian baroque composition. Becking exposes, with striking examples, the error of those researchers who, into a given musical system, read aspects of another, thus for instance interpreting a unidimensional system as a 'badly played' chromatic sequence.

As the paper demonstrates, also the principles presiding over the development of a musical system are akin to the phonological changes of language. Either an irrelevant difference becomes relevant or the opposite happens. Losses and acquisitions of relevant differences are usually connected.

In conclusion, Becking outlines the underlying difference between music and language. It is true that in the history of music there are isolated cases where certain musical forms have become an unambiguous expression (Italian opera, Wagner, etc.). It is worthy of note that the most highly organized elements of a given system frequently have a mystic signification. Nevertheless in music, as opposed to language, what is meaningful is the tonal system itself, which remains inextricably attached to the *Weltanschauung*.

Becking's comments are of paramount importance, for the musicologist and the linguist alike. They offer new material for fruitful comparisons: the relation between sonic values and their realizations, the relation between these values and writing, and the principles of mutations, are all similar in music and language. Musicology teaches us that neighbour peoples and tribes often forge curious 'musical alliances'. Thus, for instance, the Far Eastern peoples have a particular musical system which, according to Becking, is defined by the use of an extraordinary number of small intervals. Interestingly enough, these same peoples are 'phonologically allied' by the incorporation of pitch modulation in the phonological system. It is necessary to compare the boundaries and features of isolated musical and phonological alliances. The laws of the musical structure, like the laws of sound form in poetry, are an especially rewarding material for comparative study. In linguistic terms, the peculiarity of music vis-à-vis poetry is that the ensemble of musical conventions (*langue*, in Saussure's terminology) restricts itself to the phonological system; no etymological partition of phonemes exists, and consequently no vocabulary.

Musicology must exploit the achievements of phonology: the overall method, the structural theory, etc. Thus, for instance, the phonological teaching according to which a difference between two correlative values is always the opposition between a marked value and an unmarked value, would be of import in musicology too. (Jakobson 1932[A])

chapter one

1. Rather than *musique concrète*, the term concrete music will be used so as to dissociate the notion of concrete music from the *musique concrète* versus *elektronische Musik* controversy, leaving open the possibility that there may be a music which is concrete but does not represent the æsthetics of *musique concrète*. See Pierret 1969, p. 52:

   > **M. Pierret** --- A concrete, or rather electro-acoustic music, composed by such procedures, is it necessarily representative of a musical tendency which would justify, in another way, the qualifier 'concrete'?
   >
   > **P. Schaeffer** --- You'll get a good mark, my student... All the more rightfully since I've needed a few years to comprehend this distinction which you've immediately grasped. And when afterwards I wanted to avoid the misunderstanding, I didn't succeed in launching the term 'electro-acoustic', which isn't really appealing. Everybody says electronic, which is incorrect. In short, as you've just said, a music realized according to the concrete démarche may attain musical abstraction, highlighting a structure, and the opposite is also true: a music realized according to the most canonical 'abstract' démarche may try to bring concrete elements to the fore. Webern's *Five Pieces for String Quartet* are a beautiful example of this.

   Accordingly, Schaeffer's *compositeur concret* will not be 'the composer of *musique concrète*', but 'the concrete composer' instead.

2. For a description of the equipment available in the studio see Manning 1987 pp. 27--8.

   Peter Manning refers to a 5-track tape recorder: 'In addition to a set of conventionally equipped recorders, including one capable of registering five independent tracks of sound, three special versions were installed.' A 3-track tape recorder instead is mentioned by both Schaeffer (1957[A] p. 138) and Mâche (1959 p. 58).

3. When tackling concrete music, for material one should not understand notes, musical 'ideas', or sounds in general, but rather sounds (on record or tape) which have undergone denaturalization (i.e. whose source has been rendered unrecognizable).

4. Fifteen years later, Schaeffer will give this answer in 'La sévère mission de la musique' (Schaeffer 1968, p. 291):

   > *--- What are the relations between dodecaphonic, serial and experimental musics?*
   >
   > --- The worst possible!

5. The original reads 'sondées' (investigated), probably a misspelling of 'soudées' (welded).

6. See Schaeffer 1950, pp. 48--50 (with comments) and 1952[A], pp. 32--5 (with comments); see also Maconie 1976, pp. 32--3 (with comments).

7. It is doubtful whether Schaeffer intends to establish a distinction between the Saussurean notions of *langage* and *langue*. Although Ferdinand de Saussure will be often referred to in *Traité des objets musicaux*, I have as yet found no evidence to support the hypothesis that in 1953 Schaeffer had already read the *Cours de linguistique générale*. Nevertheless, in order not to filter out virtual Saussurean overtones, I am not translating this word.

8. One may deduce from Pierre Schaeffer, *La musique concrète*, Paris, 1967, p. 24, that the producer of *Timbres-durées* was Pierre Henry.

9. Boulez uses the word 'language' with reference to both music and serialism, which are thus put on an equal footing.

10. Schaeffer's phrase 'corps sonore' is used by Boulez in two different senses. Sometimes it refers to the 'corps sonore' as defined by Schaeffer, that is, the sound-producing body. Here though, Boulez's 'corps sonore' does not refer to any sound-producing body, but rather to the sound itself; it has been translated as 'sonic body'.

chapter two

11. To borrow Émile Benveniste's phrase on Charles Sanders Peirce's œuvre. See Benveniste 1969[4], p. 1.

12. The word 'opposition' is used here with reference to the meaning it acquires in linguistics. Roland Barthes observes that 'Cantineau would have preferred *relation*, and Hjelmslev *correlation*' (Barthes 1964, p. 135). Barthes nevertheless decides to 'keep the word, since it is accepted' (Barthes 1964, p. 135). For a full explanation see Barthes 1964, pp. 118--43.

13. Schaeffer's sign terminology deserves a special study which cannot be carried out here. Roland Barthes has observed that 'according to the arbitrary choice of various authors, the sign is placed in a series of terms which have affinities and dissimilarities with it: *signal, index, icon, symbol, allegory,* are the chief rivals of *sign*' (Barthes 1964, p. 101). The common element to all these terms is that 'they all refer us to a *relation* between two relata' (Barthes 1964, p. 101). In the definition of these terms, one finds contradictions between various authors. However, such contradictions 'compensate each other through transfers of meaning from term to term in the same author' (Barthes 1964, p. 103).

chapter three

14. Chion reads things differently:

> It is actually possible to distinguish between three different morphologies, linked to different phases:
>
> --- as a preliminary, elementary morphology gives elementary criteria for description, which suffice for typology to class sounds;
>
> --- main morphology, which successively studies the aforementioned seven morphological criteria: this is the most developed morphology and it constitutes the second stage of the programme of musical research;
>
> --- a much less developed external morphology, which concerns the specific cases of sonic objects formed by distinct elements (whether successive or simultaneous.) (Chion 1983, p. 101)

Whilst Chion does not count the very elementary morphology which I have termed first morphology, I am not considering Schaeffer's external morphology. As regards typology, Chion does not distinguish between identificatory and classificatory typologies, but he mentions a complementary typology of variations, which actually forms part of what I have termed third typology.

