Concrète control

Pierre Schaeffer's *concrète* in digital control algorithms

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Abstract

This thesis is concerned with the algorithms determining the manner in which digital audio is processed. My interest in this subject is due to my impression that the idiomatic and common ways of designing control algorithms for digital audio are often not of a very dynamic nature, but rather of a binary or linear design. I draw on the ideas of Pierre Schaeffer, particularly his conception of a *concrète/abstract* axis, in order to articulate this issue. An interface is programmed in order to explore the concrete aspects of sound through control algorithms. By doing this I hope to contribute to an articulation of a fluidity and complexity that sound is uniquely capable of revealing, but which is sometimes obscured by an excessive occupation with static symbols and concepts.

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Contents

Chapter 1

Introduction

> Are not the traits which I indicated [...] just like the blunting of a meaning too clear, too violent? Do they not give the obvious signified a kind of difficultly prehensible roundness, cause my reading to slip? (Barthes 1977:55)

Through the act of listening, sound is subject to an apprehension of form, concept, symbol or meaning by various processes of cognition, in what will here be referred to as the *conceptualization* of music.[1] I am here concerned with issues regarding this conceptualization — specifically the manner in which the properties of sound, a continuous substance with no intrinsic system of organization, relates to cognition of musical properties, which is by contrast proceeding by some manner of subjectively determined fragmentation. There is necessarily a selection in operation, by a hierarchy that is determined by both natural and cultural factors. Such a hierarchy determines what constitutes the most relevant properties of sound, and consequently what properties of sound are not determined to be

[1] This thesis tackles conceptualization of music from a perspective closer to art theory. For a discussion of this subject from the viewpoint of recent cognitive science, see "Conceptualizing Music: Cognitive Structure, Theory, and Analysis" by Zbikowski (2002).

of much value.

This inquiry is motivated by a sense that something of significance can be found in an alternative understanding of what is of musical value. In particular I sense that there is sometimes too much emphasis given to properties of sound having a distinct form, with more diffuse properties being undervalued. Sound exhibiting such diffuse properties — the way in which sound seems to present as a complex of interweaved layers of more or less course-grained, resonant material, continually emerging or disintegrating — has always been my preferred focal point in listening, not least for the richer, more diffuse field of meaning I derive from such listening. Conversely, listening for pre-defined and clearly discernible tonal systems, or explicit signification, has been of less interest to me.

However, I have been, from the start, embedded into the paradigm of Western music culture, where sound is being discussed, created, and listened to through a particular predetermined and limited set of concepts and symbols. Discussion of what are the meaningful properties of sound is not very refined in this discourse. Therefore, explicit awareness of my special interest in issues of *conceptualization* of music has come with some difficulty. I have found that a key to an inquiry into the nature of conceptualization of music is facilitated by certain advents of music technology. I am especially concerned with how digital sound processing has the power of breaking natural and traditional bonds between player, instrument and performing space, and thereby upsetting natural and cultural constrains on music cognition. I see here the opportunity, with the aid of digital sound processing, to perhaps upset the hierarchy of what values are apprehended from sound, and promote the diffuse properties of sound.

1.1 Theoretical and methodological frameworks

That the intrinsic properties of sound is the subject matter of this discussion is not an arbitrary choice. I find that by its nature as a fluid, temporal medium, fundamentally different from the static appearance of mediums such as text or image, sound has a special role in influencing a discussion of the nature of conceptualization in a particular direction.

Christoph Cox (2011) has proposed a way of understanding music based not on static signification, but rather on a general ontology of constant instability, a permanent state of flux, "a state of becoming", as Nietzsche describes his ontology of constant change. This approach to understanding music, termed a 'sonic ontology' by Cox, is affording a shift of discourse, from static concept to dynamic process. In this sense, sound, by its dynamic nature, can articulate a sense of dynamic process rather than static sign.

