THE RELATIONSHIP BETWEEN ELECTRO-ACOUSTIC MUSIC AND INSTRUMENTAL/VOCAL COMPOSITION IN EUROPE IN THE PERIOD 1948-70

A thesis submitted to the Council for National Academic Awards in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

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July 1989

ABSTRACT OF THE THESIS

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The study seeks to establish how theories and concepts derived from electro-acoustic practice can inform musicians about the nature of instrumental thought. Instrumental/vocal musical languages are particular representations of a wide framework of fundamental musical laws. The most successful expression of these laws is through concepts of electro-acoustic music. As a result many points of contact between hitherto unconnected areas of music are revealed.

Three principal subject areas are investigated:

1) The development of Pierre Schaeffer's musical researches: The researches under consideration are those conducted from 1948 up to the publication of the revised edition of the "Traité des Objets Musicaux" in 1977. The importance of new musical concepts and Schaeffer's Programme de la Recherche Musicale are discussed. There has been no extensive examination of these in English. Consequently, neither Schaeffer's position, nor French electro-acoustic music's role in the development of contemporary music has been efficiently assessed.

2) The Cologne studio's development during the period 1953-70: Particular emphasis is given to a discussion of the studio's relationship with the evolution of serial thought. This relationship is identified as the main stimulus for many of the studio's musical concepts in addition to its preoccupation with electronic sound generation. Furthermore, the conflict between Paris and Cologne regarding musical languages is examined and the theory of eventual convergence of views is contested.

3) The nature of Schaefferian music theory: The concepts of valeur/caractère, permanence/variation and Schaeffer's concept of the "instrument" are discussed. It is proposed that Schaefferian concepts offer a significant methodology for the study of contemporary music. They assist, therefore, our understanding not just of electro-acoustic music but contemporary music in general.

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ACKNOWLEDGEMENTS

I would like to express my gratitude to my director of studies Dr Denis Smalley of the University of East Anglia. Without his patient guidance I could neither have attempted to unravel the complexities of Schaeffer's researches nor begun to understand their significance. I would also like to extend my thanks to my supervisor, Per Hartmann, for his encouragement and advice. In addition, I am most grateful to Christine North of Middlesex Polytechnic both for her many helpful comments on my translations from the French and her explanations of contemporary French thought. Likewise, I am indebted to Sigrun Walker for her advice on translating German texts.

Preface

This study examines the development of electro-acoustic musical thought in two European studios: the research group of Pierre Schaeffer at the Radiodiffusion Télévision Française in Paris, and the Studio für elektronische Musik at the Westdeutscher Rundfunk in Cologne. The study will demonstrate the important positions of both studios in the evolution of electro-acoustic music since 1948. The central aim is an investigation of their potentially significant, though hitherto largely unrecognized relationship to the concepts of "instrument" and "instrumental" thought. With the diversity of sound resources and musical languages evident in music of the post-war period a full understanding of such fundamental concepts is increasingly necessary.

The study comprises three sections. The first two identify and examine key concepts in musical thought emanating from the Paris and Cologne studios respectively. Establishing the development of these concepts in an historical perspective demonstrates the gradual evolution of each studio in response to changing musical and aesthetic demands. Particular emphasis is given to Schaeffer's researches. No substantial investigation or assessment exists of these. Consequently, his musical theories tend to be eclipsed by more familiar developments in Cologne. Redressing this imbalance is a principal objective of the study. The third section proposes the

Schaefferian system as the most appropriate framework for understanding "instrumental" thought. This is demonstrated by elaborating Schaeffer's researches and applying them to notions inherent in instrumental language.

An important aspect of the study will be the explanations of musical concepts and terminology. Comparisons between the French and German approaches are, perhaps, inevitable and can prove immensely valuable. However, they must be based on an accurate understanding of the aims of both studios which, even though they were subject to revision, remained fundamentally different. Failure to understand key concepts has led to over-simplified accounts of electro-acoustic music's repertory and evolution thus distorting its role in contemporary music. There is no doubt that musicians at both studios utilized the potential offered by recording technology for the storage and manipulation of sound. However, this common use of the studio environment should not encourage the superficial impression of a general consensus regarding musical aims which were shared by most, if not all, musicians participating in the electro-acoustic medium. If the development of electro-acoustic music had been a neat concatenation of events leading to a single goal, then Schaeffer's early researches might be considered as little more than a tentative first step, superceded by Cologne and subsequently consigned to the history books. The differences, however, were not simply minor squabbles

regarding the aesthetic validity of the sound repertory favoured by either studio. From the outset the repertories of both studios displayed a marked preference for different sound materials - concrete in Paris and electronic in Cologne. But the exploitation of particular sound materials was in itself of less importance than the musical assumptions it represented. Goals certainly existed, but they were never common goals. On the one hand, recorded sound and the manner in which it was perceived in the studio inspired Schaeffer to embark on his lengthy research programme. The first stage of this was the creation of a framework to classify and describe the complete sound universe. On the other hand in Cologne, electronically generated sound appeared to offer solutions to the increasingly intractable problems which resulted from the application of serial thought to music realized solely by traditional instruments. Broadly speaking, the electro-acoustic medium can be described as a cause in Schaeffer's case, but an effect in reference to the Cologne studio. Such complexity cannot be reduced to a simplistic notion of convergence of aims which appears to have acquired the status of a truth largely because of its frequent repetition.

Vestiges of these sharply contrasting attitudes continue and can be recognized in the development of contemporary musical languages. The existence of such differences demonstrates that electro-acoustic composers should not be merged indiscriminately into a single, subsidiary branch

of the musical avant-garde. Even in its earliest days the electro-acoustic medium proved itself capable of encompassing and fostering divergent attitudes. Understanding these attitudes will help to disentangle the complex strands which represent electro-acoustic music's relationship with contemporary music in general and lead to a more accurate assessment of the relative contributions of the Paris and Cologne studios.

Chapter 1

The Researches of Pierre Schaeffer

1.1 Introduction

Musique concrète was the first musical medium to originate from an integration of musical research and technology. Its importance, however, should not rest solely on its historical position as the forerunner of all electro-acoustic music. Despite the relatively brief life-span of musique concrète proper it promoted a succession of developments that continues to exert a significant influence on contemporary music. Consequently a legacy exists that is more than a simple augmentation of sound resources and compositional techniques. An evaluation of the significance of musique concrète is inextricably linked to an accurate understanding of the objectives proposed by its adherents. These objectives are frequently misunderstood.

Caution is always required when examining a medium in retrospect, even more so when the subject's origin is so recent. Electro-acoustic music is not a petrified collection of compositions and musical theories. It is still developing, and encompasses a wide range of different stylistic and aesthetic interests. Any proposed evaluation must take into account these gradual and continuing changes. Significantly, an organization which is a direct descendant of the studio in which musique concrète originated continues to operate in Paris. Today

called the Groupe de Recherches Musicales(1) it provides facilities for electro-acoustic research, composition and performance. Utilizing both analogue and digital technology it was established as a centre for the promotion and dissemination of electro-acoustic music and its attendant aesthetic ramifications. The existence of this organization illustrates the unbroken evolution of both electro-acoustic music in general and the French experimental tradition in particular.

Most of the credit for the early musical and aesthetic development of musique concrète can be attributed to Pierre Schaeffer(2). It was his decision, for example, to adopt the name musique concrète. His researches, conducted during the nineteen-fifties and -sixties gradually consolidated into a comprehensive and flexible method for the classification, evaluation and (he hoped) the eventual structuring of sounds. In 1943, as the director of a research project in musical acoustics under the auspices of the Radiodiffusion Télévision Française, he began his first investigations into sound. A major feature of this project was the recording of a wide variety of sounds on disques souples(3). The new experience of hearing isolated, recorded sounds replayed in a studio environment encouraged Schaeffer to develop new musical concepts. After several years of composition and research he considered the possibility that such sounds might have musical applications, and in the first half of 1948 he began to formulate notions that were to

evolve into musique concrète.

1.2 The Concrete Attitude

The term "concrete" has been incorporated into the vocabulary of music since 1948(4). Unfortunately "concrete" has been the source of many misunderstandings. These are largely attributable to the several distinct but closely related meanings that the term has acquired. It is essential to clarify these differences in order to gain a clear understanding of French electro-acoustic practice.

"Concrete" is still frequently used as an adjective to differentiate recorded "natural" sounds (whether instrumental, vocal or environmental) from those produced by electronic generation. Its use in this sense is exemplified to an extent by the expression: musique concrète. In the nineteen-fifties this expression denoted an ideological stance regarding musical materials. It was proposed:

> "(...) not without a spirit of provocation by Pierre Schaeffer."(5)

This "provocative" aspect appears to demonstrate a conscious opposition to the electronically generated sounds and serial aesthetic favoured by musicians in Cologne. Although there is doubtless an element of truth in the suggestion that it was deliberately antagonistic it must be noted that Schaeffer's use of the term pre-dated the founding of the Cologne studio by at least three years(6). It was not, therefore, adopted simply as a reaction against other studio-based musical developments.

Despite the difficulty of ignoring the antithetical nature of the terms "concrete" and "electronic" it is too simplistic to suggest that musique concrète was so named simply because it made use of sounds with evocative, anecdotal references. This would imply that "concrete" was little more than a synonym for "real" recorded sounds.

In a wider sense "concrete" came to denote a fundamental re-balance of traditional attitudes towards sound and musical composition. The "concrete attitude" promoted an experimental methodology which emphasized the role of the listener. A new musical theory could be formulated by studying the interaction between perception and the complete sound universe(7). Schaeffer expressed his intentions as follows:

> "Instead of notating musical ideas by symbols of solfège and entrusting their concrete realization to known musical instruments, it was a question of collecting the concrete sound, wherever it came from, and of abstracting the musical values which it potentially contained."(8)

It is significant that the terms "concrete" and "abstract" were used frequently by Schaeffer. His reference to them as "the 'isotopes' of reality" ("ces deux aspects sont les 'isotopes' du réel")(9) is corroboration that "concrete" was not merely a generic opposite to "electronic". "Concrete" thus attains further significance when regarded as a pole of the concrete-abstract dualism, representing a cycle of processes undertaken by the listener's perception. This dualism was (indeed still is) the framework within which a musician can discover

experimentally the musical potential of a sound. First, every perceptible aspect of the sound should be considered - the "concrete" pole. Then certain aspects would be intentionally abstracted(10) to see if they could function as principal articulators of the musical discourse - the "abstract" pole. In practice this would entail much "systematic toing and froing" ("l'aller et le retour systématique")(11) between poles. Aspects might be chosen which could subsequently prove difficult to perceive as structures or elements of structures and the aspect's role in the musical discourse would then have to be reconsidered.

By expanding the number of potential elements which might be abstracted from a sound and which might contribute to a discourse the concrete attitude undermined traditional musical presuppositions. These were embodied in the written score, representing with considerable accuracy those sound aspects traditionally considered the only ones capable of being abstracted - pitch and duration of pitch. Other aspects such as dynamic levels and nuance can only be approximately indicated and are realized principally at the musician's discretion during a performance and are guided by appropriate performance practice. "Concrete", therefore, did not describe a musical language dependent on anecdotal reference, although it did refer to the potential "raw" resources of the sound universe(12). Schaeffer wrote unequivocally that he wanted to establish:

> "(...) musical research starting from the

> concrete, but always wholly dedicated to the reconquering of the indispensable musical abstract."(13)

It may seem surprising that a medium indivisible from technology did not take advantage of the apparently precise nature of scientific information. Schaeffer had collaborated with scientists in the first years of his researches. The physicist Abraham Moles was the co-author of the final section of Schaeffer's first book "A la Recherche d'une Musique Concrète" and his advocacy of an experimental approach is reminiscent of scientific formulation and testing of hypotheses. Schaeffer was adamant that the concrete attitude indicated that scientific instruments could provide information only about the physical nature of the sound signal. Such information may have been of great benefit in some cases but it was the role of perception to direct the abstraction of sound aspects and the creation of relationships between them.

> "It is relatively easy to know the acoustic or even the phonetic characteristics of sound, it is extremely difficult to define exactly their inherently musical characteristics."(14)

The assumption that each scientifically quantifiable characteristic had a direct perceptual correlate was shown by experiments to be false(15). For example, a measurement of two sounds may reveal chronometrically identical durations. This does not mean that the durations are <u>musically</u> equivalent. One sound may display an unusual shape or behave in an unorthodox fashion which would be more striking and probably make the sound more

musically "interesting". Accordingly the "musical", as opposed to the chronometric, duration could be perceived as longer. Schaeffer devoted much attention to the study of such "anamorphoses" or warps of perception and recognized that their musical significance could not be understood by recourse to parametric notation. He claimed such notation only created conditions in which:

> "One gets one's bearings on a false map, which is the same as being lost."(16)

Schaeffer believed that if the perceptual principles underlying musical experience were understood, then opportunities would exist for establishing new foundations for evaluating and creating musical structures. Furthermore, he believed that an understanding of these principles, in conjunction with the great potential offered by new techniques of sound manipulation, would reveal the real predispositions and limits of human perception(17). It is in this wider context that the term "concrete" must be understood.

1.3 Musique Concrète

During the period 1948-52 musique concrète emerged as the inevitable musical outcome of the concrete attitude. The first musical works were realized according to the experimental methods implied by Schaeffer's concrete attitude and set the pattern for the concurrent progression of research and composition. Schaeffer's claim of an inversion in musical composition was confirmed by work methods developed from these new studio practices.

The innovative use of equipment, both to facilitate the evaluation of sounds and to create new material, was present from the beginnings of Schaeffer's researches. He realized that the results of two early experiments using "disques souples" could be used to the benefit of composers' techniques. These experiments emphasized the significance of isolating sounds from a causal context and the effect on a listener's perception of hearing a sound repeated exactly.

The first experiment was known as the cloche coupée(18). It consisted of removing the first few milliseconds of the sound of a recorded bell. The following is Schaeffer's description of the experiment:

> "Having hit one of the bells, I recorded the sound after the attack. Deprived of its percussion the bell becomes an oboe. I prick up my ears. Would a crack appear in the enemy's ranks? Would the advantage change sides?"(19)

This experiment alone appears to have provided sufficient

encouragement to Schaeffer in his researches. It revealed that removing part of a sound might produce unforseen consequences. A completely new sound would be heard, bearing remarkably few similarities to the original. The first few milliseconds of the bell sound, for example, contained a complex harmonic spectrum resulting from the impact of the clapper against the side of the bell. This spectral content appeared to be consistently complex throughout the sound's duration. However, once the moment of percussion was removed, the spectral content of the remaining sound was in fact much less complex. A change in a sound's dynamic and temporal progress altered the perception of its spectrum. This seemed to offer limitless potential for experimentation. Schaeffer placed this experiment at the beginning of musique concrète:

> "Where does invention reside? When did it happen? I reply without hesitation: when I touched on the sound of bells. Separating the sound from the attack constituted the inventive act. All musique concrète was contained embryonically in this inherently creative act on sound material."(20)

The second experiment produced an indefinite repetition of all, or part, of a sound. This was achieved by the use of a recording with a sillon fermé(21), (a technique that was eventually superceded by the more convenient tape loop). The precise repetition of sounds thus acquired a mechanical accuracy almost impossible to achieve by human executants and allowed the listener to direct perception towards different, perhaps very transient aspects of the sound. In addition repetition would, Schaeffer hoped, allow the sound to exist as an independent element,

unrelated by reference to a source. By encouraging perception to concentrate on internal details during successive repetitions, causal reference was generally minimized. This reduction of causal reference was to become an increasingly important requirement in establishing a sound's autonomous existence in musique concrète. Referring to these points Schaeffer wrote:

> "Now the sillon fermé had given me the feeling that I possessed an incontestably powerful analytical tool. The sillon fermé, despite its discontinuous allure - which made one think of the collages of the first surrealist painting - had freed in a matière as unprepossessing as the 'pure (railway) carriage', elements of montage, which were undeniably suitable for construction without any idea of imitation."(22)

Recording technology enabled composers to collect libraries of sounds which could be evaluated empirically to determine their musical potential. Then they could be arranged in families of sounds based on their perceived attributes. Furthermore, these families could be augmented by new sounds specifically created by musique concrète techniques. This would lead to the exploration of increasingly subtle relationships between sounds. Musique concrète did not disregard the fine gradations of dynamic levels and articulation of shapes which were traditionally controlled by a performer; their realization could instead be assumed directly by the composer.

Schaeffer hoped that such processes would lead to increased sensitivity:

> "The concrete experience reveals within the ear, and almost without relationship to the musical ear, a sound eye, sensitive to forms and colours of sounds. Since there are two ears like two eyes, there should also be a sensitivity to the

> perspective of these sounds. (...) Musique concrète is nothing other than becoming aware of this phenomenon, previously implied, but unable to be grasped through instrumental sound."(23)

Eventually, by experimentation and practised listening, various methods of manipulation and combination were developed. The following list(24) was enumerated by Chion:

1) splicing
2) loops
3) reversal
4) manipulations of forme, (e.g. homogenization of dynamic envelope)
5) change of tape speed
6) manipulations of masse, (e.g. filtering, ring modulation)
7) reverberation, echo, accrochage
8) multiplication via tape delay
9) mixing, creation of stereo images
10) special and composed manipulations, (e.g. vibrato, combinations of above techniques)
11) "imaginary manipulations"

These formed the basic techniques subsequently used in musique concrète composition.

"Musique concrète", like the word "concrète" itself, is often encumbered with terminological misconceptions. Its development shows signs of distinct periods, each one displaying specific characteristics(25). The early years, often mistakenly considered as the period of naive "noise music", tend to provoke more comment than Schaeffer's more sophisticated later researches. Comments such as:

> "(...) the ambition was born to tame these noises and impose our scales on them."(26)

can lead to misconceptions if they are not understood in their correct context. The simplistic notion of using "noises" as an iconoclastic attack on the materials of

music would relegate musique concrète to little more than a facile realization of a pseudo-futurist aesthetic(27). From the earliest studies Schaeffer and his associates intended to exploit the sounds as structures in musical contexts. Despite the often recognizable sources their intention was not merely to evoke the sound's causal origins. Accordingly, the first musique concrète work, Schaeffer's Etude aux chemins de fer(1948)(28), was meant to be heard as:

> "(...) a 'study of rhythm' and not a 'still life with train'; an 'abstract' work rather than an evocation."(29)

Nevertheless, the anecdotal character of many sounds dominated. No doubt this can be largely attributed to the exploratory nature of the compositions and misjudgements regarding the manner by which qualities can be abstracted from concrete sounds. Despite later works, the anecdotal label remained to bedevil French electro-acoustic music. Schaeffer knew that a central problem was to rise above anecdotal reference in order to create an abstract musical language:

> "(...) even if noise material ensured for me a certain margin of originality in relation to music, I was, in both these cases, led to the same problem: the extraction of sound material from whatever dramatic or musical context, before wanting to give a form to it. If I succeeded there would be a musique concrète. If not there would be only trickery and procedures of radio production."(30)

It is likely that Schaeffer was excessively optimistic in believing that techniques such as the sillon fermé could in themselves nullify causal reference(31). It must be stressed, however, that these works were études and must

be examined in the context of Schaeffer's researches. It is also significant that the ability to draw from, and thus quote, recognizable sounds of the environment revealed many interesting possibilities which compelled a re-evaluation of the aesthetic value of "every-day" sounds(32). Schaeffer distinguished these early works, while in no way repudiating them, as necessary precursors of later research. He cited compositions like the Symphonie pour un homme seul(1949-50)(33) (a collaborative work realized with Pierre Henry) which deliberately capitalized on the ambiguity of its sound vocabulary. He called such music:

> "(...) an individual art, a hybrid halfway between music and poetry."(34)

However, this type of work can be singled out as exceptional and in many ways peripheral to his main aims. The strongly mimetic nature of the sounds could be distracting and could hinder the listener being drawn into the sounds as structures exhibiting musical potential. Unfortunately the explicit quotation of anecdotal sounds is still incorrectly regarded as the hallmark of Schaeffer's music.

In 1958 Schaeffer decided to abandon the name musique concrète realizing perhaps that it had become a terminological burden. Instead he adopted a more all-embracing title: musique expérimentale. He remained firmly committed to his original intentions while acknowledging musique concrète as a:

> "(...) point of departure, to which I am indebted for the whole enterprise (...) because it became possible to conceive of an experimental music, making every experimental procedure its own and without recourse to pre-existent aesthetics."(35)

It is doubtless true that some composers found the procedures advocated by Schaeffer too empirical and even anarchic. The potential of recording technology suggested other, equally valid, musical strategies. Pierre Boulez, for example, condemned the first composers as:

> "(...) 'amateurs, as worthless as they are impoverished' (...)"(36)

Much of his disenchantment, and indeed hostility, was based on his own commitment to developing a serial musical language which was apparently incompatible with musique concrète. In his two tape works(37) Boulez attempted to explore aspects of "timbre". The precise control demanded by serial requirements (which was akin to that of composers in Cologne) proved incompatible with the sounds he had to use. His principal concerns were the realization of serial aims rather than Schaefferian research. While it would be wrong to expect unanimity of either purpose or opinion among composers it is possible that this typified the lack of appreciation by many musicians of Schaeffer's researches. Any attempt to place the materials at their disposal into pre-conceived schemes was the opposite of Schaeffer's intentions. Chion expressed this view:

> "It seems that there was a misunderstanding: they wanted to sit 'the electro-acoustic child' at the piano, rapping his fingers, to make serial scales, whereas his gifts were different ones."(38)

Chion identified a fundamentally different approach between the priorities of musique concrète and serialism. Schaeffer was (occasionally) conciliatory about serial methods and accepted that they were one aspect of musical language(39). But he remained critical of "a priori" tendencies at the expense of perceptual verification. He did not believe that abstraction could best be achieved by "a priori" methods. Even in the early days of musique concrète it:

> "(...) nailed its colours to the mast - not against the abstract, which it wanted to recover - but against musical pre-conception: for ten successive years it was going to stubbornly oppose, in full independence of mind, the major stream of thought of the period which claimed to structure sounds according to serial laws."(40)

The "total ascendancy of abstract intelligence" ("totale emprise d'intelligence abstraite")(41) to which he objected appeared to mask many potentially fruitful aspects of sounds and tighten still further the "corset of abstraction" ("le corset d'abstraction")(42). And yet abstracting new foundations for musical discourse was precisely what adherents of musique concrète attempted to accomplish. According to Schaeffer:

> "This musique concrète, which is equivalent to abstract painting, deserves in the same way the adjective abstract even more than concrete. The words are not in themselves very important."(43)

The confusion caused by these terms has already been referred to in section 1.2. Schaeffer's comparison with painting is perfectly consistent when it is understood that neither "abstract" painting nor "concrete" music aimed to make explicit references to figurative or natural

objects. Broadly speaking, in both fields relationships between colours and shapes are of infinitely greater importance than direct imitation. Schaeffer even appears to have considered the name "musique abstraite"(44) but felt compelled to reject it as inconsistent.

Schaeffer was candid about the failings of early musique concrète. Similarly he was equally critical of early electronic music. He acknowledged that the concrete attitude required lengthy periods of experimentation which were necessary stages in developing new musical languages. What he could not have realized was that "a priori" methods would become so pre-eminent in music of the post-war decade and that his methodology would be largely overlooked. Schaeffer's summary of both early (German) electronic music and musique concrète encapsulated his belief that musical composition rather than ideological posturing should be the ultimate aim:

> "At that time some of us were working at constructing robots, others at dissecting corpses. Living music was elsewhere, and only revealed itself to those who knew how to escape from these simplistic models."(45)

1.4 The Acousmatic Situation and its Consequences

The acousmatic(46) situation established the conditions necessary for the development of Schaeffer's methods of evaluation and abstraction. Schaeffer experienced these conditions in his first researches in 1943 and the acousmatic situation still exists as the most common electro-acoustic environment in which contemporary composers work. Without the acousmatic situation and the concrete attitude the two most important subsequent concepts of écoute réduite and the objet sonore would have been impossible. All three notions are inextricably linked.

1) The Acousmatic Situation

An acousmatic situation is encountered when one hears sounds without being able to see their causal origins. Though the use of the term by Schaeffer was innovatory, acousmatic situations are commonplace. Whenever sounds are heard by means of a radio or record player the sources of the sounds are invisible, although strictly speaking such cases are not truly acousmatic if the sounds can be identified by memory despite the lack of visual cues. Schaeffer noticed that the absence of visual cues enabled the listener to become increasingly aware of the intrinsic properties of sounds as isolated, "objective" phenomena. This was particularly pronounced if the sounds were manipulated by techniques of musique concrète thus hampering still further an identification of source.

These conditions were necessary to counteract a natural tendency during the listening process of accepting widely differing sounds from a single source providing it was visible and aural inconsistencies were cancelled by visual confirmation:

> "A pizz. on the violin is infinitely closer to a note on the piano than a bowed note on the violin, which could in turn approach a sustained sound on a pipe.
>
> Moreover, providing the instrument is seen as well as heard, the listener is conditioned (by this) and notes (accepts) differences which appear enormous to him. But if the instrument is concealed or if the recording, without any deception, only restores certain inequalities of intensity, extraordinary confusions become possible. (...)"(47)

In the studio environment the sound was no longer entirely the product and indicator of its source. Neither was it necessary to consider it as a sign functioning as part of a message, musical or otherwise. The recording process severed the cause and effect relationship of sound and source that had always existed in music or indeed in any act of aural perception. For the first time sounds could be removed from their context, stored and thereafter subjected to close, repeated scrutiny. According to Schaeffer such conditions of hearing were not unnatural; they reversed the normal mode of listening and thereby encouraged the active participation of the listener in an investigation of how a sound is perceived. The listener would realize that:

> "(...) it is listening itself which becomes the origin of the phenomenon to be studied. (...) Henceforth the question: 'What do I hear ?...What do you really hear ?' is redirected to the subject"(48)

ii) Ecoute Réduite

Ecoute réduite - "reduced hearing" - was an intentionally limited act of perception and became an important technique for later evaluative developments. The purposeful aspect of directing perception must be stressed; this distinguishes it from an involuntary, unconscious restriction of hearing. The term "réduite" was coined from:

> "This disengagement of perception (also called: phenomenological reduction (...)"(49)

"Réduite" meant that during the act of listening to a sound everything that was not an inherent, perceptible part of the sound itself was deliberately ignored, this indifference was encouraged in any case by the acousmatic situation. Consequently, écoute réduite excluded any speculation about the origin or source of a sound. It also disregarded any meaning the sound might communicate as part of a "message". Whether a literal message, such as the warning communicated by a fire alarm, or a musical message, such as the function of a particular note in a tonal structure. Although such messages are of great importance when used as part of a "code" they are not relevant when listening to an isolated, context-free sound. Chion asserted that écoute réduite would direct attention to the sound above everything else and:

> "(...) consists of inverting this twofold curiosity about causes and meaning (...) in order to return one's attention to the sound itself."(50)

As such it could be considered as a process which contradicted forms of aural conditioning directed to

hearing sounds as intermediaries to other structures or as a means of identifying their sources. The sounds themselves, the fundamental building blocks of musical structures, were usually, if inadvertently, ignored beyond their context-dependent functions.

This form of hearing developed as a result of Schaeffer's insistence on understanding the role of perception in evaluating sounds. Ecoute réduite established a relationship between the intention of the listener's perception of a sound event and the sound "objectified" by the acousmatic situation. Generally speaking the perception of a sound is a global synthesis of all of its constituent aspects. Ecoute réduite could be directed to each one of these aspects. Thus the necessity for storage facilities offering exact repetition was vital for this process of focussed attention. Once perception is directed to certain aspects of sound, judgements and comparisons are almost certain to follow and the process of abstraction begins.

Although a detailed investigation of philosophical influences is beyond the scope of this study it is noteworthy that there are striking parallels between certain philosophical themes of the twentieth century and Schaeffer's methodology. If nothing else it demonstrates that many of Schaeffer's notions drew on areas of mutual interest between music and other intellectual disciplines(51). Ecoute réduite can be described as an

epoché(52) whereby the attitudes of the listener regarding the existence and the origins of the object of perception in the external world are suspended. The disengagement of perception and avoidance of further conjecture enables the listener to realize the "original experience" ("expérience originaire")(53) of perception.

Ecoute réduite preceded a viewpoint that is perhaps more prevalent today, which contests the belief in the perception of sounds as objective, external stimuli imprinting themselves in some mysterious way on human consciousness. There is, as the quotations in reference 51 indicate, much more of an interaction between the perceiver and what is being perceived: the world is largely a mind-created construct in a continual state of flux. Ecoute réduite recognizes this tendency.

iii) The Objet Sonore

The second part of the "phenomenological re-establishment" is the objet sonore. It was this concept more than any other which transformed investigations of sound into the first stages of a new music(54). The objet sonore was defined as:

> "(...) a perceived sound unity, whose intrinsic qualities, its colour, its dimensions, are considered independently of any signification it might convey and of the sound source, or 'sound body' to which it refers."(55)

The idea of sound as "object" was considered to be the:

> "(...) single essential concept common to all musical (human) beings."(56)

The concept of the objet sonore is an artificial construct. Unlike écoute réduite's directed division of a sound, the objet sonore is a global perception of a sound event in which each individual aspect is heard united into a totality. No sound is excluded on "a priori" grounds or according to its provenance. The wider notion of objet sonore is able to encompass every sound including the "notes" of traditional music which are regarded as special cases due to the generally stable nature of their pitch and their predictable harmonic and dynamic evolutions. By considering sounds as "objects" musicians can examine, arrange or manipulate them as if they were tangible phenomena. A sound can be heard for its own intrinsic properties or because it displays a particular sound quality that can be exploited in a specific context.

> "How can we speak in these conditions of the musical perception of <u>isolated</u> objects (whether incidentally the object is a pizz. on the violin, the squeak of a brake or the howling of a siren)? One will only be surprised at this if one insists on not taking into account that the definition of the object is relative. The same monument could appear as an element in a landscape or, considered more closely, as a structured collection. I could finally forget the monument itself in order to concentrate on the door lintel, to admire its construction, the colour of the stone...etc. A same sound could be thus integrated in a musical structure or musically appreciated for its own structure, its dynamic contour, its harmonic or melodic development...etc."(57)

The term "objet" like "concrete" and "abstract" has often given rise to misconceptions that Schaeffer has painstakingly denied. The objet sonore, he stressed, remains a qualitative experience of the musician intent on discovering from the sound itself what aspects could be

utilized in a musical discourse. Any objet sonore could be assessed by means of écoute réduite in order to extricate perceived musical values and possibly develop them as musical determinants. The evaluation and usage of an objet sonore's musical potential automatically promotes it to the level of an objet musical. However, he admitted that many objets sonores have little, or no potential as objets musicaux. Such promotion depends solely on the composer's intended musical context. In addition, the objet sonore is not synonymous with the sound recording which did appear to have an independent "physical" existence and which reproduces the original sound if replayed at the appropriate speed. As each objet sonore is evaluated according to its own intrinsic qualities, a recorded sound played at different speeds, reversed or spliced into several sections produced different objets sonores. Thus the recording, which under suitable conditions recalls the original objet sonore, becomes in turn a source for the subsequent production of new objets sonores.

1.5 Valeur and Caractère

In order to proceed to the musical/abstract stage of composition Schaeffer had to consider how musical structures, as opposed to single objets sonores are perceived. While the evaluation of objets sonores and the production of "studies" were considered necessary preliminary procedures, Schaeffer's goal was musical composition which, as always, needed to draw on and combine diverse sounds.

For Schaeffer, traditional European music provided a model for understanding how the main elements of a musical discourse function. His contention was that a musical structure conveys meaning according to the listener's ability to perceive variations of certain aspects between sounds. It follows that these variations are easily perceptible only if other aspects remain relatively unchanged. The aspects that varied he called valeurs, those that remained unchanged were called caractères. The term valeur implies a notion of quality or merit, literally of "value". It expresses what something is deemed to be worth, thus accurately conveying the pre-eminent position of valeurs as the principal articulators of musical structures. By contrast, caractère is more neutral and translates literally as "characteristic" signifying one of a number of disparate aspects or features that a person or thing exhibits. The

term has no implication of either merit or lack of it. The musical application of these two notions can be demonstrated as follows: a melody played on a flute would be perceived as the relationships between the changing valeurs of pitch and duration. At the same time these individual sounds would be recognized as originating from the same source due to the permanence of the caractères resulting from the instrumental "timbre" of the flute and the manner in which the flautist articulates the notes. The model of pitch and instrumental timbre in traditional music is the most common example of the notions of valeur and caractère. Although Schaeffer's definition may seem unremarkable, even self-evident, it clarifies the state of flux that exists between the abstract-concrete dualism. The valeurs, being the main supporters of the musical discourse, are the aspects which are <u>abstracted</u> by the listener (and traditionally indicated most accurately by notation). But the traditional rigid separation of valeurs and caractères which precluded the transformation of one into the other was undermined by the concrete attitude's process of abstraction. Abstraction, and the recognition of valeurs was applicable to every perceptible sound aspect, thus increasing the number of potential valeurs. However, this position needs to be qualified. Certain aspects have greater potential as valeurs than others. This recognizes that there is a balance between the imposition of valeurs by tradition and culture and the perceptual predispositions of human perception. Schaeffer believed that attempts by musicians to expand the number

of traditional valeurs were laudable, but it should not be assumed that any aspect could be treated as a valeur in the same way as, for example, pitch(58).

The abstraction of valeurs from sounds does not relegate caractères to the level of second rate aspects. Caractères still contribute to the overall success of the musical discourse. In traditional music practice, for example, the caractères are often the decisive factor in the assessment of a satisfying performance. This is particularly evident if two or more performances of the same piece are compared. In such performances the valeurs should be identical. Judgement will then inevitably include style of articulation, control of sound quality and intensity each of which can be described as a Schaefferian caractère. There is a great interplay between the roles of both aspects.

The concepts of valeur and caractère are of fundamental importance to all music, electro-acoustic or otherwise, and demonstrate the flexible, even ambiguous nature of many objets sonores. Any attempt to define a fixed valeur or caractère of an isolated objet sonore is meaningless until a musical context has been provided by the composer. As valeurs can only emerge in a structure of objets sonores where a difference between them in one or more aspects is perceptible the skill required of the composer in the balance and control of parameters is of paramount importance.

The dualism of permanence/variation is an obvious corollary of valeur and caractère. Schaeffer combined these into a fundamental musical "law": PCV2 - permanence of caractères (concrete) / variations of valeurs (abstract)(59). He claimed that this "law":

> "(...) was a notion which dominates all musical phenomena."(60)

Not only can this "law" be applied in evaluating how successfully a composer fashions objets sonores into effective structures but it is also linked inextricably to the development and concept of the "instrument". The full importance of both dualisms in this "instrumental" context is investigated in sections 3.4 and 3.5.

1.6 The Experimental Solfège

Schaeffer's first experiments and compositions encouraged the development of a new "experimental" solfège which formed the basis for most of his subsequent researches. He was conscious of the strengths of traditional solfège which represented traditional musical attitudes towards sound and its organization. The notions of the objet sonore and valeur/caractère demonstrated that the traditional solfège could not serve the new musical languages. It had been developed in accordance with the requirements imposed by the instrumental and vocal repertoire and its efficacy was contingent upon its restriction to this body of music. Schaeffer thus concluded that traditional solfège was unable to provide a suitable terminology capable of expressing concepts emanating from the rapidly expanding repertory of electro-acoustic music. A clear distinction had to be made between the functions and goals of the traditional solfège and the new, experimental solfège. Traditionally solfège was:

> "(...) the means of notating musical ideas, just as much as the translation of these ideas into sounds (...)"(61)

As traditional solfège existed within the confines of musics which had formalized reference structures and which used instruments with known timbres, there had been no need for a thorough description and classification of the sounds. The main purpose of such a solfège was the accurate communication of the composer's intentions to a

performer who realized these intentions for the audience. Due to the nature of electro-acoustic music this was of little concern to Schaeffer.

Electro-acoustic techniques and the concrete attitude allowed access to the complete sound universe and, more significantly, to a greater number of possible valeurs.

These advantages were of limited benefit without a systematic method of classification, description and evaluation of sound material - problems common to all musical composition. Even the nature of the acousmatic situation, so invaluable in investigating sounds thoroughly, presented simultaneously a new problem when attempting to classify them. Schaeffer wrote:

> "The sound should no longer be characterized by its causal element but by pure effect. Therefore it has to be classified, not according to the instrument which produced it, but according to its inherent morphology. It must be considered on its own terms. The best evidence is that once it is recorded on magnetic tape it is impossible to say how the most interesting sounds, brought about by new techniques, have been produced or by what combination of processes or instruments."(62)

A vastly increased vocabulary required order of some kind. It was clear that the creation of a new solfège which could suggest solutions to the classification of a sound "on its own terms" became an integral part of the discovery of a new musical language:

> "Where is concrete technique to be found? Is it at the level of the instrument, the level of composition? At both levels, but even more, to start with, at the level of solfège.
>
> As long as a new musical solfège is not clearly defined, and numerous musicians, concrete or not,

have not been able to be aware of it, all these problems will remain hidden away."(63)

The experimental solfège was facilitated by a discipline which Schaeffer called acoulogy. This neologism had an equivalent in linguistics(64) from which he derived much terminology. The aims of acoulogy were:

> "(...) the study of the mechanisms of listening, the properties of objets sonores and their musical possibilities in the natural, perceptual field of the ear."(65)

This definition provides a succint summary of the aims of an experimental solfège. It demonstrates that acoulogy directs perception in an attempt to bridge the gap between basic sound materials and the creation of musical discourse in the absence of a priori systems of classification and description. Thus acoulogy is not in itself music any more than phonology; its linguistic equivalent, is language. It provides a level of understanding, a basis on which musical composition can be established through the awareness of new structural possibilities derived from direct, unbiased perception of the sounds themselves.

While the original raison d'être of traditional solfège was inapplicable to electro-acoustic requirements the processes of translation from and into sound were generalized and incorporated into the new solfège(66). To clarify each separate process Schaeffer borrowed two terms from language teaching — thème and version. Thème signifies the act of translating from one's own language into another, foreign language whereas "version" is the

reverse process." With reference to music thème is the process of translating any written symbol or instruction into sound; a function served by the time honoured system of music notation. Its complementary term, version, denotes the reverse: the act of detailed listening to a sound in order to describe or notate it as accurately as possible. Both stages are needed, but traditional solfège, and by implication traditional music, displays an inherent imbalance. This imbalance, Schaeffer believed, was compounded by the tendency of many contemporary musicians to realize structures conceived according to a priori schemes with little, if any, perceptual corroboration. Such work methods practise thème, before the sounds and therefore the possible structures resulting from them are investigated. The latter process is the function of version and the aim of acoulogy. The correction of this imbalance was central to Schaeffer's musical philosophy and was symptomatic of his distrust of "a priori" schemes of composition where organizational plans, though justified conceptually, were imposed upon sounds. The re-balancing of these two basic disciplines was an important shift of emphasis in traditional musical thought and the re-establishment of version confirmed the new solfège as:

> "(...) the art of practising better listening;"(67)

1.7 The Programme de la Recherche Musicale

The new experimental solfège was embodied by the Programme de la Recherche Musicale. This "Programme" evolved during the course of Schaeffer's periods of experimenting and can be seen as the culmination of his concern to establish a rigorous music theory. The aims and methodology encapsulate Schaeffer's innovative approach to sound and composition. Its comprehensiveness and the disciplines it promotes demonstrate its continuing relevance to all areas of contemporary music.

Schaeffer adopted a systematic methodology by attempting to identify each distinct, though necessarily intimately connected, stage in the consideration of sound material. These ranged from the initial isolation and investigation of the sound, to theorizing how it might function in a musical context. As the "Programme" had to be applicable to every possible sound it needed a comprehensive, flexible methodology and vocabulary.

The five stages of the "Programme" were:

1) Typology: the isolation and sorting of "types" of objets sonores according to temporal and spectral features.

2) Morphology: the detailed description of objets sonores according to "classes" of criteria.

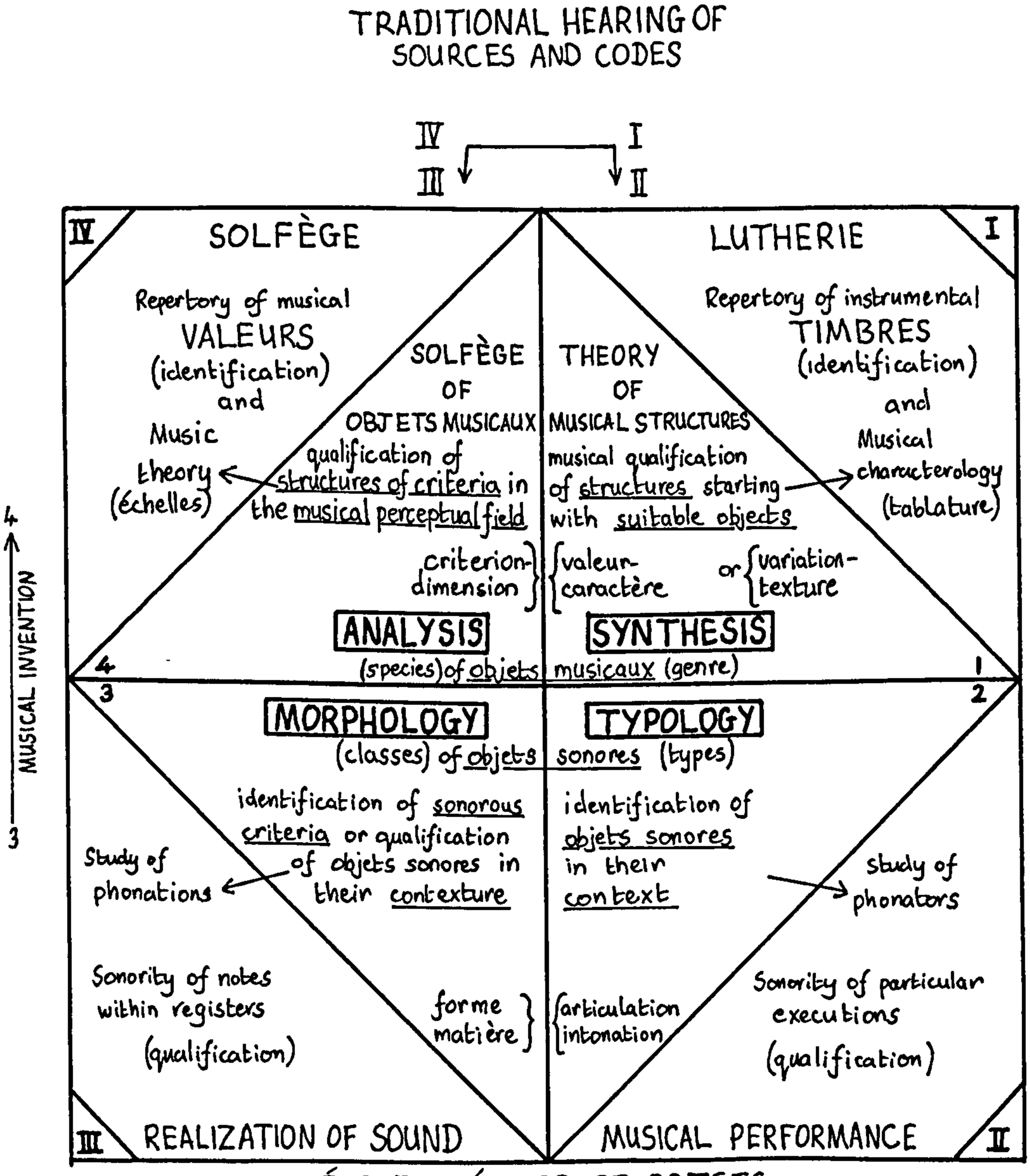
3) Characterology: the grouping of objets sonores into "genres" according to how their constituent criteria combine and are immediately perceived by the listener.

4) Analysis: the study of "species" of objets sonores in order to evaluate how they might function as valeurs.

5) Synthesis: the composition of objets musicaux individually and in structures to form a musical discourse.

Every new work or research project (the distinction between the two was often unclear) enabled Schaeffer to construct a body of music theory directly from educated listening and compositional practice. One of the key difficulties in developing such a programme was the impossibility of recourse to a large repertory of established works for the codification of rules. This explains the need for the creation of many sounds and musical studies in order to establish a framework by which sounds could be realized(68). The "Programme" therefore was a conscious, intellectual effort on the part of Schaeffer and his various associates entailing the formulation and testing of hypotheses.

In the "Traité des Objets Musicaux" Schaeffer provides a diagram which illustrates the programme's separate



I-II CONVENTIONAL
III-IV SYSTEM

EXPERIMENTAL 1-2
SYSTEM 3-4

components and from which several important underlying features emerge (diagram 1)(69) The diagram is a combination of two separate schematic representations: the inner lozenge, numbered 1-4, refers to the Programme de la Recherche Musicale itself and the outer sections, numbered I-IV, refer to the traditional musical system. A feature of the diagram is the division into an upper and a lower half which, though not made explicit by Schaeffer, reveals that the lower half of typology and morphology dealt with the preliminary stages of exploring the complete sound universe. The upper half of analysis and synthesis attempts to make the transition back to composition by examining the possibility of arranging and creating sounds in musically significant structures. The combination of the traditional and experimental systems in the diagram demonstrates how Schaeffer divided the study of sounds into basic disciplines which elaborated, generalized and supplanted the traditional system. The boxes of the diagram indicate what is being studied specifically at each stage and the pairs of criteria by which the operations are carried out. There is, therefore, a definite direction to the programme through each of the appropriate stages, revealing a purposeful musical intention: the discovery of what objets sonores are the most "suitable"(70) for music and how these can be isolated, described, arranged and created. Thus, one can start at typology in box 2 and proceed clockwise through each quadrant until the stage of synthesis in box 1. In practice such a smooth, unbroken progression is

unlikely. For example, a deviation after morphology to boxes I and II for characterology is necessary(71) for an assessement of the genres of sounds (a genre being one of the most immediately perceptible aspects of sound).

Schaeffer stated that each stage was characterized by successive approximations(72). Perceptual verification would invariably cause a certain amount of wandering from one section to another. Such a programme did, however, reveal that the ideal of synthesis would be achieved in accordance with three stages of intense and directed listening and would as a result be the culmination of the "Programme". In addition it is significant that the third stage of the "Programme", characterology, uniquely has no individual entry in the inner lozenge of the diagram. Its sole reference is in connexion with "tablature" in box I. This indicates that its function, albeit difficult to define, is inextricably linked to the stages of both analysis and synthesis. It forms an important intermediary stage between the two principal pairs of typology/morphology and analysis/synthesis.

The five parts of the "Programme" remained at different stages of completion. Schaeffer admitted that the first two stages of typology and morphology were by far the most thoroughly worked out. This is hardly surprising. Classification and description, however thorough, are easier than attempting to formulate relationships between sounds as a preliminary to composition. This must always

depend on context. Nevertheless, the "Programme" is the only thorough attempt at understanding and using the entire sound universe. Furthermore, the recognition that traditional sound resources comprise only a small fraction of this universe forces a renewed scrutiny of their potential and incorporation in new musical contexts. A strength of the "Programme" is that it was never intended as a form of doctrinal credo to which blind allegiance should be given. Its comprehensiveness and the methodology that it established invite further development and refinement(73) and testify to its continuing relevance.

1.8 Typo-morphology

The first two stages of the Programme de la Recherche Musicale were often linked as complementary disciplines(74). It is therefore necessary to study how typology and morphology function together before investigating the types and classes of each stage. As these two stages assist the initial exploration and assessment of sounds before any consideration of their musical potential they are the most comprehensive and thorough of the "Programme". Broadly speaking typology(75) isolates and sorts objets sonores into types which morphology(76) subsequently describes in detail. While this is an accurate description it risks over-simplifying and thereby not fully appreciating the flexibility and potential of both stages. In the initial consideration of sounds neither typology nor morphology can be mutually exclusive; each overlaps with the other to an extent. Even though a stage of typo-morphology might seem an unnecessary duplication of the specific tasks of typology and morphology proper, a process of sorting, which clearly requires notions of description, is needed to initiate the entire "Programme". Chion identified this problem:

> "A methodological problem which has long hampered the enterprise of a typology is that one could not sort out objects without the albeit sketchy criteria of description."(77)

Schaeffer recognized that to effect even a rudimentary sorting of types of objets sonores, criteria need to be

assessed at the typological stage even though this pre-empts to an extent the more detailed description of morphological classes. This preliminary stage of typology enables the number of different types of objet sonore to be restricted to a manageable number.

Typological criteria have to be universally applicable if they are to be appropriate for all sounds. There is one pair of criteria of identification and three pairs of criteria of classification. These can be summarized as follows:

Typology

The first stage is the isolation of objets sonores in their context(78). This is achieved by identifying units of sound according to the pair:

articulation / appui

The second stage is the classification of these objets sonores into basic types by the three pairs:

masse / facture

durée / variation

équilibre / originalité

Morphology

The detailed description of objets sonores in their contexture(79) by the pair:

forme / matière and the seven morphological criteria:

masse

timbre harmonique

grain

dynamique

allure

profil de masse

profil mélodique

Typo-morphology, therefore, is a distinct combination of typology and morphology and an admission of the difficulties encountered by Schaeffer when attempting the formidable task of formulating a method of classifying every possible sound.

1.9 Typology

The function of typology is to identify and classify any objet sonore. It is the first stage, however approximate, in sorting sounds according to their inherent perceptual qualities. Generally speaking the most "suitable" objets sonores are the ones most likely to be included in a musical discourse. Guided by typology a composer can begin to classify objets sonores according to their probable musical application (without actually rejecting any out of hand).

Before any typological investigation can be undertaken the objet sonore has to be extricated from its sound context by means of the pair of criteria: articulation/appui. These two criteria developed from studio practice. Once a sound is recorded, and possibly transformed, it cannot necessarily be separated clearly from its context. In traditional instrumental/vocal music such segmentation occurs naturally. Breath capacity and bowing, for example, impose natural divisions as do the resonant characteristics of instruments. The sole exceptions are extremely long sounds produced, for example, by instrumental ensembles or the organ, but even these are uncommon in traditional music. For composers of electro-acoustic music new articulatory criteria had to be deliberately introduced.

Articulation: As in English, articulation expresses the

distinct pronunciation of sounds in a speech act. This implies the clear linking and separation of sounds by a speaker. In French the term also refers to the joints between the bones, or the points at which one bone ends and another starts. These definitions express the notion of nodality that Schaeffer conveys in his use of the term in music. Accordingly, an articulation denotes a distinct change in a sound's energetic progress. This is usually caused by a change in the spectral constitution of the sound or its dynamic shape. Articulation thus provides a criterion for the division of any sound into long or short sections. If the sound is of long duration and displays no noticeable variation in any aspect it is possible that only the onset and termination of the sound could be perceived as distinct changes.

As articulation is concerned with the point at which energy changes during the course of a sound's progress it is closely related to a notion called: <u>entretien</u>. The term entretien denotes an act of maintenance, of keeping something going. Interestingly it also means a conversation or interview which clearly expresses the maintenance of a discourse by two or more speakers. Schaeffer defined entretien as the way in which an objet sonore's energy is maintained throughout its duration (according to the latter meaning one could say that an entretien is maintained by a series of articulations and appuis). The introduction of this notion was necessary because categorization cannot be achieved simply by

identifying the point at which a sound changes. Further elaboration is required regarding sound behaviour after such a change occurs. Entretien is sub-divided into two main categories, one of which is further sub-divided, thus comprising a total of three categories. Firstly, the entretien could be emitted instantaneously as in sounds of very short duration like the "impulse". In effect such sounds classify themselves. Secondly, it could be emitted over a period of time as either a continuous or discontinuous entretien (these were also sometimes referred to respectively as sustained and iterative). Without entretien little could have been accomplished beyond establishing where an objet sonore started and finished.

An example will illustrate the notions of articulation and entretien. A recording is made of the following sound event: a gong is struck by a moderately hard mallet and after several seconds before the sound begins to decay noticeably, a suspended thin metal rod is placed in close proximity to the gong causing it to rattle against the vibrating surface. After a few more seconds the sound is stopped by muffling the gong as cleanly as possible. The first obvious articulation would occur as the gong was struck. In addition there would be an articulation at the moment when the metal rod started to vibrate against the gong. Further distinctions could be made by considering the different entretiens after these articulations. The first could be described as continuous. Once the gong was

struck by the mallet the sound's energetic progress would continue unaltered though there would be a noticable decay in both the spectral and dynamic envelopes. The second entretien would be discontinuous as the vibrating metal rod struck the gong's surface causing rapid fluctuations in the sound's progress. The sound could therefore be considered as two juxtaposed objets sonores both of which could be identified by distinct articulations and different entretiens. It must be stressed that a different focus of hearing might modify this simple example, perhaps even separating groups of fluctuations of the second objet sonore. In addition silence might not be conveniently situated at either end of the sound thus complicating the perception of the articulations.

Appui: The term appui is defined as the support given to vowels in speech. It also indicates an act of leaning or emphasis. In a musical sense appui is similar to entretien in that it refers to the behaviour of the sound once changes in energy are identified. However, appui is specifically concerned with the objet sonore's intonation(80), or pitch contour. This is defined according to four categories. The pitch either remains fixed or varies throughout the pitch-field. Each of these broad categories can be sub-divided according to whether the pitch is considered to be a definite, clearly identifiable pitch, or complex and occupying a broad and less clearly defined pitch area. In the preceding example the appui of both objets sonores would be fixed and

complex.

It must be emphasized that articulation/appui did nothing more than aid the identification and isolation of objets sonores. Any classification derived from these two notions was at best very approximate. In some senses it is difficult to regard either articulation or appui as typological criteria like the other six. They are perhaps better described as parts of "sound topography", articulation being the point at which a change occurs and appui being the behaviour of the sound at all other points in between. The more refined classification of objets sonores was achieved by Schaeffer's three remaining pairs of criteria. These had a more specific purpose, that of classifying according to inherently "musical" criteria.

Masse/Facture

This pair of criteria provides the principal typological means of describing sounds. Both masse and facture are closely associated with articulation/appui.