External morphology studies sounds which consist of various distinct elements. These sounds are termed *compound* if the distinct elements are simultaneous, and *composite* if these elements occur in succession. (A form of notation is proposed for compound and composite objects.) On the other hand, these objects may exhibit an *accident*, a disturbance which adds itself to the main sound (small shock at the end of a long cymbal vibration) and is taken into account by the ear, or they may exhibit an *incident*, a parasitic disturbance which is not heard as a property of the sound (distortion, record scratch).

15. The *Solfège de l'objet sonore* (Schaeffer and Reibel 1967) presents a very elegant solution to the problem of translating into English the terms *thème* and *version* as applied to Schaeffer's démarche: *thème* is rendered as translation *from* sound, whilst *version* is rendered as translation *into* sound. The French phrase *un fort en thème* (literally, 'one who's good at prose composition'), meaning 'a swot', 'an egghead', certainly resounds here.

16. In the original this sentence reads: 'On découvrira alors des formes semblabes, à la matière près, et des matières comparables, à la forme près'. The Spanish abridged version (Schaeffer 1988, p. 224) reads: 'Entonces descubriremos formas parecidas a la materia, y materias comparables a la forma' ('Then we shall find shapes similar to matter, and matters comparable to shape', rather than 'One will then discover similar shapes amid sounds of different matter, and comparable matters amid sounds of different shapes'). The Spanish translator has failed to realize the sense of the phrase 'à (something) *près*', which indicates

'the level of precision of an evaluation, the distance, the difference which separates the result of a measurement from the actual value of the measured magnitude' (*Le petit Robert*), and sometimes contains the idea that this difference is inconsequential.

17. The original reads *séparable* (separable).

18. There is a mistake here. According to Dodge and Jerse 1985, p. 37, on the equal-tempered piano keyboard the frequency of A_4 is 440 Hz, that of the C above it (C_5) is 523.2 Hz, whilst the frequency of C_6 is actually 1046 Hz.

chapter four

19. Despite this clear indication of the different levels of complexity which a sonic object can exhibit, one reads in Cadoz et al. 1989, p. 495:

> We use the term *sound object* in a larger sense than that used by Pierre Schaeffer (1966). In Schaeffer's book, the notion of an object is associated with elementary sounds. In our use of this term, a complex sound structure can be an object.
>
> However, Schaeffer does actually believe that the sonic objects which are suitable to musicality are simple objects.

20. This table appears in *Traité des objets musicaux* as defining 'excess or lack of balance in sonic objects'. The notion of excess of balance is a curious one; it is not mentioned again in the text. So, maybe one ought to read 'excess or lack of originality in sonic objects'.

21. In fig. 34, p. 459 of *Traité des objets musicaux*, the arrow ('*unité causale*') which links E (échantillon) to T (thread) should actually link E to W (gross note), as the quote *infra* demonstrates (see fig. 5). This mistake has not been noticed by Chion (see Chion 1983, p. 172).

22. Probably by misprint, *Traité des objets musicaux* omits the dot on the first N of the series (see Schaeffer 1966, p. 446). Chion, who has pointed out some (but not not all) misprints, does not comment on it.

chapter five

23. One would assume that these criteria whose linkages characterology studies would be the seven criteria of morphology proper. It will be seen that characterology in fact studies the linkages between 'subcriteria' of these morphological criteria.

24. One concludes that the word texture, this jack of all trades, refers to interrelations between criteria, that is, characterology.

25. The original reads: 'Volume, augmenting with level and, at a particular level, decreasing with frequency'. This is a mistake, as has been observed by Chion (see Chion 1983, p. 152).

26. The recapitulatory table prints 'anamorphosed' for 'amorphous', a misprint which has been remarked by Chion (cf. Chion 1983, p. 155).

27. In fact, order is going to appear invariably to the left, and disorder to the right of fluctuation.

28. Claude Cadoz establishes a distinction between source and causality, and identifies mechanicalness in the instrumentalist's action too (Cadoz 1991, p. 34).

> Moreover, source and causality cannot be confused; source comprises cause, but may be larger. A well identified instrumental sound refers one to a source. Now, in an instrumental sound, there are two separable contributions to perception: that which indicates a stable object (the instrument), and that which indicates an action on this object (the instrumentalist's). The notion of causality contains the notion of stability and predictability, as the action of the instrumentalist partially corresponds to predictable constraints linked to the morphology of the effector and to stable motor schemes, but within the framework of these constraints, it is always likely to contain an element of unpredictability, of arbitrariness. To define causality, it is necessary to empty the source from that which arises from intention, keeping only that which corresponds to stable and predictable properties. These properties then are mainly those of a physical object when the sound phenomenon results from a human action upon a sound-producing body.

Schaeffer seems to use the term source in connection with Cadoz's causality and vice-versa.

29. This paragraph is confusing, given the ambiguity of the terms 'one case', 'the other case', 'the first case', 'the extreme case', and 'the last case'. Here is a sceptic reading:

> One also sees that the median case (shaped stroke of the bow) oscillates between two more distinct extremes. In one case one pays attention throughout the duration of the sound, and one therefore knows what one is 'keeping an ear on' (one does indeed say that one is 'keeping an eye on' something that moves) [probably the case of trajectories, but could also be profiles]; in the other case, sound impact is received at the beginning of the sound [probably anamorphoses, but could also be trajectories]. The median cases are situated between the other two, and they borrow from both. One suspects that, in the first case, there will be fused perceptions linking discontinuity criteria together in a temporal continuity [trajectories, I should think, but as trajectory is one of the extreme cases, and as what follows opposes the case in question to *the* extreme case, probably profiles], whilst in the extreme case, other criteria will be perceived [probably anamorphoses, but could also be trajectories]. This can only be discovered by means of experimental material. The first case therefore suggests a morphology of profiles [obviously profiles, but does this mean that in this paragraph 'the first case' invariably refers to profiles?], the last case suggests a temporal anamorphosis of percep-

tions.

30. In the recapitulatory table of solfège, the tenuto line above G (modulated trajectory) has been omitted, certainly by misprint.

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note: → indicates the publication to which the page numbers in the text refer.