This shift of focus from concept to process does not, as it may seem, entail a disinterest in the cultural aspect of listening and a 'return' to 'raw' emotion or material of no meaning. Cox is rather suggesting a fusion of cultural symbol with process, by seeing symbols as, in the words of Cox, "particular manifestations of a broader differential field: the field of nature and matter themselves" (Cox 2011), however in a very slow time frame, thus appearing static but being nevertheless in a state of constant change. I therefore find this 'sonic ontology' to be a concept of great value in this context, for suggesting a fluidity and impermanence of concept.

As Cox primarily offers a concept and not a methodological framework regarding his inclusion of the symbolic into a 'sonic ontology', there is the need for a discussion of *how* the symbolic, usually discussed in the domain of text, can be conceptually appropriated by a sonic ontology of process. I am therefore looking towards the style of critical linguistics developed by Julia Kristeva and Roland Barthes, in which the formation of symbol and system is considered to be a dynamic process rather than depending on predetermined and static systems of signification.

In employing the term 'signifying process', Julia Kristeva suggests that we understand the nature of signification as a process, a dynamic meeting of a pre-symbolic complex of all possible signifiers, and a field of solid symbols, sourced from the pre-symbolic field (Kristeva 1986). In the same vein, Roland Barthes details an 'obtuse' meaning, outside of the obvious symbols, articulated in music through a 'grain', a rich, visceral domain (Barthes 1977).

Although I will not try to reduce the complexity of their theories, nor of the field of music, to a question of the inherent properties of sound, I am nevertheless under the impression

that some of these concepts can be useful in a discussion of how the properties of sound affect the sense of meaning that is derived from sound. I find in the concept of formation of symbols as a dynamic process an entry point into discussing properties of sound in a meaningful way, in an intersection of the 'sonic ontology' of Cox and the pre-symbolic and the 'grain' of Kristeva and Barthes. I hold the view here that the extent to which music will be experienced in a sense of strong symbols or whether it will be seen as an 'obtuse' field of meaning is to an extent determined by the intrinsic properties of sound. Therefore, what I am in this thesis considering in the intrinsic properties of sound is whether there are more clearly defined formal properties of sound, e.g. stable pitch or regular rhythm, or whether there is a greater extent of 'grain' in sound. My thesis is that distinct, regular shapes indicate expression of a more distinct symbol, with grain conversely indicating a more dynamic process and an articulation of a complex meaning-field.

Since the following will be a discussion of the formal properties of sound — the manner in which spectral content of sound is perceived to evolve over time — there is the need for a conceptual framework for such a discussion. Such a framework can be found in Pierre Schaeffer's experimental theory on sound. Schaeffer's theory is useful not only because he is approaching music from the focal point of the intrinsic properties of sound, but because Schaeffer's motivation seems to me similar to the that of Kristeva/Barthes. Although his writing predates a 'post-structural turn', in which Kristeva and Barthes developed their skeptical view towards static symbols, Schaeffer, too, is identifying a natural tendency of abstracting the complexity sound into static symbols, and how this tendency might by obscuring other values to be found the rich material that is sound. By analyzing sound according to Schaeffer's framework, I expect to find in the intrinsic properties of sound the notion of a pre-symbolic field described by Kristeva, and the 'grain' of Barthes.

Schaeffer's work is engendered by advances in music technology allowing for storage and processing of sound independently of traditional bonds between player, instrument and performing space, thus exceeding the limitations of the traditional note:

> It is important to realize that, given its acoustical constitution and human manipulation, the traditional instrument, whether exotic or classical, cannot produce anything but notes, in the known restrictive sense. It is therefore

> natural that the introduction of new sonic objects and more complex notes coincides with the introduction of non-acoustic instruments and manipulations that are not directly manual. (Schaeffer, translated by Palombini (1993:26))

This realization has facilitated methods of focusing on and manipulating any aspect of sound, independently of traditional limitations, thereby bringing the entire sound field, beyond that of the Western music traditions, into play as potential musical material. With this practical possibility comes theories dealing with this new sound material. However, Schaeffer saw as problematic the preoccupation instead, in some quarters, with theoretical concepts of music production, thereby potentially neglecting the sound itself. As Godøy notes:

> One of the main criticisms that can be directed against both certain music technology enterprises and against certain theoretical schemes, is that of actually *forgetting the musical object*: The focus has been so much on the architecture of the algorithms for the production of the musical substance that the emergent qualities of the musical substance are not thematized (Godøy 1993:89)

In order to shift the focus to properties of sound, and not the concepts surrounding sound, Schaeffer used as starting point for his experiments a position of musical neutrality. This entailed utilizing sound material not sourced from a musical context, and putting himself in a listening situation that is not traditionally musical. From there, he constructed a detailed a method of classification and description of the intrinsic properties of sound. This method — starting with non-musical material, and from a non-musical listening situation — will be the central method from which this thesis is developed.

Although the ideas proposed by Schaeffer have existed for well over fifty years, I believe they are still useful in bringing forward new aspects of music theory. Although Schaeffer's name is well known in electroacoustic music culture, there has been a relatively low circulation of Schaeffer's original texts among non-French speakers, a situation prompting Palombini to state that the "*Traité des objets musicaux* is one of the most-cited and least-read books of the electroacoustic literature" (Palombini 1999:95). In addition there is the

complexity of the *Traité*, not only for its inclusion of ideas from many different disciplines such as phenomenology, hermeneutics and linguistics, but for its style, rich in obscure idioms and perhaps even a French style of humor, and seemingly impenetrable to a non-native french speaker. For these reasons, gaining a solid understanding of Schaeffer's theories is here considered a challenging prospect.

I have thus put myself in the situation of not having direct access to the key work on which my thesis is based. Not being able to read the *Traité* must be considered a weakness in my ability to grasp Schaeffer's theories. I am leaning heavily on secondary literature on Schaeffer; especially that of Chion, Dack, Palombini, Godøy, and Kane, all of whom expand on Schaeffer's thought, and are thus valued doubly for their work of translation and for original thought on Schaeffer.

One point of Schaeffer's theory often seen as problematic is the seemingly idealist tone of his work, leading to him sometimes being construed as the idealist of whom to refer in order to demonstrate one's own grasp of the complexity of music. I will, in this thesis, read Schaeffer not as an idealist, but as a theorist operating very much in a pragmatic sense, where the richness of human perception of music is his primary concern.

1.2 Research question, method, scope

Through the above discussion an attempt has been made to detail the subject matter of this thesis. I have presented my impression that there is some correlation between the clarity of the inherent properties of sound and the apprehension of a clearly defined meaning in music. Furthermore, I have declared a special interest in the more diffuse properties of sound on the grounds that I believe such properties are capable of articulating a more 'obtuse' meaning. Finding some degree of conceptual parallel to an *obtuse* meaning in Schaeffer's notion of the *concrète*, meaning the visceral, pre-symbolic aspect of music, I have identified an area into which to expand Schaeffer's *concrète*, namely the data messages controlling digital sound processing. I will argue that, by digital control messages naturally being of a clearly defined and linear nature, control data can potentially impede

a full exploration of the diffuse properties of sound.

I am now able to formulate a research question as follows: Will an introduction of Schaeffer's *concrète* into digital control data further a grasp of the 'obtuse' field of meaning in sound by limiting formation of distinct forms? In exploring this question I want to further the understanding, and the reach, of the 'obtuse' field of the properties of sound. I am expecting to observe that when boundaries between distinct sounds and the general sound field are ambiguous, and absolute definition of sounds in the diffuse, complex sound field is difficult, a complex field of meaning is seen more clearly.

The theories of Schaeffer are both a theory and a method, inseparable by their conception by practical experimentation, and by a focus on listening to actual material. Considering the role of practical music technology in engendering the ideas discussed above, it is only fitting that the method employed here is in part a practical implementation of the research question. A computer program has been created, informed by the theories discussed here. With a focus on listening to the sounding results of this program, its properties will be detailed as to their more or less distinct form. The music technology in use here is thus not a neutral tool, but a prerequisite to gaining an understanding of these issues.