Masse: The masse is literally the quantity of matter of an object, it is an expression of its bulk. Schaeffer used the term masse as a generalized notion of pitch and it features prominently as a criterion in both typology and morphology. The masse of a sound is defined as the area of the pitch-field that it occupies. This could range

from the "thinnest" sound (the electronic sine tone) to the "thickest" ("white noise"). An extension of the traditional notion of pitch is required since precise, tempered pitches, common in traditional music, are exceptional in the context of the entire sound universe. By simply referring to an occupation of the pitch-field different densities and conglomerations of pitch areas could be classified. Masse is therefore a "key concept" ("notion-carrefour")(81) capable of referring to all sounds, not only those utilized by traditional western music.

There are three types of masse:

Tonic: This is a masse of fixed tessitura. The type is identified as occupying a single, narrow register and corresponds broadly to the traditional definition of a note.

Complex: This masse is also of fixed tessitura. It has no clearly definable pitch but occupies a pitch area from relatively narrow (though not as narrow as that of tonic pitch) to broad.

Variable: Variable masse, unlike the other two types, is unstable in tessitura. The masse itself could be either tonic or complex.

These three types of masse relate therefore to the notions of fixity and variability of pitch as introduced in the

notion of appui.

Facture: This is closely related to the notion of entretien. The term facture implies an intentional act of "fabrication". It is possible that Schaeffer deliberately referred to an older meaning of the noun "facteur" which, unlike its present definition of "postman", used to denote the maker of an instrument as in "facteur d'orgues". In Schaefferian terminology it is defined as the qualitative perception of the sound's energetic progress. It is important to note that unlike entretien, facture is not impartial. The notion of facture initiates an assessment of a sound's musical potential. All sounds have entretien in the sense that they must display an energetic progress in order to be perceived. Even a sound like the impulse is characterized by a burst of energy however brief it might be. In contrast, facture only relates to sounds within a particular range of durations and which display qualities of predictability and memorability. Consequently, if a sound is too long or too short, it has no facture. Similarly it has no facture if its progress is chaotic, too banal or terminates in a way that could not be predicted by its onset. For example, an organ can produce sounds which display these tendencies. If a note is played by depressing a single key as briefly as possible, the resulting entretien is too short for the sound to have a facture. Even if the environmental acoustics create an elonga‿tion of the sound by imparting an artificial reverberation this will be perceived as a

separate part of the sound and independent of the initial, short entretien. If the key is depressed and not released for a long duration the sound's length tends to blur the listener's memory of the onset as it recedes into the past. The listener becomes aware of the continuous, unchanging entretien as the sound progresses in duration and the termination, when it happens, may seem unconnected with either the onset or the continuant phase. Thus, this sound, like the previous example, will have no facture. (It is also noteworthy that if the key is released and depressed rapidly and continuously it will have a different entretien.) However, if the key is depressed for a shorter, more "conventional" duration, all the three phases are perceived as part of a unified sound and the notion of facture is applicable. The sound's duration, contingent as its perception is on forme and matière is, therefore, an important factor in the assessment of facture. Because individual sounds in the traditional repertory invariably have facture, its qualitative nature seems inextricably linked with the physical means by which the sound is (or might be) produced.

As in the criterion of articulation there are three types of facture:

Prolonged or Continuous: This type occurs in continuous sustained sounds.

Iterative: The characteristics of this type of

facture are caused by a discontinuous entretien.

Impulse: The inclusion of the impulse is somewhat paradoxical as impulses have no facture. Its inclusion is justified, however, because impulses are common sounds and to disregard them would be a serious and untenable omission in a comprehensive system.

Useful comparisons can be made between articulation/appui and masse/facture. The function of the former pair is to identify and isolate without puporting to give anything but an approximate classification. Masse/facture (and the remaining two pairs of criteria) on the other hand did attempt to classify according to "musical" criteria. Thus in facture, qualities such as unpredictability or excessive length could be subjectively regarded as less likely to be musical than sounds with relatively conventional behaviours and readily perceived durations.

Durée/Variation

These are the temporal criteria of typology.

Durée: This expresses the duration of a sound as "psychologically" experienced. As a result of the concrete attitude towards sound Schaeffer believed that chronometric measurement of a sound was musically

unsatisfactory(82). The assessment of the duration of a sound incorporated aspects of spectral and dynamic features. In addition he believed that the human ear perceived a sound best within a certain optimum time span, above or below this duration perception will tend to be confused. Thus in an extremely long sound perception of the dynamic evolution often shifts after some seconds to an increased awareness of the spectral content. There were three types of durée, each type could be suffixed by "...for music (probably!)":

(too) Short

(ideally) Medium

(too) Long

Variation: This refers to any aspect which varies as a function of time. Such aspects could be the masse, dynamic level or any other variable criterion. Any variation has to be time-based and as such it is the obvious corollary to durée. There are three types. As with durée their assessment is necessarily context-dependent:

Non-existent: No variation is perceptible during the sound's progress.

Reasonable: There is sufficient variation to be

perceptible and "interesting".

Unpredictable: The variation is too chaotic and attracts too much attention.

Equilibre/Originalité

The final pair of criteria makes the most instinctive, subjective assessment of the sound's musicality. Consequently, as they imply a value judgement they are perhaps the most difficult to evaluate.

Equilibre: This is an assessment of how "well-formed" or "balanced" a sound is perceived to be. A consideration of the facture is part of this assessment. For example, if the sound's duration is excessively long or very short it could have no facture and as a result it could not be "balanced". "Balanced" sounds, therefore, have a facture and are, broadly speaking, of medium duration. There are no types of this criterion; the objet sonore is either balanced or not.

Originalité: The originalité of a sound is determined by the predictable nature of its progress. For example, if a sound's spectral or dynamic development is very unpredictable it could be considered too unusual for inclusion in a musical context. However, if a sound is too predictable it might not be interesting enough. A suitable compromise between the two has to be achieved.

There are three types of originalité:

None: The sound is too regular to be of much interest.

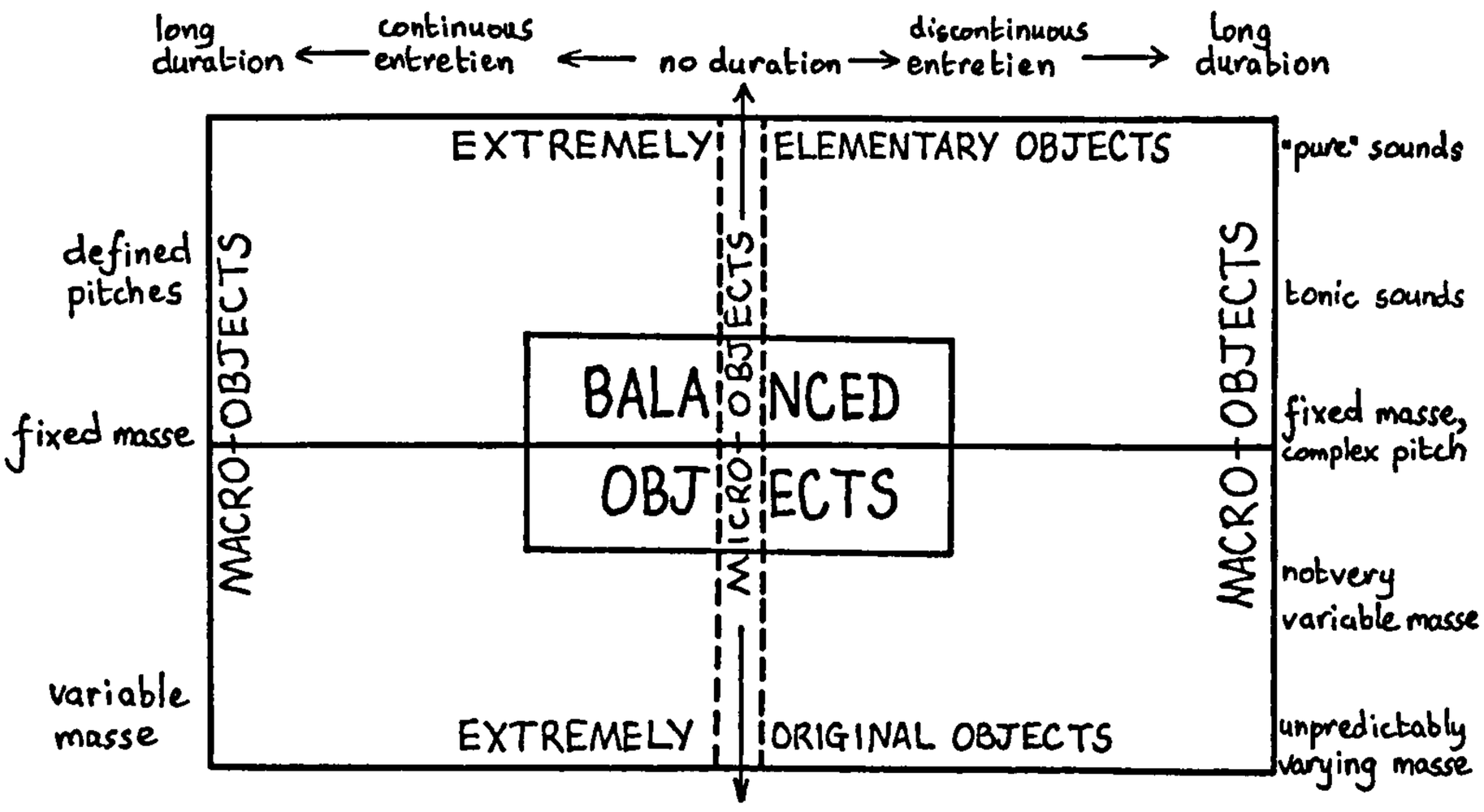
Suitable: These are the most likely objets sonores for music.

Excessive: These sounds are usually too unpredictable to be of use in music.

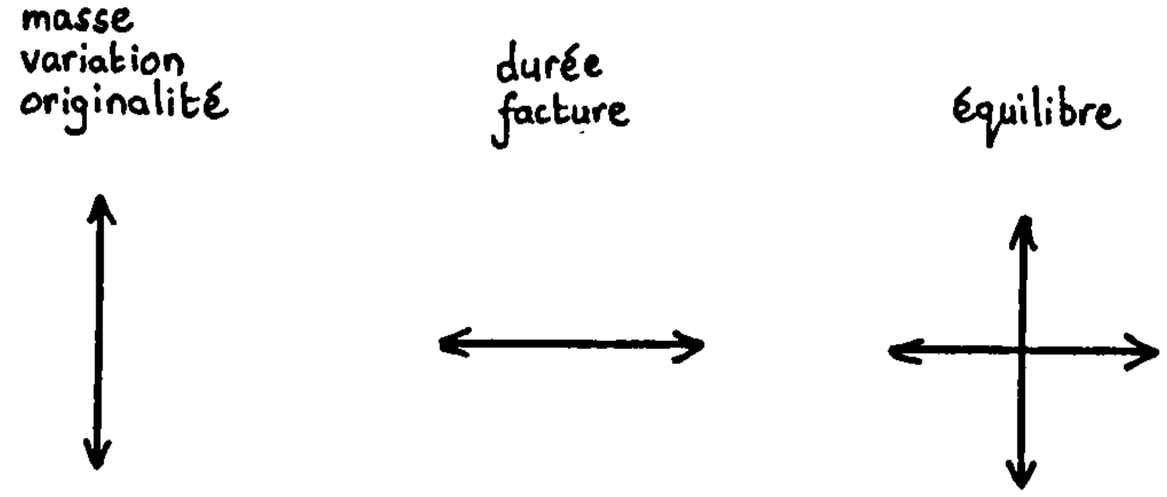
Assimilation of the three pairs of typological criteria

It is clear that these three pairs exhibit a complex network of relationships. The relationship between the criteria in each pair is the most obvious. For example, in the pair masse/facture a very mobile and complex masse, particularly in sounds of long duration, would tend to display little or no facture. Explicit, though more complex, relationships are noticable between criteria in separate pairs. For example, facture and durée are related; if the duration of a sound is too long or short there is no facture. In order to arrive at a "musical" classification Schaeffer had to attempt to express the relationships between these three interdependent pairs. He represented this in a diagram in which the six criteria were reduced to two dimensions(diagram 2)(83). The relationships between facture and durée, and masse and

DIA.2 RECAPITULATION OF TYPOLOGICAL CRITERIA



Axes of the criteria:



variation were simplified. Facture and durée were represented on a horizontal axis and were grouped symmetrically around impulses that had neither facture nor durée. To the left were grouped continuous sounds, to the right discontinuous sounds; the durée of the sounds increased in proportion to their distance from the middle line of impulses. With masse and variation there could be no such symmetrical arrangement. Masse and variation progressed downwards from fixed, "pure" pitches, that is from the electronic sine tone, to unpredictably varying masses around a central, "average" fixed masse of complex pitch. The pair equilibre/originalité could now be situated around the point where the line of impulses and the central masse crossed, producing an area of balanced objet sonores, (in practice the edges of this area would have been rather less clearly delineated). As one moved from this area towards the circumference of the diagram on the horizontal axis the sounds would become increasingly unsuitable for musical discourse as their duration increased. On the vertical axis the originalité would decrease both as one moved upwards towards the increasingly thin masse of the sine wave and downwards towards the sounds of unpredictable variation.

This diagram identifies the types of sounds that Schaeffer believed to have the greatest potential for musical discourse. It is noteworthy that almost without exception the sounds of traditional music do indeed fall within the confines of the balanced object rectangle, thus confirming

their particular status in music. Nevertheless, it is also clear that they occupy only a small section of the complete diagram demonstrating the large number of alternative sounds. It must be stressed that no sound should be automatically included or excluded from music. A compositional context may often exploit with great success a sound which could not be situated in the central box of this diagram and which appears, therefore, to have little musical potential. But when confronted with an intimidating universe of diverse sounds the combined criteria of typology suggest the first tentative steps towards a musical classification.

1.10 Morphology

Assimilating the typological criteria would only produce an approximate classification of balanced, micro- and macro-objects. Further description was necessary to refine this into a workable system. This is provided by considering the types of the seven morphological criteria.

Morphological criteria are defined as:

> "(...) properties of the perceived objet sonore (...)"(84)

They are therefore specifically descriptive. The number of morphological criteria is theoretically vast as even simple sounds can be described according to numerous (usually vague) adjectives. In practice only the seven most significant criteria are chosen. The first five of these criteria were identified by listening to sounds that were stable and unchanging, so-called deponent(85) sounds. This allowed the perception of the most distinctive criteria which were subsequently applied to all sounds.

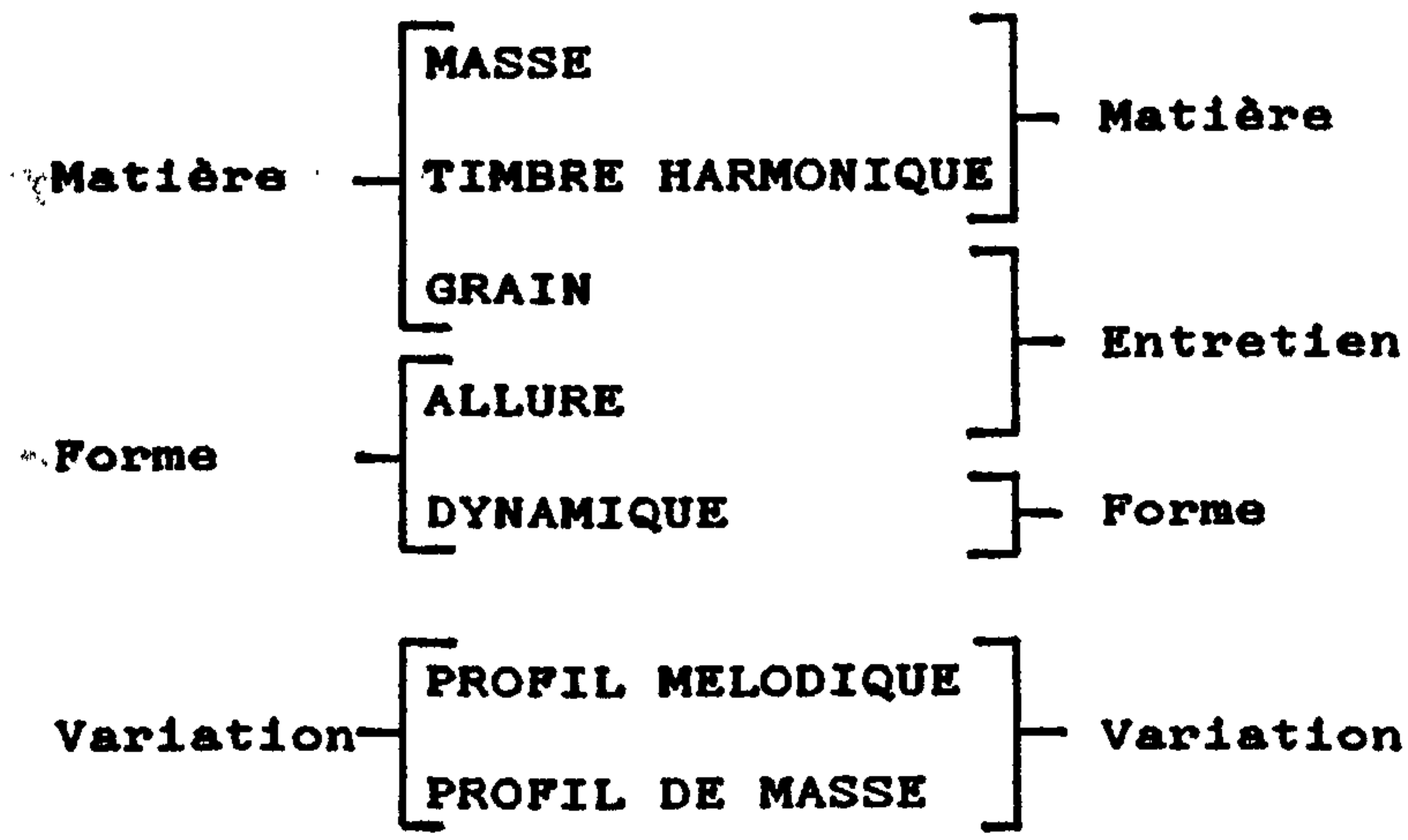
The way in which morphological criteria were structured was often clarified by the pair forme/matière. These two notions are inextricably connected. Schaeffer defined them as follows:

> "All in all matière and forme in music are made of the same elements: frequency, intensity, duration, but these elements offer contradictory aspects of being permanent and of varying. In so far as they remain permanent in a short space of time they constitute a matière; in so far as they develop in a space of time which is only ten times longer they give rise to formes."(86)

Broadly speaking, a sound's matière is its concrete substance, literally its "raw stuff", consisting of its masse, timbre harmonique and possibly grain. In the majority of sounds the matière rarely remains homogeneous throughout the sound's duration. As a result its constitution at any given moment may differ, however slightly, from the next. The forme is the overall dynamic contour of the matière's constituent elements and their possible variation during the sound's duration. Thus forme is essentially time-based and relies on an assessment of dynamique.

The seven morphological criteria can be grouped in two principal ways(87):

DIA.3 MORPHOLOGICAL CRITERIA



These arrangements confirm that particular criteria are generally associated with either matière or forme. This is demonstrated by the left-hand arrangement. On the right-hand side an alternative arrangement employs the notion of entretien by considering the criteria of grain

and allure. These criteria, if applicable, can only be perceived whilst the sound progresses in time. The time-based nature of a sound's entretien demonstrates how it unites aspects of forme and matière. These two arrangements illustrate the difficulty of separating matière and forme. The bottom two criteria refer exclusively to "evolving" or "variable" sounds the study of which is undertaken by the criteria of profil mélodique and profil de masse. This forms a distinct family of sounds and is considered separately.

Definitions of the morphological criteria

The morphological criteria are defined in descending order of diagram 3. The types of each criterion that assist typological classification are also explained.

Masse: "the way in which the sound occupies the pitch-field"(88). As masse is the one criterion that is common to both typology and morphology this statement merely repeats the definition given in the preceding section. In addition, the three types of masse outlined in typology are also identical with the morphological types. This conjunction of the two stages confirms Schaeffer's recognition of the prime importance of pitch information in music.

Timbre harmonique: "diffuse halos...and associated

qualities which seem linked with, and permit qualification of, masse"(89). Timbre harmonique refers to the spectral content, harmonic or inharmonic, of the sound. Like masse, the timbre harmonique of a sound rarely remains homogeneous and is liable to fluctuate; this change is described by the sound's spectral profile. As timbre harmonique is so inextricably linked to masse it is often difficult to distinguish the two; indeed in cases of complex masse it is impossible. Nevertheless, the criterion is useful as in some sounds one can perceive the timbre harmonique separately from the masse. For example, when a piano key in the lowest part of the register is struck changes in the spectrum are clearly perceptible. These are quite distinct from the tonic masse of the note itself. Although timbre harmonique is synonymous with the harmonic spectrum of tonic type masse it should not be confused with the notion of instrumental timbre which ignores the role played by aspects of forme, particularly the onset.

The close connexion between this criterion and masse produces only two types of timbre harmonique: <u>global</u> and <u>subdivided</u>. If the masse is perceived as a unified whole then so is the timbre harmonique. On the other hand if the masse is perceived as consisting of several distinct layers then each layer will have a particular timbre harmonique.

<u>Grain</u>: "micro structure of the matière of sound, evoking

the grain of a fabric or mineral"(90). The grain of the sound is the qualitative and global perception of small irregularities in its matière. In French the term is used to refer to the texture or roughness of a surface. Grain can be considered an aspect of the sound's entretien as any variation or irregularity in the sound's progress could produce the perception of grain. This conjunction of two aspects of matière and entretien enabled grain to be described as the "signature of the matière" ("signature de la matière")(91).

There are three types of grain, each one corresponding to a type of entretien (described in the discussion on articulation) where the sound's energy is emitted instantly, continuously or discontinuously. In addition Schaeffer admitted the possibility of mixed cases:

Resonant: Resonant grain relates to sounds of "nil" entretien, like the impulse. Although the impulse itself is too short to display any grain if such a sound has a resonance added artificially this could display a grain. In all likelihood this type of grain would be extremely fine.

Fricative: This type refers to sounds with closely packed grain in which fluctuations are barely perceptible. For example, in sustained bassoon notes in the low register a

grain is often perceptible as the sound's matière becomes increasingly "rough".

Iterative: In an iterative grain each separate fluctuation can be clearly differentiated almost like a rapid succession of impulses. A bassoon sound furnishes examples of this grain also. An iterative grain can be perceived in notes of the lowest bassoon register where separate fluctuations are easily perceptible.

Allure: "oscillation, or 'vibrato' characteristic of the entretien of the sound"(92). The allure of a sound denotes a generalized vibrato describing the characteristic undulation of the entretien. The term is closely related to the verb "aller" and thus refers explicitly to the manner of walking, the bearing or appearance of someone who is moving. Though allure generally refers to a variation in the masse or the dynamique it is a useful criterion in its own right particularly if the undulations are irregular or if they change during a sound's progress. Like the criterion of grain, which combines aspects of masse and entretien, allure combines entretien and forme and is described as the "signature of the facture" ("signature de la facture")(93). This connexion is particularly relevant in instrumental or "natural" sounds where the allure often reveals the way in which the sound vibrations are maintained and thereby alludes to the gestural actions of

the possible sound agent.

Like grain there are only three types of allure, and possible mixed types. Their names reflect factures observable in "natural" sounds.

Mechanical: So called because an allure of this type is too regular to be produced by a human executant.

Live: This type displays slight irregularities and is therefore similar to the pitch vibrato produced by instrumentalists such as violinists and singers.

Natural: The natural allure has very irregular undulations and is thus inconsistent with either human or mechanical agents.

Dynamique: "evolution of the sound in the intensity-field"(94). This criterion is also called the "shape" or "profile" of the sound and describes the profile of the intensity of the objet sonore's matière. Its assessment can be complicated by the individual dynamic evolutions that some component morphological criteria such as timbre harmonique might display.

There are seven types of dynamique:

Nul: This type is applied to sounds which do not evolve in forme.

Weak: The weak type of dynamique evolves very slowly. Consequently it can only refer to sounds of relatively long duration.

Formed: This type clearly displays the three temporal phases of onset, continuant and termination. It applies to sounds of medium duration because if a sound is too long it exceeds the limit of "memorability" and its onset may not be recalled.

Impulsion: The impulsion refers exclusively to the dynamic profile of the "impulse".

Cyclic: Cyclic types display repetitive, discontinuous characteristics.

Reiterative: The reiterative type is, like the cyclic type, repetitive. It differs from the cyclic type in that the changes of intensity are continuous and, being less distinctive, they are less easily perceived.

Accumulated: This type refers to sounds which

consist of a closely packed succession of individual sounds each one of which has a similar dynamic profile. Their close proximity and similarity of dynamique causes a global rather than individual perceptions.

The following two criteria refer to varying or evolving sounds. They are more general notions of sound and rely on the listener's assessment of the interest inherent in either the objet sonore's trajectory through the pitch field or its internal variation.

Profil mélodique: "general profile outlined by a sound evolving in tessitura"(95). The profil mélodique could be either a continuous or discontinuous variation which affects the whole masse of the sound causing it to shift up or down in the tessitura. An obvious example is the behaviour of a siren. The masse in question could be either tonic or complex. The profil mélodique is very hard to dissociate from other criteria such as dynamique and timbre harmonique both of which are usually affected by a change in tessitura.

Uniquely the types of profil mélodique comprise a small typology in itself. It is therefore discussed in section 1.11.

Profil de masse: "general profile of a sound whose masse is 'sculpted' by internal variations(96)". This criterion

describes an internal variation in the sound's masse which might, for example, cause it to evolve from tonic masse to complex masse. It is, therefore, very difficult to dissociate the variations in this criterion from changes in both dynamique and timbre harmonique. Perhaps the clearest examples of this criterion can be heard in sounds whose masses are altered by electro-acoustic filtering.

As in the case of types of profil melodique the formation of types of profil de masse is very difficult. These two criteria by definition deal with changes in sound from one state to another resulting in a large number of possible combinations. Therefore there are three types of profil de masse each of which remains fixed in tessitura:

Fluctuation: This type displays instability of masse causing it to evolve from one type to another. For example, a tonic masse changing to a complex masse and vice versa.

Evolution: The evolution type evolves in a more progressive and continuous manner. For example, a sound of complex masse might remain complex but evolve gradually through several stages of density.

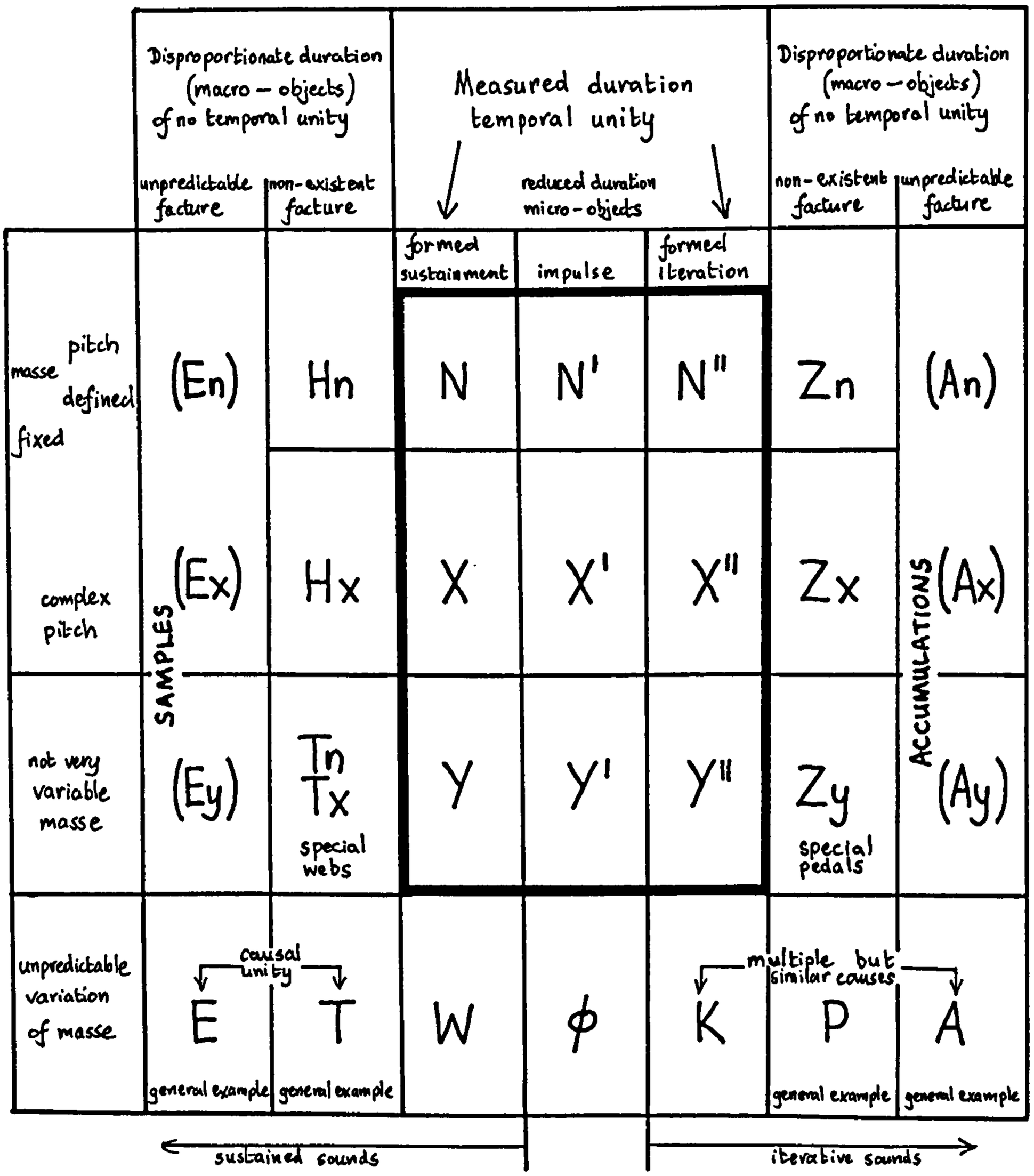
Modulation: The evolution of this type, in contrast to the previous example is discontinuous or scalic.

1.11 The Types of Typology

It is significant that the summary diagram of the typological criteria (diagram 2) outlines the universal area of objets sonores without identifying and naming specific types. After the approximate sorting achieved by typo-morphology more detailed classification would be produced by examining the objets sonores situated at the co-ordinates of the two axes and applying the types of morphological criteria. A further diagram (diagram 4) called the Tableau Recapitulatif de la Typologie (TARTYP)(97) tabulates these general types. Classification would naturally depend on context or intention of hearing, both of which might cause some ambiguity in classification. Nevertheless, as a more detailed, larger scale "map" of the sound universe showing both close and distant relationships TARTYP is a successful elaboration of the previous diagram.

There are similarities between diagrams 2 and 4. Both have a central box of balanced sounds with other types grouped around the circumference. TARTYP, however, does not extend as far vertically as the summary diagram, demonstrating that numerous differentiations of sound types approaching the electronic sine tone are unnecessary. By definition extremely thin masse will not display many types. The bottom row of TARTYP lists general cases of types and as one ascends the appropriate columns above these, particular cases are further

DIA.4 TABLEAU RÉCAPITULATIF DE LA TYPOLOGIE (TARTYP)



qualified according to variability or stability of masse.

Typology, therefore, produces a classification of three main families of sounds sub-divided into approximately 50 types. These are tabulated below with the notation that Schaeffer proposed as an aide-memoire(98):

TABLE 1 TYPOLOGICAL TYPES

Balanced sounds

		criteria of facture		
		continuous	impulse	iterative
criteria of masse	tonic note	N	N'	N"
	complex note	X	X'	X"
	varied note	Y	Y'	Y"

Eccentric sounds

	grosse note	W				
	web	T				
	sample	E	En	Ex	Ey	
	accumulation	A	An	Ax	Ay	
three artificial sounds	cell	K				
	fragment	ϕ				
	pedal	P/Zk				

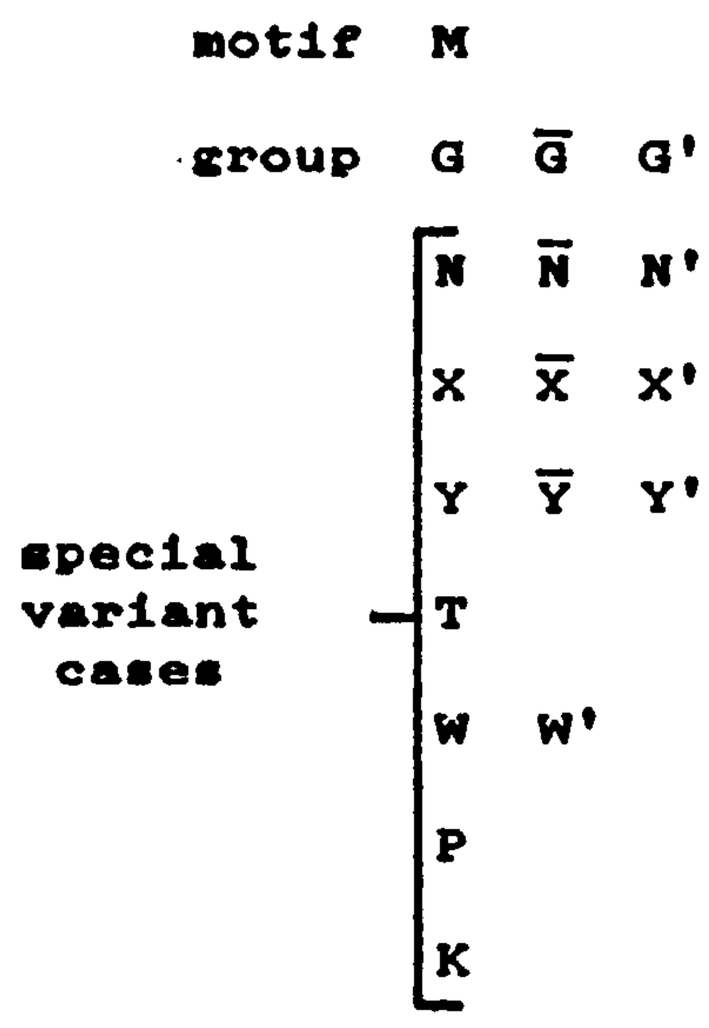
Redundant sounds

	continuous		discontinuous		
homogeneous	Hx	Hn	Zx	Zn	Zy
siren	Ȳ		Ȳ"		
redundant pedal	Zy				
redundant web	Tx	Tn			

Varying sounds constituted a separate typology that could not be included in TARTYP. This typology produced an additional 18 types many of which were special variants of types previously identified.

TABLE 2 TYPOLOGY OF VARYING SOUNDS

Varying sounds



The folowing is a description of the types. Where possible instrumental analogies have been suggested.

Balanced sounds

A balanced sound displays a facture and a forme in which each temporal phase of onset, continuant and termination is clearly perceptible. As such they represent a good compromise between boredom and confusion induced by sounds that are respectively either too simple or structurally too complex. Individual sounds in traditional music can invariably be described as balanced. It must be stressed that although the notion of balance was a precise

typological classification it is not synonymous with musical "suitability". This is, of course, context dependent.

The classification of balanced sounds is formed by combining the three types of masse with the three types of facture. This produces nine sounds. The inclusion of the impulse appears to be as anomalous as it was in the types of facture. Schaeffer was of the opinion that impulses display a kind of "natural logic". In addition, very short sounds have always played a role in traditional music. He reasoned pragmatically that this familiarity on the part of the listener justified their inclusion.

Instrumental examples are commonplace. Classifications of N, X and Y types could be produced respectively by a plucked guitar string, a struck cymbal and a fairly short violin glissando. Truncated versions of the same would serve as examples of their impulse forms. Iterative forms would arise from the same sounds being played tremolando.

Eccentric sounds

Eccentric sounds are excessively original and complex. Such sounds tend to provide too much information for the ear and as a result confuse perception. There are seven types of eccentric sounds:

Grosse note: The grosse note (W) is of a medium duration which, though it varies slowly, displays a unified,

consistent facture. Its consistent facture and clearly defined forme enable it to be described as a "note" and suggests a theoretically single sound source which thus creates an impression of unity at each successive stage of the matière's development. It could be considered as a gigantic type of balanced varied note: Y, justifying its close proximity to this column of the central box of balanced sounds in TARTYP.

Schaeffer referred to the grosse note as "inflated" ("gonfler")(99), perception of the matière being emphasized by its development and duration. He suggested that many examples exist in traditional music. On two occasions he cited a chord in Bach's Toccata in D minor as an example of a grosse note which was noteworthy not only for its harmonic function but also for the matière's apparently inexorable and consistent development(100).

Web: The web (T) has a longer duration than the grosse note and is formed by the superimposition of slowly evolving, similarly structured sounds. Because a web consists of several clearly perceptible sounds it does not, unlike the grosse note, display such a unified facture (it was in fact positioned in TARTYP in a column of "non-existent facture" though an additional indication in the diagram clarifies this). Webs are relatively common in traditional music. An example is the orchestral texture at the opening of Beethoven's ninth symphony.

Sample: The sample (E) is an extended eccentric sound with a continuous but disordered energetic progress. Because of its continuous nature the entretien creates the impression of a single sound source. Accordingly it displays a consistent facture despite being placed in the extreme left-hand column of TARTYP. As an instrumental example Chion suggested the:

> "(...) prolonged and incoherent sound produced on a violin by the clumsy bowing of a beginner."(101)

Further distinctions could be made according to

masse.

Accumulation: The accumulation (A), like the sample, has too extended a duration to be classified as balanced. Accordingly it is classed as a macro-object. However, unlike the sample, which was continuous, the accumulation displays a rapid succession of micro-objects each one of which has a similar facture and which produces a discontinuous entretien. In accumulations where the micro-objects follow each other extremely rapidly, producing an increasingly continuous texture, the distinction between this type and the sample could be very unclear. The sounds would then have to be assessed largely by context and focus of listening. Schaeffer acknowledged this:

> "So the extreme columns of our table meet up at their limits."(102)

Placed at the extreme circumference on the discontinuous

side of TARTYP the accumulation could also be further qualified according to masse. Examples of accumulations can be found in natural sound events such as the crackling of fire, and rain falling on a hard surface.

Each of the following three types of eccentric sounds was designated an "artificial object" ("objet artificiel")(103) by Schaeffer. Because of their particular qualities they appear to be applied exclusively to sounds of electro-acoustic origin though the cell does appear to have possible instrumental equivalents.

Cell: The cell (K) is of fairly short duration. It is a conglomeration of densely packed short, disordered sounds most easily produced by editing a small section of tape from a recorded, discontinuous sound. Due to the lack of order and disparity of its components it does not display any regular development. As it is formed of dissimilar short sounds it was placed beneath the column of discontinuous balanced sounds.

The cell would be difficult to produce with traditional instruments. A possible instrumental equivalent is a short flurry of varied percussion sounds.

Fragment: The fragment (ϕ) is another type of objet sonore created by editing a short fragment from a longer sound. Unlike the cell it is not disordered being removed from a relatively simple sound displaying tonic, complex or

varied masse. Placed in the column of impulses it is differentiated from them by displaying no "natural logic" in its entretien thus revealing its artificial origin. A short section edited from a dynamically unvarying sine-tone is an example of a fragment.

Pedal: The pedal(104) (P) is formed from a repeated cell. Consequently it is a prolonged, cyclic iterative sound of a fairly complex micro-object. Placed near to the box containing the special redundant pedal it differs from it due to the more pronounced nature of its cyclic characteristics. A pedal could also be produced from a cell by splicing the ends of the tape together to produce a loop. This would create a longer, cyclic macro-object notated Zk. It was called a "pedal of cells" and coincided with the pedal proper.

Redundant sounds

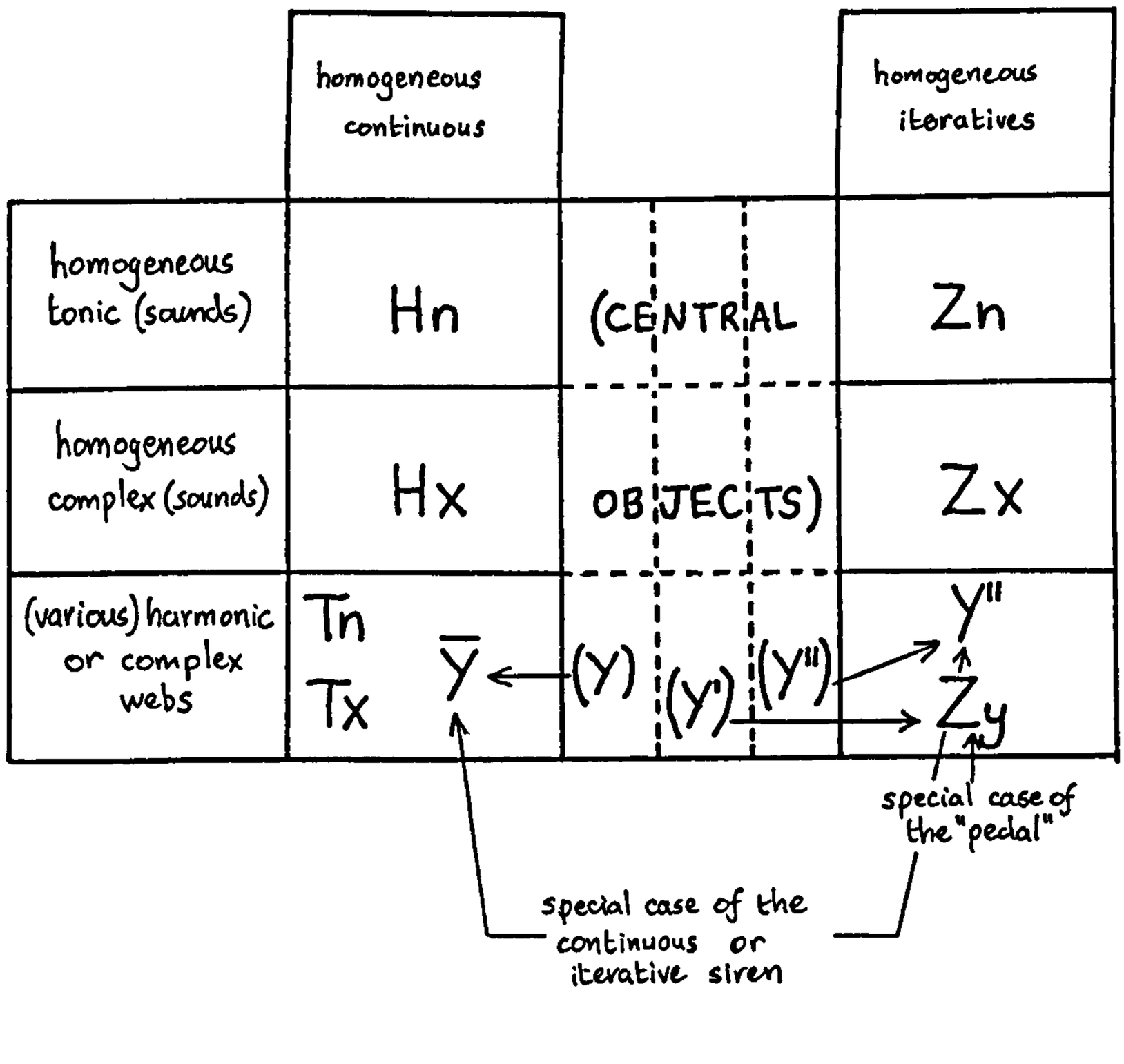
Redundant sounds are generally of long duration and are regarded as banal and too regular and thus insufficiently interesting to be generally considered "musical". Their length and lack of original development precludes any recognition of a satisfying forme or facture. Excessive length and unsatisfactory facture are the main causes of redundancy in a sound though it could also result from two specific cases of matière. For example, if the matière progresses throughout the duration without any change, the redundant nature of the sound would be a direct result of this fixed, stable masse. However, it is also possible

for a redundant sound to have an extremely variable but predictable matière. Due to such characteristics these sounds are generally produced by studio techniques and not found in traditional music. A "white noise" generator and filters could create such sounds with ease. Redundant sounds could be either continuous or discontinuous; there are two main types and two special cases. Diagram 5 (105) summarizes these types and illustrates the almost imperceptible differences between some of them.

Homogeneous sounds: Homogeneous sounds evolve neither in their matière nor forme. Such unvarying progression could, however, enhance the compositional value of this static matière. Its immobility might encourage close perception of whatever fine details exist within the matière. Instrumental analogies are difficult to suggest though a held note on the organ would be appropriate for the Hn type. Despite their discontinous nature, discontinuous homogeneous sounds such as Zn and Zx would still inspire little interest due to their excessive length and resulting lack of facture.

Schaeffer distinguished true homogeneous sounds and sounds which were "quasi-homogeneous" such as the extended tonic or complex notes in their continuous form: $\overline{N}$, $\overline{X}$ or in their discontinuous form $\overline{N}$", $\overline{X}$". In such cases their length imparts a certain homogeneity but unlike real homogeneous sounds they exhibit slight dynamic fluctuations.

DIA.5 : TABLEAU RÉCAPITULATIF DES SONS REDONDANTS OU PEU ORIGINAUX



The siren: This particular type is not included in TARTYP but displays sufficient originality to warrant a type of its own. The siren is characterized by a slow, continuous and predictable variation in the tessitura. It is notated by a $\overline{Y}$ as it could be considered a balanced varied note greatly extended in duration, thus it is also possible to distinguish a discontinuous version notated $\overline{Y}$". An air-raid siren is an obvious example.

Redundant pedal: The redundant pedal (Zy) is a special type of pedal whose cyclic repetition is less perceptible (though still predictable) than that of a pedal proper. Significantly in diagram 5 Schaeffer placed it next to the discontinuous siren which, with its regular rise and fall in the tessitura, could be perceived as having pedal-like qualities.

Redundant web: The redundant web (Tn, Tx) is a special web in which the evolution of the component sounds is hardly perceptible. The sole qualification is according to masse which could be either tonic or complex. In diagram 5 Schaeffer places these types next to the siren.

Varying sounds

A separate typology is provided for objet sonores which display internal variations of masse. The classification of these sounds appears to present problems. Although the previous typology does include sounds of varying masse (the grosse note and the sample for example) these types

have a "logical", predictable development which can be traced throughout the sound's duration. In addition varying sounds cannot be classed as samples which are of excessive duration and have no facture. Varying sounds are characterized principally by displaying a variation of masse which cannot be predicted as the sound progresses. This results in the variation itself demanding the main focus of attention and therefore it is the variation which provides the means of classification.

With only two exceptions the types in this typology repeat types that have already been described. It must be emphasized, however, that these variant types may differ greatly from their homogeneous or eccentric equivalents. For example, the grosse note has a clear facture which contributes to the perception of a consistent, regular development in the masse. The variant grosse note on the other hand would not develop in a consistent manner.

A variation can only be classified according to two notions. Firstly, a variation is determined by the way in which it progresses in time. Secondly, a variation is estimated by the speed with which it occurs. Schaeffer referred to the manner of the sound's progress as the "facture of variation"(106). This might appear to contradict the earlier definition of facture as a qualitative judgement which cannot be applied to unpredictable or excessively long sounds. The more neutral notion of entretien might have been preferable.

However, entretien refers to the unfolding of the sound's energy whereas facture refers specifically to the way a sound behaves which is more important when assessing varying sounds. In addition, the application of entretien would have been inconsistent. Entretien can be applied to all sounds regardless of duration and short sounds by definition cannot exhibit much variation. Facture is, therefore, appropriate if the variation is considered as a series of "changes of state" each one with its own individual facture.

Schaeffer divided facture into three sub-categories. Similarly he divided speed by considering three broadly different rates of change:

Facture

Fluctuation: The variation is scarcely perceptible.

Evolution: The variation is progressive and continuous.

Modulation: The variation is scalic, discontinuous.

Speed

Parcours: Slow rate of change.

Profil: Medium rate of change.

Anamorphose: Rapid rate of change.

The combination of these aspects produces the following typology:

TABLE 3 TYPOLOGY OF VARIATIONS

		speed		
		parcours	profil	anamorphose
facture	fluctuation	$\overline{N}$ $\overline{X}$	N X	N' X'
	évolution	$\overline{Y}$ T	Y W	Y' W'
	modulation	$\overline{G}$ P	G M	G' K

The two new types which must be added to the special varying cases are the motif and group. The motif occurs at the bottom of the middle column and the group occurs along the bottom row.

Motif: The motif (M) is of relatively long duration and evolves discontinuously at a moderate speed. It consists of several distinct components of complex masse each evolving separately. This discontinuous development distinguishes it from the grosse note and web which in many respects it resembles. Its speed of variation is situated between those of the slower pedal and faster cell.

Group: The group (G) is similar to the motif in its speed and length. In addition its evolution is also discontinuous and it has several distinct component sounds. The main difference is that the group consists of sounds of traditional music, that is tonic type masse,

rather than the complex or varied sounds of the motif.

This last point accounts for the double entries in the typology of variations. In each box the left hand entry refers to sounds of traditional music and the right hand entry refers to general examples. Schaeffer makes this point explicitly. Presumably he intended to make a clear distinction between sounds of traditional music which, generally speaking, do not have complex masse. However, the distinction seems to be very fine.

By formulating these sound types Schaeffer was able to create a sense of order in an otherwise largely undefined and amorphous sound universe. Thus the sounds of the traditional repertoire can be placed within the top six boxes of the area of balanced sounds in TARTYP with only the occasional inclusion of other types of sound. Indeed the expansion of sound resources in contemporary music can be mapped by charting the gradual increase in the use of objets sonores from these areas throughout the entire table of TARTYP.

Schaeffer provided a diagram (diagram 6) which summarized the entire "Programme". He named it the Tableau Récapitulatif du Solfège des Objets Musicaux or TARSOM (107). It is significant that the first column of TARSOM is headed "typo-morphological recapitulation" rather than "typological recapitulation". Schaeffer has attempted to impart two items of information in certain entries.

DIA. 6 TABLEAU RÉCAPITULATIF DU SOLFÈGE DES OBJETS MUSICAUX (TARSOM)

	1	2	3	4	5	6	7	8	9
Qualification (2-3) / Evaluation (4-9) of: / CRITERIA of musical perception	TYPES	CLASSES	GENRES	SPECIES (site and calibre of the dimensions of the musical field)					
				PITCH		INTENSITY		DURATION of variations of emergence	
	typo-morphological recapitulation	musical morphology	musical characterology	SITE TESSITURA	CALIBRE ÉCART	SITE POIDS	CALIBRE RELIEF	IMPACT	MODULE
1 MASSE	TONIC type N COMPLEX X VARIABLE Y OTHERS W, K T	1 PURE SOUND 2 TONIC 3 TONIC GROUP 4 CHANNELLED 5 NODAL GROUP 6 NODE 7 WHITE NOISE	characteristic TEXTURES of masse	Registers low-1 0 1 2 3 4 5 6 7 high 7 oct x 12 = 84 degrees HARMONIC → COLOUR	HARMONIC INTERVAL COLOUR THICKNESS	WEIGHT OF HOMO-GENEOUS MASSE [1 ppp 2 pp 3 p 4 mf 5 f 6 ff 7 fff]	PROFILE of the texture of masse		(threshold of recognition of masse of short sounds)
2 DYNAMIQUE	homogeneous H nil: iterative Z weak: web N, X formed: rete N, X impulse N' X' N, X cyclic Zk retentated E accumulated A	SHOCK V Anamorph: RESONANCE ∩ cresc. < decresc. > Profile: delta <> hollow >< mordant ^— Lifeless: flat ——	ATTACKS (dynamic timbre) 1 abrupt ▽ 2 solid △ 3 soft [powder] 4 flut [mor ∧] 5 gentle _ 6 stressed ◁ 7 nil ∩			WEIGHT OF A PROFILED MASSE according to its module [1 ppp 2 pp 3 p 4 mf 5 f 6 ff 7 fff]	MODULED OF PROFILE weak medium strong	slow / moderate / lively 1 2 3 4 5 6 7 8 9	SHORT SOUNDS MEASURED SOUNDS LONG SOUNDS
3 TIMBRE HARMONIQUE	either. GLOBAL TIMBRE or: SEC. MASSES / TIMBRE OF MASSES M1 HT1 M2 HT2 M3 HT3	(connected to masses) NIL 1-7 TONIC 2 COMPLEX 6 CONTINUOUS 3-4 CHANNELLED 4-5	CHARACTER-OLOGY OF THE SOUND BODY hollow-full round-pointed bright-matt	COLOUR dark light	FULLNESS narrow / ample 1 2 3 4	RIGHNESS poor timbre rich timbre	dan? / vol? 1 2 3 4	variation of: fullness colour richness no. 1-9	(threshold of recognition of masse of short sounds)
4 PROFIL MÉLODIQUE	Flue N, X / Evol Y, T / Modul G, P harmonic Y, X / Y, N / G, M Profil Y' / K	(only Notes Y) podatus / torculus / clivis / porrectus ✓	characteristic of profiles: pizz, melodic dragging etc	or site of profile (see masse)	melodic écart [weak / medium / strong]	linking of profil mélodique → to dynamic profile		slow / mod / quick 1 2 3 4 5 6 7 8 9	partial see col. 3 [beginning / middle / end] or total
5 PROFIL DE MASSE	typological evolution Flue N/X or Y/N Évol Y/N or Y/Y Modul G/W or Y/K	(thickness only) swelled < delta ◇ thinned > hollow ⋈	characteristic evolution of masse/harmonic timbre	incidence on the tessitura or colour (masse and timbre harmonique)	écart or interval or thickness [weak / medium / strong]	linking of profil de masse → to dynamic profile		slow / mod / quick 1 2 3 4 5 6 7 8 9	partial see col. 3 [beginning / middle / end] or total
6 ENTRETIEN — GRAIN	Pure or mixed in [resonance / friction / iteration]	tinkering / simmering / liquid rough / soft / smooth coarse / heavy / fine	harmonic compact-harmonic compact compact-discontinuous discontinuous discontinuous-harmonic	GRAIN APPRECIATED THROUGH MASSE OR TIMBRE colour of grain	thickness of grain	relative weight GRAIN-MASSE LINKED	dynamic texture of grain [weak / medium / strong]	variation of grain fullness/speed nos. 1-9	light / filled / loose 1 2 3 4 5 6 7 8 9
7 ENTRETIEN — ALLURE	Pure or mixed in [mechanical / live / natural]	Center / fluctuating / dispersion 1 2 3 4 5 6 7 8 9	regular cyclic vibrato progressive irregular abrupt decay muffled incident		distance of pitch and allure [weak / medium / strong]	relative weight allure/dynamique	dynamic contour of allure [weak / medium / strong]	variation of allure fullness/speed nos. 1-9	light / filled / loose 1 2 3 4 5 6 7 8 9

Consequently this first column can be confusing. A clear distinction must be made between morphological, "descriptive" types (which every entry contains) and typological types, indicated by a capital letter, which can be found only in the entries for masse, dynamique, profil mélodique and profil de masse. Thus where typological types are included they are meant to exemplify typical cases of types of objets sonores which display the characteristics of the appropriate morphological criteria. The absence of typological types in the entries for timbre harmonique, grain and allure indicate both the essentially descriptive nature of these criteria and the difficulty of reaching an assessment about them.