4. COMPREHENDING - for me: signs - facing me : values (sense - language) Emergence of a content of sound and **reference to, comparison with,** extrasonorous notions	1. LISTENING TO - for me: indices - facing me : exterior events (agent - instrument) Sound **emission**	1 and 4: objective
3. LISTENING OUT FOR - for me: qualified perceptions - facing me : qualified sonic object **Selection** of some particular aspects of sound	2. HEARING - for me: raw perceptions, sketches of the object - facing me : raw sonic object Sound **reception**	2 and 3: subjective
3 and 4: abstract	1 and 2: concrete	

Figure 1: table of listening functions

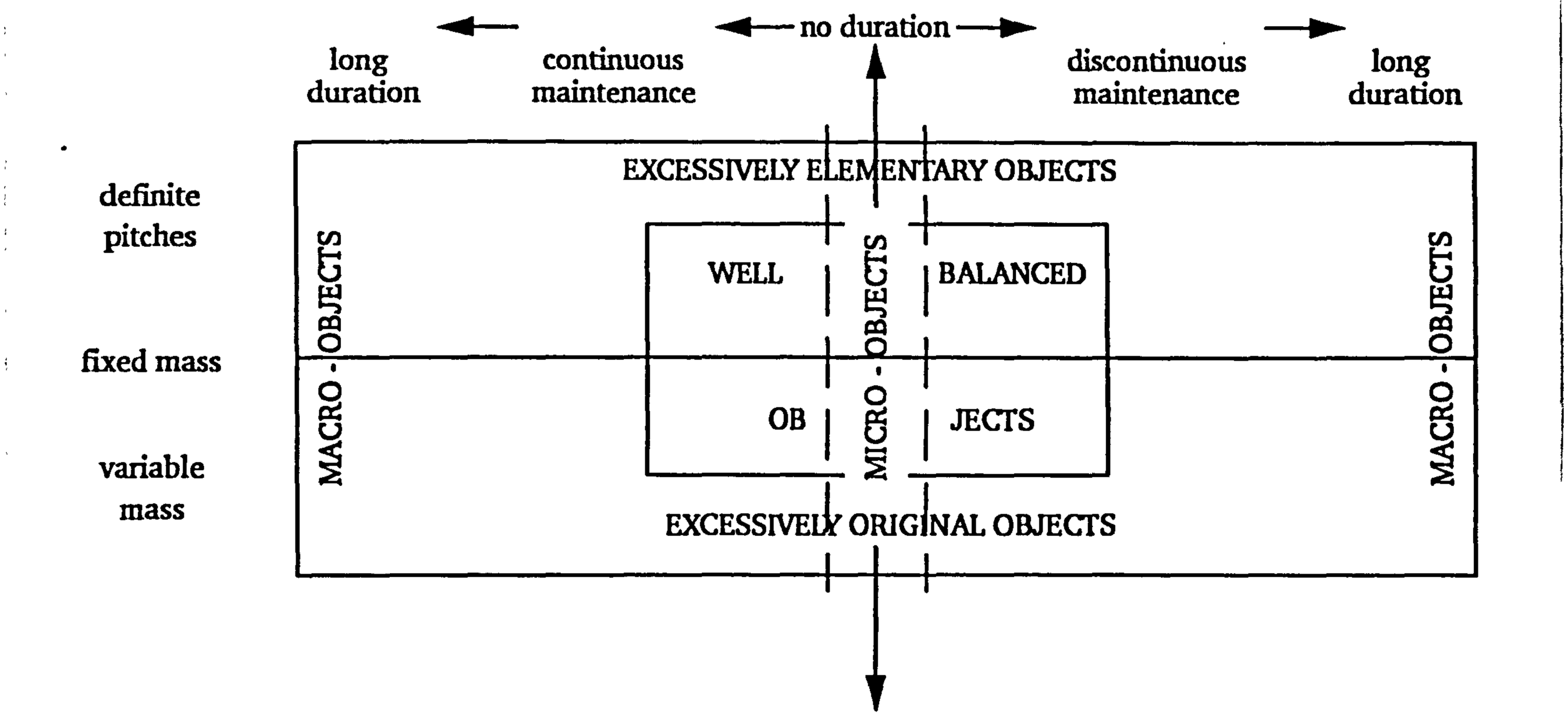


Figure 2: recapitulation of typlogical criteria

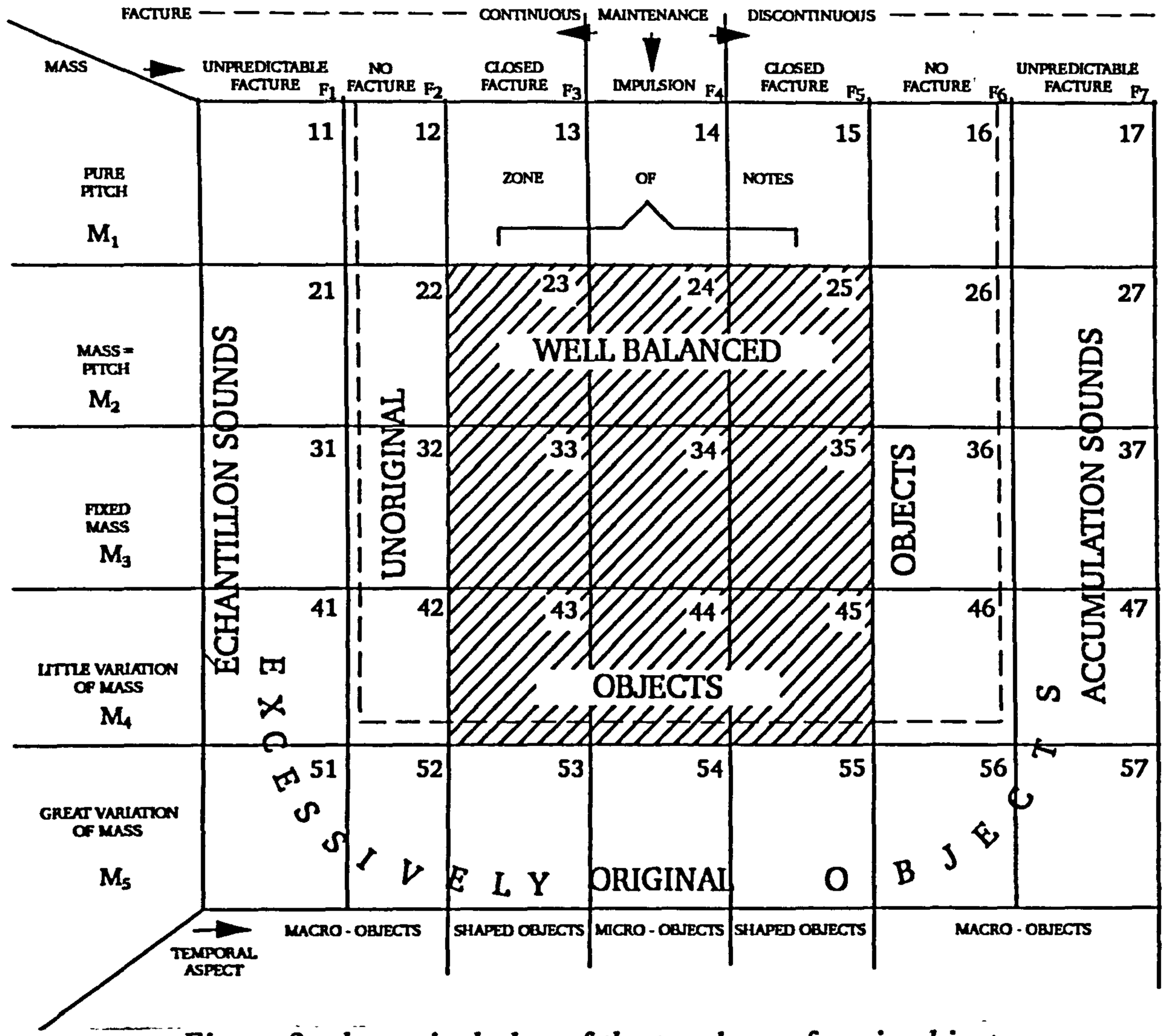


Figure 3: theoretical plan of the typology of sonic objects

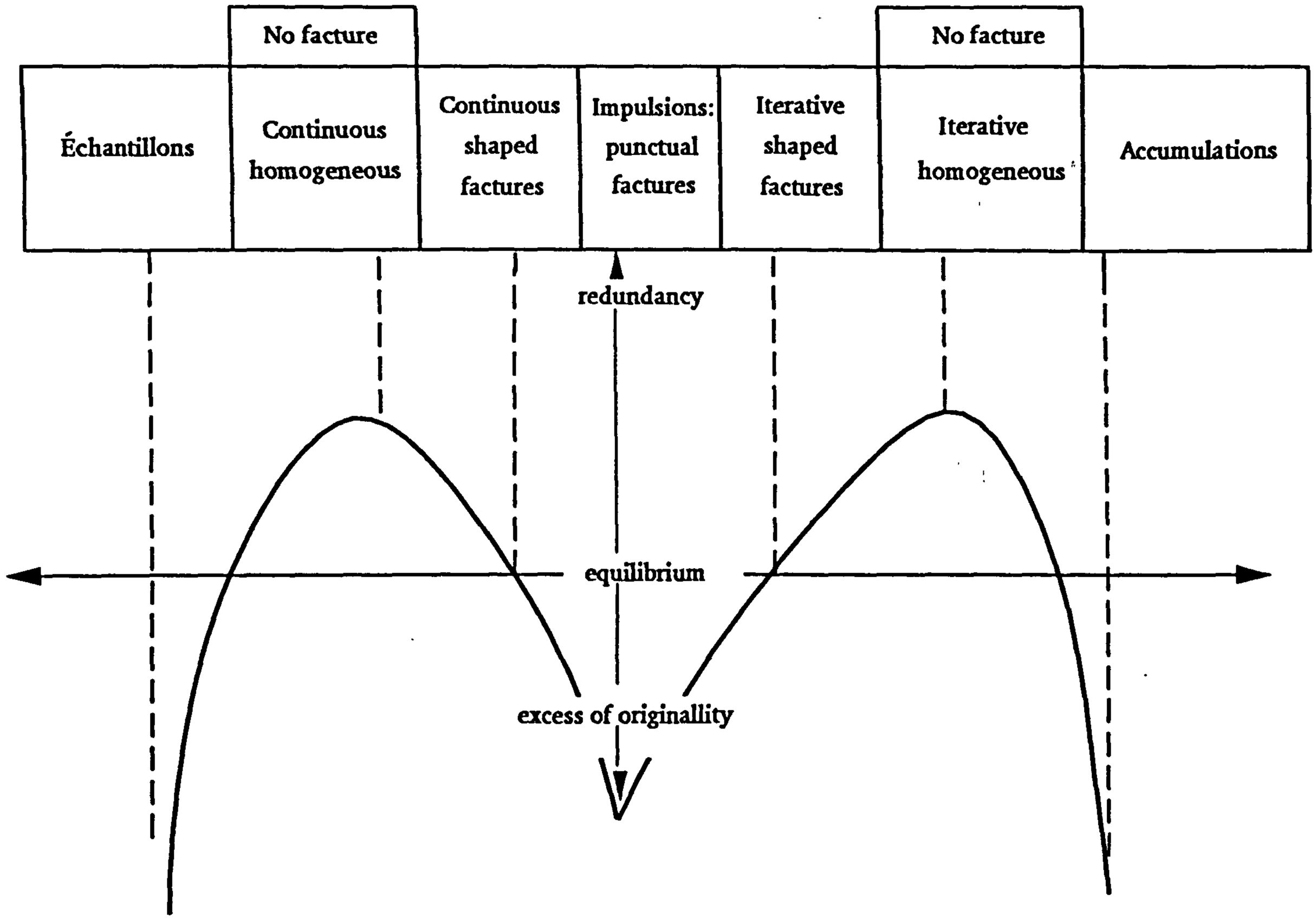


Figure 4: excess or lack of balance in sonic objects

				Disproportionate duration (macro - objects) no temporal unity		proportionate duration temporal unity reduced duration (micro - objects)			Disproportionate duration (macro - objects) no temporal unity	
				unpredictable facture	no facture	shaped sustaining	impulsion	shaped iteration	no facture	unpredictable facture
fixed mass	definite pitch	ÉCHANTILLONS	(En)	Hn	N	N'	N"	Zn	ACCUMULATIONS	.(An)
	complex pitch		(Ex)	Hx	X	X'	X"	Zx		(Ax)
little variation of mass			(Ey)	Tn Tx particular threads	Y	Y'	Y"	Zy particular pedals		(Ay)
unpredictable variation of mass			E general case	causal unity T general case	W	φ	K	multiple but similar causes P general case		A general case