Typology thus provides a powerful terminology overlapping both the instrumental and electro-acoustic repertoires. In addition by examining the juxtaposition of various types, it is possible to see which sounds are closely related and by what means it would be possible to transform one type into another. New relationships and (dis)similarities are thus made more apparent.

1.12 The Classes of Morphology

After assigning an objet sonore to a particular type, morphology proper enables the constituent criteria to be examined in detail. The finer distinctions of the classes of morphology lead to a description of the sound as a structure made up of these criteria. Finer distinctions are invariably necessary if inclusion in a musical discourse is intended. The following example illustrates this point. A recording is made of many different types of piano sounds: glissandi, chords, individual notes. All registers and levels of intensity are explored, with varying degrees of pedalling. The recording is then examined. Typology will facilitate an initial sorting of these sounds. Even in quite dense sound textures articulation/appui will enable the isolation of individual sound events. If, for example, several objets sonores are extracted it is possible that they will all be classified as complex notes. For composers (and analysts) finer distinctions must be made. The distribution and fusion of the individual pitches may be perceptibly very different. In addition, some objets sonores may resonate to silence displaying a clear forme, resonant grain and live allure. Others may result from staccato sounds and thus have no opportunity to progress long enough in duration to allow the perception of a grain. Still others may have changes in masse and varieties of allure imposed by rapidly depressing and releasing the pedal. Typology will have served a purpose by aiding the musician in the

identification of objets sonores with musical potential and their classification as notes of complex masse. Nevertheless, it is clear that more precise differentiations must be made if subtle relationships are to be exploited. Furthermore, such differentiations are even more necessary if sound processing is to be exploited and new objets sonores created in order to elaborate these relationships into a musical discourse.

Morphological criteria are closely connected to the aforementioned notions of valeur/caractère. Theoretically all of the morphological criteria could participate in the valeur/caractère balance (the effectiveness of such participation is deduced by the stage of analysis). Therefore composers have at their disposal a greatly expanded range of criteria with which to create musical relationships. An early example of the use of a relatively unexploited morphological criterion as a valeur is in the tape work Etude aux Allures(1958)(108) by Pierre Schaeffer. In this work Schaeffer attempted to exploit various allures as principal articulators of musical structure. While this was a laudable attempt it is possible that the allures were perceived as aspects, albeit important ones, which qualified masse or forme rather than valeurs in their own right. However, excessive criticism can border on the mean spirited; the work was an étude. Schaeffer's subsequent researches into the problem of establishing valeurs, one of the most important issues in contemporary music, demonstrate that

such works doubtless led to many important conclusions. These are discussed in section 3.7.

The following are descriptions of the morphological classes. They are grouped as criteria of matière, forme and variation (the same order is adopted in the next two sections).

The three criteria of matière

Masse

There are seven classes of masse (also called classes of textures of masse):

Pure sound: This is the "thinnest" sound possible. It has no constituent harmonics to provide timbre harmonique and is thus equivalent to an electronic sine tone.

Tonic sound: In this class the masse consists of a single pitch occupying a defined area of the pitch-field. It is the type of sound most often heard in traditional music such as notes played on an instrument.

Tonic group: A tonic group is a group of several distinct tonic sounds. A chord on the piano provides a traditional equivalent.

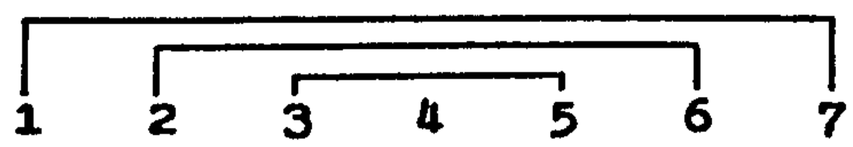
Channelled sound: This is an ambiguous class. Like the tonic group it consists of several component elements. These, however, can be either groups or notes each of which could be tonic or nodal. The sound of a bell or struck metal sheet in which distinct tonic sounds and/or nodal components can be heard exemplifies a channelled sound.

Nodal group: Like the tonic group a nodal group consists of several distinct, superimposed nodal sounds. Several cymbals played together is one appropriate instrumental analogy providing their sounds are in close proximity in tessitura.

Nodal sound: The nodal sound displays a compact, complex masse. An instrumental example is the sound of a single struck cymbal.

White noise: This is the artificial electronic white noise in which the entire pitch-field is occupied with pitches that vary statistically both in frequency and amplitude.

It is instructive to arrange these seven classes of masse in a symmetrical order around the central class of channelled sound.



This demonstrates Schaeffer's arrangement of classes by placing the two extreme classes at either end. These represent the thinnest and thickest masses. The classes numbered 2 and 6 are sounds occupying a narrow band of the pitch field and those numbered 3 and 5 consist of the superimposition of several distinct bands. The expansion in musical terminology afforded by the notion of masse is clearly demonstrated when one considers the artificial nature of the two extreme classes, pure sound and white noise, and the scarcity of the classes of nodal group and nodal sound in traditional music. Only the classes of tonic sound and tonic group exist to any extent in traditional music though the preponderance of both nodal sounds and nodal groups in contemporary music resulting from the increased use of percussion instruments should be noted. Thus these classes provide a more comprehensive description of the pitch-field than hitherto.

Timbre harmonique

As this criterion is so inextricably linked to masse it is extremely difficult to specify classes of timbre harmonique. However, Schaeffer did distinguish five classes, each relating to a particular class of masse:

Nil: This is applicable to only two classes of masse: pure sound and white noise. In the former case there are no harmonics thus there can be no timbre harmonique. In the latter case as the whole field of pitch is occupied no timbre harmonique can be perceived.

Tonic: This class is for tonic sounds. The timbre harmonique corresponds exactly with the perception of the harmonic spectrum of tonic masse.

Continuous: The continuous class is applied to tonic groups. This was similar to the above class but was applied to groups rather than individual sounds.

Channelled: This is for channelled sounds and nodal groups. There could be hybrid cases where a potentially channelled sound could be perceived as belonging more appropriately to the previous, continuous class if the majority of its components are tonic sounds.

Complex: This class applies to nodal sounds.

Grain

The classes of grain are derived from natural analogies. Each of the three types of grain previously described has

three corresponding classes. This classification is subjectively expressed and depends on how coarse or fine the grain is perceived to be. In the following table each class progresses from left to right becoming increasingly fine and imperceptible. In practice the distinctions between the classes of resonant and fricative grain are dependent on the objet sonore's entretien (or lack of it). In addition it is unlikely that there is much difference between a fine, iterative and a rough, fricative grain.

TABLE 4 CLASSES OF GRAIN

Type	Class		
resonant	quivering	swarming	lucid
fricative	rough	matt	smooth
iterative	coarse	clean	fine

The two criteria of forme

Dynamique

In order to determine the classes of dynamique the most important factor is to what extent the onset of the objet sonore influences the subsequent evolution of its dynamic profile. If the objet sonore has no entretien, as in the case of the impulse, the onset itself assumes the most significant role in the sound's classification. Indeed, with an extremely short burst of sound energy there is little else to perceive. In the cases of other types that do have entretien the objet sonore's dynamique could be

largely or even totally independent of the onset.

The first two classes are those of objets sonores whose profiles are determined by the onset. This pair is called anamorphosed.

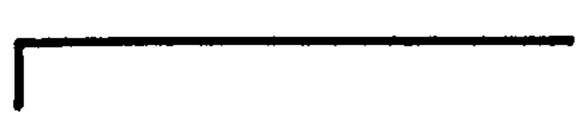
Shock: The onset influences and is therefore related to the subsequent dynamic and spectral profile of the sound. Many percussion-resonance sounds are of this class where the sound's development is initiated by a single gestural action which excites the sound body.

Resonance: The onset causes a specific noise which rapidly decreases in intensity leaving a distinct separate resonance. This class includes the "double"(109) sound of instruments like the vibraphone or bell. Another instrumental analogy would be two percussion instruments struck simultaneously. If the resonance of one sound is rapidly dampened the resonance of the second could appear to behave independently.

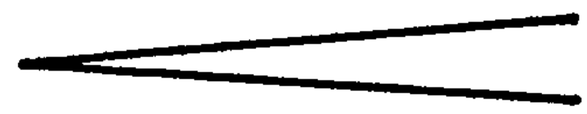
In objets sonores where the profile is not determined by the onset there are six classes. It is noteworthy that with traditional musical instruments true independence of the onset and the subsequent energetic development is rare. The first few milli-seconds of most sounds yield a great deal of information. It is likely that the following classes are mainly relevant to manipulated

sounds. Schaeffer added diagrams in TARSOM to represent these classes:

<u>Lifeless</u>: Producing a regular, homogeneous sound distinguished by the absence of a clear profile.



<u>Crescendo</u>: Profile increasing.



<u>Decrescendo</u>: Profile decreasing.

<u>Delta</u>: Crescendo followed by decrescendo.

<u>Hollow</u>: Decrescendo followed by crescendo.

<u>Mordant</u>: A point of intensity followed by a prolonged, fixed lesser level of intensity.

<u>Allure</u>

The nine classes of allure are derived by combining the three types of allure with three types of behaviour: order, fluctuation and disorder. Schaeffer numbered these to facilitate indications of change in allure. This suggests that they form a continuum from the most to the least regular allure. The classes numbered 1,5 and 9 are considered to be the most "normal cases" which might occur

in "natural" sounds.

TABLE 5 CLASSES OF ALLURE

Type	Class		
	order	fluctuation	disorder
mechanical	1	2	3
live	4	5	6
natural	7	8	9

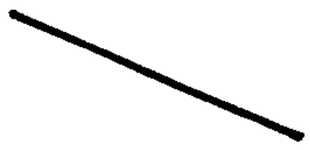
The two criteria of variation

Profil mélodique

The classes of profil mélodique are restricted to sounds that are continuously variable and thus only refer to Y type notes. The vast number of possible slight fluctuations or scalar variations precludes precise classification of such sounds. As a result Schaeffer resorted to the use of four medieval neumes which indicated a general direction of the variation. The general profile is indicated schematically:

Podatus 

Torculus 

Clivis 

Porrectus 

Profil de masse

As in the case of profil mélodique there are only four classes of profil de masse Like the use of neumes these four classes could only give a general indication of change in the thickness of the profil de masse. They are:

Swelled

Delta

Reduced

Hollow

1.13 External Morphology

External morphology is a distinct study in itself and raises important questions concerning the perception of an objet sonore as a unified whole, whereas morphology, properly speaking, describes an objet sonore in its contexture. External morphology provides a basic description of objets sonores which are constituted of several distinct elements. Consistent with the methods already established the sound is examined by means of écoute réduite and no consideration is given to the sound's causal origin. Though regarded as a secondary study, external morphology reveals important questions concerning the perception of an objet sonore as a unified whole or, in certain cases, an amalgam of several disparate objets sonores. In all such perceptual evaluations the notion of the object/structure chain(110) is relevant and these considerations are necessarily context-determined. For example, it may be important to understand at what point perception is "exhausted" by a long relatively complex objet sonore and begins to perceive it as a succession of several connected objects rather than one structure. Equally it may be significant for a composer to try and establish to what extent several disparate yet simultaneous objects fuse together.

The entire study of external morphology is based on two pairs of concepts: composé/composite and accident/incident.

Composé/Composite

Composé: An objet sonore is described as composé if it is composed of several simultaneous distinct elements which combine into a single, though possibly irregular profile. A web or grosse note might be described as composé if the individual components are heard as one sound while exhibiting independent behaviours.

Composite: Composite describes objets sonores which consist of several successive elements, each displaying an individual profile. Careful cross-fading between two or more objects would be described as composite.

Accident/Incident

Accident: An accident is essentially "musical". It is an intrusion of another sound into the objet sonore's forme. Despite being a distinct addition to the sound the listener's perception can account for it and accept it as part of the objet sonore.

> "Accidents usually represent an additional, unexpected element which intervenes in the evolution of sound. (...) Accidents are appreciated in their own right which suppresses the effect of suprise which generally accompanies them."(111)

Incident : An incident is also a noticeable disturbance of the sound but unlike accident it is perceived as alien to the objet sonore and is thus undesired and unmusical. As

an example of an incident Chion cites the unwanted click that often occurs at the end of a recording made on a disc as a "parasitic disturbance" ("perturbation parasite")(112).

1.14 Characterology and Genres

After the stages of sorting and description achieved by typology and morphology the stage of characterology is the first explicit exercise in applying the "Programme" to composition. It illustrates the direction of Schaeffer's "Programme" by preparing for the next stage of analysis and the final stage of synthesis. However, by its very nature, characterology is in many ways the most elusive stage of the entire "Programme" and was dealt with briefly by Schaeffer.

Characterology's function is the definition of genres of sounds. A genre is a collection of objets sonores each of which displays morphological criteria interacting in a specific manner. This produces a group of similar objets sonores. This concept and its fundamental significance can be illustrated as follows: a recording of a large metal sheet struck by a hard mallet is examined. Its type is determined as a complex note with resonant grain and live allure. Further description by morphology reveals a channelled masse and harmonic timbre. The dynamique and profil de masse become progressively reduced throughout the sound's duration. In addition further descriptive modifications are made and a smooth grain and slightly disordered allure are identified. If other sounds are examined, regardless of source or degree of possible manipulation, and the criteria display enough similarities of behaviour they all belong to the same genre. Genres

will create sub-categories within typological types. There is only one type of complex note but numerous genres of varying sizes subdivide it. Thus characterology begins to collect objets sonores together into distinctive families, the members of which resemble each other due to a global assessment of how their constituent criteria interact.

The essential difficulty of specifying genres results from the potentially limitless combinations of criteria. Chion summarized the difficulties thus:

> "Everything that is associated with the connexions among criteria is indeed well known in principle, but difficult to make an inventory of, to classify (...)"(113)

According to Schaeffer the most common aspect of any sound is the immediate perception of its combined characteristics(114). This enables an assessment of an objet sonore as "metallic", "percussive" or "resonant". Though these descriptions may seem vague such classification is the norm with concrete sounds where certain criteria invariably develop together. The gradual reduction in both spectral content and dynamique in percussive-resonant sounds is an example. Indeed it has been suggested that many electronic sounds are unsatisfactory precisely because they subvert these natural patterns of behaviour(115). This raises the possibility that during sound evaluation listeners refer, consciously or not, to a pool of natural sounds stored in the memory. These sounds are used as bench marks for

subsequent classification and comparison. If a sound is placed in a genre it is equivalent to describing it as: "a '---like' sound'" ("dans le genre de")(116).

It must be stressed that it is the interactions of criteria which determine genres. Sounds displaying identical criteria are not necessarily placed in the same genre. The role of the dynamique in causing different interactions between identical criteria furnishes many examples. In early experiments Schaeffer was able to confuse instrumental classification by altering the sound's dynamique, especially the first few milliseconds of the onset (an example of this was given in section 1.3 in connexion with the "cloche coupée"). By removing the onset and equalizing the dynamique (but <u>not</u> manipulating the spectral content) a piano sound might come to resemble that of a flute. Thus the sound would be transferred from a "piano-like" to a "flute-like" genre.

The notion of genre has ramifications in instrumental thought. Each particular playing technique, such as arco or pizzicato, produces notes which, if they are in a fairly limited register, have specific "physiognomies". These general physiognomies are nothing more than genres. Instruments can produce several genres which can overlap with genres of other instruments. The creation of families of sounds has been an inevitable product of the use of instruments which, due to convenience and tradition, became accepted as norms. The notion of genre,

true to its concrete origin, can transcend such exclusive categories.

In the third column of TARSOM Schaeffer attempted to place the genres of each criteria into their respective boxes. Each criterion was examined independently according to the most common cases of combinations in concrete sounds. The almost infinite number of possible genres that would result from correlating each criterion with all the others precluded a comprehensive listing. In attempting to produce a work method Schaeffer resorted to considering the most common evolutions of morphological criteria and their progression in duration.

The three criteria of matiere

Masse

The genres of masse are the numerous ways in which the masse of the sound can be distributed throughout the tessitura. Schaeffer called these "characteristic textures of masse". Such distributions could display particular characteristics making them "thin", "thick" or concentrated in a particular register. Moreover, it was possible to have mixed cases where various distributions were combined. The infinite number of combinations precluded the possibility of clearly differentiating these genres.

Timbre harmonique

As with masse, delineating the genres of timbre harmonique

could be no more exact than a provision of general descriptions of the criterion. Such adjectives ranged from "hollow" to "full", or "round" to "pointed" and are thus very subjective.

Grain

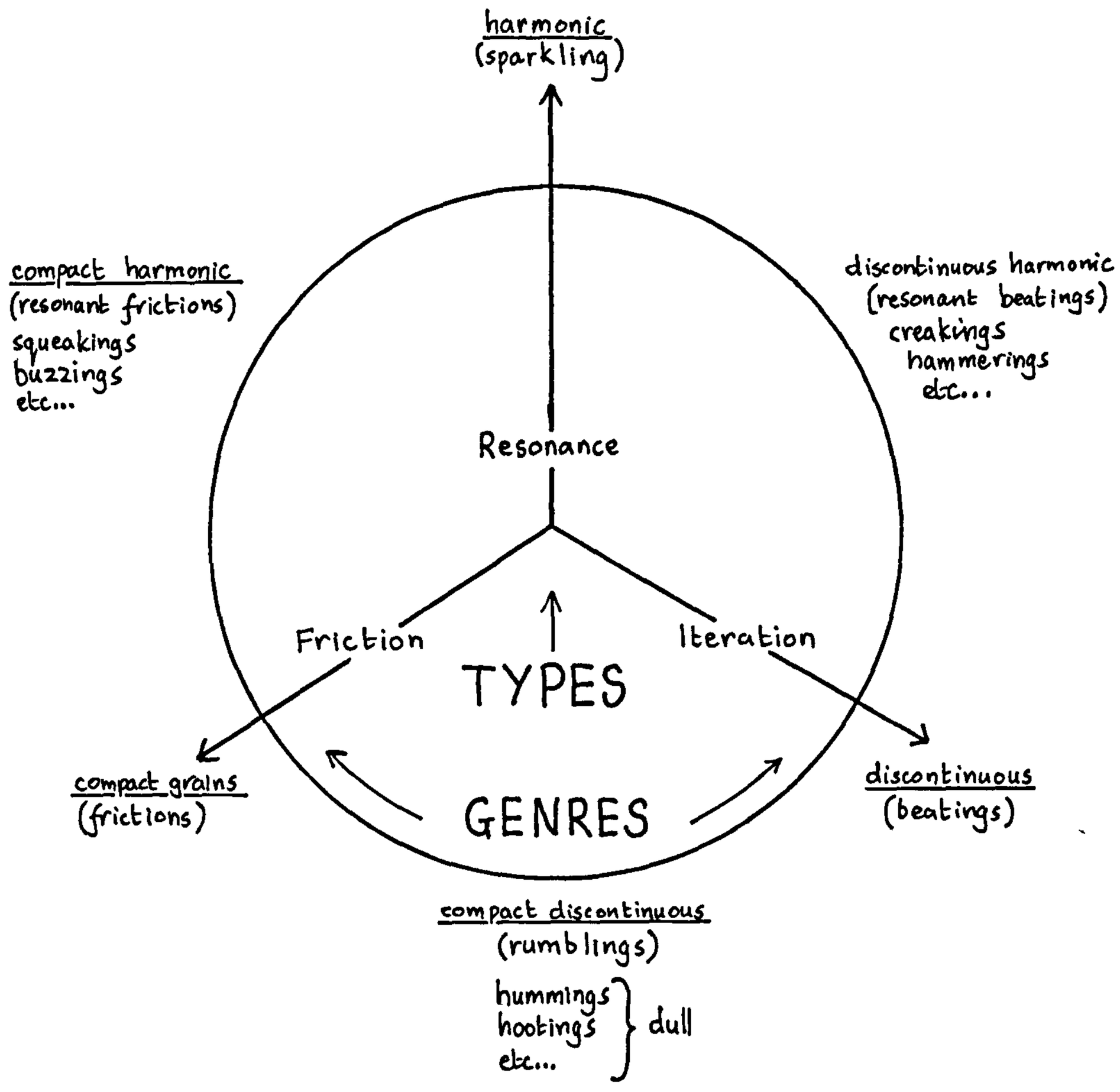
It is often possible to perceive several different types of grain combined in the same objet sonore. Three genres of grain correspond exactly to the three types. Thus the type "resonance" corresponds with the genre "harmonic". Likewise "friction" corresponds to "compact" and "iteration" corresponds to "discontinuous". Schaeffer's diagram(117), (see diagram 7) demonstrates the subjective nature of the genres of grain.

The two criteria of forme

Dynamique

The genres of dynamique were really the genres of the onset of the sound, which was called a "sub-criterion" by Chion(118). As mentioned previously many of Schaeffer's experiments confirmed the importance of the role of the onset in the global perception of the sound. He was able to demonstrate two cases of this phenomenon. In instrumental identification the first few milliseconds of the sound are decisive in the evolution not only of the dynamique (this was to be expected) but also the masse and timbre harmonique. In addition, the perception of certain sounds was shown to result from a retrospective evaluation

DIA.7 - TYPES AND GENRES OF GRAIN

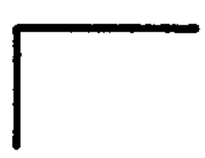


of the evolution of these criteria after the onset(119). The result of these experiments therefore caused Schaeffer to specify the possible effects that an onset would have on the evolution of both dynamique and masse by differentiating respectively two aspects: "steepness" and "colour". The seven genres of dynamique are:

Abrupt 

Strong 

Soft 

Flat 

Gentle 

Sforzando 

Non-existent 

These are graded in approximate degrees of steepness. The first three, for example, usually refer to percussion-resonance type sounds. In the dynamic profiles of the other genres the strength of the onset decreases. These genres, along with the effects they exert on the dynamic and harmonic profiles, are represented in diagram 8(120).

DIA.8 GENRES OF ATTACK

DYNAMIC TIMBRE		1	2	3	4	5	6	7
	Bathygraphic Trace							
GENRES OF ATTACK	Nature of attack	ABRUPT or explosive	STRONG	SOFT	FLAT	GENTLE	SFORZANDO or sbress	NON-EXISTENT or very progressive
	conventional symbol							
		(impact or plectrum) without appreciable resonance	(felt hammer) with strong close-knit resonance	(pizz. or soft drum-stick) with resonator	(pseudo attack) or mordant	established sound without apparent attack	or rapid crescendo	perception of the profile
PREDETER-MINATION OF PROFILE according to the genre of attack	dynamic profile	dynamic peak (impact)	regular falling away	reinforcement of the resonator	nil, except the pseudo-attack	nil profile	characteristic profile. generally short sounds	only threshold case emergence of profile
	harmonic profile	double sound (2 timbres)	reduction	response of the resonator	nil in instruments like the organ. varied in elec. music or strings	often progressive profiles	characteristic timbrage	profiles more often linked or artificially independent

Allure

The genres of allure are formed from combinations of the three types of allure. As these progress, broadly speaking, from "mechanical" (regular oscillations) through "live" (slight irregularity) to "natural" (disordered) the genres are accordingly ordered in a progression from most to least ordered:

Regular or cyclic vibrato

Progressive

Irregular

Abrupt decay

Muffled

Incident

The two criteria of variation

Profil mélodique and Profil de masse

The genres of both criteria of variation are extremely approximate. For the genres of profil mélodique Schaeffer had to be content with denoting the characteristic feature of the sound's profile such as "pizzicato" or "dragging".

Schaeffer's attempts to formulate genres of profil de masse are complicated by the difficulty of disassociating this criterion with a variation in timbre harmonique (see the definition of timbre harmonique in section 1.10). Consequently the genres of the two are largely synonymous.

1.15 Analysis and Species

The stage of analysis as outlined in the "Programme" is, like characterology, largely conjectural. Analysis is where:

> "(...) one evaluates the capacities of different sound criteria to form échelles in the field of perception. The degrees of these potential scales are called species and one seeks to situate them in the three perceptual fields of pitch, duration and intensity."(121)

In the creation of genres, characterology indicates a fundamentally musical assessment of sound families. Analysis is a further stage in the return to musical composition. The genres of characterology already imply the predominance of certain criteria. Indeed without this predominance objets sonores could not be grouped into distinct families. The function of analysis is to investigate the potential that a criterion might have for forming échelles. This is an essential precondition if the composer is to exploit relationships which are more sophisticated than those based solely on concrete differences between the sounds - like that of a "primitive" musique concrète.

Schaeffer identified two types of échelle. One is called "cardinal", the other "ordinal". Either échelle can have a varying number of individual steps or "species" according to the particular criterion under consideration. In the cardinal échelle the position of each species could be evaluated without reference to the others. Only

species of tonic type masse can produce cardinal échelles, since the faculty of "perfect pitch", which can place a sound in the tessitura accurately and independent of context as well as naming intervals, has no correlate in the fields of duration or intensity. In the more common, ordinal échelle the position of each individual step can only be assessed according to its relative position. Therefore species of ordinal échelles are context-dependent.

Echelle-creating potential is confirmed by establishing that one, or possibly two, criteria in objets sonores of a particular genre are perceived in preference to the others. This preferential perceptual bias is encouraged by the law "PCV2". Thus differences in certain criteria are perceived because other criteria do not change. If the varying criteria can be perceived clearly then a legitimate claim could be made that a particular criterion has been "abstracted" from the sound. An example is as follows: a large genre of "metallic, percussion/resonance-like" objets sonores is examined. It is possible that if the masses are classed as tonic then they could be related according to an échelle of this criterion. Likewise the dynamiques, which must resemble each other (otherwise they would not be in the same genre) have different durations and these can be similarly organized. These criteria, individually or in conjunction, might provide the principal bases for the creation of musical structures. However, this appears to

have achieved little more than create an imaginary, gigantic (and probably mis-tuned) piano; the criteria were chosen deliberately. If the masses are complex rather than tonic Schaeffer's system would still provide a framework. More significantly, if the objets display few differences in masse or dynamique but varieties of grain or allure are detected then these criteria can be selected and (possibly) formed into échelles. At all stages of the composition the composer would attempt to ensure that the selected, differing criteria are perceived in preference to the others. The former would be the valeurs of a new musical language, the latter would remain as caractères. Schaeffer's persistent attempts to establish firm foundations for the formation of échelles of all criteria demonstrate his concern for the viability of expanding the bases of musical discourse. Echelles, however rudimentary, would, he believed, be capable of creating "vectorial tensions" on the model of cardinal échelles of pitch.

Analysis is directed by the pair: <u>critère/dimension</u>. This pair defines the relationship between the morphological criteria and the "triple perceptual field" of pitch, intensity and duration. Each criterion is assessed according to two notions: <u>site</u> and <u>calibre</u>. The site of the criterion is the position it occupies in each particular field and the calibre is the amount of the field it takes up.

In the diagram of TARSOM the last six columns are devoted to the stage of analysis and are characterized by the vagueness of their entries, often simply an array of numbers, or even the occasional blank entry. Rather than an abdication of precision by Schaeffer it is a recognition of the difficulties of creating ordinal échelles. Further difficulties arise from the context-dependency and the subjectivity that inevitably increases the nearer composition is approached.

The "triple perceptual field of the ear"

Before an investigation of the species of analysis it is necessary to review the peculiarities of site and calibre in each of the three perceptual fields:

Pitch

The field of pitch is the most completely described. Schaeffer named the site and calibre tessitura and écart. Tessitura is used in the same sense as in English and is easiest to determine if the pitch belongs to either the tonic class or if it is a pure sine-tone. In these cases tessitura corresponds to the musicians' notion of the absolute value of pitch. The tessitura, however, becomes more difficult to determine if the pitch is complex or varied and thus more difficult to locate.

The term écart means the distance or gap between two objects or values. Schaeffer possibly wanted to avoid the

words for "space" or "distance" as these might imply a horizontal rather than a vertical axis. The écart in the field of pitch is the extent to which the pitch field is occupied by the sound. In addition it enables an assessment of all variable pitch-dependent criteria. Thus écart is used not only in échelles of masse and timbre harmonique but also allure, grain, profil mélodique and profil de masse. Evaluations by écart facilitate assessments of the amount of variation that such criteria exhibit in the pitch-field.

Intensity

The site and calibre in the field of intensity are named poids and relief. Poids expresses the quality of something which has weight and is, therefore, an appropriate expression for the site of intensity. The lack of an absolute value for intensity meant that the poids is assessed as the relative intensity of a given sound in a particular context. Poids can also be used in comparisons with one or more components of the sound in its contexture.

Relief is a term used in sculpture to express a contour of an embossed form and is widely used to refer to something which juts out. The relief is extremely difficult to evaluate. As it implies the occupation of a field of intensities, there has to be movement between various degrees of the field to be perceived. It is therefore assessed as the difference between the maximum and minimum

poids of such movements.

Duration

The notions of site and calibre in the field of duration are named impact and module. Impact expresses the effect of an action during which two things come together. The English word "impact" implying a collision is perhaps too strong in the Schaefferian sense. The impact attempts to measure both the:

> "(...) 'effect of the nature and speed of a variation' (...)"(122)

and the way in which this variation became apparent in a particular context. It is therefore extremely subjective. The impact of a dynamically weak sound could be assessed as greater than that of much stronger sounds if it becomes conspicuous due to other factors. For example, a relatively quiet variable note high in the tessitura could be assessed as having greater impact than surrounding, louder sounds if the listener's attention is directed to it(123). Thus the impact could be based more on differences of pitch, stability and originalité than relative volume. An assessment could be attempted by comparing the objet sonore's duration with the amount of variation. Accordingly two objets could have identical durations, but if one varied through a more extensive area of the tessitura it's impact could be greater.

A module is a standard unit of measurement to which everything is related and is thus an appropriate term for

the calibre of duration. The metre, for example, is the module for length. The module depends on the criterion being assessed. Thus for allure and grain it could be a measurement of the relationship between the amplitudes and rates of change of the fluctuations. In the case of criteria such as profil mélodique and profil de masse it could express the total duration of the criterion's variation.

The following is a description (where possible) of the species of each criterion. The order of the previous section has been maintained and the criteria of matière are described first, then those of forme and finally those of variation. Following the example of TARSOM, the criteria are subdivided successively into the three perceptual fields and their subdivisions.

The three criteria of matière

1 Masse

Both entries in TARSOM in the field of pitch accommodate the "harmonic" and "coloured" areas of pitch. The distinction between these two areas is of the utmost importance. The "harmonic" area of pitch contains tonic type objets sonores which are the most suitable for the creation of cardinal échelles. The "coloured" area contains the complex type of masse. Objets sonores of this type tend to create ordinal échelles. This is

discussed further in section 3.7.

i) Pitch:

Tessitura - the tessitura of a masse of definite, fixed pitch is synonymous with its absolute pitch level in the traditional sense of the term. This is indeed the only precise evaluation of the site of any criterion. With complex masses evaluation is more qualitative and therefore less precise. For these classes of pitch Schaeffer proposed nine registers from extremely low to extremely high.

Ecart - the écart of tonic masse is simply the interval in the traditional sense between the highest and lowest pitches. In the cases of other types of masse, evaluation is much less precise and is qualified relatively by adjectives such as "thick", "very thin" etc.

ii) Intensity:

Poids - This is very difficult to assess as it is dependent upon many, usually variable, factors during the objet sonore's progress. Moreover, the dynamic level of a sound is usually relative to other aspects under consideration. For example, in an objet sonore with chanelled masse, a particular component pitch might have its own dynamic level.

Relief - This could only be evaluated by the difference between maximum and minimum levels of the poids.

iii) Duration:

Impact - This entry is left blank in TARSOM because the impact of a sound is directly related to the degree of variation in the field of intensity as assessed in the sound's relief. As such the assessment of these two aspects is indivisible.

Module - This could be linked to other aspects of the sound which give rise to an awareness of duration such as the profil mélodique and the profil de masse. It is also dependent on the minimum time required to perceive a sound's masse.

2 Timbre harmonique

Perception of timbre harmonique is less precise than masse. Accordingly its evaluation is very vague.

i) Pitch:

Tessitura and écart - Both of these are assessed by combining the assessment of dark-light for the tessitura and narrow-full for the écart. There are naturally mixed cases of these. These can be little more than a subjective evaluation in conjunction with masse.

ii) Intensity:

Poids and relief - The close affinity between masse and timbre harmonique makes any separate assessment of either poids or relief extremely difficult. They could be determined approximately by combining the notions of

poor-rich for the poids and the criteria of density and volume for the relief.

iii) Duration:

Impact - In the course of a sound's evolution the timbre harmonique can vary in richness, colour etc. The degrees of this variation are numbered in an approximate scale from 1 to 9 by combining the variation in "richness" with the speed of variation (slow, moderate or quick).

Module - Like masse this refers to the minimum time needed to perceive a timbre harmonique.

3 Grain

As grain is the criterion which connects matière and forme, aspects of either could easily affect grain's assessment.

i) Pitch:

Tessitura and écart - If the grain is clearly perceptible and, via ecoute réduite, can be separated from its associated masse then its tessitura would be assessed as a particular "colour" relating to the masse. The écart would be assessed as having a certain "thickness" perceived due to the fluctuations in the matière.

ii) Intensity:

Poids - As in the assessment of tessitura in pitch, if the grain is heard separately its poids would be relative to

the poids of its associated masse.

Relief - This could be evaluated according to the general amplitude of the fluctuations of the grain, as weak, medium or strong.

iii) Duration:

Impact - By combining the three values of the relief stated above with three values of the module (tight, full or loose) it is possible to formulate nine values of impact. Such a table is particularly valuable when evaluating species of grain which vary during a sound's duration. The table Schaeffer proposed in TARSOM is constructed as follows:

TABLE 6 IMPACT OF GRAIN

	tight	full	loose
weak	1	2	3
medium	4	5	6
strong	7	8	9

Accordingly a value of 1-4-9 would have species of grain evaluated as tight-weak changing to tight-medium and finally loose-strong. If the sound is perceived as having several grains these would need to be analysed separately.

Module - As explained above there are only three approximate modules of grain: tight, full and loose.

The two criteria of forme

1 Dynamique

i) Pitch:

Schaeffer deduced that it is impossible to give any table of values to the species of the tessitura or écart as the relationship between the dynamique and the masse is so complex. Schaeffer made no entries in these boxes of TARSOM due to the vast number of possible entries.

ii) Intensity:

Poids - This is assessed by the traditional, and relative, notion of dynamic level. The range of levels is tabulated from fff to ppp. However, it is necessary to take into account the module of the sound which would affect the assessment of its poids. Thus there is an intimate connexion between the duration of a sound and its perceived intensity.

Relief - Also called "module of profile", this was an approximate assessment of three degrees of speed of dynamic evolution: weak, medium and strong.

iii) Duration:

Impact - The impact is evaluated according to the three degrees of the speed of the profile (slow, moderate and lively) and the three degrees of the relief. This produced the following table:

TABLE 7 IMPACT OF DYNAMIQUE

	slow	moderate	lively
weak	1	2	3
medium	4	5	6
strong	7	8	9

Module - This has been mentioned in the entry for poids.

2 Allure

As allure is a divergence in pitch and/or intensity during the duration of a sound it is extremely difficult to evaluate its species in these fields. The main evaluation is undertaken therefore in the species relating to the calibres of allure because an assessment of "congestion" or "saturation" of an area is easier than attempting to locate a precise, fixed site.

i) Pitch:

Tessitura - This is impossible to evaluate as the tessitura would be constantly varying. The only possibility was the assessment of a central tessitura above and below which the sound undulates.

Ecart - This is an approximate evaluation of the movement in the tessitura. It is assessed in three degrees: weak, medium and strong.

ii) Intensity:

Poids - This is evaluated according to the relationship of

the sound's allure to the general dynamic level. As such it is very approximate and is expressed by the term: relative weight - allure/dynamique.

Relief - This is often related to the écart of the sound and is evaluated according to three degrees: weak, medium and strong.

iii) Duration:

Impact and module - These are evaluated in a similar way to those of grain. The three values of module, that is the number of undulations in the duration, are combined with three values of relief. The proposed table is:

TABLE 8 IMPACT/MODULE OF ALLURE

	tight	filled	loose
weak	1	2	3
medium	4	5	6
strong	7	8	9

By means of this table it is possible to evaluate both sounds which have a consistent allure and those in which the allure changes. This affects the extent to which the sound's impact could be assessed.

The two criteria of variation

1 Profil mélodique

i) Pitch:

Tessitura - this is evaluated in a similar way to the tessitura of masse.

Ecart - The écart of the profil mélodique is evaluated as the distance the variation is judged to move in the tessitura. This is assessed in three degrees: weak, medium, strong.

ii) Intensity:

Poids and Relief - Both of these species are closely connected to the dynamic profile from which they are inseparable. The arrows crossing the boxes of intensity in TARSOM are a device to indicate the three vertical entries of the table in the box of impact, and thus show that the boxes of intensity are not involved.

iii) Duration:

Impact - The impact is an assessment of the speed of variation in three degrees: slow, moderate, quick. By combining these with the three degrees of écart a table of nine values is produced which attempts to outline the development of the variation:

TABLE 9 IMPACT OF PROFIL MÉLODIQUE

	slow	moderate	quick
weak	1	2	3
medium	4	5	6
strong	7	8	9

Module - The assessment of the variation's module could be complicated according to whether the variation affects the whole sound or only a part of it.

2 Profil de masse

The intimate connexion between this criterion and the profil mélodique enabled Schaeffer to repeat the same system of evaluation of species for both, with the sole reservation that the écarts of the profil de masse are usually less clear than those of the profil mélodique.

1.16 Synthesis

Synthesis is the last stage of Schaeffer's "Programme". It could not be included in the diagram of TARSOM because it was the act of musical composition to which all the others stages aspire. The creation of an infinite number of objets sonores could not be tabulated. Chion expressed the goal of synthesis thus:

> "Synthesis itself aims to create objets musicaux, made of 'networks of criteria' which 'placed together may display (...) a structure of easily perceptible valeurs'. For this it must conceive of a new way of thinking of instruments, or 'tablature', adapted to a new theory of musical structure."(124)

Synthesis, in its broadest definition, takes place whenever objets sonores are created and organized in a way that communicates musical meaning according to the law "PCV2". Thus it need not be solely restricted to objets musicaux created by electro-acoustic techniques, though such techniques can enable sounds to be shaped for the particular compositional context in a unique way. As objets sonores can originate from sounds of traditional instruments or other sound sources, they could equally well be created from pre-existent sound elements. Guided by the framework proposed by the "Programme", their inherent musical qualities could be directed to produce comprehensible, expressive musical structures.

The stage of synthesis is closely connected to those of characterology and analysis. In both of these stages Schaeffer demonstrated his intention of retaining a

greatly expanded model of instrumental thought through the concepts of the law "PCV2", caractère/valeur and the notion of genres. Furthermore, in analysis he stressed the need for organizing objets sonores within these genres in a way that would promote the creation of abstract musical structures displaying directional tensions analogous to échelles of tonic masse. The synthesis of objets musicaux would enable the families of sounds to be augmented. This would extend and elaborate relationships discovered by the previous stages of the "Progamme". Furthermore, such processes could in turn initiate the discovery of new sound relationships. The provision of musical skills developed by the "Programme" intended to ensure that the notion of creating music from chosen sounds was directed and purposeful. Synthesis recognized the intrinsic qualities of sounds but also their inherent ambiguity, and realized that sounds are multi-faceted if organized in a creative manner. Such re-assessments originated from fundamental aspects of human perception and invention.

If the final stage of synthesis was always hypothetical it was because no matter how scrupulous the preparations were, the results had to be verified by perception, the capriciousness of which can never be predicted with complete certainty. Schaeffer said that creating structures from basic elements was at best uncertain and that the "object-structure chain" becomes:

"(...) unravelled in one direction like our

> "grandmother's knitting. There is no possibility of knitting it up again so easily by progressing from pre-existing objects to automatic structures."(125)

The value of the "Programme de la Recherche Musicale" rested on its provision of a comprehensive, detailed method for approaching an understanding of the interaction between the universe of sound, human perception and compositional potential.

Chapter 2

The Cologne School

2.1 Introduction

In addition to Schaeffer's research group, only one other studio was established in the period between 1948 to 1970 which can be regarded as significantly affecting European musical thought(126). This was the Studio fUr elektronische Musik(127) at the Westdeutscher Rundfunk(128) in Cologne. The reputation of this studio has come to occupy a particularly prominent position in the evolution of contemporary music. The eclipse of the music and researches of Schaeffer's group by the Cologne studio is implied in many accounts of the electro-acoustic medium's history(129). Developments in Paris are usually discussed as if they were little more than a colourful prelude to subsequent events in Cologne. In addition, the impression is given that the ideological foundations of the Cologne studio, which encapsulated the technological beliefs and aspirations of the post-war formalist avant-garde, were the main forerunners of contemporary musical languages. Although the vociferous polemical stances and quasi-scientific arguments of the Cologne-based composers are today regarded with greater scepticism, they formed a large body of committed texts apparently unmatched by the painstaking researches of Schaeffer and his colleagues. An evaluation of electro-acoustic music's influence must be able to explain

the apparently unrivalled reputation attained by the Cologne studio during the period under investigation.

2.2 The Foundation of the Cologne Studio

A detailed account of the Cologne studio's early history is unnecessary in this study. However, a brief outline of relevant details will clarify the origins of the relationship between this studio, serial thought and developments in Paris.

Unlike the personal, and somewhat haphazard, creation of the studio of the "Groupe de Recherche" by Schaeffer, the Cologne studio was instigated by a number of influential men who were able to coerce the Westdeutscher Rundfunk into providing funds and facilities. Two of the studio's founders, Werner Meyer-Eppler(130) and Robert Beyer(131), had given lectures at Darmstadt in 1950 on the "Sound-world of electronic Music" (die Klangwelt der elektronischen Musik). The following year the same title was used for a programme broadcast by the Westdeutscher Rundfunk featuring electronic sounds - called "sound models" (Klangmodelle)(132) - created by Meyer-Eppler. The programme was presented by Herbert Eimert(133) who shortly thereafter with Meyer-Eppler, Beyer and others(134) instigated the founding of the studio which was operational in 1953.

The distinction between these men and Schaeffer could scarcely be greater. Although Schaeffer's intellectual accomplishments are impressive his background was that of a technician who became a composer and researcher. By

contrast, the founder members of the Cologne studio were established academics and composers who gave a degree of authority to the studio's standing in German musical life. Although there was no single dominating figure comparable to Schaeffer both Eimert and Meyer-Eppler were especially influential in establishing studio policy. Eimert's commitment to serial thought affected all aspects of studio work; Meyer-Eppler's contribution stemmed from the influences of his researches in phonetics and communications science. From the outset the combination of these concepts imparted a musical and intellectual direction to the work undertaken in the studio.

The Cologne studio was not established simply in response to Schaeffer's researches. For decades the Germans had demonstrated their interest in the musical applications of technology(135) and the Cologne studio can be considered as a more refined continuation of these activities. There is no doubt, however, that Schaeffer's work attracted much attention and encouraged some of the initial impetus to explore the possibility of combining recording technology and music. During the period immediately preceding the studio's foundation musique concrète from Schaeffer's group had received performances and broadcasts in Germany and stimulated great interest amongst musicians. In addition, during 1951-2, Karlheinz Stockhausen(136), who was working at Schaeffer's research group, informed Eimert of developments in Paris. Stockhausen also played Eimert his own Konkrete Etüde(1952)(137) and two tape works by

Boulez(138) while Eimert was in Paris to give a broadcast on French Radio. Although the relationship between the studios was cordial Stockhausen's assessment of the early works produced at Cologne confirmed their individual musical direction. He stated that the German works were:

> "(...) influenced by the French 'musique concrète' and the American 'tape music', but in a more indirect sense because they were opposed to the instrumental orientations of both."(139)

The particular influences of Eimert, Meyer-Eppler and later Stockhausen himself ensured that a wholly different raison d'être emerged for the Cologne studio. The purely electronic sound world, which had no need for traditional reference structures, became the focus of attention for musicians in Cologne.

2.3 The Relationship between Electronic Music and Serial Thought

If an experimental approach can be said to have supported work undertaken at Schaeffer's research group then serial thought fulfilled a similar role at Cologne. The extent to which serial thought influenced studio policies was of the greatest importance and was a product of the studio's founders who were committed to serial thought's development and dissemination. German musicologists, many of whom remained unconvinced(140) by early electronic works, agreed that the conceptual premises of serial thought created the artistic conditions, if not the technical skills, necessary for the growth of electronic music.

> "The transition from serial to electronic music is justified by arguments that suffer from far--reaching deficiencies. This changes nothing about the historical fact that serial music was the prerequisite which electronic (music) took up."(141)

Only the first electronic works realized by Eimert and Beyer before the studio was fully operational were composed "freely"(142). Thereafter the potential of the electronic medium for the precise realization of serial aims ensured that the strict application of serial methodology dominated all aspects of studio practice.

The Cologne studio was not unique in being dominated by serial thought. The ramifications of serial methodology came to be of the utmost importance for many musicians in

post-war Europe, though its influence seemed to be particularly pervasive in Germany(143) where the need to renew musical language was perhaps felt more strongly than in other countries. Such a widespread acceptance ensures that the influence of serial thought can be identified in many of the most important works of the period(144) whether instrumental/vocal or electro-acoustic. However, even this cannot in itself explain serial thought's influence on the development of the Cologne studio throughout the nineteen-fifties and -sixties.

Although it would be an exaggeration to suggest that electronic music could not have developed without serial thought, the mutual advantages of the relationship ensured unanimity of objectives. Initially, exponents of electronic music abdicated any attempt at formulating a separate, inherently "electronic" identity:

> "Numerous essays of composers who were allowed to work with Eimert in Cologne each, in their way, conclude that; 'In the meantime electronic music is not 'just' music, but serial music'."(145)

The inseparable nature of the two areas originated in the belief that only through electronic music could the demands of serial thought be rigorously fulfilled. These demands were the principal concern for many post-war composers.

Serial thought was not an unchanging, monolithic body of dogma. Different works often required unique sound repertories, and stylistic demands encouraged flexible

application of serial techniques. Such refinements are particularly important for contemporary music but are difficult to understand without examining the close, and increasingly problematic relationship with electronic music. Thus, the concurrent progression of both was a distinctive feature of German music in the post-war period and an accurate assessment of the influence of German electronic music would be incomplete without fully understanding the significance and complexity of this relationship.

A detailed examination of the historical development of serial thought is inappropriate in this study. Nevertheless, a brief summary of its characteristics is necessary to clarify its enthusiastic adoption by composers of electronic music.

Serial thought was an extension of the compositional techniques of composers of the "Second Viennese School". Schönberg's system of composition with twelve-tones had developed from the particular musical-historical situation of the nineteen-twenties. In following decades it was considered to be an intellectually artificial construct which could guide the reorganization of the elements of music, and thus renew musical language. Schönberg did not consider himself an iconoclast. He believed he was an inheritor of the Austro-German musical tradition; the founders of the Cologne studio thought that they, too, were continuing this tradition by their use of serial

thought. The unique position of the music of Webern in the canon of works admired by composers in Cologne merits special attention. His pre-eminence was based on advances in serial theory detected in analyses of his works(146). Eimert even stated that:

> "Many of Webern's structures seem like premature electronic fragments."(147)

While such claims should be regarded with caution they underline the extent to which Webern's music inspired major conceptual advances. Many of his compositions were analysed, and considered examples of ways in which various sound aspects could be differentiated and organized as separate and independent parameters. Although Webern used traditional instrumental resources, which necessarily ruled out true parametric independence(148), his compositional techniques were used as models by post-war composers. Accordingly, Schönberg's twelve-tone method and its preoccupation with pitch was transformed into a more comprehensive, essentially serial, concept. Composers applied the series and its derived forms equally to duration, articulation, dynamic levels and instrumentation. In addition, notions such as determinacy or comprehensibility were eventually included within the new musical framework. Thus, an increased number of sound aspects and methods of organization became part of the serial organization of musical structures and the proportioning grid(149) of the series created the unity, in theory if not in practice, that was the ideal for many composers.

Stockhausen's description of serial thought, written in 1953, was a typical assessment of the advantages that composers hoped would result from the adoption of such techniques. Although Stockhausen conceded that Webern's methods were comparatively rudimentary he asserted that they could form the basis of a comprehensive system. The evolution of every parameter could be regulated from the lowest to the highest structural level in instrumental music, the series being present, though not necessarily perceptible, at each level:

> "The rudimentarily employed serial thinking of Webern proves to be the only method which is universally capable of being developed that the transitional style of the last 50 years has left for us. - The serial principle generally implies that for one composition a limited choice of various dimensions is made; that these dimensions are proportionally related; that they are ordered in a certain succession and in certain interval distances; that this choice of series is made for all elements with which one is to compose; that from this 'fundamental series' further successions of series of super-ordered Gestalts can be composed that are in turn varied serially; that the proportions of the series are the comprehensive structural principle of the work to be composed and that they shall give it the necessary consistency."(150)

Many composers had a quasi-mystical faith in the unifying properties of integral serialism. By separating and relating each parameter of sound, composers felt able to distance themselves from the process of realization in favour of generating structures unified by the series - if only on paper(151). The abstract nature and undeniable facility for generating structures, regardless of performance considerations, that serial thought encouraged was believed to be a positive advantage, though it was an

extreme position few adopted permanently. Purely conceptual scores were composed which, if they could be realized at all, could only be done with great difficulty(152). In his article "The Emergence of Electronic Music" (Die Entstehung der Elektronischen Musik), written in 1953, Stockhausen admitted the conceptual nature of musical thought at that time:

> "Initially we did not think of other means of realization; furthermore, we simply did not think in the first instance of an instrument or with an instrument; first we wanted structures, systems, proportions; we thought of the tones themselves as carriers of structural functions."(153)

It was becoming increasingly obvious that rigorous serial application by means of the traditional instrumental repertory was not entirely viable.

Thus, in the search for ways to direct the new electronic medium the framework provided by serial thought was extremely attractive. To create effective relationships between sound aspects, individual parameters had to be controlled with accuracy. Such control was one of the principal advantages that the electronic studio could offer composers of serial music. In 1958 Paul Gredinger asserted that serial thought would produce:

> "(...) the transformation of every quality into a quantity (...)"(154)

By adopting the notion of the series as a set of controlled proportions it seemed feasible to compose with "physical dimensions" of sounds. Such a quantitative view of sound appeared to be particularly suitable to electronic generation since the three parameters of

frequency, duration and dynamic level could be accurately and objectively measured.

The application of serial methodology became such an integral aspect of studio practice in Cologne that a precondition for access to studio facilities was the acceptance of both the conceptual foundations and effectiveness of serial techniques(155). Furthermore, the potential of even the relatively simple equipment in the early studio must have been intimidating for composers with no technical experience:

> "Nevertheless the sum total of possibilities with which these men were then confronted must have been intoxicating, even disconcerting. From the outset the problem was how to avoid being submerged in the infinite sea (of possibilities) and how to control the new experiences artistically.
>
> At that point in time the serial system presented itself as the most useful method. The 'series' showed a way of making a meaningful choice out of millions of conceivable combinations; the elements could be co-ordinated and organized according to a super-ordered principle. Without having to 'worry about the damned violin', as Beethoven once had to, one could be carried along by the spirit and create the total serial composition.
>
> This meeting of two stages of development, synthetic sound production and the serial principle, will in the future be rated as an important moment in music history."(156)

It is significant that the above quotation emphasized the "spirit" of serial composition in preference to the methods of realization. Concept all too often preceded percept. The adoption of an established framework with clearly expressed objectives accounts for much of the self-assured nature of German theoretical writings. Like

Schaeffer, they recognized that the electro-acoustic medium need not utilize traditional, instrumentally based music theory. This attitude was confirmed by concurrent, unsuccessful attempts to realize serial aims by means of traditional instruments.

2.4 The Rejection of Instrumental and Concrete Sounds

The most obvious effect of the new relationship between electronic music and serial thought was the increasing distrust of both instrumental and then all non-electronic sounds by many composers. The desire for the consistent application of the same series in all parameters began to make impossible demands on both instruments and instrumentalists. One sound aspect that eluded real control was that of timbre. Control, and therefore unity, could not be extended to the micro-level of instrumental sounds. While pitch, duration and dynamic levels could be serially organized with some success, timbre established a permanent point beyond which composers could not pass. Creating a timbre series was fraught with difficulties when using traditional instruments. Pre-formed timbres were limited in number; they could be mixed in various instrumental combinations but new timbres could not be created ab initio. The problem was summarized as follows:

> "The number of timbres is severely restricted in traditional music: one can certainly mix timbres; but they do not create a connected, unbroken series. Instead they are separated from each other by gaps, as individuals"(157)

Inconsistencies were apparent even within the sound repertory of a single instrument. Stockhausen's impatience with instrumental sounds was unmistakable; at the time of composing Kontra-Punkte(1952-3)(158) he demanded:

"(...) a clarinet...that could still stay the

same clarinet over three octaves !"(159)

Thus serial thought began to impose unavoidable restrictions on the most basic stage of musical composition; the choice of which sound repertory would be appropriate for inclusion in a particular musical context. Although serial thought facilitated the creation of structures which required parametric independence, few suitable sounds existed. Before an electronic alternative was available the principal criterion in the selection of instruments for many composers was an "ideal" sound - ideal for serial demands. The following comment was made in reference to early instrumental compositions of Karel Goeyvaerts(160) and Stockhausen:

> "This (the serial control of timbre) required at the same time the possibility of a total parametric combination: each desired timbre could be combined with each desired dynamic, duration, relative frequency, and vice versa. Because this inter-parametric agreement had to be realized as perfectly as possible they favoured, in their instrumental works, instruments like vibraphone, glockenspiel and tympani, that seem to come closest to the ideal of a 'trans registral' and 'trans dynamic' timbre identity, (identical timbre in all positions and at all grades of intensity)."(161)

The interdependence of parameters inherent in instrumental sound production meant that insufficient control was available to achieve this. Nevertheless, it was imperative to remove this inconsistency as the accurate differentiation and transformation of timbre remained an irrevocable serial ideal. Only by adopting alternative means of sound production could this final hindrance to serial aims be removed.

Comments in the extensive correspondence between Stockhausen and Goeyvaerts in the early nineteen-fifties(162) offer evidence that serial ideals preceded and promoted interest in the electro-acoustic medium. Although neither composer had any substantial knowledge of or practical experience with electro-acoustic procedures, there were constant demands for types of sounds that were inherently impossible with instruments. They remained optimistic, however, that such sounds could be created in the studio, with concrete sounds. Only after his arrival at Schaeffer's studio in Paris could Stockhausen begin to verify these assumptions.

Stockhausen's experiences with musique concrète revealed the extent to which he was primarily concerned with realizing a conceptual scheme beyond instrumental capabilities rather than investigating the concrete sound world. In connexion with his "personal experiments"(163) Stockhausen wrote:

> "Now I wanted a structure that I could utilize in an étude, already worked into the microdimensions of a single note, so that in every absolutely tiny moment the all embracing principle of my idea would be present."(164)

This revealed the conceptual, essentially serial, desire for "unity" from the micro-level to higher, formal levels that exasperated his French colleagues. Stockhausen produced carefully worked out plans for parameters such as pitch, timbre and duration prior to any attempt at realization in the studio. But the viability of his whole scheme depended upon his sounds retaining timbral homogeneity throughout their duration. No single timbre

should dominate on account of the listener's perception being attracted to a change in spectral content or excessive dynamic level. Consequently a large proportion of his own practical studio work was directed towards achieving this ideal. His solution was to splice together the onsets of recorded piano sounds in an attempt to produce a sound that remained spectrally consistent throughout the course of its dynamic envelope. These sounds were subsequently transposed in pitch and organized according to his serial plan. Nevertheless, he could not achieve the homogeneity he wanted; certain timbres always seemed to attract too much attention. After much effort he was forced to conclude:

> "'Musique concrète', I realized this from the first day, is nothing more than a capitulation before the uncertain, it is a very dilettante-like game of chance and unbridled improvisation. (...) We shall use electronic sound in future. It will make everything easier, cleaner, more reliable - and we shall govern the sounds - not the sounds govern us."(165)

Despite completion of, and short-lived satisfaction with, his Konkrete EtÜde, Stockhausen's first studio experiences proved to him that all pre-formed sounds, whether instrumental or concrete, suffered from the same deficiencies. Consequently the musique concrète studio could not offer any solutions to Stockhausen's musical problems.

There was a large measure of truth in Stockhausen's attributing the failure of these attempts to the characteristics of the pre-formed sounds and crude

realization techniques. It is possible that some of the problems would have been reduced, if not surmounted, with more sophisticated manipulation techniques based on magnetic tape rather than discs. Nevertheless, however laudably consistent he was to his serial aims, it is difficult to escape the conclusion that he was using the medium to extend control in an instrumental fashion(166). He attempted to use the studio as a "super-instrument", resistant to normal instrumental problems. These early studio experiences led to a wholly different attitude towards the "instrument". While Schaeffer started to re-define this concept from his research standpoint, other composers (particularly serial composers) believed that the function of instruments was the accurate realization of abstract schemes. Demands for precise control in all parameters became increasingly urgent. This was never Schaeffer's intention, nor did it conform to Stockhausen's original task of description and classification. Legitimate though Stockhausen's disagreements with Schaeffer may have been, they arose from fundamentally different opinions regarding the application of the electro-acoustic medium(167). Stockhausen was not alone in using the musique concrète studio in an instrumental fashion. His efforts to realize serial-instrumental aims by means of studio techniques were pre-dated by similar attempts by Messiaen and Boulez(168). Both composers tried to control the spectral content of sounds by tape manipulations, though neither composer appeared to have any greater success than Stockhausen and, significantly,

neither repeated studio work with Schaeffer.

Stockhausen subsequently attempted the creation of artificial spectra using discs in the basement studio of the P.T.T in Paris. He tried to superimpose sine-tones on top of each other and, by controlling each individual "overtone", to create controlled spectra. Though these primitive efforts at additive synthesis were equally unsuccessful(169) they were the forerunners of later more satisfactory work in Cologne where the relationship between serial thought and electronic music would eventually reach its culmination:

> "With this argument (the synthesis of timbres) the serial compositional process could be legitimized by demonstrating its possible realization by means of electronics; on the other hand, electronic music could be legitimized by being presented as the only possibility for the rigorous realization of serial music."(170)

2.5 The Reassessment of Serial Thought

Although electronic music came to be considered the ideal medium for the realization of serial objectives it was not merely a passive recipient of influences. The relationship was characterized by an exchange of ideas and the new medium of electronic music prompted in its turn a critical reassessment of serial thought. The changes which serial thought was forced to undergo were, perhaps, inevitable. Even if electronic music had never been developed, and serial thought had been restricted to realization solely by the traditional instrumental repertory, there are indications its importance would have diminished(171). So many compromises were incorporated that despite electronic sound realization strict serial methodology in the nineteen-fifties appeared to be heading:

> "(...) towards a climax which at the same time meant that serialism became surmounted as though eaten away from within."(172)

Because serial aims could be achieved for the first time by means of the electronic studio, a real assessment of serial thought was possible, and because of the widespread use of serial techniques, any modification or rejection would have ramifications for the composition of instrumental and vocal music in general. No mitigating excuses need be made regarding the imperfection of instrumental or concrete sounds. Likewise, in works existing only on tape, performers could no longer be accused of inaccuracy. This aspect of the relationship

was recognized and, in reference to the musical situation of the nineteen-fifties, Eimert wrote:

> "Electronic music gave an immediate insight that it contained within itself quite different and more far-reaching serial possibilities than instrumental music could have realized. One can say that instrumental/serial music according to the criteria of electronic music technique - as attested by Stockhausen, Boulez, Koenig and other composers - was no longer what it had been previously."(173)

Stockhausen's first electronic compositions, completed in the first seven years of the Cologne studio, show the progression from strict serial methodology to a freer, but more compromised, approach by means of adjustments caused by studio practice. Detailed analyses are beyond the scope of the present study but certain aspects will illustrate the gradual autonomy of the electronic medium and, if not the total abandonment of serial thought, an increasingly flexible application of it.

Stockhausen's first two electronic works were the elektronische Studien(1953-54). They were more successful continuations of his earlier attempts at additive synthesis in Paris. Strict serial procedures were employed at all levels of formal organization (though, interestingly, even in these first works some details such as dynamic levels were "subject to negotiation")(174). The most important aspect was the creation of spectra, and this did not allow such compromises. In this parameter there was an innovative and fruitful exploitation of the potential of the electronic medium. Studie II, in particular, displayed spectra whose component sine-tones

have frequency relationships based on the 25th root of 5. Such spectra could not be produced by any method other than additive synthesis. Although these studies reveal an almost instrumental, "pointillist" concern with the "note" as the basic level of structure(175), the cherished desire for controlling all aspects of the composition from the same set of proportions is evident. Although the work was a success from many points of view it is significant that once this control over all aspects of sound became feasible Stockhausen did not attempt to realize further works of this nature. His refusal to exploit this area is significant. It would have been possible to continue to compose different spectra with other proportions, to explore different densities, dynamic levels, sound envelopes and so on. The principal question after the Studien was not so much the creation of structures (which was practically limitless) but how aurally rewarding such structures would prove to be. Stockhausen probably realized that no matter how accurate the realization, the vocabulary of these works was unavoidably limited. There was greater potential in other possibilities for sound manipulation and organization and the composition of further works like the elektronische Studien was a digression that he avoided.

These Studien (and perhaps only these) can be considered as the culmination of serial aims. The studies, and it must be emphasized that they were studies, can be compared in two senses to the early concrete études of Schaeffer.

Firstly, neither composer repudiated their respective works, but equally neither regarded them as anything other than starting points, first tentative steps towards exploiting, in their different ways, the enormous potential of the electro-acoustic medium. Secondly, because they were starting points, neither Schaeffer's nor Stockhausen's early works are truly representative of subsequent developments in either Paris or Cologne.

In his following electronic composition, Gesang der Jünglinge(1955-6), serial procedures were still applied to the organization of material. But the sounds' constitution inherently contradicted serial ideals. They were not created with the same time-consuming additive synthesis techniques of the two previous works. Dense sound complexes were created by statistically filtered impulse successions which could not be controlled in the same way as single sounds. In addition, Stockhausen related modulated sine-tones, noise-bands and impulses to the phonemes of a boy's voice. Thus his basic elements were no longer stable sine-tones. The combination of serial techniques to mediate between disparate sounds, and statistical procedures (acquired in his studies in phonetics and communications theory) led to a richer sound repertory than the Studien.

In Kontakte(1959-60) these tendencies are even more pronounced. Although serial proportions are still evident in the large scale structure of the work a freer typo-morphological approach is noticeable in the choice

and creation of the sounds. There are two versions of Kontakte. A version for electronic sounds on tape, and a second version which combines this tape with instrumental resources. In the latter version Stockhausen refers to sounds on tape as "sounds like cow-bells with leather-covered beaters" ("klingt ähnlich wie Almglocken mit Lederschlägel"), "skin-like" ("Fellähnlich") and "metal-noise" ("Metallgeräusch")(176) and relates the electronically generated sounds with those of the live instruments. This indicates explicit references to "real" instrumental sounds the creation of which required perceptual verification and affirms Kontakte as an important example in Stockhausen's output(177). It is likely that a main contributory factor to the success of both Gesang der Jünglinge and Kontakte is this conjunction of serial formal organization and a more instinctive, typo-morphological approach to sound classification and organization.

Careful pre-compositional planning, ensuring well directed efficient practice, was not a monopoly of composers of serial-electronic music. Although the value of perceptual verification was never denied(178), strict serial ideology tended to preclude too much intervention as an unacceptable compromise. Constant aural checking and refining was such a natural, inevitable part of the studio process that despite the rigours of serial organization compromises and modifications were bound to occur. Willingness to submit to serial realization without any

perceptual verification and adjustment could not be sustained. Indeed in Cologne it was eventually recognized that studio practice made the intervention of composers more, rather than less likely. In a series of radio talks in 1965-6 Stockhausen said:

> "(...) the composer of electronic music does not only sit at a desk and write his musical ideas on paper as up till now, but is actually present himself at the sound realization over long periods of time and reacts much more to the sound material that is selected in experiments, constantly listens and thereby - firstly without noticing it himself - works much more closely than before, since he controls every single sound hundreds of times until it is ready and fits it into context."(179)

This was certainly not an expression of detached serial control and could not have been said ten years earlier. Thus the medium that was supposed to promote objective musical organization started to assert itself and, in encouraging the increased role of perception, was principally responsible for a reassessment of serial thought.

2.6 Foundations of Electronic Music

Meyer-Eppler was responsible for introducing into electronic music additional concepts which were as influential as serial thought. Researches into phonetics and communications science - particularly information theory - benefitted not only the aims of sound synthesis, but also composition in general. Unlike serial thought which had instrumental counterparts, these notions were introduced into music by means of the electro-acoustic medium.

The researches in phonetics and communications science were closely linked. Investigating speech sounds by means of their purely acoustic rather than semantic aspects, and determining how such sounds are transmitted and perceived, is an important part of improving communication systems. Only by discovering what parts of vowels or consonants are essential to their accurate recognition can an efficient system be constructed. Synthesized sound was used extensively in these phonetic researches. The importance of speech sounds in sound research was recognized as early as the late nineteenth century by both H.Helmholtz and C.Stumpf as part of their acoustic researches(180). Although Meyer-Eppler's researches concentrated on sound's acoustic as opposed to specifically musical properties they were extremely useful to early attempts at synthesis. Unlike most of the other founder members of the studio he already had considerable experience with sound synthesis

as part of his work in creating "Klangmodelle". These synthesized sounds influenced much of the early work in Cologne(181). Many aspects of sound identified by phonetics such as the difference between "harmonic" vowels and "noisy" consonants, the transitional stages between plosives and fricatives and the notion of formants were relevant to an understanding of the complexity for sound synthesis. Additive synthesis, for example, could be described in phonetic terms:

> "The development of synthetic speech starts initially from stationary sounds, especially voiced vowels, for whose representation all the procedures utilized in music production are basically suitable and by means of which the timbre can be freely chosen. Helmholtz, Miller, Stumpf and others have shown that it is possible to put together speech sounds from harmonic oscillations providing one had at one's disposal sufficient overtone-free sound producers (e.g. tuning forks)."(182)

The other principal means of synthesis - subtractive synthesis - was also used in phonetic experiments. Progressive filtering of speech sounds was used to establish what frequencies were important to the recognition of consonants. Meyer-Eppler, therefore, had greater experience in such techniques than most musicians and was guided by scientific-acoustic criteria.

Phonetic researches also involved sound classification and description. Types of sound such as vowels, consonants, fricatives and plosives all have to be included within a comprehensive system. However, a universal system cannot exist if only known speech sounds are available for study. All types of sound must be considered. Meyer-Eppler had

already identified the difficulties of a systematization of timbres and the interdependence of parameters which was to cause many problems for composers of instrumental/vocal serial music:

> "Until the present day the procedure practised to investigate analytically the structure of available sounds can only create a system in certain cases (e.g speech sound). In general, however, the gaps between the colours of known sounds is so large that we still cannot talk of a real systematization of timbres. An improvement of our hitherto merely imperfect knowledge of the universe of sounds, therefore, can only be expected when systematic research of every possible sound on the basis of synthetic sound production is carried out. Mechanical sound producers, e.g. musical instruments of normal construction, are not sufficient for this purpose because it is almost impossible to change individual acoustic data in them without simultaneously influencing the remaining characteristic values. By comparison, electrical sound production already offers with relatively modest means a great number of possibilities for sound research."(183)

Because of the "legitimacy" of phonetics, vocal sounds were the only concrete sounds that did not appear to compromise the otherwise exclusively electronic repertory of Cologne. Although this distinction was partly based on the simplistic notion that the mere inclusion of a concrete sound in a work was enough to make it part of the genre of musique concrète, it does emphasize the unique position accorded to such sounds. Consequently the musical value of vocal sounds, even the exploitation of their semantic content, was admitted. For this reason German musicians could justifiably claim that the inclusion of vocally derived material in Gesang der Jünglinge and Epitaph für Aikichi Kuboyama(1960-62)(184) was not a sign of the abandonment of electronic

principles:

> "Thus in electronic music numerous sound and speech possibilities coincide; since 1956-7, pure electronic music had been decisively expanded by these without using musique concrète and (without) relinquishing something of the 'electronic' concept."(185)

Phonetics were not Meyer-Eppler's only field of expertise. At Bonn University he conducted seminars in which texts were cut up into ever smaller sections to estimate the amount of redundancy in language. It is likely that information theory's link with statisical and probabilistic notions was a stimulating counter-balance to the deterministic nature of serial thought. Even if many of these notions were naively applied there is no doubt that they influenced many composers at the Cologne studio. Stockhausen, for example, said of his studies with Meyer-Eppler:

> "We studied phonetics, information theory and communication science. Both in phonetics (as in the analysis of sound categories) and information theory statistical methods are of prime importance. So we did a lot of experiments trying to compose artificial texts and using cards, lottery, roulette or telephone directory numbers in order to determine their structure. (...) So he (Meyer-Eppler) taught me concepts such as matrix, micro- and macrostructure, chance, field etc. which I then integrated into my compositions. (...) it's from such experiments that I derived the inspiration to compose my first sounds with statistical characteristics, staying within a given field of certain limitations."(186)

2.7 Methods of Sound Synthesis in the Cologne Studio

Many of the early techniques for sound creation and manipulation in Cologne were similar to those used in Schaeffer's studio. For example, the following techniques listed by Eimert in 1954 can be compared with those enumerated by Chion in section 1.3:

1) Superimposition of layers of sound.
2) Playing in succession of two musically identical recordings.
3) Splicing.
4) Structuring of dynamics by equalization.
5) Rhythmic structuring by transference of time values into centimetres.
6) Alteration of tape speed to change tempo and sound spectrum.
7) Reversal of the recording.
8) Tape loops (ostinato forms).
9) Any desired rhythmic succession of tape and blank tape to create rhythmic excerpts according to a given sound scheme.
10) Mixing of recordings to create tone-colour transformations.
11) Control of the progress of sound by:
    a) natural acoustics.
    b) feedback.
    c) phase shifting up to 1/10 sec. of two identical recordings.
12) Distribution of the sound event to several loudspeakers located in space.(187)

Some techniques on both lists are identical, such as splicing, loops, reversal and change of tape speed, though there are conspicuous ommissions and repetitions in Eimert's list. For example, the distinction between the first and the tenth techniques is unclear, as is that between the second and the eighth. In addition, techniques five and nine seem related to principles of serial structuring. Curiously, filtering is not mentioned although Eimert must have been aware of the technique through Meyer-Eppler's researches.

There were three methods of German synthesis: synthetischer Aufbau (additive synthesis), analytischer Abbau (subtractive synthesis) and synthesis by impulses. The acoustic researches of the nineteenth century scientists Helmholtz and Stumpf were referred to in directing this work at Cologne. Though neither scientist had access to electronic technology both conducted experiments into the analysis and synthesis of sounds. For example, sound analysis was conducted along empirical lines with the aid of resonators and tuning forks and Helmholtz attempted to synthesize "vowels" using tuning forks(188). In addition, Fourier's theorem, that all periodic wave forms consist of a sum of simple oscillations, was utilized and extended from harmonic to inharmonic sounds. However, Fourier's theorem could not be applied rigorously. In this early period of synthesis the full importance of other perceptual factors such as phase relationships and the role of a sound's onset in determining its timbre were not fully appreciated.

Synthetischer Aufbau: In this procedure single, discrete sine-tones were layered on top of each other literally to "compose" sounds. Due to the unchanging nature of the individual sine-tone components and the apparent control with which they could be arranged vertically, synthetischer Aufbau seemed to provide the solution to the creation of timbre series. Spectra could be created independent of the sound's progress in duration. Because of this stationary quality (one of the long cherised aims

of early composers of electronic music(189)) the sounds produced had no inherent "liveliness". Every aspect of the sound's progress had to be imposed by control of the sound envelope. Nevertheless, by arranging successions rather than simultaneities of component sine-tones, complex onsets and terminations could be created. Due to its time-consuming nature synthetischer Aufbau soon gave way to faster and generally more aurally rewarding methods of synthesis.

Analytischer Abbau: By contrast, this method of synthesis used sounds with wide spectra from which frequency bands were removed by means of filters. The sound sources could be produced by noise generators or any source that produced sounds with rich spectra. A later technique involved the filtering of complex spectra created by impulse successions.

A principal advantage of analytischer Abbau over synthetischer Aufbau was the speed with which sounds could be created. The filters could be manipulated to produce a variety of sounds from the same source without the painstaking effort required in synthetischer Aufbau. However, this method did not offer the control required for strict serial formation. In a sense, therefore, it was a compromise, but the flexible techniques achieved through filters ensured the production of inherently interesting sounds.

Choice of either method was dependent on the plan of the composer:

> "One can at any rate ask why the composer laboriously puts (sounds) together by means of sound synthesis when he could arrive at the same conclusion much more quickly and elegantly by means of noise analysis? The decision which procedure to give preference to depends on the conception of a musical work. If it is a question of the composer wanting interaction of definite discrete dimensions then he will proceed from the sine-tone. If he conceives his work however as an ordering of statistically formed steps his choice will be the means of white noise and the filter."(190)

Thus analytischer Abbau, by the nature of the way the sounds were produced, relied on aural control and selection. Even though, once created, the sounds themselves could be permuted serially, the ideal of serial intervention in the micro-structure of sound became less relevant.

Synthesis by Impulse: The use of impulse generators was introduced in 1955-56, two years after the studio was operational. By control of the duration, speeds and the manner of grouping of the impulses, complex spectra could be produced. Consequently impulse synthesis was quickly recognized as a flexible way of creating rich sounds and was used extensively in many compositions.

This form of synthesis occupies a particularly important position in the Cologne studio. Although, like analytischer Abbau, the sounds produced by impulse synthesis did not appear to be most suitable for serial control, the manner of impulse synthesis was believed to

legitimize the serial unity of the two separate musical domains of pitch and duration. For example, when the frequency of a square wave is less than 16 Hz, individual impulses can be heard. When the frequency is increased beyond this threshold these impulses accelerate and fuse together until the perception of a low pitch is apparent. Similarly, if a rhythm of impulses was recorded on a tape which was then made into a loop and accelerated, a particular pitch would result according to the speed of the rhythm's repetition. The timbre of the sound would result from the rhythmic pattern of the impulses. Thus a serially organized structure in the time domain would be reflected by a phenomenon in the pitch domain.

In practice these methods were used in a variety of combinations. The exclusive use of one type of synthesis, like synthetischer Aufbau in the elektronische Studien, was rare. The original "purity" of synthesis gave way to general methods of producing sounds. Indeed, it is hard to escape the conclusion that once the time-consuming nature of serially-based synthetischer Aufbau was recognized and compromised, the term synthesis lost much of its ideological significance.

2.8 Electronic Materials of the Cologne studio

The Cologne studio had six types of electronic sound(191) which were believed to provide the elements for all purely electronic composition. Only three were regarded as "basic" elements. These were the sine-tone (the basis for additive synthesis), GerÄusch (one of the bases for subtractive synthesis) and the impulse (the basis for impulse synthesis). The remaining three, which could be derived from these, were the Tongemisch, the Klang and the Zusammenklang. Although these sounds were augmented in early works by vocal sounds it is helpful to examine them. As descriptive categories they invite comparison with the terminology of the Schaefferian system.

Sine-tone : Although Hemlholtz often referred to the notion of the sine-tone in his researches he did not mention it specifically by name(192). Sine-tones could be defined according to pitch and amplitude but due to the absence of any accompanying overtones, they were "timbre free". Despite the apparently clearly defined limits of such a basic element factors such as the psychology of music and the physiology of the ear actually complicate the perception of such an apparently simple sound. The importance of the sine-tone was based on the belief that it was the element, the "Klangatom", from which all sound phenomena could be created. Eimert described its unique position in the following terms:

"It only exists in electronic music: it is its

> (i.e. electronic music's) central problem, its theoretical, basic concept and complies with its compositional significance(193)"

Sine-tones, as defined by electronic music, were not inherently musical. Many musicians who were unconvinced by the new medium were reluctant to accept them as legitimate musical material because they did not occur "naturally" as part of the instrumental or every-day sound world. This opposition only served to encourage Eimert and others in the defence of sine-tones which was carried out with almost evangelical energy(194). Single sine-tones were rarely used in compositions without being subjected to manipulation. Thus even amongst its most enthusiastic supporters its principal value was as a building-block of more complex, and thus generally more interesting, sounds.

Geräusch : A Geräusch was defined as a large number of single sine-tones which displayed small differences of frequency and amplitude. Eimert specified that, broadly speaking, the differences in frequencies should be less than 16 Hz. which is the threshold between pitch and the perception of rhythm(195). The most extensive Geräusch was the "weißes Rauschen" or "white noise" which occupied the entire pitch-field. Bands of Geräusche could be extracted and differentiated according to their position in tessitura and the density of their components. However, no specific names were given to such bands of Geräusche beyond vague notions of "high" or "low".

Impulse: The impulse occupied a unique position in the electronic repertory. Unlike the other categories, it was not defined according to any position in the pitch-field. In addition, it was the only term inherently connected with duration. Impulses were defined as short "bursts of energy" (Energiestöße)(196) in which amplitude and duration were the main factors which determined its perception. Due to the brevity of the sound the emergence of a definite pitch was extremely unlikely though not impossible.

A precise definition of impulse was surprisingly elusive. There were two sub-categories and some confusion about their origins and differences. The differentiation of types within a basic element might seem unnecessary. It originated in the fine distinctions that could be made between characteristics of various short concrete sounds such as dripping water, shots and crashes. This differentiation was based on the noise content and tessitura. Impulses were generally regarded as inherently noisy if they originated from square-wave generators. Due to the wave form, a sudden burst of acoustic energy was produced as the air pressure changed from compression to rarefaction. This type of impulse was called a "Knack"(197). However, an impulse could also be obtained by editing a small portion of a recorded Tongemisch or even a sine-tone(198). Such an impulse, generally of large amplitude and of total duration not exceding 1/150 th sec., was called a "Knall". Knalle thus appeared to be

obtainable from any sound source and could display great variety in their timbres. The distinction was a very fine one, however, and the use of the terms was inconsistent.

Tongemisch: The Tongemisch was constituted of individual sine-tones that exhibited no harmonic relationship, either to each other or to a fundamental tone. They were, strictly speaking, closely fused sine-tone mixtures. It was a widely applicable term and, like Geräusche, no specific names were assigned to Tongemische based on position in the pitch-field or band-width. Differentiations within Tongemische could be achieved if various sine-tone mixtures were perceived to have different densities. Oscillations could result if individual sine-tones of sufficient amplitude were closely packed together and in the cases of less fused Tongemische more precise differentiations could be attempted according to the number of individual sine-tones and the intervals between them.

Unlike sine-tone and Geräusch the term Tongemisch could be applied to certain sounds in instrumental music. Fused inharmonic sounds of the attack-resonance type such as those produced by a bell or struck metal sheet could be described as Tongemische. This concept was further extended in an attempt to describe textures produced by instrumental ensembles despite the apparent contradiction that the individual elements of such instrumental sounds could not, by definition, be simple sine-tones:

> "According to the example of the theory of Tongemische in electronic music, the cluster actually converts the simultaneous continuum of all pitches (from normal intervals progressively to micro-intervals). Ligeti's 'Atmosphères' (1961) is an important indication of this."(199)

Strictly speaking, Tongemische were types of GerÄusche.

The distinction could be unclear and classification of a sound as either a Tongemisch or GerÄusch depended principally on either the perception of a dominating pitch or band of pitches, or a wide and evenly distributed number of component elements. The former would be a Tongemisch, the latter a GerÄusch.

Klang: Unlike the inharmonic relationships of the Tongemisch, a Klang consisted of sine-tones that were harmonically related to a fundamental tone. Generally the amplitude of this fundamental dominated the Klang. The individual components could not be discriminated and the whole sound was perceived as a unity. The amplitudes of the various partial components were one aspect which determined the "colour" of the Klang. Due to the harmonic relationship among the components of KlÄnge they were, by definition, the sounds most frequently used in traditional instrumental/vocal music. Electronic KlÄnge augmented the timbres of the traditional sound repertory as electronic control enabled the amplitudes of the partial tones to be individually attentuated or strengthened.

Zusammenklang: The Zusammenklang was composed of KlÄnge. Strictly speaking only two KlÄnge composed a

Zusammenklang. More than two should have been designated a chord (Akkord), a term not employed in electronic music at Cologne. In addition, the Zusammenklang was sometimes called a Klanggemisch(200), which was in some ways a preferable name as it emphasized that it consisted of a mixture of Klänge. As with Tongemische there were no attempts at more refined specifications of different types of Zusammenklänge based on the number of constituent Klänge or the intervals separating them. Ambiguous categorization was possible if the Klänge were in such close registral proximity that the ear could not distinguish between their respective fundamentals. In such cases perception of the individual identities of the Klänge might be impossible and the resulting fused sound might be categorized more accurately as a Tongemisch.

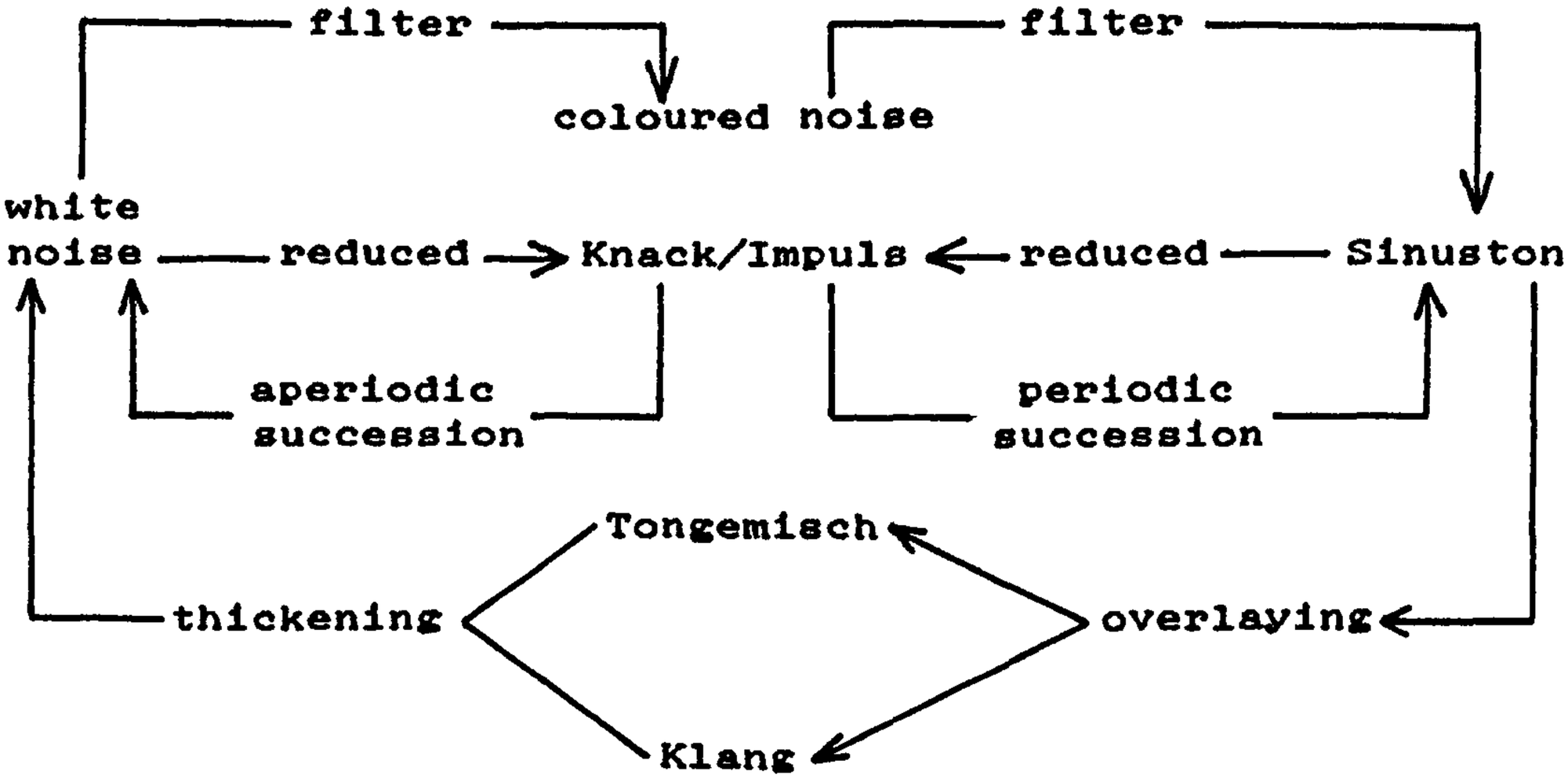
Thus the category of Tongemisch was believed to mediate between Klänge and Zusammenklänge:

> "In instrumental music Klang (Ton) and Zusammenklang are clearly differentiated; electronically, the Tongemisch with its curious degree of fusion pushes itself in between the two."(201)

Comparisons can be made with Schaefferian sound classification which, even in the early researches, was much more comprehensive(202). For example, the detection of individual bands of sine-tone mixtures in Tongemische is reminiscent of the nodal class of masse in the Schaefferian system. Likewise Klang, being harmonic, can be compared to Schaeffer's tonic sound. Despite attempts to refine aspects of pitch differentiation these six

categories could not provide a supporting theoretical framework to describe every possible sound event. With the exception of the impulse they referred exclusively to pitch aspects. The terminology seemed best suited to electronic sounds and was rarely applied to instrumental or vocal music (ref.199 is exceptional). Even the existence of the Tongemisch which provided a "solution" to the concepts of consonance and dissonance(203), terms which acquire a slightly different meaning in much contemporary music, did not appear to provide the foundations for a new description of sound. Consequently no precise terminology existed for a description of the development and possible change of a sound's harmonic content and no attempts were made to categorize the behaviour of dynamic envelopes. Diagram 9(204) illustrates the almost exclusive concern the Germans gave to pitch. Stroh places the categories (with the exception of the Zusammenklang) into a continuum. He shows the inter-connected nature of the sounds and their possible production by the three methods of synthesis.

DIA.9 BASIC ELEMENTS OF THE COLOGNE STUDIO



2.9 The Cologne-Paris Disagreements

The attitudes expressed by musicians working in the Cologne studio towards French electro-acoustic music were representative of the German musical establishment as a whole and were expressions of their commitment to serial thought and electronic sound generation. An examination of these attitudes indicates that Schaeffer's researches were either misunderstood or ignored. This investigation will neither blame nor exonerate people. Caution is always required when assessments are made with the benefit of hindsight. Many issues which at the time were expressions of genuine musical and aesthetic disagreements can now appear trivial. Nevertheless, however genuine the opinions may have been, there should be no excuses for failing to identify the sources of these disputes, particularly as they continue to exert considerable influence on contemporary musical opinion. An examination of German attitudes towards Schaeffer establishes two principal points. Firstly, it demonstrates the enormous differences between the policies of the two studios. If these policies are independent of sound materials and have remained largely intact, there can be little support for the contention that a convergence of views between Paris and Cologne has occurred. Secondly, the attitudes of German musicians are often reflected in similar misunderstandings amongst their British and American counterparts. This demonstrates general, rather than exclusively German, lack of understanding.

There is no doubt that evaluating Schaeffer's findings presents difficulties. He undertook his researches over many years and a comprehensive assessment was perhaps only possible after the publication of the "Traité des Objets Musicaux". For example, comparisons between "A la Recherche d'une Musique Concrète" and the "Traité des Objets Musicaux" reveal refinements and elaborations in the areas of classification and description(205). But increased sophistication did not constitute a major change in his initial research position. Schaeffer remained consistent in his aims. A mitigating explanation for the paucity of evaluations of Schaeffer is the difficult style of his writings and his use of specialist terminology. Consequently, problems can arise even for committed readers who are not well acquainted with his idiosyncratic style(206). Schaeffer's reputation rests almost entirely on his role in setting up the first musique concrète studio and his early "anecdotal" compositions. While these facts are certainly of historical importance, they cannot form as complete a basis for evaluation as the later theoretical writings. It is the failure to understand these researches that can be identified as the cause of most misunderstandings.

Although the German reaction to the musique concrète being produced at Schaeffer's studio was initially favourable, their enthusiasm, particularly after the Donaueschingen festival in 1953, began to diminish(207). The German commitment to serial aims and electronic sounds has

already been noted(208). These indivisible notions meant that musique concrète, with a vocabulary inherently unsuitable for serial control, could not even be accurately defined as electronic music, (though this could scarcely have been a contentious issue for either the French or Germans!). Indeed the term "electronic" came to be regarded as a shibboleth to which unquestioning allegiance was given and which, as a matter of course, presupposed a commitment to the formalist avant garde. Musicians at Cologne reserved the exclusive right to use the term and anything that did not conform to this rigid definition was not subjected to further serious examination:

> "In Cologne they endeavoured to derive the claim of universal validity of electronic music as the result of an act of serial organization from the word itself. Each designation of non-serial music as electronic music was seen as a terminological confusion; already stemming from this concept electronic music could only be that which was produced in Cologne or in the spirit of Cologne."(209)

In this sense one has to concede that Eimert was justified in describing "the uncontrolled electrical sounds" (die unkontrollierten elektrischen Klänge)(210) of musique concrète as useful for decorative or illustrative purposes but on no account could they qualify as electronic music.

In 1954 he wrote:

> "Such naturalistic additions are as far from music as Nature is from Art. How far the confusion goes in this area could be seen by the performances of 'musique concrète' at the Donaueschinger Musiktage in 1953. Many critics described these performances - a double confusion - as 'electronic music'"(211)

These early works were the least representative of the

contribution made by Schaeffer's research group to musical thought. It is always a suspect procedure to evaluate a medium on the basis of its earliest, and perhaps least representative, examples. Today, at a greater distance from such ideological disputes, many of these pieces can be appreciated for their innovative, even witty qualities. It is incontestable that this early phase was the most primitive of all the stages, both technically and musically. The initial use of discs rather than magnetic tape was perhaps partly accountable(212). No doubt the sounds and manipulations of the early "anecdotal" pieces did seem naive to Eimert who judged them from a serial-electronic standpoint. Nevertheless, such dismissals persisted for many years. The following comments were made by Eimert in 1966. The title of the concert report is also revealing: "The French no longer talk about musique concrète" ("Die Franzosen sprechen nicht mehr von Musique concrète"):

> "The most noteworthy event on this evening of Schaeffer's group was the fact that in the extensive programme text and the even more extensive documents that came with it from Paris, the word 'musique concrète' no longer occurred. Schaeffer already in 1958 took leave of this concept when he re-named his 'Groupe de Recherches de Musique concrète', which was founded in 1951, to 'Groupe de Recherches Musicales'. Thereby musique concrète became a historical concept, no longer applicable to the productions of today. When in 1953 Pierre Schaeffer made, for the first time in Cologne, a guest appearance at that 'historic' music festival, at which electronic music appeared with compositions by R.Beyer and the author, it was already predictable that nothing developed from the form of musique concrète as practised at that time with ostinato speech fragments, recorded noises and traditional disc insertions and that it had no possibilities of development beyond a

> craftsmanlike playing around. A well known critic at that time wrote that musique concrète is the only branch of new music that has got caught in a blind alley."(213)

This quotation comprises approximately one third of Eimert's article. The remainder is little more than a general discussion of the concert series as a whole and a list of works and composers. In the section quoted, Eimert undertook a retrospective evaluation, referring yet again to Donaueschingen in 1953. In addition, he assumed that the change of name of Schaeffer's research group implied an abandonment of his aims. This is demonstrably untrue. The confusion arose from Schaeffer's reiteration of the aims of the "Groupe de Recherches Musicales" in 1958. At that time he had only just returned after an absence of four years and he felt it necessary to outline his musical intentions again. However, neither Schaeffer's rephrasing nor the several name changes the research group underwent indicated a fundamental change of aims. Eimert becomes embroiled in a digressive critique of materials and techniques which, however valid in serial-electronic terms, is a convincing demonstration that even after more than ten years he had either misunderstood or was unaware of Schaeffer's aims.

As the term "electronic" was so important to the Germans' serial aspirations it is possible that they assumed an equal importance was implied by the French term "concrète". But "electronic" referred to a type of sound source and means of production leading to the realization

of serial aims whereas "concrète" described a conceptual attitude. As such, comparisons were invalid. The apparent deficiencies of musique concrète were confidently attributed to its sound repertory. Eimert claimed when discussing the history of musique concrète:

> "To the materials now belonged, as Schaeffer formulated it, 'electrically produced noises or sounds'. Thereby the historical task of musique concrète was fulfilled and brought to completion."(214)

He appeared to believe that Schaeffer's aims were so fragile that mere inclusion of electronic sounds compromised them irrevocably. Indeed, persistent confusion originates from the belief that the principal use of concrete sounds was to provide "quotations" from the real world. This has produced the frequent connexion (denied by Schaeffer) between his notions and those of the Futurists(215). Quotations are a valid function of unmanipulated concrete sounds and raise the important notion of the way in which events of the every-day sound-world can be incorporated into music. But quotation - a minor aspect of Schaefferian thought - was interpreted by German musicians as confirmation that a supression of associative hearing was difficult, if not impossible. As a result they thought that the potential of concrete sounds was restricted to their anecdotal integration in tape works where associative hearing was actively encouraged. Non-associative examination to establish new theoretical foundations for music was not a function that the Germans recognized. It is perhaps significant that the one composer who was treated with seriousness by the

Germans was Luc Ferrari. His use of explicitly anecdotal material appeared to support concrete sound's role in a particular kind of musical discourse(216).

The results of German misunderstandings continue to produce similar assessments even twenty years later in standard, presumably authoritative, texts. There are, for example, references to Schaeffer's early books but hardly any to the "Traité des Objets Musicaux"(217). It is probably fair to conclude that they still represent a commonly held viewpoint. Thus as late as 1982 one can read the following summary of the period immediately preceding the foundation of the Cologne studio:

> "Even the experience of 'musique concrète' seemed to have no future for the time being - its technical prerequisites existed only since the discovery of tape that could be edited. Although a group of Parisian composers set up after the war on the initiative of Pierre Schaeffer had worked successfully with noise montages and electrically modulated real sounds that were recorded on tape and played back over loudspeakers"(218)

By contrast, some German musicologists do have a clearer understanding of Schaeffer's researches. The following assessment by Stroh (who to his credit describes the Paris-Cologne dispute as a "grotesque polemic"("groteske Polemik")(219) in 1975 exemplifies this point:

> "The Paris circle around Schaeffer ordered basic material, which was recorded by microphone, according to 'musical sound characteristics' thus neither according to inherent criteria (in the sense of musical realism) nor according to structural criteria. 'Concrete' sound material signifying only 'itself', independently of its origin and is connected solely to the criteria of the listener's perception, (...) Although famous composers like O.Messiaen, P.Boulez and D.Milhaud

> were interested in concrete music, musique concrète had nevertheless become widely despised as 'titillating' music, as superficial and illustrative. Even with the scientific claim of the 'Groupe de Recherches de Musique concrète' (from 1955 'Groupe de Recherches Musicales') which was led by Schaeffer to conduct musical sound research, concrete music could not make a lasting impression among experts."(220)

Stroh correctly identifies the autonomous nature of Schaeffer's sound material and the importance of the role exercised by the listener's perception. However, it is less clear what he means by "structural criteria" and his final two sentences fail to evaluate Schaeffer's more significant later researches. Such a comment is acceptable only if it is qualified by specifying "concrete music" as the early anecdotal works.

It must be stressed that there were sources in German from which a more accurate picture of French electro-acoustic music could have been gained. Schaeffer had contributed a short definition to the Riemann music dictionary in which his aims were clearly set out which was referred to by German musicians and writers(221). A further source was an article written in 1969 by the Yugoslavian composer Ivo Malec(222). This appeared in the German magazine "Melos". Malec had worked at Schaeffer's studio and provided an accurate summary of the French standpoint(223). It is likely that too many preconceptions and terminological confusions inhibited a real assessment of Schaefferian ideas by the Germans.

One can be cautiously optimistic that a more balanced view

of Schaeffer is emerging in Germany. The full implications of Schaeffer's researches are gradually being investigated by musicologists such as Stroh and Frisius. One can only hope that they are the first signs of the reassessment that Schaeffer deserves amongst both German and English speaking musicians(224).

2.10 The Legacy of the Cologne Studio

No major composer who worked at the Cologne studio entirely abandoned instrumental/vocal composition. Although a similar case could be made for the musicians at Schaeffer's research group, a very different relationship with instrumental/vocal composition resulted from the studio experiences of the composers in Cologne. Despite admissions regarding the beneficial effects of direct feedback inherent in studio work(225) no German experimental attitude comparable to Schaeffer's developed. The adoption of serial thought excluded such a course of action.

One can contrast the unhesitating confidence with which the composers at the Cologne studio realized serial-electronic music with the three years of studio-based research demanded by Schaeffer before composition could even begin(226). Musicians at Cologne could deliberately disregard such a lengthy period of Schaefferian-type experimentation. It was even suggested that the notion of experimental music, where experiment is understood in the conventional sense, was unnecessary in electronic music. The aims of musicians in Cologne were incompatible:

> "Experimental music is a definition that is not easy to establish conceptually, materially and historically. First of all it can be characterized as a contrast to everything traditional and has taken from the concept of the experiment in the natural sciences the idea that what consists of matter can be taken apart into

> matter once more. (...) In this respect musique concrète, as long as it remained and was called musique concrète (until 1958), is much more connected with the theoretical main concept of the sound object of experimental music: new sounds should be discovered with the filter analysis of sound objects by means of constantly varied attempts at taking them apart. Electronic music in its first years went the other way: it did not take sounds apart but put them together, composed them even in 1956 when Krenek and Stockhausen for the first time joined non-electronic sounds in the form of singing voices. This led many to the false conclusion that the alliance between concrete and electronic experiences had finally taken place. In this compositional early stage one could not speak of experimental tendencies in connexion with electronic music."(227)

The idea of "experiments" thus seemed linked with the German notion of French synthesis and its apparent aim of expansion of the sound repertory as an end in itself(228). Subtractive synthesis was less suitable for serial organization than additive synthesis. The former depended necessarily on a perceptual assessment. Organization of the latter, it was presumed, could be achieved by building up sounds from their constituent elements with serially derived proportions. Experiments and perceptual verification did not need to be undertaken to achieve this. The serial framework already existed and constituted its own justification.

However, it is important to emphasize that the use of serial methods was not without advantages. The alliance between serial thought and electronic music was beneficial in enabling the more extravagant claims made on the behalf of both to be tested. In retrospect this was necessary. In addition, serial thought established an efficient

methodology for considering sound as a conglomeration of divisible elements whether relating to aspects of forme or matière. Separating and examining individual elements encouraged much valuable conceptualizing regarding the manner in which they might contribute to a musical discourse. For example, attempts to realize the elusive notion of "Klangfarbenmelodie"(229) were facilitated by the apparent ease with which spectra could be both created and organized according to serial principles. Nevertheless, such conceptualizing, however stimulating, tended to emphasize the paramount importance of organization at the expense of perceptual verification(230). Underlying principles regarding the relating of sounds were neither stated explicitly nor elaborated. Composers presumed a direct correlation between their serial plans and the eventual results perceived by the listener would emerge of its own accord:

> "The electronic composer can only compose physical dimensions. Tacitly he presupposes that these physical dimensions also correspond to musical (dimensions), and what we call order(ing) 'here' is also order(ing) 'there'."(231)

Such an approach is valid only if the composer is willing to abdicate responsibility in favour of an abstract, conceptual scheme (in reality a most uncommon practice). There is some evidence that occasionally composers had difficulty reconciling the rigorous application of serial thought with the new flexibility of sound creation, such as subtractive synthesis, in the studio. The relationship, however mutually beneficial, was strained by studio practice.

Possibly too much was expected of serial thought. Its organizational strengths are impressive, as are its powers of mediation, but these cannot address all the problems of musical composition or reception. At certain stages during the course of a composition choices must be made regarding how sounds are to be exploited within the musical context. The composer may become aware of ambiguous relationships between sounds, or contrasts where none were suspected. Simple processes in the studio can lead to unforseen and fruitful results. Serial thought alone can offer little assistance in these tasks. Consequently basic skills in composition such as sound description and classification which were essential to French experimental practice were not systematically investigated in the Cologne studio. This lack of a comprehensive and generally applicable system was the most obvious legacy of the adoption of serial thought.

Unfortunately, serial thought can suffer from the same casual disregard that afflicts many aspects of electro-acoustic music. Serial thought should not be considered solely as an historical stage which music had to undergo, but which is now of little relevance. Its organizational and mediational strengths still offer much of value to all contemporary composers. It would be strange, though not impossible, if such a powerful system of musical thought could be considered so irrelevant after such a short life span. Perhaps a reassessment and even a rehabilitation of certain aspects of serial thought is

overdue.

The most striking outcome of the Paris "experimental" and the Cologne "serial" approaches was the contrasting attitudes towards the "instrument". While Schaeffer started to re-define the concept of the "instrument" from his research standpoint, the Germans were committed to instruments realizing abstract schemes. Lack of control by both instruments and instrumentalists promoted the electronic studio as a "super-instrument" unaffected by many of the uncertainties of traditional instrumental realization. Though one can speculate that the lack of enthusiasm for much electronic music stemmed precisely from the type of "controlled" music being produced in Cologne. Stroh's comment is perceptive on this matter:

> "The extreme control over every sonorous and musical event that had been generally in accordance with serial compositional technique immediately after 1950 caused, however, other musical dimensions to wither away, which (is a pity as they) are of great significance for artistic communication. Electronic music could neither achieve the wealth of sound (onsets and terminations, noise components, formant characteristics etc.) and the modulation capability of conventional instrumental and speech sounds, nor could it develop an equivalent for the specific interaction between player and listener, which takes place at every act of musical communication."(232)

Although this comment is applicable to works like the elektronische Studien with their limited sound vocabularies it cannot be applied, for example, to Kontakte. In this work Stockhausen's application of principles similar to those of typo-morphology is an example of an approach to sound description and

classification which is intrinsically musical. Thus, while a convergence of views between Paris and Cologne based on materials is incorrect, there may be some truth in asserting that there were increasing similarities between certain compositional practices such as those used in Kontakte. There is no doubt that Stockhausen did not consciously adopt Schaefferian methods. Nevertheless, despite the serial framework, his compositional practices increasingly resembled a Schaefferian approach in his use of sound families and perceptual assessment.

It is possible to conclude that Schaefferian musical theory, being applicable to all sounds, was able to research the nature of instrumental thought. In Paris the absence of traditional instruments in studio practice actually encouraged a deeper understanding of how sounds can be organized in musical, "instrumental" structures. Schaefferian methodology, unlike many aspects of German studio practice, involved a constant process of perceptual verification which is still of the utmost importance for all contemporary composers. Boulez, in the early nineteen-seventies, summarized a research position that is similar to Schaeffer's:

"I should think that research scientists are a lot less speculative, in the bad sense of the word - that is, they are less liable to be hypnotised by a construction that may satisfy them from the intellectual point of view. The real research workers are precisely those who are constantly in touch with reality, and who modify their working hypotheses according to their findings. The pseudo-scientist, on the other hand, will invent a construction for his own satisfaction without being too concerned about

relating it to reality: reality is in error when it does not agree with his construction. In general, the true spirit of research, whatever field one works in, is in a continual interaction between the reality one has to take into account and the system of hypotheses one must apply to it. This constant interchange ought always to be present in our thinking, and in my opinion nothing could be more fruitful than this perpetual modification of perspective, of hypotheses, in the face of musical reality."(233)

Chapter 3

Schaeffer's Researches and Instrumental Thought

3.1 Introduction

Since the late nineteen-forties radical changes have become increasingly evident in the materials and processes of European instrumental and vocal music. Although traditional instruments are still widely used, composers frequently demand unorthodox playing and vocal techniques. For example, complex sound masses that often feature in the orchestral music of Ligeti and Xenakis are usually realized with existing instruments but do not communicate solely by traditional notions of pitch and rhythm. In addition, cursory examination of many contemporary scores reveals the use of sound sources that defy inclusion in traditional instrumental categories. Thus, modern instrumental music can now be realized by recently invented instruments, "found" objects and electronic equipment. As a result of these developments many new and established instruments produce sounds which display few similarities with those of traditional music. Neither composers nor listeners can any longer assume that musical structures communicate principally by means of the "primary" aspects of pitch and duration. The distinction between the roles of these aspects and "secondary" ones such as articulation, intensity and timbre has become increasingly unclear(234). Composers(235) frequently attempt to abstract all concrete sound features in order that they might participate more equally in musical

discourse. Consequently, composers readily exploit potentially richer and more complex interplays of sound relationships. Compositions which draw on these possibilities do not comprise a tiny collection of insignificant exercises written by an iconoclastic avant-garde. Such works are central to the development of twentieth-century music. Their importance is confirmed by numerous performances, scholarly articles and analyses. The diversity of the contemporary instrumental/vocal repertoire demonstrates that musical thought is undergoing a fundamental reassessment caused, not only by new sound materials, but also the sources from which they are produced.

A precise identification of the effects and origins of these changes is hindered by the plurality of post-war musical languages. Music cannot be separated from its immediate past. Many aesthetic notions and compositional practices evident in contemporary music can be traced to musical developments in the earlier decades of the twentieth century. Nevertheless, one specific origin can be identified as a main stimulus for encouraging changes in contemporary musical thought. Unequivocal statements by major composers have indicated the significance they attach to experiences of composition and research in the electro-acoustic medium(236). This medium is, by definition, a unique feature of post-war music and deserves, if only for this reason, a special place in investigations of contemporary music. However, the short

history of the electro-acoustic medium can be disadvantageous. Its recent appearance in musical life has hampered the inclusion of electro-acoustic music in evaluations of post-war musical languages. Often it retains an image of scientific apparatus being relentlessly coerced into a bewildering variety of musical applications. Its brief but precocious development is also partly responsible for the ostensibly uneasy co-existence of the electro-acoustic and instrumental/vocal media. As a result, accounts of the electro-acoustic medium are often littered with disparaging remarks(237), generally made from instrumental/vocal viewpoints. Criticisms are not necessarily invalid simply because they stem from, or even advocate, traditional practices. Nevertheless, they can be misleading because they are often based on misconceptions which may then be repeated and thus reinforced by contemporary writers(238). Excessive emphasis is usually placed on the unwarranted prominence accorded to minor squabbles and personal prejudices regarding the musical validity of non-traditional sounds and sources. There is no doubt that such sounds formed a major part of the early electro-acoustic medium's repertory, thus the apparent superficiality of many early tape works (particularly those of Schaeffer's group) led to the assertion that they were little more than curious additions to the fringes of music(239). Unfortunately such attitudes continue to bedevil many contemporary opinions of electro-acoustic music and a failure to

identify common areas of interest accounts for the absence of shared terminology.