sustained sounds

iterative sounds

Figure 5: recapitulatory table of typology

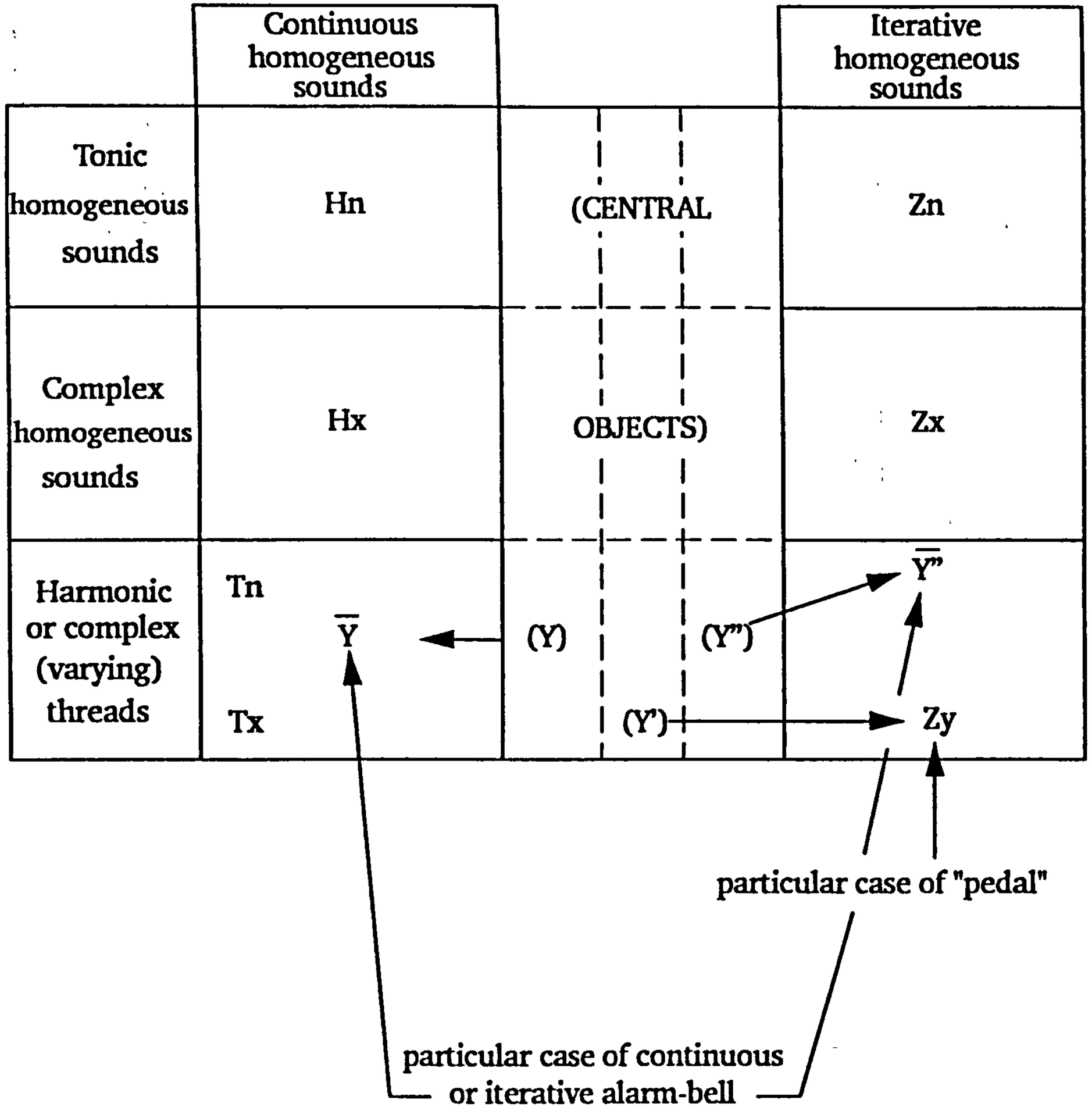


Figure 6: recapitulatory table of redundant or unoriginal objects

	Qualification (2-3) / Evaluation (4-9) of / CRITERIA of musical perception	1 TYPES typo-morphological reminder	2 CLASSES musical morphology	3 GENRES musical characterology	4 SPECIES (site and gauge of the dimensions of the musical field) PITCH SITE TESSITURA	5 PITCH GAUGE ÉCART	6 INTENSITY SITE WEIGHT	7 INTENSITY GAUGE RELIEF	8 DURATION of emergence variations IMPACT	9 DURATION of emergence variations MODULE
1	MASS	TONIC: N type COMPLEX: X VARIABLE: Y UNPREDICTABLE: W, K, T	1. PURE SOUND 2. TONIC 3. TONIC GROUP 4. STRIATE 5. NODAL GROUP 6. NODE 7. BAND	characteristic TEXTURES of mass	REGISTERS: infralow-1, very low 0, low 1, mod. low 2, diapason 3, mod. high 4, high 5, very high 6, ultrahigh 7 7 oct. x 12 = 84 degrees COLOUR HARMONIC	INTERVAL HARMONIC THICKNESS COLOUR	WEIGHT OF A HOMO-GENEOUS MASS: 1 PPP, 2 pp, 3 p, 4 mf, 5 f, 6 ff, 7 fff	PROFILE of mass texture		(threshold of mass recognition for brief sounds)
2	DYNAMIC	homogeneous H null: iterative Z poor: threads N, X, T shaped: notes N, X, N', X' impulsion: N', X' cyclical: Z_k reiterated: R accumulated: A	SHOCKS Anamorphosis: RESONANCE Amorphous: cresc., decresc., delta, hollow, mordent, flat profiles:	ATTACKS (dynamic timbre) 1. abrupt 2. steep 3. soft 4. flat (pseudo-mordent) 5. mellow 6. sforzando 7. null			WEIGHT OF A PROFILED MASS as a function of its module: 1 PPP, 2 pp, 3 p, 4 mf, 5 f, 6 ff, 7 fff	PROFILE MODULE minor medium major	PROFILE VARIATION slow / moderate / fast 1 2 3 4 5 6 7 8 9	BRIEF SOUNDS MEASURED SOUNDS LONG SOUNDS
3	HARMONIC TIMBRE	either: OVERALL TIMBRE or: secondary masses: M_1, M_2, M_3 mass timbre: t_1, t_2, t_3	(linked to masses) NULL 1, 7 TONIC 2 COMPLEX 6 CONTINUOUS 3, 4 STRIATE 4, 5	CHARACTER OF THE SOUND-PRODUCING BODY hollow/full round/pointed resonant/dull etc.	COLOUR dark bright	WIDTH narrow / wide 1 2 3 4	RICHNESS poor timber rich timbre	dens.? / vol.? 1 2 3 4	variation of: width, colour and richness; from 1 to 9	(threshold of timbre recognition for brief sounds)
4	MELODIC PROFILE	Trajectory / Profile / Anamorphosis Fluct. N, X / N, X / N, X Evol. Y, T / Y, W / Y' Modul. G, P / G, M / K	(Only Y notes) podatus torculus clivis porrectus	profile character pizz., melodic, trainage, etc.	or profile site (see mass)	melodic écart: minor, medium, major	link of melodic profile to dynamic profile		slow / mod. / fast 1 2 3 4 5 6 7 8 9	Partial (see col. 3): beginning body decay or total
5	MASS PROFILE	Typological evolution Fluct. N/X or X/N Evol. Y/W or W/Y Modul. G/W or W/G	(Thickness only) swelling delta thinning hollowed	Characteristic evol. of: mass, harm. timbre.	effect on tessitura or on colour (mass and harmonic timbre)	écart of interval or thickness: minor, medium, major	link of mass profile to dynamic profile		slow / mod. / fast 1 2 3 4 5 6 7 8 9	Partial (see col. 3): beginning body decay or total
6	GRAIN	Pure or mixture of: Resonance, Rub, Iteration	shiv. / teem. / limp. rugged / mat / smooth coarse / neat / fine	harmonic harmonic-compact compact discontinuous-compact discontinuous harmonic-discontinuous	GRAIN ASSESSED IN MASS OR TIMBRE grain colour	grain thickness	Relative weight GRAIN / MASS LINKED	Dynamic texture of grain: minor, medium, major	grain variation amplitude/speed from 1 to 9	dense / adjusted / slack 1 2 3 4 5 6 7 8 9
7	ALLURE	Pure or mixture of: Mechanical, Live, Natural	order / fluct. / disord. 1 2 3 4 5 6 7 8 9	Regular allure: cyclic vibrato; Progressive; Irregular: steep or cushioned fall; Incidental.		pitch écart of allure: minor, medium, major	Relative weight allure/dynamic	Dynamic relief of allure: minor, medium, major	allure variation amplitude/speed from 1 to 9	dense / adjusted / slack 1 2 3 4 5 6 7 8 9