By working in the electro-acoustic studio composers in the nineteen-fifties could exploit two obvious characteristics of the medium. Firstly, the sound repertory could be augmented by generating new and often unorthodox sounds. Secondly, studio equipment facilitated increased accuracy in the realization of pitch, duration and intensity. This was particularly important to composers who wanted to realize strict serial schemes(240). Nevertheless, this study will attempt to demonstrate that neither augmentation, nor accuracy in themselves were as important as the unique work conditions created by the studio environment. A more fundamental readjustment was almost certainly caused by the absence of instruments which could encourage the reassessment of theoretical notions previously derived from instrumental practice. The discovery of the manner in which sounds were formed, manipulated and, most importantly, perceived in the electro-acoustic studio prompted some musicians to investigate basic questions regarding musical communication. Theoretical deductions were made, tested and, if need be, modified directly from musical practice. The studio provided conditions for the development of an essentially experimental musical attitude (though few musicians undertook this approach). By ignoring this vital aspect credence is given to the view that "recent" electro-acoustic and "time-honoured" instrumental/vocal

media, far from being complementary, actually comprise separate domains with augmentation and accuracy as the only points of contact. On this basis the true nature of a potentially fruitful relationship can never be established.

The following comment, made in 1976 by the French composer Guy Reibel, states clearly his conviction that studio experiences can have a fundamental effect on the development of composers' languages:

> "The studio is not simply tinkering about, it is in truth the only means to a musical discovery, so much so that one of the most important things of present day musical writing has been the influence of the studio."(241)

Such an extravagant claim is plausible if the compositional practices of musicians are scrutinized. Commitment to electro-acoustic composition varied among different composers and significantly no major composer entirely abandoned the use of "live" instrumental resources; the attractions of a "live" performance still confirmed its importance in the communication process in music(242). Regardless of the advantages of the electro-acoustic studio, however crudely equipped they were by today's standards, few musicians were dissuaded from writing works using "live" instruments or a combination of these and electro-acoustic resources. Unless a remarkable degree of self-restraint was exercised inevitably there would have been instances of cross-fertilization where studio experiences and instrumental/vocal languages began to influence each

other. Music is greater than the sum of these two parts, and participation in both media suggests that despite obvious differences in realizing electro-acoustic and instrumental musics, common ground existed and was first recognized by composers in the electro-acoustic studio. In investigating the relationship between these two areas in the period in question there is, therefore, an increasing need, not for mutually exclusive electro-acoustic and instrumental concepts, but for notions which can be applied to common areas of musical composition.

It would be simplistic, and ultimately incorrect, to imply that only a limited number of possible influences on contemporary music can be derived from the electro-acoustic medium. The two principal and generally widely differing approaches to European electro-acoustic composition were outlined in the preceding sections of this study. In addition, each composer will adopt a different, and possibly changing, viewpoint. The concluding section will suggest that one approach offers a new and useful methodology in the examination of contemporary music generally. This is based on the theoretical system of Pierre Schaeffer and his "Programme de la Recherche Musicale". Although Schaeffer's system may need to be modified it provides the basis for a valuable approach to composition and analysis(243). Furthermore, Schaeffer's system could only have developed from his studio experiences and his subsequent theoretical

deductions. While the studio was the origin of these discoveries Schaeffer's system also has the unique property of being universally applicable and intrinsically "musical". An evaluation of its insights suggests that beyond direct influences common and fundamental musical "laws" exist. The clarification of these changes the relationship between composers and the sound sources they use to realize their music. The unjustified neglect of electro-acoustic music by many musicians is duplicated with even greater unfairness by the neglect of Schaeffer within the electro-acoustic community. By demonstrating the relevance of Schaeffer's theories to contemporary music generally it is hoped that both injustices can be highlighted.

3.2 The Nature of Schaefferian Theory

A distinction must be made between the nature of Schaefferian and traditional theory. If music theory can be defined as a systematic account of general principles by which music can be explained and understood, Schaeffer's system can be described as "descriptive" rather than "prescriptive"(244). A descriptive music theory will attempt to formulate a methodology for the precise description of all sounds and will seek to evaluate how sounds might function in every type of musical structure and discourse. Past practices and materials may be considered, but not solely on the basis of previously codified, or artificially constructed systems. Rules will be derived from how sounds are observed to behave and interact, and a basic level of understanding will be attempted before all else. By contrast, a prescriptive theory will tend to concentrate on systems by which sounds have been organized. Theories explaining compositions making use of tonal, modal or serial systems furnish obvious examples. Past practices will provide criteria which will be projected forwards and elaborated as likely developments. The disadvantage of prescriptive theory is that it is frequently used to concentrate on organizational aspects in preference to any examination of the materials such that generation of strategies and formulae begins to assume an importance over and above the sound materials the composer wishes to organize. Both definitions are deliberately simplistic.

In reality neither concept represents a diametrically opposed pole; there are many gradations between the two.

The characteristics of Schaeffer's studio practice demonstrates his essentially descriptive theory in contrast to other electro-acoustic musicians who generally adopt a more prescriptive approach. The relationship between German electronic music and serial thought in Cologne can be cited as an example of a prescriptive bias(245) in which the electro-acoustic medium was used to realize goals which were neither necessarily intrinsic to the medium nor perceptually verifiable. Schaeffer's system emphasized the initial tasks of description and classification before a composer could assess a sound's potential for inclusion in a musical context. This progression is exemplified by the "Programme de la Recherche Musicale" in which the typo-morphological stages of description and classification of individual sounds removed from causal context are the first to be undertaken. Only thereafter can the more creative stages of characterology, analysis and synthesis begin to return to musical composition properly speaking. The universality of this approach can be compared with that of other musicians with studio experience. Stockhausen, for example, wrote many articles on matters directly related to his own electro-acoustic compositions and researches(246). These are often revealing about many aspects of Stockhausen's music and deserve to be studied in evaluating his works. Nevertheless, they are inherently

personal and less easily applied to general musical questions. In addition, they usually relate to formal aspects of organization. Typo-morphological notions exist in his compositions but can be deduced effectively only by aural analysis rather than by references to a general musical theory(247). The creation of sound families with explicit or ambiguous relationships in Kontakte, for example, indicates that Stockhausen applied his own Schaefferian-type approach though he did not discuss it in any detail as a writer/theoretician. Similarly studies in phonetics and acoustics were used by many composers in both electro-acoustic and vocal/instrumental works. These studies applied scientific classification procedures which were often better than traditional ones but still unsuitable for many musical sounds(248).

Clearly it would be uncharitable to criticize musicians for failing to develop a particular type of theory. Composers are not necessarily good theorists beyond their personal compositional activities and may have neither the time nor the inclination for elucidating their own practices for the benefit of other musicians.

Furthermore, it is possible that many composers assumed that the augmentation of the musical repertory by many new sounds and processes, whether electro-acoustic or instrumental, might in itself promote new theoretical notions. The relationship between practice and theory has always been complex and never displayed a neat causal relationship. No set pattern determines which should

follow or precede the other, or to what extent the two should proceed concurrently.

These points demonstrate that to have worked in the medium of electro-acoustic music would not as a matter of course have produced Schaefferian-type theory. A fundamentally descriptive approach was equally necessary to initiate investigations and support researches. For such a conjunction of theory and practice Schaeffer must be given credit. Schaeffer used the studio as a fertile environment for theoretical speculation and its equipment provided the greatest potential for gaining an understanding of fundamental musical "laws":

> "Using these machines is only the learning stage of music theory."(249)

Many contemporary musical languages, both electro-acoustic and instrumental/vocal, have one aspect in common. They are rarely adequately served by traditional theory. Any unorthodox sound repertory ensures that description and classification of its sound types and formal procedures resist satisfactory explication if limited to existing theoretical notions. For example, well documented inadequacies of notation, are based on its prescriptive bias towards both pitch and duration(250). This can actively prevent the exploitation of other sound qualities as too much emphasis is given to obvious aspects at the expense of others. One can speculate that recourse to non-musical disciplines is symptomatic both of the realization that new theoretical concepts are required and

the resigned attitude that music alone seems unable to provide them. Musicians today are inclined to adapt discoveries from many different, and hitherto unrelated, areas of the arts and sciences. Consequently, references to specialist vocabulary from information theory, phonetics and mathematics can commonly be found in musical journals(251). While this may demonstrate a laudably open-minded attitude there is perhaps a regrettable readiness on the part of musicians to shelter behind ready-made systems out of expediency. In doing so a time-consuming approach such as Schaeffer's is avoided but so too is its intrinsically musical advantages.

3.3 The Schaefferian Concept of "Instrumental" Thought

Schaeffer intended to clarify, define and generalize "instrumental" thought and investigate how it is manifested at all stages of music, from composers' initial explorations of sound materials to the perceptual complexities encountered by listeners. This was, therefore, an attempt to address the fundamental problem of the concept of "instrumental" thought rather than an investigation of a specific instrument:

> "From the very moment when musique concrète made its proper subject the constitution of 'unheard (of)' objects, it pushed into the background all 'note-making machines' which is what traditional instrument making is. This was because musique concrète, by replacing the concept of the note by the concept of the objet sonore, aimed to collect new objects in the universe of sounds and assemble them, if not according to its whim then at least according to inherent rules, the definition of which was one of the main tasks of the concrete team."(252)

Schaeffer concluded that although electro-acoustic music was not usually created using traditionally defined instruments, a process of theoretical speculation derived from studio work-methods suggested that his approach to sound organization was inherently "instrumental" and thus potentially applicable beyond the confines of the studio. This may seem contradictory, but if such an "instrumental" approach is possible without traditionally defined instruments (and consistent electro-acoustic practice indicates that it is) the notion of Schaefferian "instrumental" thought becomes a fundamental, archetypal musical concept which can transcend the limitations of a

physical sound source. According to Schaefferian theory, exploring the potential for abstract discourse latent in all the concrete features of a sound is equivalent to "playing" an instrument. There was, of course, one essential difference: instruments, because of their physical construction, have predetermined structures imposed on their "raw" materials. Thus the unfolding of the abstract/concrete dualism can only operate within narrow confines which allow little scope for exploring new arrangements. But, liberated from a causal context, new "instrumental" notions, broadened and supported by the appropriate theory, could establish the foundations for a more thorough understanding of <u>all</u> sounds, sources and processes in music.

Schaeffer's belief in the experimental nature of "instrumental" thought is illustrated in his "Traité des Objets Musicaux". This work is a comprehensive exposition of the researches he conducted over a period of nearly twenty years from 1948 until the publication of the "Traité" in 1966(253). The book outlines not only the description and classification of sounds, both immense undertakings in themselves, but also the activities of making and perceiving music in the context of "nature" and "culture". The seven main sections of the "Traité" are divided into chapters. The first section is entitled "Faire de la Musique" (Making Music) and its opening two chapters are called "Le Préalable Instrumental" (The Instrumental Pre-requisite) and "Jouer d'un Instrument"

(Playing an Instrument). The early position in the book and subject matter of these chapters (reference is made to instrumental, concrete and electronic sounds) demonstrates the importance that Schaeffer attached to an understanding of what is meant by the concept "instrument". It is to Schaeffer's credit (and to contemporary musicology's discredit) that these sections of the "Traité" still represent a rare investigation by a musician who was attempting to go beyond merely describing the mechanical idiosyncracies of instruments and other sound sources in order to understand the principles underlying musical languages regardless of the medium in which they are realized.

Schaeffer's notion of "instrumental" thought can be deduced from five connected concepts of the Traité:

The two dualisms:

1) Permanence/Variation.

2) Valeur/Caractère.

Instrumental analysis, consisting of:

3) The redefinition of "timbre".

4) The investigation of "registers" within the three perceptual fields.

5) The investigation of sounds' potential for "jeu".

Based on these notions the "Traité" formulated a new musical concept: the "pseudo-instrument" as a supplement to the "Programme de la Recherche Musicale".

> "The 'Traité' emphasizes on the other hand the emergence of 'pseudo-instruments': 'within the range of the ear', a certain sequence of sounds of various origins appears to come from the same source. A different approach for the researcher intent on elucidating the instrumental mystery."(254)

The notion of "instrumental" thought thus occupies a particularly important position in Schaeffer's system and connects each stage of the programme, elevating it beyond an arid, if sophisticated, exercise of classification and description. Although the term instrument is rarely employed beyond the opening two chapters an implicit "instrumental" theme connects the entire "Traité" and is discernable throughout all Schaefferian musical thought. He was aware of criticisms that he failed to progress beyond a description and classification of objects to composition(255). Such criticisms underestimate the necessarily hypothetical, and thus problematic, nature of the three last stages of the "Programme de la Recherche Musicale": characterology, analysis and synthesis. The practical, creative nature of Schaefferian "instrumental" thought answers these criticisms and demands a reassessment of the programme's effectiveness. The most complete stages of typology and morphology suggest a methodology of classification and description of objets sonores. In order to progress beyond this description and classification and encourage listeners to perceive relationships, the stage of characterology assumes an important, and perhaps hitherto unrecognized role. Characterology initiates a return to the act of composition by attempting to group related objets sonores

into "families" or genres which appear to originate from "pseudo-instruments". This encourages a process by which the composer can start to exploit the order revealed by typology and morphology and makes possible a musical discourse exploiting relationships within and between genres. In addition, the perception of similar morphological criteria emerging between objets sonores permits the possibility of genres based on new models of permanence/variation. This can result in flexible and potentially more complex languages. An equally important reassessment must be made of analysis. This stage directs the complex task of determining how successfully objets sonores within genres can be formed into graded series or échelles. By means of these échelles "direction" in structures will be possible, creating the potential for tension or resolution. After characterology and analysis the stage of synthesis will direct the creation of specific sounds thereby extending genres and exploiting new échelles. Only by understanding the creative implications of the "instrumental" thought can an accurate evaluation be made of these three stages of Schaeffer's programme.

It is significant that Schaeffer did not suggest an easy option in his studio practice: the iconoclastic rejection of traditional instrumental practices and definitions. In the "Traité" Schaeffer neither advocates abandoning these sound sources nor does he suggest the frantic invention of new instruments. He realized that traditional European instrumental practices represented particular

manifestations of sound structuring(256) which should be understood if a re-balance was to be achieved. The centuries-long development of instrumental and vocal practice was not a series of haphazard accidents. The "Programme de la Recherche Musicale" is a confirmation and elaboration, rather than a rejection, of traditional instrumental notions.

3.4 The Dualism of Permanence/Variation

According to Schaeffer, permanence/variation and valeur/caractère(257) are two of the interacting networks of dualisms(258) which explain the processes of musical thought. Permanence/variation and valeur/caractère are the most intricately connected and are inherently linked to Schaefferian "instrumental" thought. The former pair of permanence/variation is examined first. This dualism establishes abstract concepts which facilitate an understanding of the specific examples of valeur/caractère.

Schaeffer is adamant that the dualism of permanence/variation is a fundamental "law" of all musical structures and essential to an understanding of the "instrument". Chion, quoting and elaborating Schaeffer, claims:

> "The law Permanence/Variation 'which dominates all musical phenomena' is linked to the very birth of the instrument and is found at the origins of all music."(259)

An example of how permanence/variation is manifested is illustrated by traditional European musical languages. Broadly speaking, traditional music communicates because of the variations in discrete units of certain aspects of sound, like pitch, duration and, to a lesser extent, intensity. These variations create the musical discourse within the language-constraints imposed by particular styles. By implication certain aspects of the sounds must

remain stable, or "permanent", for the listener to perceive the variations. Schaeffer concluded that while pitch, duration and intensity varied, instrumental timbre provided the permanent feature. For example, in a traditional composition for piano, the performer would produce many sounds. Each key would produce a unique pitch and the player would be able to vary the dynamic evolution of the notes. Despite these dissimilarities the notes would display an invariance of dynamic evolution and spectral constitution (particularly within narrow confines of the pitch-field) such that the listener would recognize a homogeneous piano timbre. The ability to identify sounds as coming from a single, instrumental source would create "permanence". Due to this stability the listener's perception would then be directed to the most important aspect of the musical discourse: the variations of pitch, duration and intensity. By asserting that timbre is the permanent feature in such traditional discourses Schaeffer did not trivialize its role. A composer's decision to make use of the particular qualities of an instrument ensures that the timbre is an integral part of the composition. Even though the substitution of a different instrument might retain the correct pitches and durations, there is little doubt that the composition would be changed in a fundamental way. Instrumental timbre is not an inconsequential aural background. Schaeffer simply realized that it was necessary for a listener to be able to recognize a sense of "permanence", consisting of common, unchanging features for the successful

identification and comprehension of variations in other aspects of sound.

By suggesting the dualism of permanence/variation Schaeffer was able to speculate whether instrumental timbre fulfilled the role of "permanence" adequately, and whether other aspects could, under certain circumstances, be substituted. In the traditional instrumental repertory the introduction of such a re-balance was not generally questioned. The manner of instrumental construction ensured that a combination of the instrument's mechanical systems and the physical techniques of the player could produce changes of pitch or duration with relative ease. In order to change the timbral characteristics to any appreciable extent the construction of the instrument itself, or the method of sound excitation would have to be altered. Since the creation of a perceptually homogeneous timbre throughout the tessitura has always been a principal concern for instrument makers this was the very aspect which was deliberately designed to be the least likely to alter(260). Accordingly, it was a natural assumption, possibly hardly questioned, that the aspects which contributed to the homogeneous nature of the sounds, the instrumental timbre, would be regarded as the permanent feature of musical discourse. By equating "permanence" with instrumental timbre there was an implicit assumption that sounds would always be produced via physical sources. This particular manifestation of permanence/variation became entrenched in music as an

apparently unshakable foundation. It was only seriously undermined when the electro-acoustic medium prompted Schaeffer's researches.

Schaeffer asserted that the manner in which both "permanence" and "variation" are assigned is a prime task in composition and a far more delicate balance than many composers in the immediate post-war era seemed to realize. During this period there was understandable excitement about the increased opportunities which composers could exploit to vary every aspect of sound. This was promoted by the organizational possibilities of serial thought and the control offered by electronic music. In the enthusiastic belief that everything could be accurately regulated, and thus varied, the role of "permanence" was often disregarded. But by ignoring the need for "permanence" an excess of "variation" tends to overwhelm a listener's perception. The result can be a confused compositional discourse. According to Chion an excess of "variation":

> "(...) saws off the branch on which musical discourse sits."(261)

Schaeffer was able to show that "permanence" is an artifice rather than a specific attribute of instrumental realization. It should be considered as a general notion, enabling the listener to imagine a "pseudo-instrumental" source capable of producing a series of related sounds, this assessment being based solely on intrinsic properties and established by the composer on firm perceptual foundations.

3.5 The Dualism of Valeur/Caractère

The corollary of permanence/variation is the dualism of valeur/caractère. Unlike the general notions of permanence/variation valeur and caractère are terms applied to specific perceptual attributes of objets sonores. These individual criteria, or more usually groupings of criteria, tend to polarize into a category of either "permanence" or "variation" according to whether they function as the principal carriers of the abstract discourse or remain part of the "permanence" from which variations will emerge. The interplay between these two dualisms is established by a complex network of interactions at all stages of a composition. A succinct definition is provided by Chion:

> "Valeurs are the pertinent features which emerge between several objets sonores in their structural context, forming the elements of abstract musical discourse in its true sense; the other aspects of the object which are not pertinent in the musical structure but which constitute its concrete substance, its matière, are grouped under the name of caractère."(262)

From this definition it follows that valeurs are the principal varying criteria of sound which are abstracted from the relatively unchanging caractères. The connexion with the previous dualism is established when it is understood that a "variation" of valeurs can only be perceived if there are enough common, unchanging caractères present between sounds to create a notion of "permanence". "Permanence" allows the comparison and emergence of valeurs. If a variation of valeurs cannot be

perceived because too many aspects are varying simultaneously, a clearly directed musical discourse between valeurs and caractères is unlikely to be maintained. It is important to note that a clear distinction between valeurs or caractères may not be possible in all sounds. Sounds which display variation of masse either internally or in tessitura, as expressed by the criteria profil mélodique and profil de masse, tend to produce a different kind of discourse(263) in which the terms of valeur and caractère are less applicable.

In traditional music tonic-type pitch and duration are, strictly speaking, the only valeurs. Their historical dominance is confirmed by the effort undertaken by musicians to represent them accurately on a traditional score. Both of these criteria can be represented accurately within a tonal and traditional rhythmic framework. This underlines their capacity to function abstractly as valeurs allowing comparison and arrangement in échelles. Since the construction of échelles, crude or otherwise, can facilitate "direction" and "motion" in music, it follows that the aspects of sound that are considered to have the greatest potential for arrangement in such échelles are those most likely to be used as valeurs. It should be stressed, however, that cultural influences also play an important part in this assessment.

The example of permanence/variation in the previous

section can demonstrate these notions. The notes in a piano composition would vary in pitch and duration. Because they constitute the principal means by which the discourse is established these aspects would be considered valeurs. This status is confirmed by the prohibition on changing any of the individual steps, or species, of the valeurs. In this case these species would be the pitches of the notes and their durations. A change of either pitch or duration would be immediately apparent because the relationships created between each sound would be changed and the composer's intentions altered. By contrast, the permanent feature which facilitates the perception of these variations is the timbre of the instrument. As a result all remaining aspects of the sounds which comprise the instrumental timbre and do not participate in the discourse to such an extent are the caractères. Even though all the caractères could theoretically be changed by playing the music on another instrument the basic dualism would remain fundamentally intact. This balance might be changed, however, in certain circumstances if aspects assessed as caractères assume an increased importance. For example, the manner of articulation is an important factor in the overall performance. Even though the performer can intervene in the shaping of the concrete substance of the notes by changing the articulation, providing pitches and durations are played accurately, its function remains that of a caractère. However, if the same phrase is repeated, the

first time legato and the second time staccato, the articulation, because it is varied, immediately becomes more prominent and assumes greater, if only temporary, significance. The same would be true of a series of repeated, identical pitches played at increasing levels of intensity. The gradual crescendo might demand as much attention from the listener as the pitches or durations of the notes.

Therefore, as in the case of "permanence", one must not assume that caractères are unimportant. Perhaps Chion in reference 262 is guilty of exaggeration in saying that caractères are "(...) the other aspects of the object which are not pertinent in the musical structure, (...)". A more balanced view is expressed as follows:

> "In other words, objects should have enough caractères in common to bring out the feature which varies from one object to another, and to which one wishes to draw attention."(264)

Because valeurs and caractères do not presuppose a specific manifestation of permanence/variation they are, in theory, extremely flexible. A valeur cannot be established by listening to a single objet sonore: it can only function within a structure of several objets sonores. Even then the notions are part of a finely balanced and constantly shifting interplay of relationships in which there can be no a priori distinction until the composer has abstracted the concrete features and established them as either valeurs or caractères. The composer then hopes to prompt a

corresponding response from the listener. In this sense a valeur can be described simply as one of several caractères contributing in a major sense to the perception of a musical structure. Only in traditional music have the roles become clearly, even rigidly, defined. This can be illustrated in the following manner where several Schaefferian dualisms have been paired:

The PERMANENCE of the CARACTERE TIMBRE constitutes the
CONCRETE SOUNDING basis on which is built
the VARIATIONS of the VALEUR PITCH representing the
ABSTRACT MUSICAL discourse (265)

Schaeffer's terminology demonstrates the possibility of re-balancing the poles of each dualism according to the requirements of the composer. These notions can assist composers who deliberately attempt to create structures based on new relationships of valeur/caractère. This approach can be compared with the "parametric" view of sound structure which coexisted with Schaeffer's researches and was adopted enthusiastically by many serial composers. The assumption inherent in this approach was that each parameter was independent and could be used, theoretically at least, to subvert the traditional pitch-duration dominance. The main advantage that pitch and duration had over other parameters was the relatively easy means by which they could be accurately produced and organized via instruments. The advent of accurate electronic synthesis combined with the organizational

potential of serial thought appeared to extend these advantages to the domains of both intensity and timbre. Nevertheless, means of organization and increased facility of production do not guarantee the creation of valeurs and successful musical discourse. The identification of a common criterion among several objets sonores cannot ensure that it will be perceived as a valeur. Perceptual and cultural predispositions may sabotage these notions; they must be established and perhaps constantly emphasized by the composer.

The concept of "Klangfarbenmelodie" was a simplistic attempt to re-balance, or even invert, the principal means by which sound aspects lead to a musical discourse. By composing stable pitch-structures with changing instrumentation it was assumed that distinctions of timbre might be perceived as easily as "melodies" of pitches. Thus pitch would become the permanent caractère while the instrumental colours would be the varying valeurs. This inversion of the "law" of PCV2 is theoretically feasible. Such reasoning, however conceptually important, failed to take into account the unique nature of tonic type pitches. These types function in a way that cannot be applied simplistically to other sound aspects. Although the sound colour of instruments could be mixed into numerous combinations, the creation of "Klangfarbenmelodien" was not possible. The directional tensions of consonance and dissonance inherent in relationships among pitches do not have direct timbral equivalents. A pitch-type scalic

differentiation is inapplicable in the case of instrumental colour where "motion" can only be implied. Thus the listener may be aware of a series of sounds or complexes becoming "brighter" or "darker", or that a particular instrumental timbre gradually begins to become more prominent. But these distinctions are continuous and qualitative rather than discrete and quantitative. As such they are unlikely to be able to create and sustain the notions of timbre as valeur and pitch as caractère. This inablilty to organize timbre in the same manner as pitch was blamed on gaps in the instrumental timbral continuum rather than the basic complexity of the notion of timbre itself(266). Even though attempts were made to fill these gaps by electronically synthesized sounds, timbres did not function as valeurs and the problem was unresolved. Significantly, Schaeffer was not the only musician to be sceptical about the notion of "Klangfarbenmelodie"(267).

It must be emphasized that the unique ability of tonic-type pitch to create cardinal échelles does not exclude the likelihood of a greater degree of participation in musical discourse by duration, timbre and intensity. Nevertheless the dualism valeur/caractère and the notion of cardinal/ordinal échelles established the difficulties that might occur if such re-balances are attempted. Schaeffer even conceded that in reality there may be a relatively limited number of combinations in which unambiguous relationships between valeurs and

caractères are possible:

> "One can well imagine that if such structures were easily achieved outside the traditional pitch-timbre structure, besides basic structures we would simultaneously have invented as many new foundations for music, or as many new musics. We are far, very far, from having found a single one that is convincing. In fact this is the whole problem, all of music research is staked on it."(268)

3.6 Timbre

One of the central aims of the "Programme de la Recherche Musicale" was the clarification and definition of the problematic notion of timbre(269). According to Chion this task was so necessary that the successful creation of a new solfège would not be possible until timbre had been investigated through the acousmatic situation and écoute réduite(270). Timbre could not be examined in the same way as other notions. For example, the traditional concept of pitch was generalized by the criterion of masse and subsequently systematized by classification into types and classes. By contrast, the concept of timbre required extensive revision and re-definition rather than generalization. Schaeffer acknowledged that the timbre of a sound is a fundamental, almost instinctive musical concept which, because it embraces several distinct notions, had become increasingly muddled(271). Thus he used three terms in specific, though related senses. These were: "timbre", "genre" and "timbre harmonique". Schaeffer's precision in identifying three distinct concepts contrasts with the confused writings about timbre that proliferated in the post-war period. Furthermore, it is noteworthy that it pre-dates the concern expressed by many contemporary musicians about the elusive nature of timbre(272).

Timbre: Schaeffer continued to use the term in reference to sounds which lead to an identification of their source.

His use in this sense reinforced the causal connexion between the sounds and the listeners' recognition of the source(273) and, therefore, did not attempt to provide typo-morphological details. Because Schaeffer emphasized the causal connexion the term can even be used in cases where in its previous, instrumental sense it would have been inappropriate. In Schaefferian terms it is possible to refer to the "timbre" of a galloping horse or a car if one can identify a particular origin. It is also possible to refer to the "timbre" of an electronic manipulation if its characteristic behaviour can be recognized as having been applied to several different sounds(274). The reference back to a recognized source was the fundamental aspect of Schaeffer's use of the term and is confirmed by the common experience of hearing instruments via a cheap radio the loudspeaker of which will not be able to reproduce low frequencies. Despite the distorted spectra there is usually little doubt about the origins of the sounds; because they can be identified their "timbre", in Schaefferian terms, remains unchanged.

By restricting the term to denote identification rather than description one can claim that the "timbre" of an instrument such as a violin includes every aspect of aural information which enables the source to be recognized. Despite the widely differing morphologies of pizzicato and arco sounds an experienced listener has little difficulty in identifying a violin. The contemporary composer has extended this repertory of sounds to include tapping on

the body, bowing behind the bridge and many other techniques. In Schaefferian terms these are all part of the violin's "timbre" providing they enable the source to be identified. However, the introduction of such techniques resulted in the breakdown of "instrumental unity"(275) since even experienced listeners confronted with such a diversity of sound types can fail to recognize instrumental sources with accuracy. This problem was addressed by formulating the concept of "genre".

Genre: A genre is a collection of objets sonores displaying a sufficient number of common aspects for them to appear to originate from the same source. These aspects can be, for example, combinations of pitch, spectral content or dynamic evolution. Thus one can perceive genres of "resonant-metallic" or "grainy-rumbling" sounds. Schaeffer recognized the tendency of the perceiver immediately and instinctively to identify an objet sonore and place it in a particular category. An immediate judgement establishes guidelines which enable an objet sonore to be compared and possibly included within a genre of related sounds. The assessment would be clarified in the listener's mind by comparing the objet sonore with the listener's total experience of sounds and/or by relating it to others within the given musical context. Thus a genre need not consist of sounds from one actual source. There can be several sources or no physical source at all as in the case of many electro-acoustic sounds. Such an assessment would

inevitably lead to the grouping of objets sonores into related families leading to the impression of a common origin (the Schaefferian pseudo-instrument). It is important to stress this distinction between "timbre" and genre: genre is generally an artificial construct whereas "timbre" implies that the sounds actually originate from one recognized source. Genre, therefore, combines information conveyed both by morphology and duration without purporting to give a detailed or systematic description of either the spectral content or dynamic evolution. Thus, Schaeffer's intention is not a simplistic replacement of instrumental timbre by genre. His term concedes that a genre is a complex interaction of "bundles of criteria" which results from a globalized perception of sound.

The notion of genre can thus explain more fully the "multi-instrumental" potential of many instruments. For example, the violin can produce sounds of different genres by techniques of either arco or pizzicato. By relating objets sonores according to genres, new families can be created which could transcend instrumental classification. These genres will create the Schaefferian "pseudo-instruments" and can, according to new notions of permanence-variation, promote interplay between the multiplicity of different sound sources employed by contemporary composers(276).

Timbre harmonique: "Timbre harmonique" was the term

coined by Schaeffer to refer to the spectral content of a sound progressing in time. This term corresponds to the relatively recent notion of a "spectral envelope" and concedes that a timbre harmonique rarely remains homogeneous throughout the course of sound's development. The continued use of the word "timbre" in the term is perhaps an acknowledgement of the importance of a sound's spectral content in the recognition of a possible source and its use in classification into a genre. Unlike genre, timbre harmonique is not an artifice. It is intended to be a specific morphological criterion(277).

Thus the two terms "genre" and "timbre harmonique" enabled the separation of notions which had become inextricably linked by traditional definitions of timbre and related to instrumental sound sources. The acousmatic situation of the electro-acoustic studio rendered many previously identifiable sounds unrecognizable, and studio techniques produced sounds that had few, if any, similarities to traditional instrumental sounds.

The importance of the globalized, retrospective(278) nature of sound perception was confirmed by many experiments conducted by Schaeffer. These were important as they questioned not only the unity of the instrument in producing several different genres, but also the assumed homogeneity of sounds within one genre. He demonstrated that alteration of a sound's dynamic envelope could affect

the way it was perceived more significantly than filtering out portions of its spectrum. This confirmed that the spectrum itself is not the only factor in the assessment of the sounds's genre and that there were apparent discrepancies perceived at different registers, usually of pitch or intensity. Schaeffer's inevitable conclusion was that an instrument did not have a timbre but timbres. The single term timbre could only encompass such heterogeneity if it was understood in the Schaefferian sense of the recognition of a sound source by any of its genres. To account for the changes within genres "laws" of variation were suggested which operated throughout the tessitura of an instrument(279). These accounted for the perception of a seamless series of slightly different sounds which would amount to a single genre. Extreme changes of constituent morphological criteria were only perceptible if sounds were compared beyond an immediate registral proximity where, for example, more significant changes in spectral content were likely to occur. Indeed if identical harmonic spectra had various dynamic envelopes imposed on them the resulting sounds would be perceived as belonging to different genres(280). This would result from the complex interactions among the spectral constituents during the attack or continuant phases. Neither congruency of harmonic constitution nor dynamic evolution can guarantee identical genres. It is a tribute to the pragmatism of composers that different genres of single instruments have always been exploited, an obvious example being the use of the clarinet's chalumeau and other

registers(281).

A useful comparison can be made between the conclusions drawn from the results of these experiments and other observations about timbre during the nineteen-fifties and -sixties. The only comparable investigations into the nature of timbre resulted from Stockhausen's early experiments in timbre synthesis and composition in Paris and Cologne. These resulted from a description of sound as constituted of four distinct parameters and promoted the erroneous notion that the evolution of the sound in time, its spectral constitution and their combined perception could be separated. The resulting conclusion was that a timbre could be extracted from a sound and then reconstituted. This separation of the dynamic and spectral aspects of sound (forme and matière in Schaefferian terminology) was theoretically valid but perceptually suspect(282). It implied that timbre could be considered as just one of several parameters of sound, like pitch or intensity, which ignored its innate complexity. This in turn led to the popular assumption that the serial organization of timbre would have a perceptual correlate. Schaeffer's assertion that timbre in this sense could not even be abstracted from its other morphological aspects raises doubts about the theoretical validity which supported many (mainly serial) attempts at timbral organization. The perception of timbre, being a complex amalgamation of pitch/time and intensity, means that it is difficult to consider it as a separate

parameter which can be abstracted and organized. The possibility of a re-balance was not doubted by Schaeffer, but success was most unlikely without reference to the law "PCV2" and morphological criteria.

A good example of the tenacity with which traditional notions of timbre have erroneously connected sources and sounds is that of traditional instrumental classification. Taken at face value the term is entirely correct. Instrumental classification is exactly what it claims: the classification of instrumental sources rather than sounds. The apparent tautology is important. Classifying instruments does not necessarily instigate a perceptually valid classification of their sounds and is, moreover, conspicuously unsuccessful in describing and categorizing non-traditional sounds and processes. And yet attempting to undertake such description and classification remains one of the most important areas in musical composition. An account of classification practice provides evidence of many inadequacies of traditional thought and demonstrates an overriding concern with the sound source to the detriment of a detailed examination of the resulting sound. These organizational criteria have remained largely untouched until the present day and thus they undoubtedly continue to have an effect on the way in which sounds are organized.

The main factor in instrumental classification is the material from which the instrument is made and its

mechanical construction. According to this classification method the large families of strings, brass and wood-wind can be defined. Most studies of instruments catalogue examples of instrumentation from the standard repertory. They attempt little more than a description of evocative sound characteristics and a listing of the pitch ranges and idiosyncracies of articulation.

The weaknesses of the traditional systems of classification have caused many, albeit minor, discrepancies. For example, flutes and saxophones are classed as woodwind instruments although they are customarily made of metal. Such anomalies have instigated various attempts at rationalizing and improving the system. These improvements however are usually little more than elaborations on the same basis of classification by source(283).

There have been several attempts by composers to improve methods of instrumental classification on musically perceptual bases. Greater emphasis was placed on the methods of sound excitation leading to a more fundamentally "acoustic" assessment. However interesting the resulting compositions may be, their theoretical foundations are unsatisfactory in attempting a systematic classification of "timbre". They are, therefore, further examples of the intractable problems between, on the one hand, the construction of the instrument and the method of sound production, and on the other, the perceived sound.

What was assumed to be a rationalization proved only to be an approximate grading of sound types. The instrumental music of Goeyvaerts written in the nineteen-fifties demonstrates his preoccupation with such problems:

> "Goeyvaerts occupied himself in his following works, Opus 2 and Opus 3, with the problem of the inclusion of the timbre-dimension in a rationally determined conception of composition. He carried out the necessary categorization on the basis of the method of sound production: plucked, bowed, struck, blown with a mouthpiece, etc."(284)

The underlying theoretical principles of Goeyvaerts compositional practice were clearly those of early serial thought (a relationship beset by problems(285)). No such explanation can be offered however for the music of Penderecki in the nineteen-sixties. Even if his music displays striking use of contemporary sound resources the tenacity of regarding the sound source as the prime means of classification is still noticeable:

> "The means introduced by me represent only an expansion of the sound characteristics of an instrument, as was formerly the case with pizzicato, tremolo, harmonics, glissando or col legno. Some of the means of articulation I used on string instruments have only apparently a percussive characteristic, but nevertheless they are related to the characteristic sound of the instrument. That is the same thing with pizzicato on the violins: although in this case it seems that the transformation of the string instrument produces a plucked instrument, all the same we are still dealing with the sound of a violin, which differs for example from that of a guitar. If we in some way or another bow, pluck or hit we are always dealing with an instrument that consists of string and a resonator, and is constructed exactly in this and no other way - and this determines the sound characteristic."(286)

By stating that all the sounds are "...related to the characteristic sound of the instrument" Penderecki implies

that this is a source to which every sound can be positively traced. His assertion that "...all the same we are still dealing with the sound of a violin" ignores the enormous differences between the sounds in his list of pizzicato, tremolo, harmonics, glissando and col legno each of which belongs to a different genre. It is a dubious yet intractable point which is contradicted by his later admission that a string instrument (which is presumably played with a bow) can be transformed into a plucked instrument. There is no doubt that plucked sounds produced on string instruments with resonating bodies such as the violin or guitar will have dissimilar spectral contents and morphologies and will therefore differ from each other. The difference is in degree. The significant fact is that, perceptually speaking, a pizzicato note on the violin is generally more closely related to a note played on the guitar than it is to a similar note on the violin played by a bow. This is particularly evident if there are congruencies of register and dynamic level. Perceptual verifications usually contradict assumptions based on causal relationships. These attempts by Goeyvaerts and Penderecki demonstrate that though they recognized the problems as composers their sound classification methods remained grossly inadequate.

3.7 Registers

Registers specify areas of the three perceptual fields of pitch, duration and intensity where valeurs vary. Broadly speaking the pitch-, duration- and, to a lesser extent, intensity-fields can be considered the main registers(287). There are two reasons for this. Firstly, the concrete features of pitch and duration are most likely to function as valeurs. Secondly, almost without exception, traditional instrumental registers comprise only these three perceptual fields. Thus an instrument like the violin has well-defined registers of pitch, duration and intensity as the sounds it produces can vary in all these concrete aspects. By contrast, a gong has good registers of intensity and duration (in this case these two are inseparable) but no register of pitch. However, other concrete features of sound might also become registers if a series of objets sonores displays these criteria. For example, if a variation of allure can be perceived among several objets sonores such that it contributes significantly to the discourse it may be considered a valeur and as a result a register of allure might be established within the appropriate perceptual fields. Registers, like valeurs, are often speculative. Because they relate to composition they are necessarily context-dependent.

Registers appear to have been derived from instrumental practice where the combination of the performer's physical

movements and the mechanical system which excited the air into vibration produces variations in certain sound aspects:

> "Entirely independent of the type of instrument, we unearth a registration. Not, as one would prematurely be tempted to say, a sounding structure discernable in the series of objects which it delivers, but those factors which produce the variation of these objects."(288)

One can speculate that if a musician experimented with an instrument and was able to produce a sufficient number of variations of vibrato or texture (usually concrete caractères) a legitimate claim might be made that the particular instrument had physical registers of these aspects(289) analogous to those of pitch or duration. With the advent of Schaefferian "pseudo-instruments" where physical actions are not necessarily applicable, the notion of registers became a general concept.

The concept of register does not exactly duplicate perceptual fields. Usually a field contains more than one register. For example, the pitch-field contains the registers of both tonic type and complex type masse. Furthermore, a register can involve more than one field. The possibility of a register of allure has already been suggested. As a "generalized vibrato" allure might be a variation in the pitch- or intensity-field. In addition, the distance between these pulsations in either field might give rise to an increased awareness of time and thus include the duration-field. Therefore, a register of allure involves more than one field and is perhaps an

indication of the problems in creating such a register. The following table summarizes information given by Chion(290). He described the morphological criteria and the principal perceptual field in which each might vary. Where appropriate, their secondary fields are enclosed in brackets. This table confirms that if a criterion is limited in its occupation of the three fields its potential as a register is enhanced:

TABLE 10 MORPHOLOGICAL CRITERIA AND PERCEPTUAL FIELDS

morphological criterion	perceptual field		
masse	pitch	-	-
timbre harmonique	pitch	-	-
dynamique	-	intensity	(duration)
grain	pitch	intensity	duration
allure	pitch	intensity	duration
profil mélodique	pitch	(intensity)	duration
profil de masse	pitch	(intensity)	duration

According to this table allure and grain occupy all three fields. This inhibits both their valeur-potential and their registers. By contrast, masse's occupation of only one field promotes its role as valeur. (It should be stressed that the same cannot be said of timbre harmonique which is rarely perceived independently of masse.)

The investigation of new registers in addition to those traditionally promoted by instruments was consistent with Schaeffer's determination to consider the potential of all perceptible aspects of sound and how they might

participate more significantly in an abstract discourse:

> "The discovery of registers is no more than the making use of the instrumental material which one or another civilization has to hand. The concrete precedes the abstract."(291)

If abstract relationships among sounds are to be exploited, the composer must be able to create échelles in the chosen register. In order to organize the varying criteria discrete steps must be perceived within the three perceptual fields according to position - the "site", and how much of the area it occupies - the "calibre". (The methodology for investigating a criterion's échelle-forming potential is outlined by analysis(292).) A discourse is unlikely to be created and sustained by abstract relationships if échelles cannot be formed:

> "(...) only the <u>échelles of criteria</u> would be capable of creating abstract relationships and not just dynamic or impressionistic ('plastic') relationships. This is because they bring into play relationships, differences and not only concrete qualities attached specifically to objects."(293)

This distinction is significant. Although some sounds cannot create abstract relationships they are not without value in music (particularly contemporary music). They give rise to a different kind of music. For example, cardinal échelles of tonic type masse create a register by which intervals, transpositions and many other pitch-based procedures are usually easily perceived. These abstract relationships promote "musical" discourses which use discontinuous échelles. However, if échelles are created with complex type masse few comparable relationships can be identified. The broad bands that such sounds occupy in

the pitch-field may lead to échelles based on position in tessitura but these will not be capable of sustaining the same intervallic relationships as tonic type échelles. Perception is drawn to the particular quality of masse and appreciated largely for its own sake. The same is true of varying sounds. Such a discourse based on these concrete aspects is called "plastic" music. The existence of these two types necessitated the formulation of two principal registers within each of the perceptual fields of pitch and duration.

The three perceptual fields and their registers are examined as follows:

Pitch: The pitch-field occupies a particularly important position in music, an assessment of masse being one of the most fundamental aspects of both typology and morphology. Of all the aspects of sound pitch is the most immediately perceptible(294), and thus the most common valeur. The pitch-field comprises two registers:

a) Harmonic: The harmonic register of pitch contains objets sonores of tonic type masse. This type of masse is the most suitable for the perception of intervallic relationsips, though naturally these need not necessarily conform to conventional temperaments. The term "harmonic" is perhaps a reference to the creation of structures that demonstrate directional tensions resembling the traditional concepts of consonance and dissonance. It is

in this register that discontinuous, cardinal échelles can be created most effectively leading to "musical" music. For example, the notes of traditional "melodic" instruments produce sounds in this register of pitch.

b) Coloured: This register contains the two remaining types of masse: the complex type and the variable type. Unfortunately including both of these types in the same register can be confusing. Because neither type could create "musical" music, by definition they had to lead to the more fluid, vague discourses of "plastic" music. However, both types behave in different ways and sub-dividing this register again would have been extremely unwieldy(295). The objets sonores of the complex type are discontinuous and stable in tessitura though they might display slight, "internal" fluctuations in matière. Objets sonores of the variable type move through the pitch-field or have significant changes in masse and their variations are, therefore, usually continuous. Ambiguous cases may occur if an objet sonore describes a scalar trajectory through the pitch-field, each step possibly resembling one objet sonore of complex masse. Thus while both complex and variable types tend to produce "plastic" music they are not perceived in the same way; a series of discontinuous complex masses is completely different from an objet sonore which describes a trajectory in the pitch-field. Examples of both types are as follows. A struck cymbal will display a complex masse whose spectral content may vary as it fades to silence. A kettle-drum

glissando provides an example of a variable objet sonores in this register.

Duration: The duration-field is difficult to summarize as every sound of necessity exists in time. In addition, the concept of musical, as opposed to chronometric time must also be taken into account. Furthermore, masse, timbre harmonique and intensity cannot be perceived clearly if sounds are too short which creates problems when comparing and relating them. Such sounds are of the "impulse" type and the listener is usually more aware of the gaps between the sounds or of their "impact"(296) rather than the sounds themselves. On the other hand if objets sonores are too long their lengthy duration tends to distract the listener's perception of the sound's forme and attention might drift to aspects of the matière such as the dynamique or variations in masse. These may assume greater importance and the listener's perception oscillates between intrinsic sound qualities and the amount of time taken for the sounds to progress. Like pitch, duration has two registers:

a) Rhythmic: This register contains objets sonores which can exhibit clear durational relationships. The ability to compare the overall length of individual sounds makes it (like the "harmonic" register of pitch) the most suitable for the creation of abstract relationships. Though it must be emphasized that durations cannot be estimated in the same way as pitch; they can only form

ordinal échelles. It is important that such sounds display little or no variation in matière so that the listener is not distracted from an awareness of the duration(297). Notes of various lengths played on an organ occupy this register. It is unlikely that an organ's morphology would distract a listener from an assessment (however approximate) of the durations.

b) Dynamic: The "dynamic" register contains objets sonores which have a clear onset(298). This "warps" the sound because perception, being directed to the "attack", may only gradually become aware of the subsequent behaviour of masse and timbre harmonique. The sound's impact derives principally from this localized moment of the "attack". For example, when listening to piano sounds more attention is generally paid to the distance between each onset than the way the rest of the note behaves.

The distinction between this register and the "rhythmic" register seems to depend on the behaviour of the sound after the onset. If the behaviour is very slight the sound's duration is most clearly perceived and leads to a "musical" music. If, as in the "dynamic" register, the sound displays a distinct behaviour, perception is drawn to aspects of the sound's forme. Schaeffer does not make it clear whether it is necessary for the sound specifically to have an "attack". Presumably any distinct point in each of several sounds would still lead to the perception of distance between them regardless of where in

the forme it occurs. By paying attention to aspects of forme rather than abstract relationships of "absolute" duration this register is most suitable for a "plastic" music. This tendency is enhanced if the sound is of long duration(299). With such sounds a clear perception of either duration or a single reference point may not be possible. Accordingly a sub-section is created like that of variable sounds in the "coloured" register of the pitch-field and the listener is aware of the forme's dynamic evolution

Intensity: The intensity-field is problematic because it is closely related to the field of duration. Indeed in the "Traité" Schaeffer gives the impression that the two fields are inextricably connected(300). The creation of a register in this field is complicated by the sound's individual dynamic profile and its relationship to other sounds in the context of a composition. Both of these can be affected by the sound's originalité and the attention this demands from a listener. Such a register is perhaps the most subjective and "expressive" of all in the three fields. In addition, intensity is usually variable in a continuous manner and is thus most unlikely to lead to abstract relationships.

The complexity of interaction among these three fields demonstrates the difficulty of formulating registers and échelles of some criteria. An interesting and early example of an attempt to explore a register other than the

explicit ones of "harmonic" pitch and "rhythmic" duration can be heard in Schaeffer's Etude aux Allures(1958). In this work Schaeffer tried to exploit the potential of allure as a valeur:

> "(...) strenghthened by having found a caractère as precise as that of allure (understood as every type of generalized vibrato, both in timbre and dynamique, both rhythm and density) he begins to exploit this sure point of departure."(301)

The nature of this criterion ensured that it occupied every perceptual field to an extent though, naturally, some sounds would be biased towards one particular field. For example, if duration is considered as the principal aspect the gaps between the fluctuations and how they develop from loose to tightly packed will be of paramount importance. If, on the other hand, pitch is considered, the distance travelled in the tessitura by the fluctuations will be evaluated. It should be stressed that the existence of such a register was very hypothetical. There could be no certainty that species of allure could be established as variations of a valeur(302).

3.8 Jeu

Jeu(303) is Schaeffer's term for the entire range of possibilities involved in varying the concrete substance of a sound and how these variations interact. Like register, jeu is most clearly illustrated by considering traditional instrumental playing and has been extended by Schaeffer to include "pseudo-instruments". For example, a violinist might explore the potential of the instrument by playing a series of tonic type notes, ensuring that they remain at the same pitch level. By the use of different bowing techniques many sounds could be produced with a variety of formes and matières. The manner of fabricating the sounds would create individual combinations of caractères as the physical action of the bow alters the notes' concrete aspects. Some notes may be very grainy as excessive bow-pressure is applied, while others may display allure if vibrato is added. Because the sounds do not change in tessitura, this exploratory activity of a musician experimenting with the potential for variation offered by the particular instrument will not create a register in, for example, the pitch-field. If a sufficient number of different grains or allures are formed then these might (depending on the musical context) lead to valeurs and registers and a jeu of these criteria might be possible. By contrast, if the concrete aspect of pitch alone is changed, the harmonic register in the field of pitch would almost certainly become apparent. The pitch relationships perceived between each objet sonore

would create pitch-jeux; the actual manifestation of the register's possibilities.

It must be stressed that the exploratory nature of these instrumental techiques is invaluable: the more ways concrete aspects can be varied the greater is the potential of an instrument (and the ability of a player). This illustrates that, like the relationship between valeur and caractère, there is a close connexion between jeu and registers. The activity of jeu may create many interesting sounds but it will not in itself create a register any more than the existence of a common caractère will ensure its potential as a valeur. Only perception and ultimately musical context can do this. In addition, like registers, certain jeux are more easily achieved than others. Schaeffer refers to four:

> "In this instinctive activity prior to every codification of rhythmic or melodic structures, we see the emergence of four <u>jeux</u>: two of them are relatively explicit, rhythms and pitches; the other two, timbres and intensities are implicit."(304)

As each criterion interacts, it is perhaps more accurate to say that the principal jeu would create the variation of valeurs in the register, while other jeux contribute to the musically satisfying nature of the caractères.

Schaeffer's attempts to create new jeux in new registers has already been mentioned in reference to his <u>Etude aux Allures</u>. Another comparable example is that of Pierre Henry's <u>Variations pour une Porte et un Soupir</u>(1963).

Henry's manipulation of recorded fragments of a creaking door exploits the transition between smooth and rough surfaces of his objets sonores and can be cited as an example of a jeu of grain. His technique was described by Chion in the following terms:

> "(...) he plays in an organized fashion on the creakings of a door. If it is not music, it is at least the study of instrumental jeux."(305)

Chion qualifies the work as a study rather than music. Nevertheless, he refers to the playing on the creakings of a door as if these were the results of activity with a physical instrument. This suggests that it is possible to promote sounds which exist in no other form than the manipulations of recorded sounds to the status of an "instrument". Henry recognized one particular concrete aspect of his sounds and attempted by jeu to extract different qualities and thus exploit grain's valeur-potential. As a result the recorded sound source can be used to create "pseudo-instruments" which are "played" to create a discourse. Thus although the instrument in this composition as a physical sound source has disappeared it still exists as a concept in the skill that the composer demonstrates in creating sound structures which attempt to establish the relationship between permanence-variation and valeur-caractère.

The entire complex process of jeu and the "instruments" on which it can be undertaken is summarized by Moles:

> "In reality the term instrument must be taken in a phenomenological sense and corresponds less to machines for making notes of conventional music

(violin, piano or harmonica) than to apparatus that the concrete musician encounters in his artistic journeying between the exploration of the sound universe and its exploitation in an organized composition. This term should therefore be expanded, retaining only one of the aspects of the classical meaning of the instrument: an instrument with which one plays; the word "play" being in all its ambiguity one of the keys to artistic creation."(306)

3.9 Musical Discourses

The existence of two principal registers within each of the two perceptual fields of pitch and duration illustrates problems that a composer might encounter in creating an abstract musical discourse. By emphasizing the difference between "abstract" and "plastic" relationships outlined in the discussion on registers, Schaeffer concluded that there are two principal types of discourse, in addition of course, to an infinite number of mixed cases(307). His assertion of the "plastic" discourse's existence and his examination of its particular properties is significant. It suggests that the absence of explicit registers is not necessarily a disadvantage. Indeed, Schaeffer suggested that the value of a "plastic" discourse depended on the continuous, fluid qualities of sounds not found in traditional "musical" music:

> "One could even imply that it (i.e the 'plastic' discourse) gains its meaning where the preceding music lost its (meaning)."(308)

By becoming aware of the evolution of a sound's forme, or of the intrinsic nature of its matière, it might be appreciated as a structure in its own right(309). As a result, the perception of abstract relationships between sounds is revealed as typical of only one type of musical discourse.

In order to retain a rigorously consistent approach Schaeffer recognized that the dualism of valeur/caractère

is only applicable to registers which display discontinuous relationships. This dualism relies on the listeners' ability to perceive and compare concrete aspects of individual sounds. It is for this reason that tonic type masse and sounds which vary very slightly, if at all, are the most typical in the "harmonic" and the "rhythmic" registers. These encourage the most accurate perception of pitch- and duration-relationships.

The notions of valeur and caractère are difficult to apply to continuously varying sounds such as those of the "coloured" and the "dynamic" registers. Because of their evolving formes these sounds tend to "warp" perception. Schaeffer had undertaken a detailed classification of sound types by means of typology and identified many sounds whose matières and formes excluded their organization by means of valeur/caractère. For example, if a composer uses a siren in a work a listener may attempt to assess the highest or lowest pitch levels or the type of masse in the manner of an abstract discourse. However, the principal factor will almost certainly be the sound's originalité resulting from the unorthodox behaviour of the masse moving in the tessitura. The sound will be perceived as a unique structure in its own right and unsuitable for inclusion in an abstract discourse. The two criteria of variation: profil de masse and profil mélodique can be employed to assess this behaviour according to facture and speed(310). Because such sounds display continuous variation the dualism of

variation/texture(311) is more appropriate than that of valeur/caractère.

By emphasizing that the discourse is a result of the type of objet sonore Schaeffer reiterated his belief that the method of organization, however important it may be for the composer, may be less significant than the sounds themselves and the manner in which they are perceived. Thus sounds in the "coloured" register such as gongs and cymbals, whether organized serially or not, will be perceived as belonging to a "plastic" discourse.

In formulating the "musical" and "plastic" discourses Schaeffer was able to use his notion of the "pseudo-instrument". In either type of discourse individual genres of sounds will be identified and contribute to the perception of one or more instrumental or "pseudo-instrumental" sources. Schaeffer utilized the traditional notion of polyphony to emphasize the existence of separate genres. Thus, he identified the following types of discourse:

<u>polyphonic-musical</u>: Many traditional musics can be cited as examples of this type of discourse. Each separate part consists of individual, thus discontinuous, notes produced by (hopefully) clearly differentiated instrumental timbres. The "harmonic" register will particularly encourage the creation of pitch relationships both horizontally and vertically. Other registers may

participate if their valeurs are perceived to promote abstract relationships. For example, several distinct allures may be perceptible among different objets sonres that are in all other respects identical.

polyphonic-plastic: Many contemporary scores can be described as polyphonic-plastic. For example, a work may use several metallic percussion instruments such as cymbals, gongs, crotales and vibraphone. Individual genres could be created giving the impression of several distinct layers of sounds. However, these would be the result of "pseudo-instrumental" genres as, for example, high clusters played on the vibraphone might be related to the sounds of crotales. In addition sounds which move through the pitch-field or which have varying formes will be included in this discourse. Intrinsically interesting though these sounds might be they would not be related by clear échelle-creating registers.

It must be stressed that ambiguous cases are possible. Sounds in different contexts can produce either type of discourse. For example, string players may produce notes of relatively limited durations which are terminated by short but distinct descending glissandi. If a listener hears one or two such notes the glissandi might prompt a tentative prediction of an imminent "plastic" discourse. However, if these notes continue and, because of their tonic type masse, begin to create "abstract" relationships, the glissandi will probably be heard

instead as a distinctive feature of a particular genre. The sounds will then be perceived for their structure-forming potential, rather than their intrinsic qualities.

In addition to the polyphonic discourses Schaeffer outlined another type called polymorphic. This can also be subdivided into polymorphic-musical and polymorphic-plastic discourses. Unlike polyphonic discourses which consist of the perception of several distinct genres, the polymorphic type exhibits successive blocks of sounds more or less fused together. Schaeffer believed that polymorphy was the inevitable outcome of polyphonic discourse and cited the development of "chordal" music from early polyphony as an example. He considered such music as a later development in which the individual functions of each voice became combined into single chords. The distinction between these two types is perhaps less clear than the polyphonic types.

<u>polymorphic-musical</u>: This type can be illustrated by traditional music of a "chordal" nature. Each chord can be perceived as a unity though the individual components may be single notes. The sound block will display relationships (though not necessarily tonal ones) resulting from these tonic type components.

<u>polymorphic-plastic</u>: By contrast "fused" blocks of sound in which no clear distinction between components is

possible exemplifies this type of discourse. The connexion between each sound aggregate may be less logical than in the polymorphic-musical type. Thus non-pitch based relationships may become apparent.

These four types of discourse were the principal ingredients of all musical discourses. Schaeffer called them:

> "(...) four poles of musical functioning, cardinal points which help to situate the various areas of musical organization (...)"(312)

3.10 Schaeffer and the Instrument

Despite the diversity of the contemporary instrumental repertory instruments have tenaciously survived all the stylistic disruptions throughout music's history. They are, therefore, self-evidently amongst the most important factors in music. In instrumental music the composer's ideas, in conjunction with the skills of the performer, are filtered through these intermediary physical sources before their sounds can be perceived by the listener. The complexity of contemporary musical languages demands a fuller understanding of this most fundamental relationship. However, the indiscriminate use of the term "instrument" has hindered any attempt to achieve a precise definition, or indeed initiate any examination at all. Consequently, as a concept, the "instrument" remains largely unexplained; its ubiquitous presence producing little other than updated, but still conventional, works on instrumentation(313). By providing terminology and generally applicable concepts, Schaefferian theories are unique in the assistance they offer contemporary musicians in gaining a fuller understanding of the sources from which they produce sounds.

The following is Schaeffer's definition of an instrument:

> "An instrument defies any theoretical definition other than that of permanence-variation (...), a notion which dominates all musical phenomena. Every device from which one can obtain a varied collection of objets sonores - or varied objets sonores - while keeping in mind causal permanence, is a musical instrument in the

traditional sense of an experience common to every civilization.

If the adjective 'musical' arises mainly from the variety and organization of the collection of objects, this instrument displays registers and leads to a musical field dominated by the corresponding structures. If the qualification (musical) is applied mainly to the objects themselves, which are interesting on account of their forme or their matière, but isolated or disparate such that they do not display registers and do not lead to structures, one discovers a kind of traditional instrument of which there are some examples in history, but which has always been placed, in the West at any rate, at the limits of the musical domain: such as gongs, cymbals, cow-bells and (other) maraccas. These instruments do not give strictly speaking a collection of distinct objects which could be arranged (in series) according to an abstract quality, but unchanging objects, though in various forms, which are differentiated only by concrete caractères. Thus, instrumental practice already displays the alternation between a <u>structure</u> of sounds and the <u>caractères</u> of a sound's structure."(314)

One can see the hallmarks of Schaefferian instrumental thought in identifying two main groups of instruments. The first comprises every instrument that can display the principal registers of pitch and duration. The second group contains, broadly speaking, the "untuned" instruments of the percussion family. These do not display the explicit registers of the former group apart from intensity. They are, nevertheless often interesting in their own right and offer a supplement to the traditional sound repertory beyond providing illustrative rhythmic punctuations. Schaeffer assigns these to the two principal discourses based on discontinuous "musical" relationships and "plastic" continuous relationships. It is significant that Schaeffer bases his definition on the manner in which the sounds function rather than the

sources from which they originate. By demonstrating the potential that all sounds have for particular kinds of structures and discourses Schaeffer has liberated instrumental thought from purely physical restrictions. Such a method is invaluable to composers who concentrate on "plastic" type discourses whether realized instrumentally or by electro-acoustic means. A vocabulary thus exists for describing types of sound complexes and how they vary both in forme and matière.

This inversion of instrumental examination, considering the sounds before the source, can be contrasted with traditional investigations. The following is a typical assessment:

> "'Musical instrument' is a self explanatory term for an observer in his own society; it is less easy to apply on a worldwide scale because the notion of music itself escapes definition. Hornbostel (...) advised that 'for purposes of research everything must count as a musical instrument with which a sound can be produced intentionally'."(315)

To state that the term is self explanatory only to qualify it by accepting the culturally based problems of defining music offers little assistance. Nevertheless, the quotation is helpful in two ways, though neither is a definition as such. Firstly, it identifies an act of intention: the creation of objets sonores within a musical structure. Secondly, and more importantly, it emphasizes the production of sound from an "instrument", thus placing whatever device is under discussion in a simple chain of physical systems: source - medium - receptor(316). As

"source", the "instrument" clearly occupies a position of prime importance. Naturally, without a source of some kind to initiate this sequence it would be impossible to create music at all, but one should not be tempted to regard any sound source whatsoever as an "instrument" simply because it occupies this primary position. As Schaeffer indicates, instruments are best defined according to particular capacities for the creation of registers or jeu. If an implement is placed in this position regardless of these considerations the term becomes so wide as to be almost meaningless. "Instrument" and "source" should not be regarded as synonymous. The following quotation by Chion illustrates the established practice of appraising the source before examining the sound dispassionately:

> "The paradox is that by being attached like a fetish to the western instrument, composers and music lovers who nevertheless regard themselves as avant-garde have instinctively more respect for an insignificant objet sonore got out of a Steinway piano (thus 'ennobled' by its source) than from a very beautiful sound from a rubber band, which will appear to them more or less vulgar."(317)

It is a sobering thought that no matter how "avant-garde" a musician professes to be, a pre-occupation with the sound source rather than the sound is principally an inheritance of traditional instrumental practice.

Schaeffer also offers a more balanced view of the invention of new instruments. Many attempts have been made to invent new instruments. These were usually designed to improve upon the basic characteristics of the

two aforementioned instrumental groups. For example, a desire for accurate differentiation within registers was apparently possible by the use of electronic equipment and electronic instruments. This extended the production of precise valeurs beyond human capacity in the form of superhuman virtuosity. However, Schaeffer summarized the errors in this approach. In connexion with electronic instruments he said:

> "Basically it (the electronic instrument) did not correspond to the definition of an instrument. Seeing that it intended to epitomize every instrument at both one and the same time, that meant it contained not only registers as we have defined this term but a super-register: the same which could allow passage from one instrument to another. In point of fact the notion of the instrument was minimized. People thought they were going beyond it to the profit of structures; there was confusion about the notion of timbre: whose second meaning was extrapolated prematurely, timbre became a single characteristic of the objet musical and no longer the perception of a common cause of a family of objects.(318)

Such a remark might be interpreted as Schaeffer's criticizing electronic music in order to promote a factional interest in musique concrète. However, he was equally critical of the equipment used to realize such music. Recorded concrete sounds were usually very rich both in forme and matière. By definition such sounds had few, if any, easily recognized registers, but in compensation, they had enormous potential for jeu. Like the registers of electronic instruments this aspect was insufficient to produce a satisfying discourse:

> In contrast to what gave rise to the electronic instrument, there were few possibilities of <u>register</u> but on the other hand extraordinary possibilities of <u>jeu</u>, at both one and the same

> time in the invention of sonorous entities captured by the microphone and in the adjustments made after recording. Finally, if one refrained from all electronic fiddling, there was clearly no presence of an instrumental timbre, each objet sonore declaring without equivocation its own origin."(319)

As Schaeffer began to formulate the stages of his "Programme de la Recherche Musicale", the relationship between the dualisms of permanence/variation-valeur/caractère and "instrumental" analysis revealed fundamental musical principles. Schaeffer has thus contributed a major theoretical system which can be of benefit to all composers.

Epilogue

The preceding discussions have demonstrated the extent of French and German contributions to the evolution of electro-acoustic musical thought. Both approaches have had a significant influence on contemporary instrumental music. Due to continuing technological developments in the electro-acoustic medium and the prominence of new attitudes towards instruments since the nineteen-fifties any discussion of the relationship between these fields must avoid generalizations. Furthermore, simplistic declarations of one studio's superiority over the other are of little value. It is more beneficial, therefore, to summarize each studio's relationship with instrumental thought in order to indicate the potential merits of both French and German approaches.

The Cologne studio helped to establish the use of technological equipment in music composition. Early attempts at synthesis and sound processing are direct forerunners of many present-day digital techniques. The exploitation of mixed electro-acoustic and instrumental resources created a precedent for much contemporary mixed-media musical activity. The Cologne studio can also be cited as a principal source of applying scientific concepts to music resulting in the widespread use of notions from acoustics and phonetics for classifying and relating sounds. In addition, Cologne initiated the application of techniques derived from communication

science, particularly information theory, in composition and analysis. These encourage rational, objective attitudes to musical composition and perception. Perhaps this was most evident in the Cologne studio's elaboration of serial thought. By the rigorous application of serial principles to all aspects of composition the advantages and disadvantages of the system could be accurately appraised. One can detect in these developments the tendency to organize as a first principle, to impose a scheme on the chosen sounds and thereby promoting abstract thought at the expense of perceptual investigation. Cologne's relationship with instrumental thought evolved principally from this conceptual, organizational approach which remains a common strategy for many contemporary composers.

In Paris, Schaeffer's emphasis on experimentation and perceptual verification established a methodology which has enormous potential for contemporary musicians. The first three stages of Schaeffer's "Programme de la Recherche Musicale" provided a method for classifying, describing and grouping sounds into families. The last two stages, though more hypothetical, considered how sounds could be formed into structures suitable for musical discourse. Its usefulness has not diminished. The "Programme" forms a comprehensive pedagogical framework invaluable to composers and theorists. Each stage and the related terminology can be applied equally to instrumentally realized sounds. In addition, the

Schaefferian concepts of abstract/concrete, permanence/variation, valeur/caractère and "instrumental" analysis clarify fundamental musical principles. By liberating instrumental thought from purely physical restrictions, the "pseudo-instrument" exists as a point of reference during the course of composition and listening. Sounds rather than sources assume a more important role in music.

Because emphasis is placed on sounds and how they are perceived, Schaefferian methodology is appropriate for many kinds of musical language. The universality of Schaeffer's approach, as demonstrated in the third section of this study, promotes an understanding of musical thought that could not be uncovered by the conceptual methods of Cologne. Even contemporary composers with little or no interest in the electro-acoustic medium per se can benefit by considering the principles identified by Schaeffer. Much modern orchestral writing with its emphasis on texture, fused sound agglomerations and spectrally dispersed masses as well as the exploitation of multi-instrumental possibilities could profit from the application of such principles. For musicians who are committed to the medium it is reassuring to know that the ineffectiveness of many electro-acoustic compositions is due not to the absence of instruments but a failure to recognize and control "instrumental" concepts. It is perhaps ironic that the inherent predispositions both of instruments and instrumentalists might be better uncovered

by research originating in a medium in which there is no compulsion for composers to use either.

References

1) Schaeffer's original studio was called the "Studio d'Essai". In 1948 this was expanded and re-named the "Club d'Essai". The purpose built studio stems from 1951 and was called the "Groupe de Musique Concrète, Club d'Essai". In 1958 this studio became the "Groupe de Recherches Musicales".

2) Pierre Schaeffer was born in Nancy in 1910 into a musical family. He studied as an electronics engineer and received diplomas from l'Ecole Polytechnique and l'Ecole des Télécommunications de la Radiodiffusion Télévision Française. He has spent most of his working life at the Radiodiffusion Télévision Française becoming fully conversant with the equipment of radio broadcasting. His importance lies in his skills as a researcher and theoretician as much as composer.

3) Before the widespread introduction of magnetic recording tape the "disque souple" or "supple disc" was the only means available for recording and manipulating sounds in musique concrète. Precise details are scarce but one can assume that such discs resembled blank versions of conventional recorded discs, the sounds being recorded directly onto the lacquer surface of such discs. The term "souple" perhaps refers to a flexible material from which the discs were made.

4) The innovative nature of many concepts necessitated the careful development of much new terminology which was derived from two principal sources. Either Schaeffer invented appropriate neologisms or (and this was by far the larger class) he adapted words from a variety of non-musical disciplines. Idiosyncratic though they may be, the neologisms (derived usually from Greek or Latin) indicate Schaeffer's intellectual background as a "polytechnicien" and provide further insights into his choice of terms. In addition, the disciplines to which Schaeffer turned for suitable terminology reveal his knowledge of linguistics and philosophy. These undoubtedly affected his methodology and the aspects of music to which he felt obliged to appoint specific terms. The adapted French words often have particular connotations to native French speakers. The full implications of such words can be lost in a literal translation. A brief explanation of certain key terms is therefore appropriate. In the text French has been retained for those terms which have no direct English equivalent or where a literal translation might be misleading.

5) Michel Chion, Guide des Objets Sonores (Paris: Editions Buchet/Chastel, 1983), p.40

> "(...) où elle fut proposée, non sans esprit de provocation, par Pierre Schaeffer."

6) The "Studio für elektronische Musik" at the

Nordwestdeutscher Rundfunk in Cologne was fully operational in 1953 after nearly two years of planning.

7) The following quotation from Schaeffer's first book illustrates his intentions regarding experimentation.

Pierre Schaeffer, <u>A la Recherche d'une Musique Concrète</u> (Paris: Editions du Seuil, 1952), pp.179-180

> "(...) I propose an experimental step in music which implies a scientific method. This method, as we know, is the method of permanent verification of theory by the result. However, I find before me two categories of musicians: classical (musicians), for whom this step is against nature, and who are frightened by the idea of experimenting with sounds which do not lead to an immediately intelligible work. The others burst into the studio and, under the pretext of experimentation, charge into theory, insist on procedures and mimic engineers. Placing numbers with regard to sound, measuring them in eighths of a tone or in half decibels and in centimetres, fills them with confidence. They are confusing disciplines. They were urged to a specific experimental method, that is to say, to keep within the rigorous framework of the musical purpose. They hurry towards an algebra of sound, to a combinational analysis of the pure object. Good grief, I have asked often enough that the objet musical should be considered directly. I also have the right to ask that the subject plays his role. An experimental method in music should mean <u>to listen</u>: above all, all the time, before, during, afterwards."
>
> "(...) je propose une démarche expérimentale en musique, ce qui suppose une méthode scientifique. Cette méthode, comme l'on sait, est celle du contrôle permanent de la théorie par le résultat. Or, je trouve devant moi deux catégories de musiciens: les classiques, pour lesquels cette démarche est contre nature, et qu'effraie l'idée d'expérimenter sur des sons qui ne conduiraient pas à une oeuvre immédiatement intelligible. Les autres font irruption dans le studio, et sous prétexte d'experimentation, foncent dans la théorie, exigent des mesures, et contrefont les ingénieurs. Mettre des chiffres en regard des sons, les mesurer au huitième de ton, ou au demi decibel et au centimètre, les remplit d'assurance. Ils confondent les

disciplines. On les conviait à une méthode expérimental spécifique, c'est-à-dire à inscrire dans le cadre rigoureux de l'objectif musical. Ils se dépêchent à une algèbre des sons, à une analyse combinatoire de l'objet pur. Diable, j'ai suffisamment demandé que l'objet musical soit pris en considération. J'ai bien le droit de demander, aussi, que le sujet y joue son rôle. Méthode expérimentale, en musique, veut dire <u>écouter</u>: tout d'abord, tout le temps, avant, pendant, après."

8) Pierre Schaeffer, <u>Traité des Objets Musicaux</u> (Paris: Editions du Seuil, 1966, revised edition 1977), p.23

> "Au lieu de noter des idées musicales par les symboles du solfège, et de confier leur réalisation concrète à des instruments connus, il s'agissait de recueillir le concrète sonore, d'où qu'il vienne, et d'en abstraire les valeurs musicales qu'il contenait en puissance."

9) Ibid., p.24

10) The important difference between an "abstract" and an "abstracted" language is discussed in "The Relation of Language to Materials" by Simon Emmerson: Simon Emmerson (ed.), <u>The Language of Electroacoustic Music</u> (London: The Macmillan Press Ltd, 1986), pp.17-39. Emmerson constructs a grid of nine musical languages (and hybrid types) ranging from an abstract syntax and dominant aural discourse to abstracted syntax and dominant mimetic discourse. These two extreme language types exemplify respectively a language in which the syntax is imposed on the (usually) electronic sounds and one in which the syntax is abstracted from the materials.

11) Schaeffer, Recherche, p.37

12) Chion cites the following definition from Lalande's "Vocabulaire de la Philosophie".

Chion, Guide, p.39

> "'Abstract: every notion of quality or relationship which is considered in a more or less general manner without consideration for the representation. In contrast the complete representation as it is or could be given is called concrete.'"
>
> "'Abstrait se dit de toute notion de qualité ou de relation que l'on considère de façon plus ou moins générale en dehors de représentations où elle est donnée. Par opposition, la représentation complète telle qu'elle est ou peut être donnée est dire concrète.'"

13) Schaeffer, Traité, p.24

> "(...) la recherche musicale à partir du concret, certes, mais tout entière vouée a la reconquête de l'indispensable abstrait musical."

14) Pierre Schaeffer, Situation Actuelle de la Musique Expérimentale, La Revue Musicale No.244, (Paris: Editions Richard-Masse, 1959), p.15

> "S'il est relativement aisé de connaître les caractères acoustiques ou même phonétiques des sons, il est fort malaisé de définir au juste leurs caractères véritablement musicaux."

15) Schaeffer conducted many experiments which demonstrated that the relationship between perception and sound was more complex than had been hitherto imagined. The experiments related to the following main areas:

1) Frequency and pitch are not equivalent.

2) Timbre and harmonic spectrum are not equivalent.

3) The perception of a sound's duration is affected by the complexity of behaviour of its component parts.

4) A sound's attack affects not only the dynamic aspects but also the perception of the harmonic profile.

These are listed in book 3 of the Traité and themes 1,2 and 4 of the work by Pierre Schaeffer and Guy Reibel, Solfège de l'Objet Sonore, (Paris: Editions du Seuil, 1966). In addition there are several references to experiments in the first section of "A la Recherche d'une Musique Concrète". These are discussed in section 1.3.

16) Schaeffer, Traité, p.493

> "Se repérer sur une fausse carte équivaut à être perdu."

17) This more comprehensive view of the concrete attitude is confirmed by Chion:

Chion, Guide, p.91

> "From the beginning of musique concrète, Pierre Schaeffer did not only seek a new music, but also the natural perceptual bases capable of establishing a 'concrete experience' of music."

> "Dès les débuts de la musique concrète, Pierre Schaeffer ne cherche pas seulement une nouvelle musique, mais aussi des bases naturelles perceptives susceptibles de fonder une 'expérience concrète' de la musique."

18) The cloche coupée was an experiment of interruption

where one removed a "(...) fragment of the resonance of the sound of a bell after its attack (...)" "(...) fragment de résonance de son de cloche après son attaque (...)". Chion, Guide, p.20.

19) Schaeffer, Recherche, p.15

> "En faisant frapper sur une des cloches, j'ai pris le son après l'attaque. Privée de sa percussion, la cloche devient un son de hautbois. Je dresse l'oreille. Se produirait-il une fissure dans le dispositif ennemi? L'avantage changerait-il de camp?"

When Schaeffer reports that he "(...) recorded the sound after the attack." it is important to remember that magnetic tape and, therefore, splicing techniques were not available. Presumably the disc cutter was lowered onto the disc surface or the turntable was switched on after the sound had started.

20) Ibid., p.16

> "Où réside l'invention? Quand s'est-elle produite? Je réponds sans hésiter: quand j'ai touché au son des cloches. Séparer le son de l'attaque constituait l'acte générateur. Toute la musique concrète était contenue en germe dans cette action proprement créatrice sur la matière sonore."

21) The sillon fermé was a "...groove closed in on itself, thus isolating a recorded fragment which can be heard repeated indefinitely." "...un sillon refermé sur lui-même, isolant par conséquent un fragment d'enregistrement, dont l'écoute peut se répéter indéfiniment.". Schaeffer, Traité, p.23

22) Schaeffer, Recherche, p.47

"Or, le sillon fermé m'avait donné le sentiment que je possédais une puissance d'analyse incontestable. Le sillon fermé, malgré son allure discontinue, - qui faisait penser aux collages de la première peinture surréaliste - avait libéré, dans une matière aussi rébarbative que le 'wagon pur', des éléments de montage, qui, indéniablement, étaient aptes à la construction, sans aucune idée d'imitation."

The "wagon pur" is a reference to Schaeffer's Etude aux chemins de fer (see ref.28). The notion of "allure" is discussed in 1.10.

23) Ibid. p.194

"L'expérience concrète découvre à l'intérieur de l'oreille, et presque sans rapport avec l'oreille musicale, un oeil sonore, sensible aux formes et aux couleurs des sons, et aussi, puisqu'il y a deux oreilles comme deux yeux, au relief de ces sons. (...) La musique concrète n'est autre chose que la prise de conscience de ce phénomène jusqu'alors implicite, et dont aucun instrument n'avait encore permis que l'on s'emparât."

24) Michel Chion, La Musique Electroacoustique Collection: Que sais-je? (Paris: Presses Universitaires de France, 1982), pp.46-64

1) Le montage.
2) Mise en boucle.
3) Lecture a l'envers.
4) Opérations sur la forme.
5) Transpositions.
6) Opérations sur la masse.
7) Révérberation, écho, accrochage.
8) Réinjections, lectures avec retards.
9) Mixage, répartition spatiale.
10) Manipulations spéciales et composées.
11) Les manipulations imaginaires.

"Accrochage" (no.7) has no precise equivalent in English. Its literal meaning is "hooking onto, coupling together". It can be described as the rapid succession of several

distinct echoes which, unlike "normal" echoes, display little decrease in amplitude.

"Les manipulations imaginaires" was a term that Chion seemed to apply exclusively to techniques behaving in particularly illustrative ways. These create the impression of sound actually "stopping", "reversing" or "disintegrating", all of which are naturally impossible. Chion did not specify any particular technique for inclusion in this category. Presumably several of the above could produce "les manipulations imaginaires" if the resulting sounds seemed to imitate overtly illustative behaviour.

25) Pierre Schaeffer, La Musique Concrète Collection: Que sais-je? (Paris: Presses Universitaires de France, 1967), pp.19-24. Schaeffer refers to four stages as:

1) Primitive, 1948
2) Poetic, 1950
3) Baroque, 1953
4) Expressionist, 1954

Schaeffer does not give specific dates for these periods although he does cite works as examples. The above dates are the approximate starting points for each period.

26) Schaeffer/Reibel, Solfège, side 4, theme 7

> "(...) de domestiquer ces bruits de leur imposer nos échelles."

27) A connexion between Schaeffer and the Futurists (particularly the musician Russolo) is frequently assumed

by many musicologists though there is little evidence for such a claim. Schaeffer stated that during his early researches he had little knowledge of Futurist aims, though he was not unsympathetic once he did learn about them. Corroborative evidence of this claim exists in two passages in "A la Recherche d'une Musique Concrète". The first, a footnote on page 31, refers to one of several letters he received after the first "concert de bruits" in 1948. Schaeffer conceded that concerts given twenty years previously by Italian Futurists could be considered to predate his own efforts. By contrast, however, the Futurists used "performers" playing devices in real-time. Despite the innovative nature of these Futurist "instruments" and the sounds produced from them such practices could not promote the fundamentally important notions of the acousmatic situation or écoute réduite. Unlike Schaeffer, the Futurists were elaborating traditional concert procedures: "But it was a question of concerts of direct noises leading, as has been seen, to an impasse." ("Mais il s'agissait de concerts de bruits, conduisant, comme on l'a vu, à une impasse.") In addition, on page 98, Schaeffer refers briefly to a meeting with representatives of the Italian broadcasting network. He mentions Russolo's "intonarumori" but his comments clearly reveal his unfamiliarity with this instrument: "What was this instrument exactly? A kind of prepared piano? Or something similar to my first organ of noises?" ("Qu'était-ce au juste que cet instrument? Une sorte de piano préparé? Ou quelque chose d'analogue à mon

premier orgue à bruits?")

Schaeffer's claim that he was oblivious to Futurist ideas seems to surprise some writers. David Ernst, for example, states: "It is astonishing to hear Pierre Schaeffer, the originator of musique concrète, say that he was unaware of Futurist experiments with noise." (The Evolution of Electronic Music, (New York: Schirmer Books, 1977), p.XXV). This remark stems from a discussion about "noise" in music and appears to disregard Schaeffer's determination to abstract musical values from noise (however "noise" is defined) rather than use noises in an anecdotal fashion - an important distinction. Ernst's remark typifies the misunderstandings on which the Futurist connexion is based. Anecdotal references in the earliest musique concrète works resulted from technical inexpertise and lack of experience in balancing the abstract-concrete dualism. Works which exploited such references as a deliberate musical strategy are exceptional. (The music of Luc Ferrari is one exception and is discussed in section 2.9.) Consequently, such works provide little more than circumstantial evidence for asserting that Schaeffer was influenced by the Futurists.

It is interesting to examine Schaeffer's reasons for endorsing certain Futurist aims once he was familiar with them. In the midst of many differences some similarities with Schaefferian notions can be identified. The following work is a recent translation of Russolo's

principal essays written in the period immediately before and after the First World War:

Luigi Russolo, The Art of Noises (trans. Barclay Brown) Monographs in Musicology no.6, (New York: Pendragon Press, 1986)

On page 1, as part of his introduction, Brown repeats the usual assertion that anecdotal sound material is the basis for a connexion between musique concrète and Futurism: "The doctrines of musique concrète find their first expression in Russolo's opening manifesto (from March 1913) which envisions entire symphonies composed of the sounds of everyday urban life." Disregarding this customary inaccuracy, three principal features of Russolo's musical thinking can be compared with Schaefferian ideas. Firstly, Russolo, like Schaeffer, intended to expand the repertory of musical materials to include all types of sound. However, his methods were based on the invention of new instruments whose sounds he tried to represent by notation. Schaeffer would have been suspicious of both of these a priori procedures although doubtless he would have approved of Russolo's attempts to produce microtones, glissandi and complex timbres all of which exist on the periphery of the traditional sound universe. Secondly, Russolo classified "noises" into six families according to inherent acoustic criteria:

Ibid., p.28

1	2	3
Roars	Whistling	Whispers
Thunderings	Hissing	Murmurs
Explosions	Puffing	Mumbling
Hissing roars		Muttering
Bangs		Gurgling
Booms		

4	5	6
Screeching	Noises obtained	Voices of
Creaking	by beating on:	animals and
Rustling	Metals	people:
Humming	Woods	Shouts
Cracking	Skins	Screams
Rubbing	Stones	Shrieks
	Pottery etc.	Wails
		Hoots
		Howls
		Death rattles
		Sobs

An exhaustive categorization of the sound universe was also one of Schaeffer's goals though the "Programme de la Recherche Musicale" (see section 1.7) provides a more elaborate framework than that offered by Russolo.

Thirdly, there is a striking similarity between Russolo's explicit demands for a methodology of abstraction of sound qualities and those suggested by Schaeffer:

Ibid., p.86-87

"But it is necessary that these noise timbres become <u>abstract material</u> for works of art to be formed from them. <u>As it comes to us from life</u>, in fact, noise immediately reminds us of life itself, making us think of the things that produce the noises that we are hearing. This reminder of life has the character of an impressionistic and fragmentary episode of life itself. And as I conceive it, 'The Art of Noises' would certainly not limit itself to an impressionistic and fragmentary reproduction of the noises of life. Thus, the ear must hear the noises mastered, servile, completely controlled, conquered and constrained to become elements of

> art. (This is the continual battle of the artist with his materials.) Noise must become a prime element to mould into the work of art. That is, it has to lose its accidental character in order to become an element sufficiently abstract to achieve the necessary transformation of any prime element into an abstract element of art."

It is unlikely that Schaeffer would object to this statement. According to the quotation Russolo was reluctant to use sounds in a purely associative manner. Significantly these three valid points of contact are not mentioned by any writers. The use of anecdotal sounds seems the only evidence that is presented in establishing a link between Schaeffer and Russolo. This is ironic as neither Schaeffer nor (apparently) Russolo was satisfied to allow sounds to remain on the level of anecdotal reference. One can perhaps conclude that both Schaeffer and Russolo have been misunderstood.

Additional examples of assuming a Futurist influence based particularly on anecdotal reference can be found in the following:

1) Dieter Kaufmann, Die PrÄsenz futuristischer Ideen in der elektroakustischen Musik <u>Der Musikalishe Futurismus</u> Studien zur Wertforschung, Band 8 (Graz: Universal Edition für Institut für Wertforschung, 1976), pp.50-51.

Kaufmann claims that Futurist ideas rather than the generally unsuccessful attempts to create new instruments were a powerful influence on electro-acoustic music:

"(...) it remains uncontroversial that a really essential root of this music, (...) is to be sought in Futurism."

("(...) unbestritten wird bleiben, daß eine ganz wesentliche Wurzel diese Musik, (...) im Futurismus zu suchen ist.") He defines Futurist ideas as the use of sounds "from the daily human environment" ("aus der tÄglichen Umwelt des Menschen"). As an explicit example he cites the "anecdotal music" of Luc Ferrari.

ii) Hans Ulrich Humpert, Elektronische Musik, (Mainz: B.Schott's Söhne, 1987), p.23

Humpert states that an element of musique concrète is the "postulates of Futurism" ("Postulate des Futurismus"). He then quotes Schaeffer from "Musique Concrète" but claims the notions of concrete sound as "(...) one of the few legitimate connexions to the mechanical noise art of the Futurists (...)" ("(...) eine der wenigen historisch legitimen Verbindungen zur technifizierten Geräuschkunst des Futurismus (...)"). He cites as examples of concrete sound material noises originating from streets, railway stations, factories, wind, rain and water.

iii) Peter Manning, Electronic and Computer Music, (Oxford: Oxford University Press, 1985)

On page 20 Manning states: "Schaeffer's preliminary investigations, inspired to some degree by an interest in the Futurists, were concerned with an exploration of the properties of percussion sounds."

28) Etude aux chemins de fer (duration: 3 minutes 25 seconds) was the first musique concrète work. Its materials were recordings of railway sounds such as hissing steam, carriages being shunted, wheels clicking etc.

29) Chion, Musique Electroacoustique, p.5

> "(...) une 'étude de rythme' et pas une 'nature morte au train'; une oeuvre 'abstraite' plutôt qu'une évocation."

30) Schaeffer, Recherche, p.46-7

> "(...) même si la matériau du bruit me garantissait une certaine marge d'originalité par rapport à la musique, j'étais, dans les deux cas, conduit au même problème: arracher le matériau sonore à tout contexte, dramatique ou musical, avant de vouloir lui donner une forme. Si j'y parvenais, il y aurait une musique concrète. Sinon, il n'y aurait que truquage et procédés de mise en onde."

31) In the early researches Schaeffer appeared to believe that a composed sequence of sounds repeated by a sillon fermé was enough to produce an autonomous sound event (though he still expressed some doubts):

Schaeffer, Recherche, p.21

> "It therefore creates for itself a kind of identity and its repetition makes one forget that it is actually a train.
>
> Is this a sequence that could be described as musical? If I extract any kind of sound element and if I repeat it without caring about its forme, but by varying its matière, I practically nullify this forme, it loses its meaning; only the variation of the matière emerges, and with it the musical phenomenon.
>
> (...) But how is it possible to lose meaning, to

isolate the 'in itself' from the sound phenomenon?"

"Il se crée ainsi une sorte d'identité et sa répétition fait oublier qu'il s'agit d'un train.

Est-ce là une séquence qu'on peut qualifier de musicale? Si j'extrais un élément sonore quelconque et si je le répète sans me soucier de sa <u>forme</u>, mais en faisant varier sa <u>matière</u>, j'annule pratiquement cette forme, il perd sa signification; seule sa variation de matière émerge, et avec elle le phénomène musical.

(...) Mais comment est-il possible d'oublier la signification, d'isoler l'en-soi du phénomène sonore?"

32) This type of language figures prominently in the music of composers such as Luc Ferrari and Mike McNabb. Both use a language that relies to a large extent on a mimetic discourse and abstracted syntax.

33) <u>Symphonie pour un homme seul</u> existed in three versions, the last providing the music to a ballet. The original version lasted 46 minutes and had 22 sections.

34) Schaeffer, <u>Traité</u>, p.24

"(...) un art particulier, hybride entre musique et poésie."

35) Ibid., p.24

"(...) point de départ, auquel je suis redevable de la démarche entière (...) qu'il devenait possible de concevoir une musique expérimentale, faisant sien tout procédé d'expérimentation et antérieure à toute esthétique."

36) Chion, Musique Electroacoustique, p.74

"(...) 'amateurs aussi misérables que besogneux' (...)"

The French word "besogneux" is an indication of spiritual rather than financial poverty.

37) Boulez realized two tape works in Schaeffer's studio in 1951. They were:

Etude I sur un son (duration 2 minutes 25 seconds)

Etude II sur sept sons (duration 2 minutes 41 seconds)

38) Chion, Musique Electroacoustique, p.74

"Il semble qu'il y eut, c'est le cas de la dire, malentendu: on a voulu mettre 'l'enfant électroacoustique' au piano, à coup de règles sur les doigts, à faire des gammes sérielles, alors que ses dons étaient ailleurs."

39) The following quotation is an example of this attitude: Pierre Schaeffer, La Musique Par Exemple, Cahiers Recherche/Musique no.2 Le Traité des Objets Musicaux dix ans après (Paris: INA/GRM, 1976), p.60

"(...) composers make choices which express, it would be pointless to deny it, the opposition of two types of temperament: some of them, determinists, start from structures and demand techniques to supply them with appropriate elements; empiricists, the others - of which I am one - prefer to start from objects, the possibilities of jeu that they suggest and, as far as organization is concerned (from which meaning will or will not emerge), rely on their instinct. Provided these two poles of composition are taken into consideration with integrity it is impossible to quibble over the choice of these, any more than with tastes or colours."

"(...) les compositeurs font des choix qui traduisent, il serait vain de le nier,

l'opposition de deux types de tempérament: les uns, volontaristes, partent des structures et demandent à la technique de leur fournir des éléments sur mesure; les autres - dont je suis - préfèrent partir des objets, des possibilités de jeu qu'ils suggèrent, et, pour l'organisation (dont émergera ou non un sens), s'en remettent à leur instinct. A condition que ces deux pôles de la composition soient loyalement envisagés, on ne saurait discuter de ces choix, pas plus que des goûts ni des couleurs."

In addition Schaeffer explains permutational schemes of sound elements in relation to his Etude aux chemins de fer that are reminiscent of serial permutational processes.

Schaeffer, Recherche, pp.33-4.

40) Schaeffer, La Musique Concrète, p.13

"(...) annonçait sa couleur - non pas exactement contre l'abstrait, qu'elle a aussitôt à récupérer - mais contre l'a priori musical; elle allait opposer, dix ans de suite, en toute indépendance d'esprit, un front têtu au courant majeur de l'époque qui prétendait structurer les sons selon des lois sérielles."

41) Schaeffer, Traité, p.20

42) Pierre Schaeffer, Vers une Musique Expérimentale La Revue Musicale no.236 (Paris: Editions Richard-Masse, 1957), p.16

43) Schaeffer, Recherche, p.192

"Cette musique concrète, qui a pour équivalent la peinture abstraite, mérite comme elle la qualificatif d'abstrait plus encore que de concret. Les mots importent peu."

44) Schaeffer, Traité, p.22-3

45) Ibid., p.61

> "Nous travaillions alors, les uns à construire des robots, les autre à disséquer des cadavres. La musique vivante était ailleurs, et ne devait se donner qu'à ceux qui allaient savoir s'évader de ces modèles simplistes."

46) The term acousmatic is derived from the members of the Pythagorean brotherhood, called "acousmatics". The lecturers who taught them spoke without being seen from behind curtains or screens. They believed that the words, and therefore the meanings of the words, could be heard more intently without the visual distractions of a speaker.

The term remains in the current vocabulary of electro-acoustic music. The Groupe de Recherches Musicales refers to "musique acousmatique" and has a series of concerts entitled "le Cycle Acousmatique" as well as a radio programme named "acousmatéque".

47) Schaeffer, <u>Traité</u>, p.53

> "Un pizz de violon est infiniment plus proche d'une note de piano qu'un son filé de violon, que l'on peut à son tour rapprocher d'un son tenu au pipeau.
>
> D'ailleurs, tant qu'il voit l'instrument en même temps qu'il l'entend, l'auditeur se trouve conditionné et note des différences qui lui paraissent énormes. Mais, si l'on dissimule l'instrument, ou si l'enregistrement, sans aucun truquage, rétablit seulement certaines inégalités d'intensité, d'extraordinaires confusions deviennent possibles, (...)"

48) Ibid., p.92

"(...) c'est l'écoute elle-même qui devient l'origine du phénonmène à étudier.(...) C'est vers lui, (le sujet) desormais, que se retourne la question: 'Qu'est-ce que j'entends? ...Qu'entends-tu, au juste ?'"

49) Chion, Guide, p.31

"Ce désengagement de la perception (appelé aussi: réduction phénoménologique (...))"

50) Ibid., p.33

"(...) elle consiste à inverser cette double curiosité pour les causes et les sons (...) pour la retourner sur le son lui-même."

51) There are, for example, parallels between many of Schaeffer's notions and those of exponents of both Existentialism and Phenomenology. In the twentieth century these notions have been derived from philosophers such as Husserl, Heidegger and Merleau-Ponty though phenomenological concepts were discussed by Hume and Kant. The following are examples from:

John Macquarrie, Existentialism, (Harmondsworth: Penguin Books, 1973)

p.22 "Husserl set aside or 'bracketed' questions concerning the reality or the genesis of the objects of consciousness and tried to devise a method for the detailed and accurate description of the various kinds of objects in their pure essences. (...) To ensure the accuracy of the description, it is necessary first of all to clear the mind of presuppositions and prejudices."

p.24 "The point about phenomenology is that it offers a description in depth, so to speak, causing us to notice features that we ordinarily fail to notice, removing hindrances that stand in the way of our seeing, exhibiting the essential

> rather than the accidental, showing interrelations that may lead to a quite different view from the one that we get when a phenomenon is considered in isolation."

It is also interesting to note the similarity between écoute réduite and structuralist ideas:

Terence Hawkes, Structuralism and Semiotics (London: Methuen, 1983), p.17

> "(...) despite appearances to the contrary the world does not consist of independently existing objects, whose concrete features can be perceived clearly and individually, and whose nature can be classified accordingly. In fact, every perceiver's method of perceiving can be shown to contain an inherent bias which affects what is perceived to a significant degree. A wholly objective perception of individual entities is therefore not possible: any observer is bound to create something of what he observes. Accordingly, the relationship between observer and observed achieves a kind of primacy. It becomes the only thing that can be observed."

In view of Schaeffer's interest in linguistics and the connexion between this discipline and Structuralism it is possible that Schaeffer was influenced by such ideas.

52) "Epoché" is derived from the Greek and was a term used by the exponent of Phenomenology, Husserl. It means to disengage, put out of the running, put in brackets, suspend.

53) Chion, Guide, p.9

54) The notion of objet sonore inspired as much reverence as a fundamental concept as that of the sine-tone in Germany, (the sine-tone is discussed in section 2.8). The following quotation by Ivo Malec is taken from comments by

various musicians on the effects of Schaeffer's "Traité". It is an example of the liberating effect the concept of the objet sonore had on some musicians:

Ce que le G.R.M. pense du T.O.M. Cahiers Recherche/Musique no.2, p.29

"In 'Das Kapital' there is only one idea, that of added value; in the 'Traité', that of object, contained in its title. If it had been talked about once it would not have had the impact that it has, filled up by a whole book. From the very moment where a notion like the notion of object is supported by this careful scrutiny the notion itself ends up by being a great discovery, at least to my way of thinking. I go along a street, I see a lamp and I project myself into it saying 'But what is behind it?'. The objet sonore is exactly like this: a cluster which suddenly opens, like a kind of mental liberation. Suddenly many things become possible because the word has been released."

"Dans 'le Capital', il y a une idée, une, de la plus-value; dans le 'Traité', celle d'objet, contenue dans le titre. Si on en avait parlé une fois, n'importe comment, elle n'aurait pas eu l'impact qu'elle a, accompagnée de tout un livre. A partir du moment où une notion comme la notion d'objet est soutenue par une telle intendance, la notion elle-même finit, à mes yeux du moins, par être une grande découverte. Je vais dans la rue, je vois une lampe et je me projette à l'intérieure, en me disant: 'Mais qu'est-ce qu'il y a derrière?' L'objet sonore, c'est exactement cela: un faisceau qui s'ouvre tout d'un coup, comme une espèce de libération mentale. Subitement beaucoup de choses deviennent possibles parce que le mot a été lâché."

55) Chion, Musique Electroacoustique, p.30

"(...) c'est une unité sonore perçue, considérée dans ses qualités intrinsèques, sa couleur, ses dimensions, indépendamment de la signification dont elle peut être porteuse et de la source sonore dite aussi 'corps sonore', à laquelle elle renvoie."

56) Schaeffer/Reibel, Solfège, side 4, theme 7

"(...) la seule notion essentielle qui puisse être commune à tous les êtres musicaux."

57) Pierre Schaeffer, La Musique par Exemple Cahiers Recherche/Musique no.2, p.63

"Comment pouvons-nous parler, dans ces conditions, de la perception musicale d'objets isolés (que l'objet soit, par ailleurs, un pizz de violon, un grincement de frein ou le hurlement d'une sirène)? On ne s'en étonnera que si l'on s'obstine à ignorer que la définition de l'objet est relative. Le même monument peut m'apparaître comme élément d'un paysage ou, considéré de plus près, comme un ensemble structuré. Je peux enfin, oublier le monument lui-même pour m'intéresser au linteau de porte, admirer sa facture, la couleur de la pierre... etc. Un même son peut être ainsi intégré à une structure musicale ou musicalement apprécié pour sa structure propre, son contour dynamique, son évolution harmonique ou mélodique... etc."

Regarding "these conditions", Schaeffer was referring to the ability to recognize the same melody although played on different instruments. A melody is usually perceived independently of its constituent elements, whereas a single note may be appreciated for its unique qualities.

58) This subject is discussed in sections 3.6 and 3.7.

59) Chion, Guide, p.39

"(...) permanence des caractères (concrets) / variation des valeurs (abstraites)."

60) Schaeffer, Traité, p.51

"(...) notion qui domine l'ensemble des phénomènes musicaux."

61) Ibid., p.490

"(...) le moyen de noter les idées musicales, tout autant que le traduire ces idées en sons (...)"

62) Schaeffer, Vers une Musique Expérimentale La Revue Musicale no.236, p.26

"Le son ne saurait plus être caractérisé par son élément causal, mais par l'effet pur. Aussi, doit-il être classé, non selon l'instrument qui le produit, mais selon sa morphologie propre. Il doit être considéré pour lui-même. La meilleure preuve en est, qu'une fois gravées sur bande magnétique, il est impossible pour les plus intéressantes sonorités dues aux techniques nouvelles, de dire comment elles ont été produites, ni par quel ensemble de procédés ou d'instruments."

63) Schaeffer, Recherche, p.185

"Où se trouve la technique concrète? Est-ce au niveau instrumental, est-ce au niveau de la composition? Aux deux, mais bien plus encore pour commencer, au niveau du solfège.

Tant qu'un nouveau solfège musical ne sera clairement défini, et que de nombreux musiciens, concrets ou non, n'auront pas pu en prendre conscience, tous ces problèmes resteront hermétiques."

64) Acoulogy was modelled on the branch of linguistics called phonology. Phonology studies the entire content of a linguistic sound event in the belief that certain sounds might be disregarded in one language by mutual, cultural agreement (an English speaker appearing to cough for example). However, these sounds might be of semantic significance in another language. Thus every aspect of a linguistic message should be examined according to the totality of its characteristics and not on the basis of

another language with its own, possibly inappropriate, terms of reference. The connexion between the two disciplines therefore was based on Schaeffer's insistence (however difficult it might be to achieve) that no sound should be disregarded purely on the basis of culturally acquired listening habits.

65) Chion, Guide, p.94

> "(...) l'étude des mécanismes de l'écoute, des propriétés des objets sonores et de leurs potentialités musicales dans le champ perceptif naturel de l'oreille."

66) The necessity of notating new sounds was disputed by Schaeffer, considering the matter of little relevance: "(...) notation is not a point of departure but an outcome." ("(...) notation n'est pas un point de départ, mais un aboutissement." Schaeffer, Traité, p.492) The very nature of traditional notation: "(...) prejudges relationships between objets musicaux." ("(...) préjuge des relations entre objets musicaux." Chion, Guide, p.92) Thus relationships should be discovered by empirical methods.

It is interesting to note that this indicated a shift in Schaeffer's thinking. During the first few years of musique concrète Schaeffer attempted to formulate a three dimensional representation of the sound, the "trihedron of reference", based: "(...) on the harmonic, dynamic and melodic dimensions." ("(...) sur le plan harmonique, le

plan dynamique, et le plan mélodique." Chion, Guide, p.91)
This was eventually abandoned, being too impractical. A very simplified system of reference was initiated by Schaeffer in connexion with typology and morphology, this is described in 1.11.

67) Chion, Guide, p.90

"(...) l'art de s'exercer à mieux entendre;"

68) The necessity of creating many sounds as a first step was expressed by Schaeffer thus:

Schaeffer, Vers une Musique Expérimentale La Revue Musicale no.236, p.19

"(...) it was first necessary to make a lot of them, to determine their categories and families, before even knowing how they could develop, how they could be matched and combined with each other, (...)"

"(...) qu'il fallait d'abord en fabriquer beaucoup, en déterminer les catégories et les familles, avant même de savoir comment ils pouvaient évoluer, comment ils pouvaient être assortis et combinés les uns aux autres, (...)"

69) Schaeffer, Traité, p.369

70) The notion of "suitablity" was a necessarily imprecise and open term. It denoted an objet sonore whose suitability depended solely on its location in a particular context inviting comparison between other objets sonores and leading to the emergence of a valeur. Criteria such as memorability and lack of anecdotal implications were consequently considered but context was

equally important. Such objects therefore were the most likely to be used in a composition. "Suitable" objects were related to the equally imprecise concept of the objet musical which, however, defined an object in a specifically musical context. Thus, despite the close relationship, the two terms were not synonymous, an objet sonore might be "suitable" in one context but not in another.

71) Schaeffer, Traité, p.497

72) Chion, Guide, p.99

73) An example of this development is: Denis Smalley, Spectro-morphology and Structuring Processes, The Language of Electro-acoustic Music, pp. 61-93

74) Chion, Guide, p.113

75) Typology is a system of classification used in many fields such as linguistics, biology and archaeology. It is typified by creating types or groupings, members of which display specific, exclusive attributes.

76) Morphology has two related definitions both of which are applicable to Schaeffer's "Programme". Firstly, in biology and zoology it is the study of the size, shape and structure of animals, plants etc. This conforms to the "morphological" stage of typology. Secondly, in

linguistics it refers ot a study of the internal construction of words leading to an analysis of the constituent morphemes. This definition is comparable to the function of morphology proper in the programme.

77) Chion, Guide, p.99

> "Un problème méthodologique qui a longtemps gené l'entreprise d'une typologie est qu'on ne peut trier des objets sans des critères de description même sommaires."

78) The context of a objet sonore is the overall environment within which the object could be identified as a unit.

79) The contexture of an objet sonore is an internal description of the object as a structure composed of distinct, separate elements.

80) Schaeffer also described the pair articulation/intonation which is identical to that of articulation/appui. See: Schaeffer/Reibel, Solfège, theme eight, third point

81) Chion, Guide, p.145

82) See ref.15.

83) Schaeffer, Traité, p.125

84) Ibid., p.501

"(...) propriétés de l'objet sonore perçu (...)"

85) A sound is described as deponent if one, or even two, of the stages of its temporal development are missing. The study of such sounds was particularly valuable in connexion with morphology. In this stage of Schaeffer's programme it was necessary to perceive and identify certain criteria which was difficult, if not impossible, with sounds which were constituted of evolving criteria. Thus an extremely long and stable sound could be examined according to spectral criteria and its lack of onset or termination would be a positive advantage. A sustained sound played on an organ could be described as deponent. If the sound was sufficiently long the onset would be forgotten and the listener would tend to concentrate on aspects of the matière. Similarly, aspects of forme would be examined most easily if the masse remained relatively simple.

86) Schaeffer, Recherche, p.52

> "En somme, matière et forme sont faites, en musique, des mêmes éléments: fréquence, intensité, durée, mais ces élements offrent l'aspect contradictoire d'être permanents et de varier. En ce qu'ils restent permanents, dans un court espace de temps, ils constituent une matière; en ce qu'ils évoluent, dans un espace de temps seulement dix fois plus grand, ils donnent naissance à des formes."

The term matière is also common in literature where forme and matière can be translated as "form and content".

87) Chion, Guide, p.142

88) Ibid., p.142

"mode d'occupation du champ des hauteurs par le son"

89) Ibid., p.142

"halos diffus...et qualités annexes qui semblent associées à la masse et permettent de la qualifier"

90) Ibid., p.142

"micro-structure de la matière du son, évoquant le grain d'un tissu ou d'un minéral"

91) Ibid., p.153

92) Ibid., p.142

"oscillation, 'vibrato' caractéristique de l'entretien du son"

93) Schaeffer, Traité, p.550

94) Chion, Guide, p.142

"évolution du son dans le champ des intensités"

95) Ibid., p.142

"profil général dessiné par un son évoluant dans la tessiture"

96) Ibid., p.142

"profil général d'un son dont la masse est 'sculptée' par des variations internes"

97) Schaeffer, Traité, p.459

In diagram 4 the central box of balanced sounds is more pronounced than in Schaeffer's original diagram. This is to demonstrate the connexion between this diagram and diagram 2.

98) Schaeffer's system of elementary notation used upper case letters for the type of sound. These could be suffixed by lower case letters qualifying the masse: n denoted a tonic type, x denoted a complex type and y a variable type. Two additional symbols were used to denote particular cases of entretien. The symbol ' indicated an impulse, and " indicated an iterative sound. The only qualification relating to duration was provided by a ¯ over the letter to indicate a greatly extended version of a particular type.

99) Schaeffer, Recherche, p.150

100) Ibid., p.150 and Traité, p.456

The chord in question is a diminished chord on C# played as an arpeggio over an octave D pedal. Schaeffer stated that as the chord was an "inflation" of the first note it "(...) aims much more at a concrete effect than the abstract construction of a chord." "((...) vise beaucoup plus à l'effet concret qu'a la construction dans l'abstrait d'un accord.")

On page 441 of the "Traité" Schaeffer also suggests a more

mundane example of a grosse note - the hissing of water passing through a plumbing system!

101) Chion, Guide, p.137

> "(...) le son prolongé et incohérent produit sur un violon par le coup d'archet maladroit d'un novice."

102) Schaeffer, Traité, p.454

> "Les colonnes extrêmes de notre tableau se rejoignent ainsi à la limite."

103) Ibid., p.454

104) It is noteworthy that the term "pedal" as used by Schaeffer differs from traditional usage by referring to sounds that displayed clearly repetitive characteristics, comparable to an "ostinato". The traditional term "pedal" conforms more accurately to Schaeffer's definition of a continuous homogeneous sound.

105) Schaeffer, Traité, p.451

106) Ibid., p.572

107) Ibid., pp.584-7

The diagram of TARSOM differs in some respects from that in the "Traité". Firstly, in the "Traité" there is a misprint in column 2, row 2. The lower occurrence of "Anamorph" should read "Amorph". This has been corrected

by Chion (Guide, p.174). Secondly, certain features of the entry of column 1, row 4, the "typology of variations" are extremely indistinct. There are bars above some letters which have not been reproduced clearly in the "Traité" or even in the "Guide". A clearer and more exhaustive version of this "typology of variations" is reproduced in the "Traité" on page 572. This has been inserted into the diagram of TARSOM in this study.