VARIATIONS

MAINTENANCE

Classes	MASS TEXTURE	TEXTURE OF THE HARMONIC TIMBRE	PITCH DIMENTIONS DEGREES
1	pure sound	none	
2	tonic sound	tonic	
3	tonic group	striate tonic or continuous	
4	striate	complex or continuous	
5	nodal group	complex or continuous	
6	nodal sound	complex or continuous	
7	white or coloured noise	none	COLOUR

Figure 8: classes of mass textures and of textures of harmonic timbre

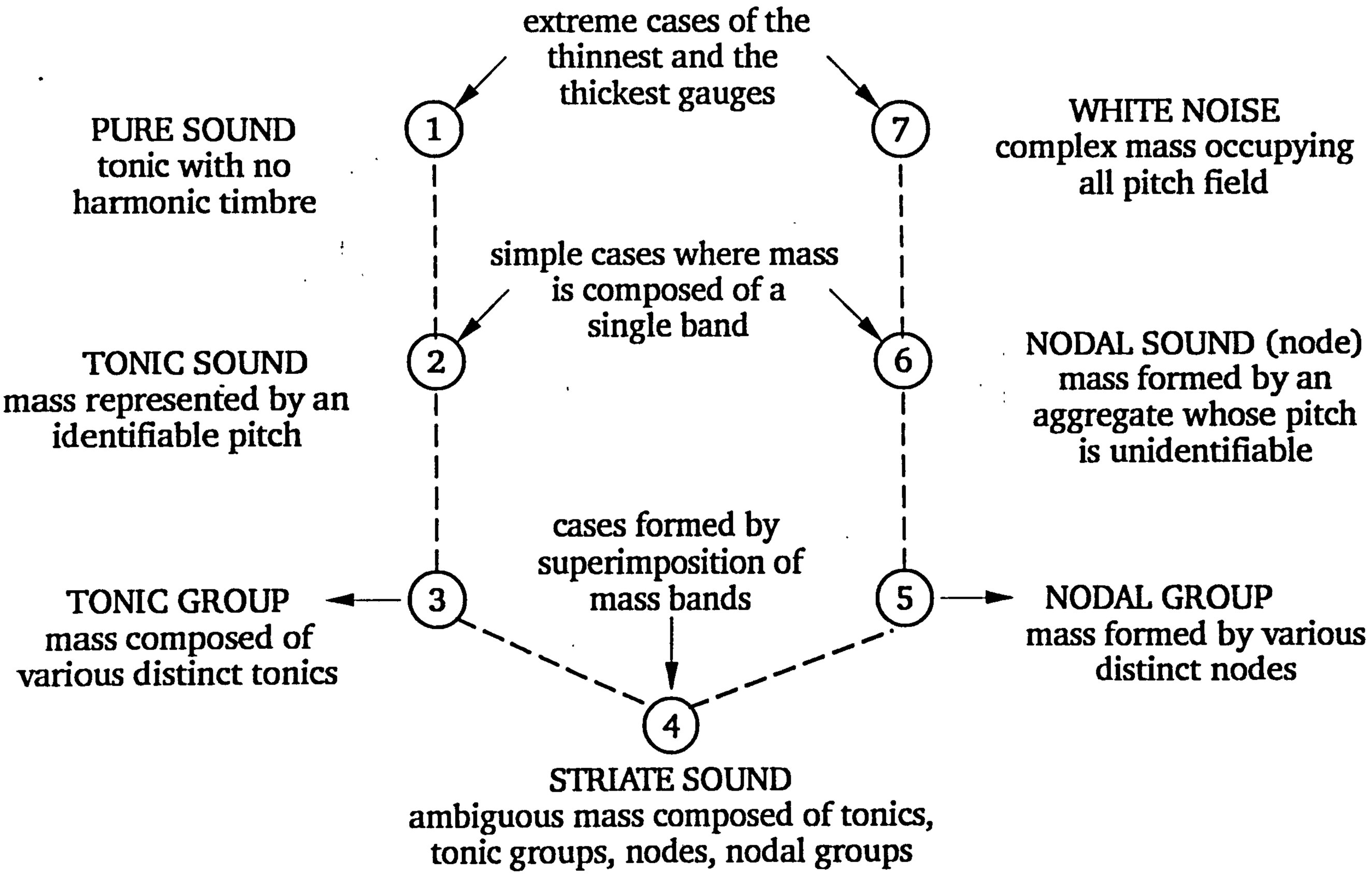
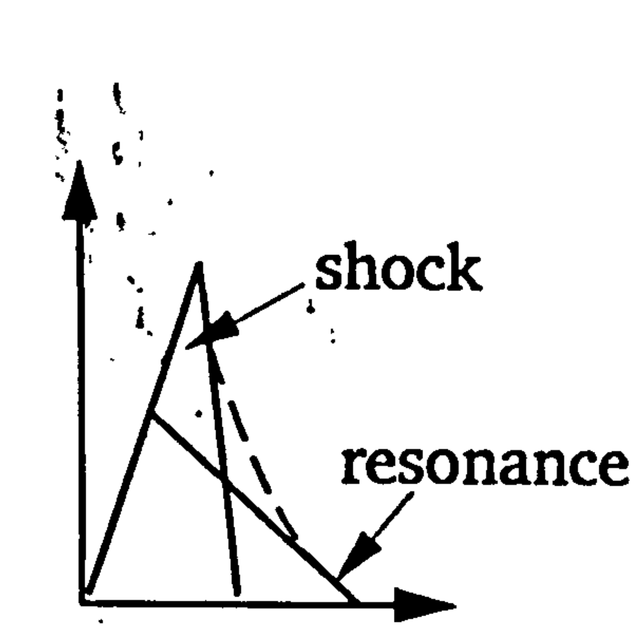


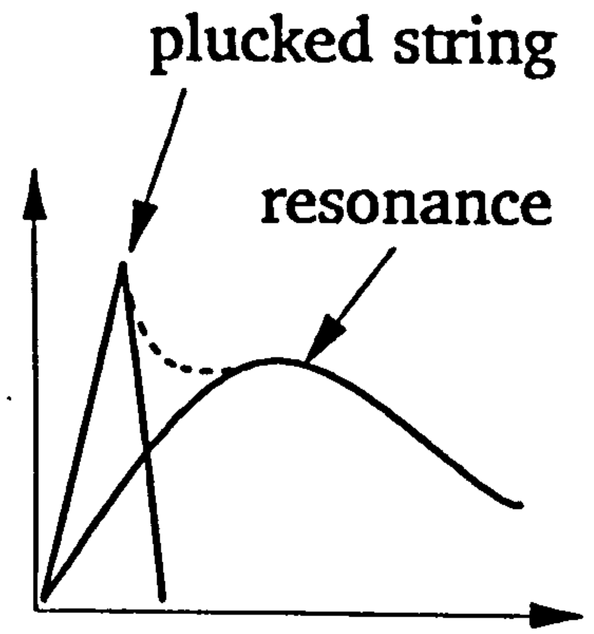
Figure 9: mass classes according to Chion

DYNAMIC TIMBRE		1	2	3	4	5	6	7
ATTACK	Sonogram							
	Attack nature	ABRUPT or explosive	STEEP	SOFT	FLAT	MELLOW	SFORZANDO or input	NULL or very progressive
	Conventional symbol							
GENRES		(shock or plectrum) no appreciable resonance	(felted hammer) with strong resonance attached	(pizzicato or soft mallet) with resonator	(pseudo-attack) or mordent	sound emitted without apparent attack	or fast crescendo	perception of profile
PRE-DETERMINATION OF PROFILE according to attack genre	Dynamic profile	dynamic peak (shock)	decreasing and regular	resonator reinforcement	none, apart from pseudo-attack	no profile	characteristic profile generally brief sounds	only case of threshold emergence of the profile
	Harmonic profile	double sound (2 timbres)	impoverish-ment	resonator response	none in instruments such as the organ varied in electronic music or the strings	often progressive profiles	characteristic "timbring"	profiles usually linked or artificially independent

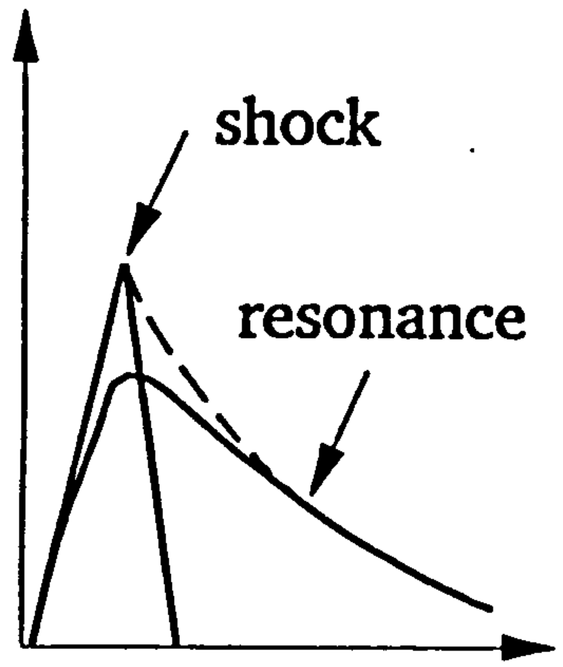
Figure 10: attack genres



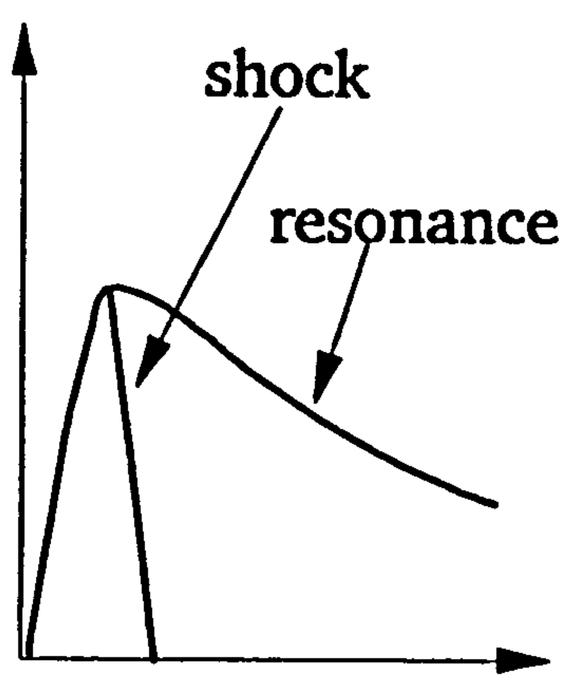
a) wood-block



b) pizzicato



c) piano (high tone), vibraphone



d) piano (low tone)