108) The Etude aux Allures lasts 3 minutes 27 seconds. It exists in three versions. The first version was mono, whereas the third was stereo. The second version was adapted for a film score and was extended in length to five minutes.

109) The term "double" refers to sounds from certain percussion-resonance type instruments like the vibraphone. If a recording of a vibraphone sound is examined a tiny noise-like click is heard before the main body of the sound creating in effect two connected objets sonores.

110) The size of sample introduces the object/structure chain which was related to the concepts of context and contexture. Every objet sonore was considered as an object if it was perceived as a unit contained within a structure or context. It was also considered as a structure in itself if it was perceived to be constituted of several distinct components. This notion can be extended if, by perception or intention, one considers

each constituent element of an object as an individual object. This demands a reconsideration of the original object as a structure in its own right. Schaeffer considered the object/structure chain to be: "the two infinities" of perception ("Les deux infinis", Schaeffer, Traité, p.279). By such an innovative method one could in certain cases invert the orthodox view and think of a symphonic movement as an object and a single note as a structure!

111) Notices et Analyses La Revue Musicale no.244, p.61

The following is from a programme note to the Etude aux Accidents by Luc Ferrari:

> "Les accidents représentent en général un élément supplémentaire et inattendu qui intervient dans le déroulement du son. (...) Les accidents sont pris pour eux-mêmes, ce qui supprime l'effet de surprise qui les accompagne généralement."

112) Chion, Guide, p.142

113) Ibid., p.103

> "Tout ce qui relève des liaisons entre critères est en effet bien connu dans son principe, mais difficile à inventorier, à classer (...)"

114) Schaeffer, Traité, p.580

115) Chion, Guide, p.103

> "(...) in order to produce 'living' sounds, electronic synthesis of sounds must proceed precisely by 'associated evolutions of criteria', since it has been noticed that sounds where the parameters evolve independently of each other are

not well perceived, appearing weaker, more artificial."

"(...) la synthèse électronique des sons, pour aboutir à des sons 'vivants', doit procéder justement par 'associations d'évolutions de critères', puisqu'on a remarqué que les sons où les paramètres évoluent indépendamment l'un de l'autre sont mal perçus, apparaissent plus pauvres, plus artificiels."

116) Schaeffer, Traité, p.519

117) Ibid., p.553

118) Chion, Guide, p.155

119) Schaeffer conducted numerous experiments investigating the effect of splicing tape at different angles to obtain different attacks. In addition to varying the attack his experiments included sounds with various harmonic evolutions and at different registers. By collating the results of these researches he was able to make a finely differentiated study of the hitherto undiscovered connexion between the attack and both the dynamic and harmonic evolution of a sound. These experiments are described in Traité, chapter 12 and Solfège, side 2 theme 4.

120) Schaeffer, Traité, p.533

121) Chion, Guide, p.46

"(...) où sont évaluées les capacités des différents critères du son à former des échelles

dans le champs perceptifs. Les degrés de ces échelles possibles sont appelés des espèces, et on cherche à les situer dans les trois champs perceptifs de la hauteur, de la durée, et de l'intensité."

122) Chion, Guide, p.110

"(...) 'effet de la nature et de la vitesse d'une variation' (...)"

123) A good illustration of this notion is provided by Schaeffer (Traité, p.545). He claims that a sound such as a cat miaowing in a very noisy environment may attract a disproportionate amount of attention despite the realtive weakness of its dynamic level.

124) Chion, Guide, p.105

"La synthèse se donne, elle, pour projet de créer des objets musicaux, constitués de 'faisceaux de critères', qui,'mis en collection, puissent faire apparaître (..) une structure de valeurs aisément perceptible'. Pour cela, elle doit concevoir une lutherie nouvelle. ou 'tablature', adaptée a une nouvelle théorie des structures musicales."

125) Schaeffer, Traité, p.381

"(...) comme le tricot de nos grand-mères, se démaille à sens unique. Pas question de retricoter si facilement, en remontant d'objets préexistants à des structures automatiques."

126) Other major European studios founded in the period 1948-70 included:

Milan, Studio di Fonologia Musicale, 1955
Warsaw, 1957
Brussels, APELAC, 1958
Utrecht, Institute of Sonology, 1961
Berlin, 1962
Stockholm, 1962

With the possible exception of Milan, whose composers to some extent combined French and German approaches, the influence that these studios exerted was not as original or fundamental as the two studios under consideration.

127) The term "elektronische Musik" has not been retained in the original German. Unlike musique concrète which is commonly (if imprecisely) used in books on music, "elektronische Musik" is usually translated as electronic music.

128) In 1955 the name of the Nordwestdeutscher Rundfunk was changed to Westdeutscher Rundfunk.

129) There are many accounts of the electro-acoustic medium's history. Schaeffer's books, which include his personal recollections, are the most informative on the development of French electro-acoustic music. See:

Schaeffer, Recherche, sections I and II

Schaeffer, Musique Concrète, pp. 10-15

Schaeffer, Traité, pp. 22-26

Specific references to the Cologne studio can be found in the following:

Herbert Eimert, How Electronic Music Began Musical Times, 113, 1972, pp.347, 349

Herbert Eimert, Hans Ulrich Humpert (eds.), Das Lexikon der Elektronischen Musik, (Regensburg: Gustav Bosse Verlag, 1973), p.166

Karlheinz Stockhausen, The Origins of Electronic Music

Musical Times, 112, 1971, pp.649-50

The following references deal with both studios. The majority of works were written by composers (Griffiths being an exception). However, they are not all personal accounts and provide a representative selection of historical viewpoints regarding the medium's development.

Jon Appleton, Ronald Perera (eds), The Development and Practice of Electronic Music, (New Jersey: Prentice Hall, 1975), pp.13-15

Chion, Musique Electroacoustique, pp.4-10

Lowell Cross, Electronic Music 1948-1953 Perspectives of New Music 7/1, 1968, pp.45-52

Eimert/Humpert, Lexikon, pp.22-26

Ernst, Evolution of Electronic Music, pp.26-7

Paul Griffiths, A Guide to Electronic Music, (London: Thames and Hudson, 1979), p.12-15

Humpert, Elektronische Musik, pp.23-7, 30-40

Manning, Electronic and Computer Music, pp.19-78

Hans Vogt, Neue Musik seit 1945, (Stuttgart: Philipp Reclam jun., 1972), pp.32-6

In the above works Manning is exceptional in devoting ten pages to Schaeffer's researches. Despite this he concentrates on the fourth section of the early book "A la Recherche d'une Musique Concrète" and discusses few developments after 1953. Both he and Griffiths suggest that there was a convergence of views regarding the ideologies of both studios. See: Griffiths, Guide, p.15

and Manning, Electronic and Computer Music, p.41.

This viewpoint has since been contested. See:

Simon Emmerson, The Relation of Language to Materials The Language of Electroacoustic Music, p.39.

It is significant that many Germans are equally adamant, though for different reasons, that no such convergence has taken place.

130) Werner Meyer-Eppler (1913-1960) was the director of the Institut für Phonetik und Kommunikationsforschung at the University of Bonn. He was an early researcher into sound synthesis contributing many articles on the subject. His great influence is confirmed by many composers; see Eimert's article in die Reihe 6. Further influences are discussed in section 2.6.

131) Robert Beyer (b.1901) was a musicologist who wrote many articles on modern music. He displayed an interest in the combination of technology and music since 1928. However, after the founding of the Cologne studio he does not appear to have made any further significant contributions beyond articles and collaboration with Eimert.

132) Meyer-Eppler's Klangmodelle were created by recording and mixing selected sounds. The source of some, if not all, of the sounds for these Klangmodelle, was the Melochord. This keyboard instrument was invented by Harald Bode and used oscillators tuned to a tempered

scale.

133) Herbert Eimert (1897-1972) was a composer, musicologist and first director of the Cologne studio. He wrote books and articles on music many of which reflect his commitment to the 12-tone, and later serial, system of composition. The importance of Eimert and his personal contribution in creating a link between electronic and serial music is demonstrated in the following quotation which refers to German electro-acoustic music at the time of Eimert's death:

Wolfgang Martin Stroh, die elektronische Szene 1972 Melos, 1973/V, pp.279-80

> "Eimert's death, in contrast to that of Schönberg's or Adorno's, has not only symbolic, but also real significance, since Eimert possessed objective power to make use of general musical - to be precise: electronic - means of production. That is why the revival of Schönberg, following the programmatic cry 'Schönberg is dead', may not lead to the expectation of a similar resurrection of the ideas of the electronic circle of Cologne of the nineteen-fifties, which Eimert had, as it were, embodied. Boulez and Ligeti show that the 'Eimert concept' of electronic composition, which they had swiftly and decisively moved away from, has in the present day perished due to inner contradictions, it has shrunk to the object of posthumous textbooks and to 'electronic music as a college discipline'. This concept could not really survive the death of serial music."

> "Eimerts Tod hat im Gegensatz demjenigen Schönbergs oder Adornos nich allein symbolische, sondern auch reale Bedeutung, da Eimert objektive Verfügungsgewalt Über allgemeine musikalische - genauer: elektronische - Produktionsmittel besessen hat. Daher darf die Wiederbelebung Schönbergs, die dem programmatischen Ruf 'Schönbergs (sic.) ist tot' inzwischen gefolgt ist, nicht dazu verleiten, eine Ähnliche Auferstehung der Ideen des elektronischen Kreises von Köln aus den fünziger Jahren, die Eimert

gleichsam verkörpert hat, zu erwarten. Boulez und Ligeti zeigen, daß das Eimertsche Konzept elektronischen Komponierens, von dem sie sich früh und demonstrativ abgewandt hatten, heute an inneren Widersprüchen zugrunde gegangen, zum Gegenstand nachgelassener Lehrbücher und zum Hochschulfach Elektronische Musik geschrumpft ist. Den Tod der seriellen Musik hat dies Konzept in Wirklichkeit nicht überstehen können."

The above quotation also appears in Stroh's book. See: Wolfgang Martin Stroh, Zur Soziologie der elektronischen Musik, (Berg a.I./Zürich: Amadeus Verlag, 1975), p.137

134) Besides Eimert, Meyer-Eppler and Beyer the others present at the meeting held on the 18th October 1951 were: Hartmann, Nestel, Schulz, Semmelroth, Müller, Werner, Enkel, Exner. See: Cross, Electronic Music 1948-53, p.49

135) The best known predecessors in this field were: Jörg Mager (1880-1939), Friedrich Trautwein (1888-1956), Harald Bode (b.1909) and Oskar Sala (b.1910). Each of these men were inventors of electronic instruments rather than composers. Their contribution to electronic music in the strict sense was limited due to their concentration on instruments producing fixed timbres. The composers Hindemith (1895-1963) and Ernst Toch (1887-1964) conducted experiments with reproduced sounds in Berlin between the years 1929-30. These, along with others at the Bauhaus, might be the experiments in sound manipulation by referred to by H.H.Stuckenschmidt: "I will never forget the amazement with which we undertook such attempts on discs in the twenties in Berlin and at the Weimar Bauhaus. (These) attempts were preliminary stages which led to the

creation of musique concrète which was developed by Pierre Schaeffer and his colleagues since 1948." ("Ich werde nie die Verblüffung vergessen, mit der wir in den zwanziger Jahren in Berlin und am Weimarer Bauhaus solche Versuche an Schallplatten unternahmen, Versuche, die Vorstufen zu dem bildeten, was dann seit 1948 von Pierre Schaeffer und seinen Mitarbeitern als Musique Concrète ausgebildet wurde.") (Hans-Peter Reinecke (ed.), Das musikalisch Neue und die neue Musik, (Mainz: B.Schott's Söhne, 1970), p.18) It would be interesting to know why Stuckenschmidt believed these experiments "led to the creation of musique concrète". To justify this claim more would be required than the mere use of discs and manipulation of "concrete" sound events. See 1.2 and 2.9 for a discussion of this important distinction.

136) Karlheinz Stockhausen (b.1928) is probably the best known composer to have worked at the Cologne studio. He was appointed assistant director in 1953 and became director in 1962. His numerous compositions and theoretical articles provide a particularly well documented source of material relevant to this study.

137) The Konkrete Etüde (dur. 2min.20sec.) was realized in Paris in 1952. It was Stockhausen's first completed tape work.

138) see ref.37.

139) Ekbert Faas, Interview with Karlheinz Stockhausen Interface 6, 1977, p.193

In this interview (held in English) it is not clear what Stockhausen means by "instrumental orientations". Many examples of American "tape music" utilized instrumental sounds transformed by tape techniques. However this is only true to a limited extent with French musique concrète. His objections are probably based on the recognition of the sounds' origins and the failure to synthesize the sounds according to the German definition.

140) Eimert relates the well known comment made by Adorno in which he compared the sound of electronic music to "Webern played on a Wurlitzer", hardly an enthusiastic endorsement of the new medium. (Eimert, Musical Times 113, p.347). Similar misgivings are expressed by Vogt (Neue Musik, p.35).

141) Carl Dahlhaus, Schönberg und Andere, (Mainz: B.Schott's Söhne, 1978), p.236

> "Daß der Übergang von der seriellen zur elektronischen Musik mit Argumenten begründet worden ist, die an tiefgreifenden Mängeln kranken, ändert nichts an dem geschichtlichen Faktum, daß die serielle Musik die Voraussetzung war, an welche die elektronische anknüpfte."

142) The early works realized at the Cologne studio whilst it was being set up were mainly collaborations between

Eimert and Beyer. Together they composed:

Klang in unbegrenzten Raum (1951-2) dur. 10min.20sec.

Klangstudie I (1952) dur. 3min.50sec.

Klangstudie II (1952-3) dur. 4min.30sec.

Ostinate Figuren und Rhythmen (1953) dur. 3min.45sec.

Eimert composed two works on his own:

Struktur 8 (1953) dur. 4min.

Glockenspiel (1953) dur. 1min.

Stockhausen asserted that a technician "(...) had already handled the sounds of Eimert and Beyer" (Stockhausen, Musical Times 112, p.650). See also an extract from a letter to Goeyvaerts (R.Toop, Stockhausen and the Sine-Wave, Musical Quarterly, July 1979, p.390). Stockhausen also commented that he "(...) heard nothing musically significant in them, (...)" ("(...) in ihnen nichts musikalisch Sinnvolles höre, (...)", Herman Saabe, Karlheinz Stockhausen ...wie die Zeit verging... (Musik Konzepte 19), (München: edition text+kritik GmbH, 1981), p.469). It is important to note, however, that Eimert did not disguise the compositional methods of these works and his admission that they were "'freely' composed" ("'frei' komponiert" Eimert and Humpert, Lexikon, p.25) indicates he regarded them principally as preliminary studies.

143) Both Schaeffer and Messiaen made use of modular ordering which is similar to serial methods. Thus though such thinking was not the exclusive concern of German musicians it was promoted more in Germany than elsewhere.

144) There are many works in which serial techniques were used. The following is a list of the most important works:

Pierre Boulez, Structures I (two pianos), (1951-2)

Pierre Boulez, Le Marteau sans Maître, (contralto, alto flute, xylorimba, vibraphone, percussion, guitar, viola.) (1953-55)

Luigi Nono, Il Canto Sospeso (choir, orchestra) (1955-56)

Karlheinz Stockhausen, Gruppen, (three orchestras) (1955-57)

Karlheinz Stockhausen, Gesang der Jünglinge, (tape) (1955-56)

145) Stroh, Soziologie, p.70-1

> Die zahlreichen Aufsätze der Komponisten, die bei Eimert in Köln arbeiten durften, ergeben ja auf ihre Weise das Fazit: 'Indessen ist elektronische Musik nicht 'auch' Musik, sondern serielle Musik'."

146) The second volume of the periodical "Die Reihe" was completely devoted to Webern. This contained analyses of his works by Eimert, Boulez, Stockhausen and other leading composers.

147) Herbert Eimert, Der Sinus-Ton Melos XXI, (Mainz: B.Schott's Söhne, 1954), p.171

> "Manche Strukturen Weberns wirken wie verfrühte elektronische Fragmente."

148) See sections 1.14 for a discussion on "Genres" and 3.6 regarding timbre in Schaefferian "Instrumental analysis". True parametric independence was never

feasible though it was useful as a concept.

149) The most obvious parallel to the notions of "unity" and "balanced proportion" is the "modulor" of the architect le Corbusier. Frequent references were made by musicians in Cologne connecting this and serial thought. See: die Reihe 1 (English version), (Bryn Mawr/London: Presser/Universal Edition, 1958), p.38-39, 44.

150) Karlheinz Stockhausen, Texte zur elektronischen und instrumentalen Musik Band 1, (Köln: Verlag M.DuMont Schauberg, 1963) p.46

> "Das bei Webern rudimentär einsetzende Reihendenken hat sich als die einzige dazu fähige und universell ausbaumögliche Methode erwiesen, die uns die Übergangsstile der letzten 50 Jahre hinterlassen haben. - Das Reihenprinzip besagt allgemein so viel, daß für eine Komposition eine begrenzte Auswahl von veschiedenen Größen proportionsverwandt sind; daß sie in bestimmter Folge und in bestimmten Intervallabständen angeordnet sind; daß diese Reihenauswahl für alle Elemente getroffen wird, mit denen komponiert werden soll; daß aus diesen 'Urreihen' weitere Reihenfolgen übergeordneter Gestalten komponiert werden, die wiederum reihenvariiert sind; daß die Proportionen der Reihe das umfassende Strukturprinzip des zu komponierenden Werkes sind und ihm die notwendige formale Konsequenz verleihen sollen."

151) This detachment was deliberately required by some composers in the nineteen-fifties. Boulez, for example, in reference to his Structures I(1951-2) for two pianos said:

Pierre Boulez: Conversations with Célestin Deliège, (London: Ernst Eulenberg, 1976), p.56

> "For me it (the composition of Structures) was an experiment in what one might call Cartesian doubt: to bring everything into question again, make a clean sweep of one's heritage and start all over again from scratch, to see how it might be possible to reconstitute a way of writing that begins with something which eliminates personal invention."

Eimert believed he detected "objectivity" in Webern's music: "Alone among the twelve-tone composers, Anton Webern conceived the row non-subjectively, so that to a certain extent it functioned externally." (Eimert, die Reihe I, p.6)

152) Early examples of such conceptual scores are those produced by Goeyvaerts in the 1950's. For example, his composition Nummer 4 mit toten Tonen (Number 4 with dead sounds) required unvarying timbres for its realization. At that time, December 1952, such timbres were not available and despite Stockhausen's enquiries on his behalf the piece remained unrealized.

153) Stockhausen, Texte Band 1, p.41

> "Man hat dabei zunächst nicht an andere Realisationsmittel gedacht; man hat weitgehend überhaupt nicht primär an das Instrument oder mit dem Instrument gedacht; man wollte zuerst Strukturen, Systeme, Proportionen; man dachte die Töne selbst, als Träger von strukturellen Funktionen."

154) Paul Gredinger, Die Reihe 1, p.41

155) Eimert/Humpert, Lexikon, p.62

> "The didactics of electronic music must be looked at with the proviso that the music of Schönberg and Webern is the presupposed requirement, along

with the foundations and the typology of serial technique."

"Didaktik der elektronischen Musik muß unter der Bedingung gesehen werden, daß die Musik Schönbergs und Weberns als bekannt vorausgesetzt wird, ebenso wie die Grundlage und die Typologie der seriellen Technik."

156) Vogt, Neue Musik, p.34

"Trotzdem muß die Summe der Möglichkeiten, denen sich jene Männer damals gegenübersahen, berauschend gewirkt haben, daneben auch beunruhigend. Von allem Anfang an stellte sich ihnen das Problem, nicht im Meer des Unendlichen unterzugehen, sondern die neuen Verfahren auf irgendeine Weise künstlerisch in den Griff zu bekommen.

Hierzu bot sich zu jenem Zeitpunkt das serielle System als brauchbarstes Mittel an. Die Reihe zeigte einen Weg, aus Millionen von denkbaren Kombinationen eine sinnvolle Auswahl zu treffen; die Elemente konnten koordiniert und nach einem übergeordneten Prinzip ausgerichtet werden. Ohne sich, wie einst noch Beethoven, um 'die verfluchte Geige' zu müssen, konnte man sich vom Geist treiben lassen und die totale Reihenkomposition herstellen.

Dieses Zusammentreffen zweier Entwicklungsstadien, synthetische Klangproduktion und Reihenprinzip, wird sicher einmal als musikhistorischer Moment gewertet werden."

157) Dahlhaus, Schönberg, p.236

"Die Anzahl der Klangfarben ist in der traditionellen Musik eng begrenzt: Man kann die Klangfarben zwar mischen; aber sie bilden keine zusammenhängende, lückenlose Reihe, sondern stehen sich, durch Sprünge voneinander geschieden, als Individualitäten gegenüber."

158) Kontra-Punkte as written in 1952-3. Stockhausen considered it his first mature composition. It was written for ten instruments: trumpet, trombone, bassoon,

violin, bass-clarinet, harp, clarinet, cello, flute, piano.

159) Saabe, Karlheinz Stockhausen, p.47

> "(...)eine Klarinette...über drei Oktaven doch die gleiche Klarinette bleiben konnte!"

160) Karel Goeyvaerts was born in Belgium in 1923 and studied in Antwerp and at the Paris Conservatoire with Messiaen. He was an early exponent of integral serialism and greatly influenced Stockhausen whom he met in Darmstadt in 1951. Their correspondence is an interesting account of the development of the ideas of both men, (see ref.162).

161) Ibid., p.47

> "Dies erforderte zugleich die Möglichkeit einen totalen parametrischen Kombinatorik: jede beliebige Klangfarbe sollte mit jeder beliebigen Dynamik, Dauer beziehungsweise Frequenz kombiniert werden können, und vice versa. Der so vollkommen wie moglich zu realisierenden interparametrischen Stimmigkeit wegen hatten sie in ihrem instrumentalen Schaffen Instrumente wie Vibraphon, Glockenspiel und Pauken bevorzugt, die sich dem Ideal 'transregistralen' und 'transdynamischen' klangfarblichen Identität (gleichbleibende Klangfarbe in allen Lagen und bei allen Intensitätsgraden) am meisten zu nähern schienen."

162) Extracts of much of this correspondence appear in: Saabe, Karlheinz Stockhausen, (the entire book draws on these letters).

Richard Toop, Stockhausen's Konkrete Etüde Music Review, Nov. 1976

Richard Toop, Stockhausen and the Sine-Wave Musical Quarterly, Jul. 1979

Richard Toop, Stockhausen's Electronic Works: Sketches and Work-sheets from 1952-1967 Interface 10, 1981

163) The "personal experiments" (persönlichen Versuchen) (Saabe, Stockhausen, p.43) to which Schaeffer objected were, presumably, anything that did not conform to the instructions given to Stockhausen. In addition, there is some confusion in Stockhausen's correspondence about which work he is referring to. In his aforementioned articles Toop had identified three works planned in Paris, the only completed one was the Konkrete EtUde.

164) Saabe, Stockhausen, p.42

> "Nun wollte ich eine Struktur, die ich in eine EtUde verwirklichen wollte, bereits in Mikrodimensionen in einen einzigen Ton hineinarbeiten, sodaß in jedem noch so kleinen Augenblick das umfassende Prinzip meiner Idee anwesend wäre."

This is a quotation from a letter to Goeyvaerts written on December 3rd, 1952.

165) Ibid, p.42,43

> "Die 'musique concrète' und das spürte ich vom ersten Tag an, ist nichts als die Kapitulation vor dem Unbestimmten, ist ein arg dilettantisches Glücksspiel und ungezügelte Improvisation. (...) Wir werden elektronische Klangerzeugung gebrauchen in der Zukunft. Sie werden das alles leichter, klarer, zuverlässiger machen - und wir werden die Klänge regieren -, nicht das Material wird uns regieren."

166) Stockhausen's attitude is an example of the sort of techniques that prompted Chion's comment quoted in ref.38.

167) An interesting example of the differing approaches of Stockhausen and Schaeffer is the following statement by Schaeffer. It stems from an interview with Michael Kurtz in 1986 and also touches on the attitudes of other composers:

Michael Kurtz, Stockhausen. Eine Biographie, (Kassel: Bärenreiter- Verlag, 1988), pp.83-4

> "It was already strange; when Messiaen came into the studio he said: 'I'd like almost no sounds', those are his words. When Stockhausen came he said: 'I'll work with a single note.' And Boulez came and wanted to make a study on a single note. (...) And with these requests they came to me, of all people, and to a place where I had discovered exactly the opposite. (...) Well, when Stockhausen arrived he took a small piece of sound, ten centimetres of magnetic tape, and said: 'I'll cut this sound into millimetre lengths and then I'll make a permutation.' I said: 'You poor man, don't do that, you'll build up a heap of background noise, and that is just not interesting!' (...) But he did not want to follow my advice at all, he simply did not want any advice, and so that he could do what he intended all on his own, I sent him to the rue Barrault, where he could cut his sound into millimetre lengths. Then he got on with sticking them together and came back completely satisfied, and we said: 'Right, let's just listen to it,' we played the tape, it was no more than 10 centimetres long, with the permutations it came perhaps to 50 centimetres, and all you could hear was: 'Chuuutt'. That was Stockhausen's sound study, a kind of small Chuuutt. He was very pleased with himself - I certainly was not. I really do not know how he recalls this episode - for me the memory remains of a charming young man who should have been secure in the position to receive and to give, with the exchange that should have been mutually interesting and who did not want to listen to any rational opinion and who was attached with a perfectly natural ambition to his study on one sound."

"Es war schon seltsam; als Messiaen ins Studio kam, sagte er: 'Ich möchte fast überhaupt keine Klänge', das sind seine Worte. Als Stockhausen kam, sagte er: 'Ich werde mit einem enzigen Ton arbeiten.' Und Boulez kam und wollte eine Studie über einen einzigen Ton machen. (...) Und mit diesem Anliegen kamen sie ausgerechnet zu mir und an einen Ort, wo ich genau das Gegenteil entdeckt hatte. (...) Schön, als Stockhausen ankam, nahm er ein kleines Stückchen Klang, zehn Zentimeter Tonband, und sagte: 'Ich werde diesen Klang in Millimeterstücke zerschneiden, und damit werde ich eine Permutation machen.' Ich sagte: 'Sie Unglücklicher, tun Sie das bloß nicht, Sie werden jede Menge Hintergrundgeräusche anhäufen, und das ist überhaupt nicht interessant!' (...) Er wollte also meinem Rat absolut nich folgen, er wollte überhaupt keinen Rat, und da er das, was er vorhatte, ganz alleine machen konnte, habe ich ihn in die rue Barrault geschickt, wo er seinen Klang in Millimeterstückchen zerschneiden konnte. Dann hat er sich ans Kleben gemacht und kam völlig zufrieden zurück, und wir haben gesagt: 'Also gut, hören wir es uns einmal an', wir spielten das Band ab, es war nich mehr als 10 Zentimeter lang, mit den Permutationen kam es vielleicht auf 50 Zentimeter, und alles was man hört, war: 'Chuuttt'. Das war Stockhausens Klangstudie, eine Art von kleinem Chuuttt. Er selbst war hochzufrieden - ich überhaupt nicht! Ich weiß ja nicht, wie er an diese Episode zurückdenkt - für mich bleibt die Erinnerung an einen charmanten Jungen, der sicherlich in der Lage gewesen wäre, zu empfangen und zu geben, mit dem ein für beide Seiten interessanter Austausch möglich gewesen wäre und der doch keine vernünftige Ansicht hören wollte und mit einem vollkommen natürlichen Ehrgeiz an seiner Studie über einen Klang hing."

168) Messiaen composed one tape work called Timbres-durées (dur. 15mins 5secs). The works by Boulez are listed in ref.37.

169) In reference to these early attempts at additive synthesis Kurtz quotes A.Moles and adds the opinion that the attempts were unsuccessful:

Kurtz, Stockhausen, p.83

"'It follows absolutely that Stockhausen (...) during the work on sound generation in the rue Barrault, experimented extensively with a sine-generator One part of these experiments was made with great precision and all the care that characterized him.' But, if we bear in mind the technical direction of the studio, they were still completely insufficient and unsatisfactory attempts."

"'Es trifft unbedingt zu, daß Stockhausen (...) während der Arbeiten an Klangerzeugung in der rue Barrault ausgiebig mit einem Sinusgenerator experimentiert hat. Ein Teil dieser Experimente wurde mit große Präzision gemacht und mit aller Sorgfalt, die ihn ausgezeichnet.' Aber es waren, wenn man sich die technische Einrichtung des Studios vor Augen hält, noch völlig unzureichende ind unbefriedigende Versuche."

170) Stroh, Soziologie, p.112

"Mit dieser Argumentation konnten serielle Kompostionsverfahren dadurch legitimiert werden, daß auf ihre durch die Elektronik möglich gewordene Realisierung hingewiesen wurde; anderseits konnte sich die elektronische Musik dadurch legitimieren, daß sie sich als die einzige Möglichkeit konsequenter Realisation der seriellen Musik präsentierte."

171) Ligeti, who was unconvinced of the merits of integral serialism, outlined his reservations in: "Metamorphoses of Musical Form" (die Reihe 7 (English version), (Bryn Mawr/London, Presser/Universal Edition, 1965), p.5-19). He suggested that even if the basic precepts of serial thought remained, the original ideals had been so adapted that the term itself had become almost meaningless. In the nineteen-fifties Xenakis had similar opinions, doubting the effectiveness of a system that developed from the organization of pitch. He also questioned the need to organize parameters according to the number twelve and the

weakness of serial manipulation of durations.

172) Seppo Heikinheimo, The Electronic Music of Karlheinz Stockhausen (trans. Brad Absetz) (Helsinki: Suomen Musiikkitieellinen Seura, 1972), p.217

173) Eimert/Humpert, Lexikon, p.280

> "Vielmehr eröffnete die elektronische Musik sofort die Einsicht, daß sie ganz andere und viel weitreichendere serielle Möglichkeiten in sich barg, als die Instrumentalmusik je hätte verwirklichen können. Man kann sagen, daß die instrumental-serielle Musik nach der Konzeption der elektronischen Musiktechnik - wie auch von Stockhausen, Boulez, Koenig und andern Komponisten bezeugt worden ist - nicht mehr das gewesen ist, was sie vorher war."

174) Toop, Stockhausen's Electronic Works Interface 10, p.167

175) Adorno's remark in ref.140 is particularly appropriate in connexion with these studies.

176) Karlheinz Stockhausen, Kontakte Realisationspartitur (London: Universal Edition, 1968), pp.6,24,28

177) Toop, Interface 10, p.189

See also Heikinheimo, Electronic Music, p.220-1

178) In addition to ref.179 there are many examples of German composers who from the outset emphasized the role of perception. See also in die Reihe 1 (English edition)

pp.6, 22, 28, 42, 43.

179) Karlheinz Stockhausen, Texte zur Musik 1963-1970

Band 3, (Köln: Verlag M.DuMont Schauberg, 1971), p.252

> "(...) der Komponist Elektronischer Musik nicht wie bisher nur am Schreibtisch sitzt und seine musikalischen Vorstellungen aufs Papier schreibt, sondern bei der klanglichen Realisation über längere Zeit selbst dabei ist und viel mehr auf in die Experimenten aussondierte Klangmaterie reagiert, ständig hört und dabei - ohne es selbst zunächst zu bemerken - viel dichter arbeitet als sonst, da er ja jedes Detail, jeden einzelnen Klang hunderte Male mit dem Ohr kontrolliert, bis er fertig und in den Zussamenhang eingefügt ist."

The above quotation is from a transcript of a talk broadcast from Cologne on the electronic studio in Milan. Stockhausen was discussing Omaggio a Emilio Vedova(1960) by Luigi Nono.

180) Helmholtz conducted researches in the latter half of the nineteenth century. Stumpf was active in the last decades of the nineteenth century and the first thirty years of the twentieth. See:

Hermann Helmholtz, On the Sensations of Tone, (trans. Alexander Ellis) (New York: Dover Publications, 1954)

Vowel Qualities of Tone p.103

Artificial Vowels produced by Tuning Forks p.123

Artificial Vowels produced by Organ Pipes p.128

181) Eimert/Humpert, Lexikon, p.253

> "At the beginnings of electronic music (1950-1) the encounter with the Bonn phonetician W.Meyer-Eppler was of decisive significance, he had produced in his institute a series of Klangmodelle which he produced like a painter's

colour palette."

"Bei den Anfängen der elektronischen Musik (1950-1) war die Begegnung mit dem Bonner Phonetiker W.Meyer-Eppler, der in seinem Institut eine Reihe von Klangmodellen, in dem von ihm charakterisierten Sinne der Farbpalette des Malers, hergestellt hatte, von entscheidender Bedeutung."

See also ref.132.

182) Werner Meyer-Eppler, Elektrische Klangerzeugung. (Bonn: Ferd. Dümmlers Verlag, 1949), p.116

"Die Entwicklung der synthetischen Sprache ging zunächst von den stationären Klängen, vornehmlich den stimmhaften Vokalen aus, zu deren Darstellung sich grundsätzlich alle diejenigen zur Musikerzeugung verwendeten Verfahren eignen, bei denen die Klangfarbe frei gewählt werden kann. Helmholtz, Miller, Stumpf und andere hatten gezeigt, daß es möglich ist, Sprachlaute aus harmonischen Schwingungen zusammenzusetzen, wenn man über genügend obertonfreie Schallgeber (z.B. Stimmgabeln) verfügt."

183) Ibid., p.1

"Das bisher geübte Verfahren, die Struktur der zufällig vorhandenen Klänge analytisch zu untersuchen, reicht nur in Einzelfällen (z.B. bei den Sprachlauten) zur Aufstellung eines Systems aus; im allgemeinen sind jedoch die Lücken zwischen den Farben der bekannten Klänge so groß, daß von einer wirklichen Systematik der Klangfarben noch nicht die Rede sein kann. Eine Verbesserung unserer bisher nur unvollkommenen Kenntnis der Klangwelt ist erst dann zu erwarten, wenn eine systematische Erforschung aller klanglichen Möglichkeiten auf Grund einer synthetischen Klangerzeugung vorgenommen wird. Mechanische Klangerzeuger, z.B. Musikinstrumente der gewohnten Form reichen hierzu nicht aus, weil es fast unmöglich ist, einzelne akustische Daten bei ihnen ohne Beeinflussung auch der übrigen Eigenschaftswerte zu verändern."

184) Herbert Eimert's Epitaph für Aikichi Kuboyama

(1960-61) (dur.23min. 30sec.) was composed exclusively from vocal sounds.

185) Eimert/Humpert, Lexikon, p.253

> "Damit berühren sich in der elektronischen Musik die zahlreichen Laut- und Sprechmöglickeiten der Sprachklänge, mit denen seit 1956-7 die rein elektronischen Mittel entscheidend erweitert wurden, ohne daß Musique concrète in Anspruch genommen und vom "elektronischen" Konzept etwas preisgegeben wurde."

Additional confirmation of the importance of speech sounds in German electronic music can be deduced from the space devoted to their study in books on electronic music. Werner Kaegi had an entire chapter called "The Human Voice as a Standard of Electronic Music" (Die menschliche Stimme als Mass der elektronischen Musik) (Werner Kaegi, Was ist elektronische Musik, (Zürich: Orell Füssli Verlag, 1967) pp.114-160). Humpert also has a section called "Speech Composition" (Sprachkomposition) (Humpert, Elektronische Musik, pp.162-185)

186) Faas, Interview with Stockhausen, p.194-5

187) Dieter Zimmerschied (ed.), Perspektiven neuer Musik, (Mainz: B.Schott's Söhne, 1974), p.253-4

1) Übereinanderschichten von Klängen.
2) das Nacheinanderspielen von zwei musikalisch gleichen Bändern.
3) der Bandschnitt.
4) die dynamische Gestaltung durch Lautstärkeregelung.
5) die rhythmisch Gestaltung durch Übertragung der Zeitwerte in Zentimeterlänge.
6) Änderung der Bandgeschwindigkeit, die Tempo und Klangspektrum ändert.
7) Umkehrung der Bandlaufrichtung.
8) endlose Bandschleife (ostinate Formen).

9) Die beliebig rhythmisierte Folge von Tonband und Weißband zur Herstellung rhythmisierter Ausschnitte an einem gegebenen Klanggeschehen.
10) Überblendung von Bändern zur Herstellung von Klangfarbenübergängern.
11) Die Verhallung des Klanges durch
    a) natürlichen Hallraum.
    b) Rückkopplung.
    c) Zeitphasenverschiebung bis zu 1/10 Sekunde von zwei gleichen Bändern
12) Verteilung des Klanggeschehens auf mehrere im Raum verteilte Lautsprecher.

188) Helmholtz described his experiments in synthesizing vowels in:

Helmholtz, On the Sensations of Tone, pp.123-4, 398-400

189) Both Stockhausen and Goeyvaerts believed that only by means of completely static, essentially non-instrumental sounds could sound synthesis be achieved. See section 2.4.

190) Kaegi, elektronische Musik, pp.59-60

> "Man kann sich nun allerdings fragen, weshalb denn der Komponist mittels Klangsynthese aus Sinustöne mühsam aufbaut, was er viel rascher und eleganter durch Geräuschanalyse erreichen kann? Die Entscheidung darüber, welchem Verfahren der Vorzug zu geben sei, ist abhängig der Konzeption eines musikalischen Werkes. Geht es dem Komponisten um das Zusammenspiel definierter diskreter Größen, dann wird er vom Sinuston ausgehen wollen. Begreift er sein Werk jedoch als eine aus statistischen Raten gebildete Ordnung, dann sind weißes Rauschen und Filter die Mittel seiner Wahl."

191) There are particular problems in translating German musical terminology. German appears to have many more words relating to sound than English and an exact

translation is often difficult. Klang, Ton, Schall and Laut for example can all be translated as "sound". Likewise Lärm and Geräusch can be translated as "noise" (Collins German-English dictionary), though Lärm tends to imply that the sound is unpleasant and unwanted. More accurate translations are possible if the context reveals a musical or scientific usage (some scientific words have "official" DIN definitions).

The risk of confusion over terms such as Klang and Ton is recognized by many Germans. Klang is used in such a bewildering number of ways that it prompted the remark: "The poor word 'Klang'" ("Das arme Wort 'Klang'") by J.Handschin (Eimert/Humpert, Lexikon, p.159). In connexion with electronic music Ton usually implied a "simple" Ton, or sine-tone. Since the German terminology will be defined the original language has generally been retained.

192) Eimert/Humpert, Lexikon, p.159

> "The word Sinuston does not occur with Helmholtz; only once did he refer in a footnote to 'sinus oscillations'"
>
> "Das Wort Sinuston kommt bei Helmholtz nicht vor; ein einziges Mal spricht er in einer Fußnote von 'Sinusschwingungen'."

193) Herbert Eimert, Der Sinus-Ton Melos XXI, (Mainz: B.Schott's Söhne, 1954), p.169

> "Es gibt ihn nur in der elektronischen Musik; er ist schlechthin ihr zentrales Problem, ihr theoretischer Grundbegriff, und dem entspricht

"seine kompositorische Bedeutung."

194) Eimert/Humpert, Lexikon, p.314

The following quotation is typical of such defences:

> "Thus it must be repeated with emphasis that the Sinuston as a musical Ton can be put to an infinite number of uses in electronic music. Opposing claims are meaningless, flimsy, out of the question or falsely opportunistic."
>
> "So muß mit allem Nachdruck wiederholt werden, daß der Sinuston als musikalischer Ton in der elektronischen Musik unbeschränkt verwendbar ist. Gegenteilige Behauptungen sind nichtssagend, fadenscheinig, indiskutabel oder gewollt opportunistisch."

195) Eimert/Humpert, Lexikon, p15

> "Geräusch: Tongemisch that is put together from from a great number of single Töne the differences of frequencies of which are mainly smaller than the lowest audible Tönen (<16 Hz)."
>
> "Geräusch: Tongemisch, das sich aus sehr vielen Einzeltönen zusammensetzt, deren Frequenzdifferenzen überwiegend kleiner sind als die tiefsten hörbaren Tönen (<16 Hz)."

196) Ibid., p.142

197) Knacke, for example, were referred to in Gesang der Jünglinge as "filtered impulses" (gefilterte Impulse). Karlheinz Stockhausen, Texte Band 2, (Köln: Verlag M.DuMont Schauberg, 1964), p.52.

198) This claim is made by Kaegi. He appears to suggest that a Knack could be produced from a source other than a square wave:

Kaegi, Elektronische Musik, p.65

"The sensation of pitch produced by a sine oscillation changes with the increased shortening of the signal duration into the successive sensations of a noisy Klang, a Geräusch and finally a short Geräusch (or Knack). (...)."

"Die von einer Sinusschwingung erregte Tonhöhenempfindung verwandelt sich bei fortschreitender Verkürzung der Signalzeitdauer nacheinander in die Empfindungen eines geräuschhaften Klanges, eines Geräusches und schließlich eines Kurzgeräusches (oder Knackes). (...)"

The derivation of an Impuls from a sine-wave oscillation was not universally agreed however:

Eimert/Humpert, Lexikon, p.143

"(...) Impulse do not consist of sine- but square-wave oscillations."

"(...) Impulse nicht aus Sinus-, sondern aus Rechteckschwingungen bestehen."

In addition, Meyer-Eppler referred to Knack and Knall as if they were the same sound phenomenon. See:

Meyer-Eppler, Elektrische Klangerzeugung, p.25.

199) Walter Gieseler, Komposition im 20. Jahrhundert, (Celle: Moeck Verlag, 1975) p.30

"Der Cluster setzt nach dem Vorbild der Theorie der Tongemische in der elektronischen Musik das Simultan-Kontinuum aller Tonhöhen (über die üblichen Intervalle bis zu Mikrointervallen fortschreitend) in die Tat um. Ligeti's 'Atmosphères' (1961) sind dafür ein wichtiger Hinweis."

200) The term Klanggemisch specifically referred to at least two Töne the frequencies of which formed difference and summation tones. Thus this term was infrequently used in electronic music.

201) Eimert/Humpert, Lexikon, p.352

"In der Instrumentalmusik sind Klang (Ton) und Zusammenklang klar geschieden; elektronisch schiebt sich hier das Tongemisch mit seinen eigentümlichen Verschmelzungsgraden dazwischen."

202) See sections 1.8-1.15

203) Eimert/Humpert, Lexikon, p.172

"The consonance and dissonance problem has been completely turned on its head because in electronic music new sound dimensions in the area between Tongemische and coloured noise gained compositional relevance and thereby mediate between the hitherto unknown degree of fusion of the ear and musical consciousness."

"Vollends auf den Kopf gestellt wurde die Konsonanz und Dissonanz-Problematik, als in der elektronischen Musik neue Klangdimensionen im Bereich zwischen Tongemischen und Farbgeräuschen kompositorische Aktualität gewannen und damit bisher unbekannte Verschmelzungsgrade dem Ohr und dem musikalischen Bewußtsein vermittelt."

204) Stroh, Soziologie, p.13

205) In Schaeffer's "A la Recherche d'une Musique Concrète" the final section entitled "Esquisse d'un solfège concrèt" comprises twenty-five pages. By contrast, sections five and six of the "Traité des Objets Musicaux", which also deal with formulating a new solfège, are almost two hundred pages long.

206) Guidance in the methodology and terminology of Schaeffer is now less problematic due to the availability of a book such as Michel Chion's "Guide des Objets

Sonores". Nevertheless, Schaeffer is badly served by translators. For example, in Robin Maconie's book on Stockhausen a translation is provided of a short passage from "A la Recherche d'une Musique Concrète". The original is as follows:

Schaeffer, Recherche, p.15

> "Devant toute musique électrique j'ai la réaction de mon père violiniste, de ma mère chanteuse. Nous sommes des artisans. Mon violon, ma voix, je les retrouve dans tout ce bazar en bois et en fer blanc, et dans mes trompes à vélos. Je cherche le contact direct avec la matière sonore, sans èlectrons interposès."

This is rendered:

Robin Maconie, The Works of Karlheinz Stockhausen, (London: Oxford University Press, 1976) p.40

> "Before all electric music I recoil, mindful of the fact that my father was a violinist and my mother a chanteuse. We are craftsmen. My violin, my voice, I recapture in all this hardware of wood and metal, and in the sound of my 'revolving clarions'. I want to achieve direct contact with the matter of sound, without electrons getting in the way."

Although Schaeffer has a very literary style it is often quite witty. This translation seems both unnecessarily pompous and, in the case of "revolving clarions", inaccurate. An alternative translation is:

> "When I come up against electric music I have the reaction of my father who was a violinist, my mother, who was a singer. We are craftsmen. My violin, my voice, I rediscover them in all this wooden and tin junk, and in my bicycle horns. I am seeking direct contact with sound material without electrons getting in the way."

207) Schaeffer also believed that the Donaueschingen incident was decisive for later events. He referred to it

as "The 'battle of Donaueschingen' (...)" (La 'bataille de Donaueschingen' (...)) and, continuing the metaphor, described it as "(...) a kind of Waterloo of musique concrète." ((...) une sorte de Waterloo de la musique concrète.) (Schaeffer, Musique Concrète, p.23)

208) See section 2.3.

209) Stroh, Soziologie, p.71

> "In Köln war man bestrebt, den Allgemeingültigkeitsanspruch elektronischer Musik als Ergebnis eines seriellen Ordnungsakt aus dem Wort selbst herzuleiten. Jede Benennung nicht-serieller musik als elektronische Musik wurde als terminologische Verwirrung betrachtet; schon aus dem Begriff heraus könne elektronische Musik nur das sein, was in Köln oder in Geiste Kölns produziert wurde."

210) Ibid., p.69

The term "elektrisch" was not synonymous with "elektronisch" in this context. "Elektrisch" was a term applied to mechanical instruments that were amplified electronically (pianos, guitars etc.) and to "(...) real sound events (every day noises, exotic music) structured according to their own laws with the aid of electrical recording and playback methods." ((...) reale Schallereignisse (Alltagsgeräusche, exotische Musik) unter Zuhilfenahme elektrische Aufzeichnungs- und Wiedergabeverfahren nach eigenen Gestzen gestaltet. Stroh, Soziologie, p.69).

211) Ibid., p.69

"Solche naturalistischen Beigaben sind von der Musik so weit entfernt wie die Natur von der Kunst. Wie weit die Verwirrung auf diesem Gebiet geht, konnte man bei der Vorführung der 'Musique concrète' auf den Donaueschinger Musiktagen 1953 feststellen. Viele Kritiker haben diese Darbeitungen - eine doppelte Verwirrung ! - als 'elektronische Musik' bezeichnet."

212) Humpert claimed when comparing early disc and tape techniques:

Humpert, Elektronische Musik, p.24

> "In comparison primitive disc technique could never achieve this mobility, it always remained an apparatus of reproduction, whereas the tape recorder in the electronic studio became an 'active' means of production. The early music of German provenance as well as American 'music for tape' did not undergo such 'childish illnesses', since they used tape techniques from the beginning."

> "Die im Vergleich dazu primitive Schallplatten--technik konnte diese Mobilität nie erreichen, sie ist immer ein Reproduktionsgerät geblieben, während das Tonband im elektronischen Studio zum 'aktivieren' Produktionsmittel wurde. Die frühe elektronische Musik deutscher Provenienz sowie die amerikanische 'Music for tape' haben übrigens solche 'Kinderkrankheiten' nicht durchgemacht, da sie sich von vorn herein der Magnettontechnik bedienten."

Disdain for early disc techniques was also expressed in:

Paul Griffiths, Modern Music - the Avant Garde since 1945, (London: Dent and Sons Ltd., 1981), p.32

> "With the arrival of the tape recorder to revolutionize techniques (...) and with the formal establishment by French Radio of a Groupe de Musique Concrète in 1951, the path was open for electronic music to leave the kitchen of sound effects and make a decisive contribution to the course of the art."

Both authors disregard the importance of Schaeffer's early experiments (see refs.21-24) all of which were conducted

with discs and which were concerned with both research and composition.

213) Herbert Eimert, Die Franzosen sprechen nicht mehr von Musique concrète Melos XXXIII, 1966, p.280

> "Das Bewerkenwerteste an diesem Abend von Schaeffers Gruppe war die Tatsache, daß in dem umfangreichen Programmtext und den noch viel umfangreicheren Unterlagen, die dazu aus Paris gekommen waren, das Wort 'Musique concrète' nicht mehr vorkam. Schaeffer hat bereits 1958 von diesem Begriff Abschied genommen, als er seine 1951 gegründete 'Groupe de Recherches de Musique concrète' in 'Groupe de Recherches Musicales' umbenannte. Damit ist 'Musique concrète' ein historischer, auf heutige Produktionen nicht mehr anwendbarer Begriff geworden. Als Pierre Schaeffer 1953 zum erstenmal in Köln gastierte, and jenem 'historischen' Musikfest, an dem mit Kompositionen von R.Beyer und dem Unterzeichneten die elektronische Musik ins Leben trat, war schon vorauszusehen, daß die damals praktizierte Form der Musique concrète, mit ostinaten Sprachfetzen, Geräuschaufnahmen und traditionellen Schallplatteneinblendungen, über die kunstgewerbliche Spielerei nicht hinauskam und keine Entwicklungsmöglichkeiten hatte. Ein bekannte Kritiker konnte damals schreiben, die Musique concrète sei der einzige Zweig der Neuen Musik, der in eine Sackgasse geraten sei."

214) Eimert/Humpert, Lexikon, p.216

> "Zu den Materialien gehörten nun auch, wie Schaeffer formuliert, 'elektrisch erzeugte Geräusche oder Klänge'. Damit war die historische Aufgabe der Musique concrète erfüllt und beendet."

215) See ref.27.

216) See ref.32.

217) Although bibliographies may not reveal every source a

writer has consulted the following writings by Schaeffer are listed as source material in works referred to in this study:

Eimert/Humpert, Lexikon - A la Recherche d'une Musique Concrète

Humpert, Elektronische Musik - Musique Concrète (German edition, 1974)

Musique Concrète (article in Riemann Musik Lexikon vol.3, (Mainz: B.Schott's Söhne, 1967), p.618

Stroh, Soziologie - article in Riemann Lexikon

Rudolph Frisius, Musique Concrète Musik im Alltag (Mainz: B.Schott's Söhne, 1980)
- Musique Concrète (German edition)

A la Recherche d'une Musique Concrète

Traité des Objets Musicaux

218) Vogt, Neue Musik, p.33

"Auch dem Verfahren der Musique concrète, für das die technischen Voraussetzungen spätestens seit der Erfindung des schneidbaren Tonbandes bestanden, schien zunächst keine Zukunft beschieden, obwohl eine nach dem Krieg unter der Initiative von Pierre Schaeffer sich konstituierende Pariser Komponistengruppe mit derartigen Geräuschmontagen und elektrisch modulierten, real produzierten Klängen, die auf Tonband festgehalten und über Lautsprecher abgespielt wurden, erfolgreich gearbeitet hatte."

219) Stroh, Soziologie, p.136

220) Ibid., p.151

"Von dem Pariser Kreis um Schaeffer wurde das

über Mikrophon aufgenommene Ausgangsmaterial nach 'musikalischen Klangeigenschaften', also weder (etwa im Sinne eines musikalischen Realismus) nach inhaltlichen, noch nach strukturellen Kriterien geordnet. Das 'konkrete' Klangmaterial soll nur 'sich selbst' bedeuten, unabhängig von seiner Herkunft und nur an die Kriterien der der hörenden Wahrnehmung gebunden sein. (...) Obgleich sich namhafte Komponisten wie O.Messiaen, P.Boulez und D.Milhaud für die konkrete Musik interessiert haben, ist die musique concrète doch weitgehend als Reizmusik, als illustrativ und oberflächlich verachtet worden. Auch mit dem wissenschaftlichen Anspruch der von Schaeffer geleiteten 'Groupe de Recherches de Musique concrète' (ab 1958 'Groupe de Recherches Musicale'(sic.)), musikalische Klangerforschung zu betreiben, konnte die konkrete Musik in Fachkreisen keinen nachhaltigen Eindruck machen."

221) See ref.217.

220) Ivo Malec was born in Yugoslavia in 1925. He was a founder member of the Groupe de Recherches Musicales and continues to live and work in Paris. He has composed many electro-acoustic and instumental works.

221) Ivo Malec, Musique Concrète 1948-1968 Melos 2 1969, pp.53-57. Malec's article appeared in German and is a clear summary of the development and aims of musique concrète. He asserts that musique concrète's greatest success was the Symphonie pour un homme seul and that it had not stopped "(...) rattling at the boundaries of music, in order to unsettle old listening habits." ((...) nicht aufgehört, an den Grenzen der Musik zu rütteln, die alten Hörgewohnheiten zu erschütten.). In his historical survey he mentions the Donaueschingen "incident" of 1953 and accepts that much early musique concrète during the period of Schaeffer's absence tended towards banal "background music" (Untermalungsmusik). Of greater

significance is his description of Schaeffer's intentions on his return to the group and his reference to the "Traité des Objets Musicaux".

224) The following are four examples of more balanced views of Schaeffer:

i) Frisius, Musique Concrète, pp.133-150

In this article Frisius challenges the view that concrete sounds are intrinsically anecdotal. To demonstrate this he briefly analyses four compositions: Schaeffer's Etude aux chemins de fer and Etude pathétique, Henry's Suite 14 and the Schaeffer/Henry collaboration Symphonie pour un homme seul. However, these are descriptions of sources and techniques rather than a purely aural appreciation of the musical value of the sounds. In addition, Frisius describes the nine balanced objects of typology and discusses the value of Schaeffer's musical theories, based on aspects other than rhythm and pitch.

ii) Carl Dahlhaus, Aesthetische Probleme der elektronischen Musik in Schönberg und Andere, pp.234-43

Although this article does not discuss Schaeffer specifically, there are several interesting points of contact. Dahlhaus condemns associative hearing in electronic music, claiming that in order to hear a noise musically one must be able to: "(...) perceive it for itself, isolated from the outside world, instead of grasping it as a sign and signal of an event that produces it or of which it reminds one." ("(...) es für sich,

isolisiert von der Außenwelt wahrnehmen, statt es als Zeichen und Signal eines Vorgangs aufzufassen, der es hervorbringt oder an den es erinnert).

iii) Wayne Slawson, Sound Color, (University of California Press: Berkeley and Los Angeles, 1985), pp.5-10

Slawson undertakes the biggest appraisal of Schaeffer's researches and correctly identifies many important aspects. He concedes that the "Traité" could be relevant to music in general and suggests the influence of musique concrète as the starting point for Schaeffer's researches. Schaeffer's contribution to classification and pedagogy are mentioned as are the notions of écoute réduite, objet sonore, objet musical and morphological types. However, Slawson's accounts of both typology and morphology are brief and not entirely clear. He concedes that Schaeffer's prose style can be difficult and admits that probably only committed musicians could become adept at Schaefferian methodology. Slawson also criticizes Schaeffer's lack of detail in describing experiments where sound is assessed on perceptual rather than scientific criteria. A principal criticism is Schaefferian terminology which Slawson believes to be too closely related to the "real world" and not sufficiently "objective". Slawson is the only writer to state that no detailed assessments of Schaeffer's work have appeared in English and lists three other brief references. These are: N.Kay, F.Evangelisti and I.Bengtsson. All of these appeared in the late nineteen-sixties and are reviews of

the "Traité".

iv) Ian Bent, Analysis The New Grove Handbooks in Music (London: The Macmillan Press Ltd., 1987), p.65

Bent, in connexion with the "Traité des Objets Musicaux", briefly discusses Schaeffer's attempts to discover general musical laws. He also enumerates Schaeffer's seven morphological criteria and mentions the particular importance of masse.

225) See ref. 179.

226) Schaeffer was adamant that a lengthy period in the studio was needed as a form of "ear cleansing" before composition:

Schaeffer, La Revue Musicale no.236, p.XV

> "One would need as a minimum one year of solfège, one year of objets sonores, one year of manipulation, before the slightest attempt at composition."
>
> "Il y faudrait au minimum un an de solfège, un an d'objets sonores, un an de manipulation, avant le moindre essai de composition."

One can understand Schaeffer's desire to impress upon musicians that in order to produce a composition of any value as much discipline is required in the studio as with traditional musical studies. Nevertheless, few composers would be willing to submit to these restrictions. Schaeffer himself was composing after only a few months of experiments, though he might argue that at the time he did not realize the enormity of the projects he eventually undertook and should have acted with more self-restraint.

One composer (besides Stockhausen) who found these restrictions impossible to accept was Xenakis. In a letter to Schaeffer in 1959 he wrote: "Must I stop composing in order to become a seeker of psychometry applied to sounds? No, it is not my chosen field." In a draft of the same letter (eventually omitted) he wrote: "If Stravinsky came to compose in the studio, would you ask him to do so on condition that he spend two years doing probationary work?" (Nouritza Matossian, Xenakis, London: Kahn and Averill, 1986) p.138.

227) Eimert and Humpert, Lexikon, p.85-86

"Experimentelle Musik ist eine begrifflich, sachlich und historisch nicht genauer zu fassende Bestimmung, die zunächst zu allem Traditionellen charakterisiert werden kann und die vom naturwissenschaftlichen Begriff des Experiments die Vorstellung übernommen hat, daß das, was aus Materie besteht, auch wieder in solche zerlegt werden konne. (...) In dieser Hinsicht ist weit eher die Musique concrète, solange sie Musique concrète war und hieß (bis 1958), mit ihrem theoretischen Hauptbegriff des Klangobjekts der Experimentellen Musik zuzurechnen; mit der Filteranalyse von Klangobjekten sollten durch ständig variierte Zerlegungsversuche neue Klänge erschlossen werden. Die Experimentelle Musik ging in ihren Anfangsjahren den umgekehrten Weg: sie nahm nicht Klänge auseinander, sondern setzte

sie zusammen, komponierte sie, auch dort, wo nun 1956 bei Krenek und Stockhausen zum erstenmal Nicht-Elektronisches in Gestalt von Singstimmen hinzutrat, was manche zu dem falschen SchluB verleitet hat, es sei nun endlich die Allianz zwischen konkretem und elektronischem Verfahren zustandegekommen. In diesem kompositorischen Frühstadium konnte bei der Elektronischen Musik nicht von experimentellen Tendenzen gesprochen werden.

228) The following quotation is in connexion with Stockhausen's criticisms of the early works by Eimert and Beyer. Even though the sounds were electronic they were not created according to serial proportioning and were, according to Stockhausen, little better than traditional sounds:

Saabe, Stockhausen, p.47

> "The reproaches also applied in general to an aesthetic which understood the 'experimental' only in the sense of an expansion of the 'sound palette' for the achievement of illustrative effects."
>
> "Die Vorwürfe bezogen sich im allgemeinen auch auf eine Ästhetik, die das 'Experimentelle' nur im Sinne einer Erweiterung der 'Klangpalette' zur Erzielung illustrativer Effekte verstand."

229) The concept of Klangfarbenmelodie is investigated in 3.5.

230) See ref.153.

231) Stroh, Soziologie, p.116

"Der elektronische Komponist kann nur physikalische Größen komponieren. Stillschweigend setzt er dabei voraus, daß diesen physikalischen Größen auch musikalische entsprechen und daß das, was hier 'Ordnung' heißt, auch dort 'Ordnung' ist."

232) Ibid., p.14

"Die extreme Kontrolle über sämtliche klanglichen und musikalischen Vorgänge, die unmittelbar nach 1950 der seriellen Kompositionstechnik im allgemeinen entsprochen hat, läßt aber andere musikalische Dimensionen verkümmern, die für die künstlerische Kommunikation von großer Bedeutung sind. Die elektronische Musik konnte weder den Klangreichtum (Ein- und Ausschwingvorgänge, Geräuschkomponenten, Formantcharakteristiken usw.) und die Modulationsfähigkeit des herkommlichen Instrumentalklangs und der Sprache erreichen, noch ein Äquivalent für die spezifische Wechselwirkung zwischen Spieler und Horer entwickeln, wie sie bei jedem Akt musikalischer Kommunikation stattfindet."

233) Boulez, Conversations with Célestin Deliège, p.60

234) It is a widely held opinion that certain aspects are more important for the communication of musical structures than others. The following is a typical assessment of such a hierarchy:

Pierre Boulez, Boulez on Music Today (trans. Susan Bradshaw, Richard Rodney Bennett) (London: Faber and Faber, 1971), p.37

"Pitch and duration seem to me to form the basis of a compositional dialectic, while intensity and timbre belong to secondary categories. The history of universal music practice bears witness to this scale of decreasing importance, as is confirmed by the different stages of notational development. Systems of notating both pitch and rhythm always appear highly developed and

> coherent, while it is often difficult to find codified theories for dynamics or timbre, which are mostly left to pragmatism or ethics (hence the numerous taboos concerning the use of certain instruments or of the voice)."

See also:

Trevor Wishart, On Sonic Art (York: Imagineering Press, 1985), chap.2 pp.18-20.

Wishart (who also uses the quotation above) cites Boulez as a composer who recognizes the primacy of pitch and duration but tries to subvert the dominance of this pair in his compositions. Attempts to re-balance this hierarchy are central issues in much contemporary composition. In addition, the question of appropriate terminology has to be considered. By referring to sound "aspects" or "features" specific concrete attributes of the sound in question are being considered. Schaeffer's formulation of the terms valeur and caractère is helpful but presupposes a process of abstraction has taken (or is taking) place. Nevertheless, Schaeffer's terms and the more neutral one of "aspect" or "feature" are preferable to "parameter" which is burdened by too many quasi-scientific notions.

235) The following list of compositions has been selected on the basis of works which display more equal participation of sound aspects and is restricted to the period under discussion. Examples are based on perceptual criteria rather than the preoccupations of the composer. The compositions utilize traditional instruments as well as unorthodox sound sources and playing techniques. Five

categories of new techniques have been identified and listed next to the appropriate compositions. These are:

A - sound families (corresponding to Schaefferian genres.)

B - instrumental colour
C - dynamics
D - space
} new models of valeur/caractère

E - non-semantic use of voice

Berio:

Sequenza III(1965), voice. E

Circles(1960), mezzo-soprano, harp, percussion. A,E

Sinfonia(1968), (2nd. movement) orchestra. B,E

Boulez:

Structures I(1951-2), two pianos. C

Structures II(1956-61) two pianos. C

Pli selon Pli(1957-62) soprano, orchestra, percussion. B

Le Marteau sans Maître(1953-5) chamber group. B

Ligeti:

Atmosphères(1961), orchestra. B

Ramifications(1968-9), string orchestra. B

Aventures(1962), 3 vocalists, 7 instruments. E

Nouvelles Aventures(1962-5) 3 vocalists, 7 instruments. E

Lux Aeterna(1966), 16 vocalists B,E

Nono:

Il Canto Sospeso(1956), vocalists, choir, orchestra. B,E

Sara Dolce Tacere(1966), 8 vocalists. B,E

Penderecki:

Threnody for the Victims of Hiroshima(1960), string orchestra. B

Anaklasis(1960), string orchestra, percussion. B

Polymorphia(1961), string orchestra. B

Stockhausen:

Gruppen(1955-7), 3 orchestras. B,D

Carré(1959-60), 4 orchestras, 4 small choirs. A,D,E

Zyklus(1959), percussion. A

Stimmung(1968), 6 vocalists. B,E

Xenakis:

Metastasis(1953-4), orchestra. B

Polytope(1967), orchestra. B,D

236) The following quotations are collected from comments made by the composers whose works were listed in the previous reference.

Berio:

Open University Contemporary Music Case Studies II, p.9 (Quotation taken from notes on a record sleeve of a recording of Visage, TV34046S)

> "I regard the experience of electronic music as very important precisely because rather than opening the door to the discovery of 'new' sounds it proved the possibility of a definite outcome of dualistic conceptions of musical materials (i.e. 'noise' versus 'musical notes') and gives the composer the practical means of integrating in a musical thought a larger domain of sound phenomena viewed as segments of the sound continuum."

Berio has not participated to any great extent in the

electro-acoustic medium since the late nineteen-sixties despite his involvement with IRCAM. He valued the ability of the medium to mediate between noise and musical sound and thereby expand the resources available to composers.

Ligeti:

György Ligeti, Auswirkungen der elektronsichen Musik auf mein kompositorisches Schaffen Experimentelle Musik, (Berlin: Gebr.Mann Verlag, 1970), p.74

> "When my orchestral piece 'Apparitions' (composed 1958-9) was performed in 1960 in Cologne and a year later the orchestral piece 'Atmosphères' was performed in Donaueschingen, often the following (remark) was mentioned: these pieces actually seem to be electronic music but 'arranged' for orchestra. This claim is certainly strange - how something could be electronic when it is purely instrumental - however it contains a grain of truth, that is, without the experience in the electronic studio the orchestral pieces would never have been composed in that way. The first ideas in the orchestral pieces 'Apparitions' and 'Atmosphères' consist in fanning out, dividing the orchestra into individual voices: not only the wind section, that had already been done, but also all the strings; so it was a matter of complete 'divisi'. The single voices do not have the same function as in classical music, but they disappear completely under a global web, and the transformations, the internal changes of this large network are essential for the musical form. That is, the musical Gestalts are not achieved from single notes, single harmonies, rhythmic configurations or single voices, but from the combination of these many single elements, whereby their individuality to a large extent disappears. The possibility of composing something like this, or to think compositionally in this way, results above all from experience in the electronic studio."
>
> "Als mein Orchesterstücke 'Apparitions' (1958/59 komponiert) 1960 in Köln und ein Jahr später das Orchesterstück 'Atmosphères' in Donaueschingen aufgeführt worden waren, wurde oft folgendes bemerkt: diese Orchesterstücke seien eigentlich elektronische Musik, aber für Orchester 'gesetzt'. Freilich ist diese Behauptung merkwürdig - wie könnte etwas elektronisch sein,

was rein instrumental ist -, dennoch enthält sie einen Kern von Wahrheit, d.h. ohne die Erfahrung im elektronischen Studio wären die Orchesterstücke nicht so komponiert, wie sie eben komponiert worden sind. Die ersten Vorstellungen zu den Orchesterstücken 'Apparitions' und 'Atmosphères', bestanden darin, das ganze Orchester aufzufächern, aufzuteilen in Einzelstimmen: nicht nur die Bläser, wie das schon früher der Fall war, sondern auch alle Streicher; es handelt sich also um ein totales Divisi. Die Einzelstimmen haben nicht die Funktion wie in der Klassischen Musik, sondern sie tauchen vollkommen unter in ein globales Gewebe, und die Wandlungen, die internen Veränderungen dieses großen Netzwerkes sind wesentlich für die musikalische Form, d.h. die musikalischen Gestalten werden nicht aus Einzeltönen, aus einzelnen Harmonien, rhythmischen Konfigurationen oder Einzelstimmen gewonnen, sondern aus dem Zusammenwirken dieser vielen einzelnen Elemente, wobei ihre Individualität weitgehend verschwindet. Die Möglichkeit, so etwas zu komponieren oder auf dieser Weise kompositorisch zu denken, resultiert vor allem aus den Erfahrungen im elektronischen Studio."

See also:

Paul Griffiths, György Ligeti, (London: Robson Books Ltd, 1983), p.26

> "(...) the idea of micropolyphonic webs was a sort of inspiration that I got from working in the studio, putting pieces together layer by layer. I was very much influenced too by older music, (...) But it was the studio work that gave me the technique."

The above quotation is taken from an interview between Griffiths and Ligeti.

P.Varnai, J.Häusler, C.Samuel, G.Ligeti, Ligeti in Conversation, (London: E.Eulenberg Ltd., 1983), p.39

(trans. Gabor Schaben)

> "All this (re: changes in 'Atmosphères') really goes back to what I was doing in the electronic studios; I applied what I had learnt there to instrumental and vocal music."

Ligeti's involvement with electro-acoustic music was short. It is all the more remarkable, therefore, that its effect was so profound. He continues to express interest in the medium but is unlikely to return to the studio.

Nono:

Hansjörg Pauli, Für wen komponieren Sie eigentlich?, (Frankfurt M: 1971), pp.119-120

> "(...) the difficulties that arose with instrumental and vocal music were wiped away with the electronic pieces which offered acoustic material of today. There were no longer any fundamental objections and also no aesthetically oriented questions."
>
> "(...) die Schwierigkeiten, die bei instrumentaler und vokaler Musik auftauchten, waren bei der elektronischen Stücken, die mit dem akustischen Material von heute aufwarteten, wie weggeputzt. Da kamen keine grundsätzlichen Einwände mehr und keine ästhetisch orientierten Fragen."

Nono valued the medium's ability to quote from the "real" sound-world. This was important for him; in his music an explicit political message is often communicated by the use of such quotations.

Penderecki:

Zimmerschied, Perspektiven, p.228

> "But that (new sounds from traditional instruments) is actually the result of electronic studios. I spent thousands of hours there, and tried to transpose all of my experiences in the electronic studio onto instruments."
>
> "Aber das ist eigentlich das Verdienst des elektronischen Studios. Tausende von Stunden habe ich dort verbracht, und alle meine Erfahrungen in dem elektronischen Studio habe ich auf die Instrumente zu übertragen versucht."

Penderecki imitated many electronic sounds in his

orchestral works but he stated that he had no desire to compose exclusively in the electro-acoustic medium.

Other composers such as Boulez and Xenakis are, after an absence of several years, now actively involved in the medium. This is no doubt due as much to technical advances beyond the scope of the present study as to aesthetic preferences.

237) See reference 140.

238) The confused remarks regarding musique concrète in section 2.9 illustrate how such misconceptions can become established by repetition rather than unbiased observation.

239) See sections 1.3 and 2.9.

240) The facility for absolute accuracy was directly linked to attempts to realize strict serial control in music. The following quotation is from one of Schaeffer's books. Significantly Schaeffer quotes Boulez who was certainly not an advocate of Schaefferian methods.

Schaeffer was discussing abstract demands for "(...) a precision prohibited to human interpretation." ("(...) une précision interdite à l'interprète humain.")

Schaeffer, Musique Concrète, p.81

> "(...) if we want to fracture basic units (of rhythm), which makes practically all execution impossible, and the graphic writing of the score

unfeasible, if we want, therefore, to introduce a notion of total liberty of rhythm, what can we do apart from addressing ourselves to the machine?"

"(...) si nous voulons fractionner les unités de base (du rythme), ce qui rend pratiquement toute exécution impossible, et irréalisable l'écriture graphique de la partition, si nous voulons, donc, introduire une notion de liberté totale du rythme, que pouvons-nous faire sinon nous adresser à la machine?"

241) Reibel, Cahiers Recherche/Musique, p.32

> "Le studio, ce n'est pas seulement du bricologe, c'est en fait le seul moyen d'accès à une découverte musicale, à tel point qu'une des choses les plus importantes de l'écriture orchestrale actuelle a été l'influence du studio."

This quotation is a remark by Guy Reibel collected by François Delalande. The orchestral works of Ivo Malec are referred to in a footnote.

242) A principal reason for this assertion is that the visual presence of the performer is a factor in the enjoyment of a concert, particularly if a degree of virtuosity is required in the playing of the work.

Wishart, Sonic Art, p.70

> "(...) in the tradition of virtuoso performance our awareness of the source and the performer's physiological, balletic and dramatic relation to the source can become part and parcel of our aesthetic reaction to the concert experience."

243) An interesting application of Schaefferian notions to analysis appeared in the following article:

François-Bernard Mâche, "Connaissance des structures sonores", La Revue Musicale no.244, pp.17-25. Mâche cites

several examples from contemporary music. For example, he suggests variations of allure in Le Marteau sans Maître by Boulez and different classes of grain in Metastasis by Xenakis. By using such terminology Mâche implies that Schaefferian notions can be helpful in analysis.

244) These two terms are frequently used in linguistics though there is a precedent for their use in connexion with music theory:

Joseph Kerman, Musicology, (London: Fontana Paperbacks and William Collins, 1985), p.14-15

> "We no longer agree on how new music is to 'work'. Hence composers continue actively to seek new ways of making it do so. Modern theory is sometimes not (or not only) descriptive, then, but rather (or also) prescriptive."

245) This is best illustrated by the relationship between serial thought and the Cologne studio discussed in section 2.3

246) The main articles dealing with electronic music and research by Stockhausen are included in his first volume of Texte.

Karlheinz Stockhausen, Texte I, (Köln: Verlag M.DuMont Schauberg, 1963)

p.39 Arbeitsbericht 1953: Die Entstehung der elektronischen Musik

Stockhausen outlined the problems of serial organization of instrumental timbre which, he suggested, could be

solved by electronic synthesis. He described the principal elements of electronic compositions in the Cologne studio and referred to his own Studie I, as well as Komposition Nr.5 by Goeyvaerts and Structures by Boulez.

p.45 "Zur Situation des Metiers (Klangkomposition)"

As in the previous article Stockhausen emphasized the advantages offered by the electronic medium of constructing the sounds of a composition.

p.99 "...wie die Zeit vergeht..."

This is possibly one of the best known and most influential articles by Stockhausen. Stockhausen applied the notion of a continuum of duration and pitch. He suggested scales of duration and tempi based on the overtone series and referred to his works Gruppen, Zeitmasse and Klavierstück XI.

p.140 "Elektronische und Instrumentale Musik"

Stockhausen gave another summary of electronic music and discussed certain aesthetic differences between the electronic and instrumental media.

p.152 "Musik im Raum"

This article concentrated on the form-creating potential of a sound moving in space. Stockhausen referred to his electronic compositions and also to Gruppen.

p.211 "Die Einheit der musikalischen Zeit"

Using examples from Kontakte Stockhausen discussed "four

criteria" of electronic music: i) the connexion between harmonic-melodic and metric-rhythmic composition, ii) the composition and decomposition of timbre, iii) the differentiation of intensities, iv) the scalic ordering of tone and noise.

247) Typo-morphological tendencies were noted in Kontakte in section 2.5.

248) See vocal works listed in ref.235.

249) Schaeffer, La Revue Musicale no.236, p.XIV

> "Manipuler ces appareils ce n'est faire, en quelque sorte, que l'apprentissage de la théorie musicale."

250) See ref.66 regarding Schaeffer's claims of the inadequacies of notation.

251) Journals in which such references can be found are:

Interface
Perspectives of New Music
Journal of Music Theory
Computer Music Journal
Computer Music Review

252) Moles, Instrumentation électronique et musiques expérimentales La Revue Musicale no.244, p.40

> "A partir du moment où la musique concrète faisait son sujet propre de la constitution d'objets 'inouïs', elle rejetait à une place subsidaire toutes les 'machines à faire des notes' que constitue la lutherie traditionelle, puis-qu'elle voulait, remplaçant le concept de note par la concept d'objet sonore, collecter des objets nouveaux dans l'univers sonore et les

assembler, sinon à sa guise, du moins selon des règles qui lui sont propres, et que ce fut une des premières tâches de l'équipe concrète de dégager."

253) All quotations and references are taken from the revised edition of 1977.

254) Schaeffer, Cahiers Recherche/Musique, p.58

"Le Traité insiste d'autre part sur l'émergence de 'pseudo-instruments': 'à vue d'oreille', telle séquence de sons dont les provenances sont diverses paraît issue d'une même source. Autre angle d'attaque pour le chercheur désireux d'élucider le mystère instrumental."

255) Schaeffer's admission of this point is made in his candid penultimate chapter of the "Traité".

Schaeffer, Traité, p.663

"The main fault of this work is indeed that it remains the only one (of its kind). More than six hundred pages dedicated to objects weigh down one side of the scale. To restore the balance the author would also have had to produce a "Treatise of Musical Organization" of equivalent weight.

Would my critics be so good as to excuse me: I had neither the time nor the genius to embark on such a work, in a domain where, moreover, everything remains to be done."

"Le principal défaut de cet ouvrage est en effet d'etre resté seul. Plus de six cents pages consacrées aux objets pèsent sur un plateau de la balance. Pour rétablir l'equilibre, l'auteur aurait du produire aussi un "Traité des organisations musicales" d'un poids équilvalent.

Que mes censeurs daignent m'en excuser: je n'ai eu ni le temps ni le génie d'entreprendre pareil travail, dans une domaine où, par ailleurs, tout reste à faire."

256) For example, the dualism of permanence/variation

which is discussed in section 3.4 is an example of a principle that was observed in traditional music and subsequently generalized to other forms of sound structuring:

Annexe: Un Article du Lexique: Permanence-variation

Cahiers Recherche/Musique, p.52

> "The law permanence-variation stands up wonderfully in traditional musics, since it is by observing them that the principle has been derived."
>
> "La loi Permanence-Variation se porte à merveille dans les musiques traditionelles, puisque c'est de leur observation qu'on en a tiré le principe."

257) The dualism of valeur/caractère was discussed in secion 1.5. This was in connexion with Schaeffer's intention of abstracting a musical valeur from the concrete sound material.

258) Schaeffer uses other interlinked dualisms to represent different aspects of music. Examples are musical/sonorous, concrete/abstract, musical/musicality, continuous/discontinuous.

259) Chion, Guide, p.74

> "La loi Permanence/Variation 'qui domine l'ensemble des phénomènes musicaux' est liée à la naissance même de l'instrument que l'on trouve à l'origine de toute musique."

Chion is elaborating the quotation in reference 60.

260) The principal exception to this is the organ although causal permanence is still apparent because of relatively

unchanging morphologies within each setting of the organ stops. For this reason Schaeffer accorded the instrument a special place in organology. See also reference 287.

261) Chion, Guide, p.75

"(...) scie la branche sur laquelle est assis le discours musical."

262) Ibid., p.70

"Les valeurs sont les traits pertinents, qui émergent entre plusieurs objets sonores mis en structure, en forment les éléments du discours musical abstrait proprement dit; les autres aspects de l'objet qui ne sont pas pertinents dans la structure musicale mais qui constituent sa substance concrète, sa matière, sont rassemblés sous le nom de caractère."

263) These different discourses are discussed in section 3.9.

264) Schaeffer, Cahiers Recherche/Musique, p.59

"Autrement dit, les objets doivent présenter suffisamment de caractères communs pour que soit mis en valuer le trait, variable d'un objet à l'autre, sur lequel on désire attirer l'attention."

265) Annexe: Une article du Lexique: Permanence-Variation, Ibid., p.52

"La PERMANENCE du CARACTERE TIMBRE constitue la base SONORE CONCRETE sur laquelle s'édifie la VARIATION de la VALEUR HAUTEUR qui représente le discours MUSICAL ABSTRAIT."

266) The confusion surrounding the term timbre is discussed in section 3.6

267) Carl Dahlhaus voiced his doubts about the notion of "Klangfarbenmelodie" in his article "Schönbergs Orchesterstück op.16 und der Begriff der 'Klangfarbenmelodie'". This appears in:

Dahlhaus, Schönberg, p.181

> "The appearance at the beginning of the orchestral work of a three bar long, unchanged five note chord with varying instrumentation seduced (people) to the simplistic interpretation that a Klangfarbenmelodie is the varied colouring of a held pitch. (...) A melody need not be considered simply as changing pitches in a single timbre any more than a Klangfarbenmelodie need be changing instrumentation restricted to one held pitch. Instrumentation does not become Klangfarbenmelodie because of pitch melody shrivelling to monotony, but because of a balance between instrumentation and pitch, rather than a dominance of pitch."
>
> "Daß am Anfang des Orchesterstücks ein fünftöniger Akkord drei Takte lang in wechselnder Instrumentation unverändert wiederholt wird, verführte zu der simplifizierenden Auslegung, eine Klangfarbenmelodie sei die verschiedene Färbung einer festgehaltenen Tonhöhe. (...) So wenig aber ein Tonhöhenwechsel, um eine Melodie zu sein, sich in einer einzigen Klangfarbe präsentieren muß, so wenig ist ein Instrumentationswechsel, um als Klangfarbenmelodie zu erscheinen, an eine festgehaltene Tonhöhe gebunden. Instrumentation wird nicht dadurch zur Klangfarbenmelodie, daß die Tonhöhenmelodie zur Monotonie einschrumpft, sondern durch ein Gleichgewicht zwischen Instrumentation und Tonhöhenmelodie statt der gewohnten Vorherrschaft der Tonhöhnemelodie."

Also relevant is the following quotation:

Dahlhaus, Ibid. , pp.346-7

> "The concept of parameter is a fetish to which theory clings more stubbornly the more experience shows how doubtful its usefulness is. (...) Timbre is indeed a sound quality, but not a parameter, since it does not fulfill the condition whereby it can be varied independently of the other parameters.
>
> "Der Begriff des Parameters ist ein Fetisch, an dem die Theorie um so hartnäckiger festhält, je

deutlicher die Erfahrung zeigt, daß seine Brauchbarkeit zweifelhaft ist. (...) Die Klangfarbe ist zwar eine Toneigenschaft, jedoch kein Parameter, denn sie erfüllt nicht die Bedingung, unabhängig von den anderen Parametern variabel zu sein."

268) Schaeffer, Traité, p.484

"On imagine bien que si du telles structures étaient facilement atteintes, en dehors de la structure traditionnelle hauteur-timbre, on aurait inventé du même coup autant de fondements nouveaux de la musique, ou autant de musiques nouvelles, que de structures de base. On est loin, bien loin, d'en avoir trouvé encore une seule qui soit probante. C'est même tout le problème, tout l'enjeu de la recherche musicale."

Schaeffer cites examples of scale-type organization based on pitch- type scales. Schaeffer understood, and was undoubtedly in sympathy with, the aims of the composers attempting such re-balances of the dualism. Nevertheless, he thought the methods used to produce new valeurs were generally unsuccessful because they were too simplistic:

Schaeffer, Ibid., p.49

"The success of the 'Modes de valeur et d'intensité'(sic) by Messiaen and of the notion of Klangfarbenmelodie are very characteristic in this respect (ie too simplistic): curiosity about those areas of music which are less worn out than those of the register of pitches, but also naively impatient to grasp them with the aid of an ambivalent notation, whose abstract nature does not correspond very well with the (sounds') concrete contents."

"Le succès de 'Modes de valeur et d'intensité' de Messiaen, celui de la notion de Klangfarbenmelodie, sont bien caractéristiques à cet égard: curiosité pour des domaines musicaux moins ressassés que celui du registre des hauteurs, mais aussi hâte naïve de s'en emparer, à l'aide d'une notation, elle-même équivoque, dont le caractère abstrait répond mal au contenu concret."

269) The choice of term for this musical concept seems to cause problems in English, French and German. English-speaking musicians have adopted the French word and consequently inherited the very problems that Schaeffer was determined to solve. The German equivalent "Klangfarbe" (Klang- or sound-colour) refers more specifically to the spectral content. One could speculate that a literal translation of "Klangfarbe" might provide a more exact, and preferable, English term. This was discussed in On the Sensations of Tone by Helmholtz. Ellis, the translator, considers the problem in some detail on page 24 and rejects (wisely) the term "clangtint" in preference to "quality of tone". It is unlikely that his suggestion, however sensible, will be widely adopted: the term "timbre" seems to be too entrenched in musicians' vocabulary to be dislodged completely.

270) Chion, Guide, p.48

> "It is only when the notion of timbre has been re-defined according to the principle of écoute réduite, and no longer in a physicist's manner, can we undertake a new solfège of objets sonores based on new principles."
>
> "Ce n'est qu'une fois que la notion de timbre aura été redéfinie selon les principes de l'écoute réduite, et non plus d'une façon physicienne, que pourra être entrepris sur de nouvelles bases un nouveau solfège des objets sonores."

271) Chion asserts that Schaeffer, in reference to the notion of parameters, even called timbre a "faux ami" and

considered the concept as one of the main sources of confusion in German electronic music.

Chion, La Musique Electroacoustique, p.7

> "In the early days the followers of electronic music (...) claimed that only the serial technique of Schoenberg, adapted and extrapolated to four officially recognized 'parameters' of sound (pitch, intensity, duration, timbre - the final one being refuted by Schaeffer as a 'faux ami') was solely capable of providing electronic music its language."
>
> "Dans les premiers temps, les adeptes de la musique électronique (...) postulaient que seule la technique serielle de Schoenberg, adaptée et extrapolée aux quatre 'paramètres' officiellement reconnus du son (hauteur, intensité, durée, timbre - ce dernier étant un 'faux ami' dont Schaeffer a fait justice), était seule capable de donner à la musique électronique son langage."

272) The following are contemporary views on the subject of timbre.

Wishart, Sonic Art, p.33

> "(...) we should become aware that the strict separation between pitch and timbre is an artefact of the way we have constructed our musical reality."

Paul Griffiths, New Sounds, New Personalities, (London: Faber Music Ltd., 1985), p.48

> Jonathan Harvey: "(...) I think we've come to the point where timbre has been dissolved, because vertically it's a matter of formant spectra, a subcategory of harmony, and horizontally it's a matter of both the evolution of spectra and the evolution of the fundamental pitch as melody. And culturally it's a matter of mental picture, of associating a sound semantically with an instrumental type. Everything really belongs to a more basic category, and you can't find timbre any more."

273) The following remark is interesting because Schaeffer

refers to an original meaning of the word "timbre" which is relevant to his own use of the term:

Schaeffer, Traité, p.55

> "(...) it (the word timbre) designated a kind of drum consisting of a series of taut strings giving the sound a characteristic colour: there was therefore actually a correlation between the word 'timbre' and the thing itself insofar as it is a musical instrument; similarly let us consider the ancient meaning of 'timbre' as 'indication of origin' affixed to this or that object in order to indicate where it came from. We must admit immediately that we can hardly consider musical timbre as anything else but a reference back to the instrument, an indication of manufacture."
>
> "(...) il désignait une sorte de tambour comportant une série de cordes tendues et donnant au son une couleur caractéristique: il y avait donc, pratiquement, coincidence entre le mot 'timbre' et la chose elle-même en tant qu'instrument de musique; que l'on pense aussi, dans la même perspective, au sens ancien de 'timbre' comme 'marque d'origine' apposée sur tel ou tel objet pour indiquer sa provenance, et l'on admettra que nous ne puissions guère, pour commencer, faire du timbre musical autre chose qu'un renvoi à l'instrument, une marque de fabrique."

See also:

Ibid., p.164

> "Timbre is that characteristic quality of a sound which makes it so that two instruments cannot be confused with each other, although producing a sound of the same pitch and intensity."
> (Danhauser, Théorie de la musique)
>
> "Le timbre est cette qualité particulière du son qui fait que deux instruments ne peuvent être confondus entre eux, quoique produisant un son de même hauteur et de même intensité."

Chion, Guide, p.48

> "timbre is that by which one is aided in identifying one instrument from another."
>
> "timbre is what makes one recognize different sounds coming from the same instrument."

"le timbre est ce qui fait qu'on identifie un instrument plutôt qu'un autre."

"le timbre est ce à quoi on reconnaît que divers sons proviennent du même instrument."

274) Ibid., p.49

275) Ibid., p.55

"Classical instruments themselves are pressed into a use that will divert them from their usual function. Violins are struck, flute keys rattled etc., the instrument is used as a 'sound body', good for anything. The permanence of instrumental timbre is no longer guaranteed, the law of permanence-variation is breached."

Les instruments classiques, eux-mêmes, sont conviés à un emploi qui les détournera de leur fonction habituelle. On percute les violons, on fait claquer les cées des flûtes, etc., on utilise donc l'instrument comme un 'corps sonore' bon à tout faire. La permanence du timbre instrumental n'étant plus garantie, la loi permanence-variation est battue en brèche."

276) This was not a totally new concept. It had been exploited by other composers but was never formulated into a systematic compositional concept. The following quotation, made with the benefit of hindsight, refers to Spiel(1952) by Stockhausen:

Maconie, Stockhausen, p.41-2

"The piece's extraordinary range of attack instruments reflects two things; Stockhausen's systematic study of instrumental timbre through the recording and dissection of a wide variety of individual sounds; and his discovery through this study that most musical sounds could be separated into 'attack' and 'decay' components, and that the personalities and distinctive timbres of wind and percussion instruments chiefly reside in the initial attack. These revelations suggest an entirely new categorization of musical instruments according to purely acoustic

criteria; throw light on previously unrecognized affinities between instruments of different families; and - most important at the time - suggest the possibility of creating new timbres by transplantation of attacks to different resonances."

277) Chion, Guide, p.49

"The empirical notion of instrumental timbre should therefore be redefined by means of écoute réduite, and in each case distinguished clearly from the specific criterion of timbre harmonique."

"La notion empirique de timbre instrumental devra donc être redéfinie en termes d'écoute réduite, et en tout cas distinguée clairement du critère spécifique de timbre harmonique."

278) "Retrospective" in this context refers to the tendency of perception to gain much of the information from the onset of the sound. As the onset may be extremely brief and may have passed by the time the brain actually processes the aural information, such perception can be said to operate retrospectively.

279) An example of this is the "piano law". Schaeffer established that piano sounds present unified characteristics in every position of the pitch-field despite the steeper dynamic profile and relatively weak harmonic content in the high tessitura and the richer harmonic content but more graduated dynamic profile of the low tessitura. As these two have an inverse relationship he stated: dynamic steepness x harmonic richness = constant. This experiment is described in the Traité, pp.235-8.

The following quotation also recognizes that homogeneity exists mainly within relatively confined areas of the tessitura:

Boulez, Boulez on Music Today, p.64

> "In the world of 'natural' sound, timbre, as we have said, is presented in the form of constituted ensembles. What is an instrument, in fact - what is the voice for that matter - if not an ensemble constituted of timbres of limited evolution within a given tessitura?"

280) Schaeffer described an experiment in which a recorded piano sound was made to resemble that of a flute, not by any alteration of the spectral content but simply by removing a portion of the onset.

See: Solfège de L'Objet Sonore, fourth theme, point two - attacks and dynamic structure.

281) Not every composer believed this to be an advantage.

See reference 159.

282) The following remark demonstrates that timbre is the result of interactions between the three parameters and had no independent existence:

Chion, Guide, p.51-2

> "The notion of timbre actually seems the least amenable to abstraction since it represents the qualitative residue at the bottom of the psycho-acoustician's test-tube once the sound has been decomposed into three quantifiable parameters: frequency, amplitude and duration."
>
> "Or la notion de timbre semble justement être la moins propice à l'abstraction puisqu'elle désigne justement ce résidu qualitatif qui reste au fond de l'éprouvette

des psycho-acousticiens une fois qu'ils ont décomposé le son en trois paramètres quantitativement mesurables: fréquence, amplitude, et duration."

In the following quotation Schaeffer uses traditional instruments to demonstrate the difficulty of using instrumental timbres to create a valeur:

Schaeffer, Traité, p.302

"Let us now take this borderline case. A bassoon, a piano, a kettledrum, a cello, a harp, etc., playing the same pitch are supposed to be creating a melody of timbres. This sequence, or structure, will be described by inverting the usual terminology. In preceding examples the timbres generally appeared as caractères and pitch as valeur. Here, as all the sounds have the same caractère of pitch, we need to look elsewhere for valeurs. But when we try to do this we are not inevitably going to find a clear valeur in front of us; perhaps we will still recognize instruments and not a true Klangfarbenmelodie. These timbres are either too pronounced or too blurred for a clear valeur to result from them and for us to perceive them."

"Prenons maintenant ce cas limite. Un basson, un piano, une timbale, un violoncelle, une harpe, etc., jouant à la même hauteur sont censés créer une mélodie de timbres. Cette séquence, ou structure, va donc se décrire en inversant les termes habituels. Dans des exemples précédents, les timbres apparaissaient en général comme caractères, et la hauteur comme valeur. Ici tous les sons ayant un même caractère de hauteur, il nous faut chercher autre part les valeurs. Mais, lorsque nous tenterons de le faire, nous n'allons pas forcément trouver devant nous une valeur évidente; peut-être allons-nous reconnaître encore des instruments et non une véritable Klangfarbenmelodie. Ces timbres sont, ou trop marqués, ou trop flous pour qu'il s'en dégage une valeur nette, émergeant à notre écoute."

See also reference 267.

283) An example of such an improvement is:

Juan Roederer, Introduction to the Physics and

Psychophysics of Music, (New York: Springer-Verlag, 1973) pp.1-2

Roederer discusses the "instrument" on the basis of its three basic components. The first is the primary excitation mechanism which initiates the sound vibrations. Examples are the violin bow rubbing against the string, the vibrating reed of a clarinet. The second is the vibrating element which sustains the vibrations. This can be the strings of a violin or the column of air in a wind instrument. Thirdly he suggests, where appropriate, the resonator which transmits the vibrations of the vibrating element to the air. It is clear, therefore, that while this may be a more rational basis it still takes account of the mechanics of the instrument in preference to the sounds as heard.

284) H.Saabe, Das Musikdenken von Karel Goeyvaerts in Bezug auf das Schaffen von Karlheinz Stockhausen, Interface 2, 1973, p.107

> "Mit dem Problem der Einbeziehung der Klangfarben-Dimension in eine rationell determinierte Konzeption des Komponierens hat sich Goeyvaerts in seinen folgenden Arbeiten, Opus 2 und Opus 3, beschäftigt. Die notwendige Kategorisierung hat er vorgenommen auf Grund der Erzeugungsart der Klänge: gezupft, gestrichen, geschlagen, mit Mundstück geblasen, u.s.w."

285) These problems were discussed in sections 2.3 and 2.4.

286) Zimmerschied, Perspektiven, pp.228-9

"Die durch mich eingeführten Mittel stellen nur eine Verbreiterung des Klangcharakters eines Instruments dar, wie einst pizzicato, tremolo, flageolett, glissando oder col legno. Einige der von mir auf den Streichinstrumenten verwendeten Artikulationsmittel haben nur scheinbar einen Schlagzeug-Charakter, aber trotzdem verbinden sie sich mit dem charakteristiken Klang des Instruments. Das ist die gleiche Sache wie mit dem pizzicato auf den Violinen: obwohl hier scheinbar die Verwandlung des Streichinstruments in ein Zupfinstrument vorliegt, haben wir es immerhin noch mit dem Klang einer Violine zu tun, der ein anderer ist als beispielweise der einer Gitarre. Ob wir auf diese oder eine andere Weise streichen, zupfen oder schlagen, immer bearbeiten wir hier ein Instrument, das aus Saiten und einem Resonanzkorper besteht und eben diese und keine andere Bauweise hat - und dies gerade determiniert den Klangcharakter."

287) Schaeffer also accepted that timbre could be a register on an instrument but only with reference to the organ:

Schaeffer, Traité, p.49

"Indeed it is the only instrument to possess explicitly the four registers: pitches, timbres (we can see its keyboards and stops), durations and intensities (strongly indicated by the mechanical context)."

"Seul, à vrai dire, il possède explicitement les quatres registres: hauteurs, timbres (on en voit les claviers et les jeux), durées et intensités (fortement marquées par le contexte mécanique)."

288) Ibid., p.55

"Tout à fait indépendante du type de l'instrument, nous lui découvrons une registration. Non pas, comme on serait prématurément tenté de lire, une structure sonore décelable dans les séries d'objets qu'il délivre, mais ce qui produit la variation de ces objets."

289) Ibid., p.56

"Of course in every instrument there are multiple

registers: a principal register which in developed instruments as a rule governs pitch, and additional registers which allow us to work on, to use the usual terms, the intensity or the timbre."

"Bien entendu, dans tout instrument, il y a de multiples registres: un registre principal qui, dans les instruments évolués, régit en principe les hauteurs, et des registres accessoires permettant d'agir, pour reprendre les mots habituels, sur l'intensité ou le timbre."

290) Chion, Guide, p.63-4

291) Schaeffer, Traité , p.46

"La découverte des registres n'est que l'art de se servir du matériel instrumental dont se trouve disposer telle ou telle civilisation. Le concret précède l'abstrait."

292) See section 1.15.

293) Chion, Guide, p.46

"(...) seules des échelles de critères seraient susceptibles de donner lieu à des relations abstraites, et non plus à des relations dynamiques ou impressionistes ('plastiques'); cela parce qu'elles mettent en jeu des rapports, des différences, et pas seulement des qualités concrètes attachées pontuellement aux objets."

294) Various experiments have demonstrated that the recognition threshold of pitch is much smaller than that of timbre. See Schaeffer/Reibel, Solfège de l'Objet Sonore, Side 2 (Time thresholds of the ear).

295) On page 635 of the Traité Schaeffer illustrates the sounds in these four registers (diagram 10).

DIA.10 OBJETS DONNÉS À ENTENDRE

OBJECTS PRESENTED TO THE EAR:	discontinuous harmonic sounds (fixed tonic)	discontinuous non-harmonic sounds (complex fixed masses)	glissando sounds (tonic or complex)
PROPERTIES OF THE PERCEPTUAL FIELD FOR ÉCHELLES OF PITCH:	repetitive, logarithmic structure of intervals of pitch: degrees	linear continuum of nuances in the register: colour	evaluation of melodic trajectories referring to registers of intervals or colour according to their speed of development
OBJECTS PRESENTED TO THE EAR:	homogeneous sounds	sounds with attack	sounds with sustained profile
PROPERTIES OF THE PERCEPTUAL FIELD FOR TEMPORAL ECHELLES:	repetitive, arithmetic structure of intervals of: duration	anamorphosis and localization of an impact: rhythm of spacings out	evaluation of dynamic trajectories referring to valeurs of duration or to rhythm of spacings out, according to their speed of development

Significantly he adds another column for "sons en glissando" in the pitch-field and "sons avec profil entretenu" in the duration-field. Thus he refers to "(...) six kinds of fundamental relationships (...) according to the speed of development (...)" ("six sortes des relations fondamentales (...) en fonction de la vitesse d'évolution (...)"). Possibly he felt it necessary to differentiate between the sounds in this column as the result of research conducted during the eleven years between the first and second editions of the Traité. Chion implies that the table on page 635 was "revised and corrected" ("revu et corrigé"). see Chion, Guide, p.67.

296) "Impact" is a term used in the stage of analysis. It refers to the "site" of a sound's duration and attempts to assess how the behaviour in the musical context makes the sound conspicuous. See 1.15

297) In the table on page 635 Schaeffer refers to "sons homogènes". In the text he on page 633 he qualifies this by referring to sounds that are "approximately homogeneous" ("sensiblement homogènes"). It is likely therefore that he was referring to fairly stable sounds rather than the specific typological type of homogeneous sounds.

298) On page 635 Schaeffer refers to "sons avec attaque". In the box immediately beneath he refers to "localisation

of an impact" which is less specific.

299) In the table on page 635 these sounds seem to fit in either register according to the speed with which they evolve.

300) Schaeffer, Traité, p.633

In chapter 35 section 15, "The two musics" ("les deux musiques") Schaeffer discusses the two principal types of musical dicourse. He refers to rhythmic and dynamic structures on "the plane of intensity" ("le plan de l'intensité") rather than duration. In the next paragraph he connects the three fields by referring to "les dimensions de hauteur et d'intensité en fonction de la durée" (the dimensions of pitch and intensity as a function of duration). This inconsistency is no doubt due to the complexity inherent in attempting to separate intensity and duration.

301) Schaeffer, Notices et Analyses - Premier Concert, La Revue Musicale no.244, p.64

> "(...) fort d'avoir trouvé un caractère aussi précis que celui des allures (entendez toute espèce de vibrato généralisé, aussi bien en timbre qu'en dynamique, aussi bien en rythme qu'en densité) il commence à se servir de ce sûr point de départ."

302) Annexe: Un article du Lexique: Permanence-variation, Cahiers Recherche/Musique, p.53

> "And if one makes an ETUDE AUX ALLURES it is only a study where the idea of putting allures into an

échelle is sketched out, an échelle which might lead to a new 'valeur-caractère' relationship etc."

"Et si l'on fait une ETUDE AUX ALLURES, celle-ci n'est qu'une étude, ou se trouve esquissée l'idée de mettre en échelle des allures, mise en échelle qui pourrait conduire à un nouveau couple 'valeur-caractère' etc."

303) There appears to be no suitable English term in this context for "jeu"; consequently it has been left in the original French. "Jeu" can be translated as "play" or "game". The use of these terms could trivialize the concept which also implies interaction, involvement, interplay. An analogous situation exists in the notion of "Spiel" in the writings of Ludwig Wittgenstein. "Spiel" is also translated as "game" (for example "Sprachspiel" - language-game) and like "jeu" has other connected but subtly different shades of meanings which the English word tends not to communicate. One can sympathize with the following statement:

Magee, <u>The Great Philosophers</u>, p.330

> "I must say I think it's something of a disaster that he (Wittgenstein) fastened on this term 'language game'. It makes it sound as if what he's doing, or what he's talking about, is somehow frivolous. (...) I have often heard the term 'language game' used in disparagement of philosophy by people who have jumped to wrong conclusions about what the term means."

The following is another, similar reference to "play". It conveys more of the musical nature of Schaefferian "play"; David Keane, At the Threshold of an Aesthetic <u>The Language of Electroacoustic Music</u>, p.110-11

> "It would seem that exploration relies upon three frames of reference: one as a base from which to

to start, another for initial processing, and a third for deciding what will be processed further.

(...)

Art is concerned with that particular kind of exploration that systematically extends perception; a kind of exploration called 'play'. Despite the fact that we use that very word to describe the performance of music, we have long taken art too seriously and failed to appreciate how serious the business of play really is (...)"

304) Schaeffer, Traité, p.45

"Dans cette activité instinctive, antérieure à toute codification des structures rythmique ou mélodique, on voit apparaître quatre jeux: deux d'entre eux sont relativement explicites, celui des rythmes et celui des hauteurs; les deux autres, celui des timbres celui des intensités, sont implicites."

305) Chion, Guide, p.55

"(...) il joue systématiquement des grincements d'une porte, il s'agit là sinon de musique, du moins de l'étude des jeux d'un instrument"

The following quotation is also relevant to Henry's piece:

François Delalande, Pertinence et Analyse Perceptive,

Cahiers Recherche/Musique, p.88

"(...) the sounds (of which the 'instrumental' origin is a creaking door) have a strong, constantly varied 'iterative grain' from the most 'coarse' to the 'finest' grain. The piece is a jeu of grain."

"(...) les sons (dont l'origine 'instrumentale' est un grincement de porte) ont un fort 'grain itératif' constamment varié, du grain le plus 'gros' au grain le plus 'fin'. La pièce est un jeu de grain."

306) Abraham Moles, Instrumentation Electronique et Musiques Expérimentales, La Revue Musicale no.244, p.40

"En fait, le terme d'instrument doit être pris dans un sens phénoménologique et correspond moins aux machines à faire des notes de la musique conventionelle (violon, piano ou harmonica), qu'aux appareils que le musicien concret rencontre dans son périple artistique entre l'exploration de l'univers sonore et l'exploitation de celui-ci dans une composition organisée. Ce terme doit donc être élargi, et ne retient de l'acception classique d'instrument qu'un des aspects de celle-ci: un instrument avec lequel on joue; le mot 'jouer' étant, dans son équivoque même, une des clefs de la création artistique."

307) Schaeffer, Traité, p.637

"According to how things are one would have a more 'musical' music or a more 'plastic' music."

"Selon la tendance, on aura une musique davantage 'musical' ou une musique davantage 'plastique'.

308) Ibid., p.636

"On pourrait même insinuer qu'elle cherche son sens là où la précédente le fuyait."

309) Schaeffer, La Musique par Exemple Cahiers Recherche/Musique, p.63

"A same sound could be thus integrated in a musical structure or musically appreciated for its own structure, its dynamic contour, its harmonic or melodic development... etc"

"Un même son peut être ainsi intégré à une structure musicale ou musicalement apprécié pour sa structure propre, son contour dynamique, son évolution harmonique ou mélodique... etc."

310) The assessment of these notions was described in section 1.11.

311) There are very few references to the dualism of

variation/texture in the "Traité". This was no doubt due to the complexity of assessing the manner in which a variation behaves (according to facture and speed) and then relating this to the texture.

312) Schaeffer, Traité, pp.637-38

> "(...) quatre pôles de la mise en oeuvre musicale, points cardinaux qui pourraient aider à situer les divers domaines de l'organisation musicale (...)"

313) There are many books on instrumentation that could be included in the category of listing examples from the standard repertoire. In recent years other approaches in dealing with contemporary instrumental/vocal resources are evident. Of particular interest are:

Gieseler, Lombardi, Weyer, Instrumentation in der Musik des 20.Jahrhunderts , (Celle: Moeck Verlag, 1985)

Jarmil Burghauser, Antonin Spelda, Akustische Grundlagen des Orchestrierens , (Regensburg: Gustav Bosse Verlag, 1970)

Reginald Smith-Brindle, Contemporary Percussion, (London: Oxford University Press, 1970)

The first two books attempt a more thorough investigation of the acoustic bases for instrumental sounds. The Smith-Brindle work on percussion includes a record. Similarly Wishart's On Sonic Art has examples on cassette

of different vocal techniques. These are interesting developments, on reflection it is self-evident to use modern recording and reproduction techniques to enable a listener to hear the sounds that are described.

314) Schaeffer, Traité, p.51

"Un instrument ne répond à aucune définition théorique, sinon celle de permanence-variation (...), notion qui domine l'ensemble des phénomènes musicaux. Tout dispositif qui permet d'obtenir une collection varieé d'objets sonores - ou des objets sonores variés - tout en maintenant présente à l'esprit la permanence d'une cause, est un instrument de musique, au sens traditionnel d'une expérience commune à toutes les civilisations.

Si la qualification musicale s'attache surtout à la variété, à l'ordonnance de la collection des objets, cet instrument révèle des registres, et conduit à un domaine musical dominé par les structures correspondantes. Si le qualificatif s'applique surtout aux objets eux-mêmes, interessants par leur forme ou leur matière, mais isolés ou disparates au point de ne pas révéler de registres, de ne pas conduire à des structures, on découvre une sorte d'instrument dont la tradition connaît des examples, mais qui ont toujours été placés, par les Occidentaux du moins, aux limites du domaine musical: tels les gongs, cymbales, sonnailles et autres maraccas. Ces instruments ne donnent pas, à vrai dire, une collection d'objets distincts qu'une qualité abstraite permettrait de sérier, mais des objets stéréotypés, quoique en divers échantillons, que seuls différencient des caractères concrets. Ainsi la pratique instrumentale révèle-t-elle déja l'alternance entre une structure de sons et les caractères d'un son structuré."

315) Klaus Wachsman, The New Grove Dictionary of Music and Musicians vol.9, (London: Macmillan Ltd., 1980) p.237

The rest of the article is concerned with various approaches to the problems of instrumental classification.

316) This simple system is outlined in:

Roederer, Physics and Psychophysics of Music, p.1

317) Chion, La Musique Electroacoustique, p.30

> "Le paradoxe est que, par attachement fétichiste à l'instrument occidental, des compositeurs et des mélomanes qui se disent pourtant d'avant-garde ont instinctivement plus de respect pour un objet sonore insignifiant tiré d'un piano Steinway (donc 'ennobli' par sa source) que pour un très beau son fait avec un élastique, qui leur paraîtra toujours plus ou moins roturier."

318) Schaeffer, Traité, p.63

> "Dans son principe, il ne correspondait pas à la définition d'un instrument. Puisqu'il se proposait de résumer tous les instruments à la fois, cela voulait dire qu'il comportait non seulement des registres, au sens où nous avons défini ce terme, mais un super-registre: celui même qui eût permis de passer d'un instrument à l'autre. En fait, la notion d'instrument était minimisée. On pensait la dépasser au profit des structures; on faisait une confusion à propos de la notion de timbre: on extrapolait prématurément le second sens du mot, le timbre devenant une simple caractéristique de l'objet musical et non plus la perception d'une cause commune à une famille d'objets."

319) Ibid., p.65

> "Contrairement à ce que permettait l'instrument électronique, il n'y avait aucune commodité de registre, mais par contre, d'extraordinaires possibilités de jeu, à la fois dans l'invention des êtres sonores captés par le micro, et dans les interventions pratiquées après enregistrement."

Both of these viewpoints were consistent with those previously expresssed by Schaeffer:

Schaeffer, Situation Actuelle de la Musique Expérimentale

Revue Musicale no.244, p.13

"One refuses to generalize the notion of the musical instruments to electronic or electro-acoustic apparatus. One is content to notice that these are devices allowing the manipulation of sounds."

"On se refuse à généraliser la notion d'instrument de musique à l'appareillage électronique ou électro-acoustique. On se borne à constater que ce sont des dispositifs permettent la manipulation des sons."

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