Figure 11: attack profiles

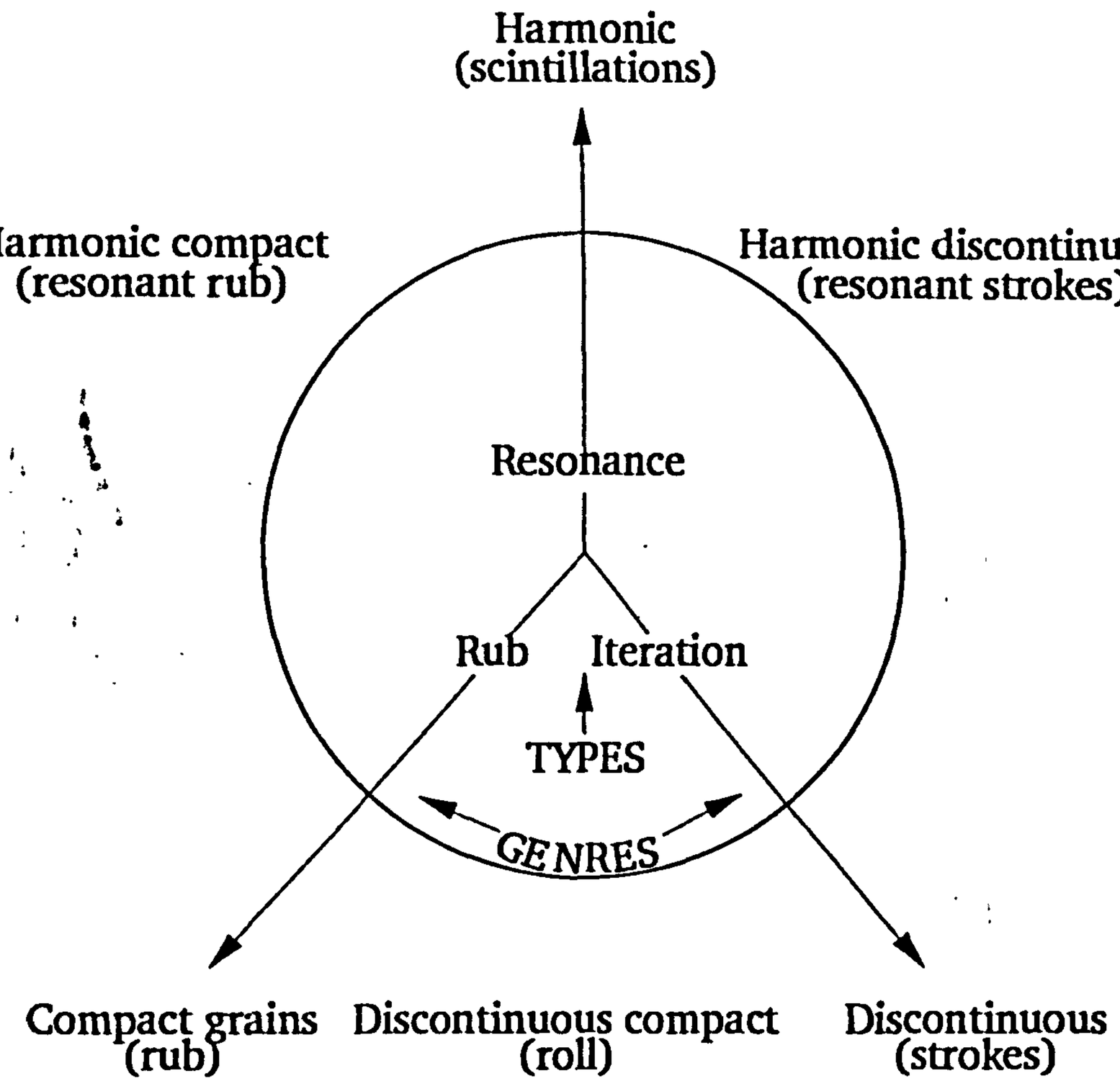


Figure 12: types and genres of grains

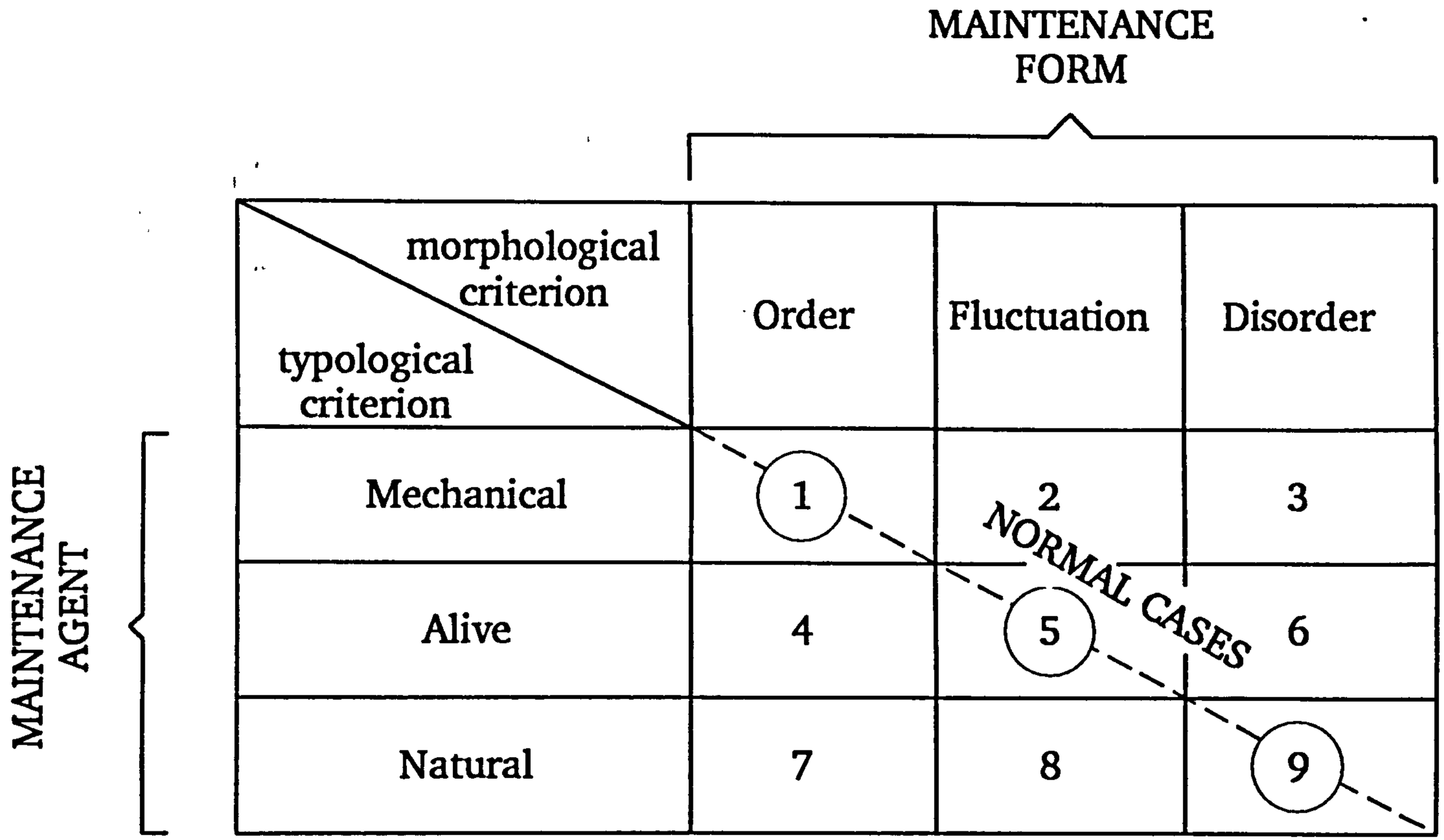


Figure 13: typo-morphology of allures

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