At this point I want to declare the limitations of the scope of this thesis and of what I expect to find. By focusing the theoretical framework at a point where the fields of semiotics, philosophy and art theory meet, I am focusing the scope of this thesis more towards the area of art theory than of cognitive science. My interest lies in the way in which a discussion of the nature of conceptualization of music can inform aesthetic practice. However it is worth noting that recent work in the field of cognitive science is finding conceptualization to be fluid rather than static, as noted by Zbikowski: "There are now persuasive arguments that concepts are quite fluid, that they are not irrevocably wedded to words or to concrete representations" (Zbikowski 2002:ii) In a similar vein, there is in the emerging field of embodied music cognition found an alternative to a textual or a computational understanding of signification in music (Leman 2008). In embodied music cognition the role of the moving body is seen as an integral part of the understanding of music, thus adding a fluid dimension to the understanding of music cognition.

The practical implementation based on this theoretical framework is focused on the data messages determining behaviour of the sound processing, as I found in this area a chance of, and a need, to expanding Schaeffer's *concrète*, originally concerning sound, into the realm of control data. However, I consider a discussion of the control of sound processing incomplete without a consideration of the *mapping* of the connections between performer and instrument, for I consider mapping to be an area of central importance in current digital music research.

1.3 Structure of thesis

This thesis consists of both a written text and of a practical implementation of the ideas discussed here. The practical part is considered to amount to twenty-five per cent of the total amount of work done towards completion of this thesis.

Over the following three chapters I will detail the conceptual basis underlying the development of this thesis as well as the conceptual tool set to be used in the practical implementation of this thesis. Chapter 2 is a presentation of the conceptual basis of this thesis. Here I will be discussing the nature of conceptualization of musical sound, and my specific interest of how some musical sound might be engendering more or less a sense of static symbols. I will show how this is in some way related to the clarity of form in sound. I will present the theoretical concepts I find to be fruitful in exploring this problem of complexity of conceptualization, namely Cox' 'sonic ontology' of process, Kristeva's notion of signifying as a process and Barthes' concept of 'grain'. In chapter 3 I am detailing how music technology is engendering such ideas. I will show how this happens chiefly by rupturing traditional links between performer, instrument and note, and in the resulting deconstruction of the concept of the note finding a rethinking of how conceptualization happens. In chapter 4 I will be detailing Schaeffer's typo-morphology, here used both as a conceptual tool set and a practical method of understanding sound.

Chapter 5 is an account of the practical implementation of the programs designed in order to explore the ideas discussed in this thesis. This includes the reasoning behind the

choices made in the practical implementation. I will argue that the prominence of certain values in sound arises both from decisions taken in traditional design of instruments, and in how the surrounding discourse works. Additional remarks on the workings of the programs can be found in the programs themselves. An analysis of the results of the practical implementation will follow in chapter 6. Some concluding remarks detailing problems encountered will be made in chapter 7.

Chapter 2

The ontology of musical sound

This chapter details the fundamental ideas inspiring and shaping the development of this thesis, in an expansion of what was presented in the introduction. Out of my declared concern with the special function of sound in articulating an 'obtuse' meaning, I will start this chapter by detailing a general ontology of process as opposed to ontology of idea. I will argue that what can be understood as a 'sonic ontology' opens for a discussion of sound as primarily an agent for articulating, by its dynamic nature, a pre-symbolic field of meaning. I will continue by showing that a way that traditional musical symbols can be appropriated by such a 'sonic ontology' can be found in the experimental work in linguistics done by Kristeva and Barthes, by them emphasizing the dynamic nature of formation of symbols. Lastly, the role of modern thought and of advances in music technology in allowing a practical exploration of these ideas will be discussed, focusing on how these advances can bring about a deconstruction of the primary symbol of musical value, the note.

2.1 Fundamental conceptual issues

On the nature of conceptualization of music

As described in the previous chapter, the underlying motivation for developing this thesis is a concern with how sound is especially suited to articulating an 'obtuse' meaning, and how certain practices undervalue such meaning, instead engaging with obvious meaning and strong symbols. Pierre Schaeffer has, inspired by gestalt theory, pointed to how some situations present a clearer conception of musical material:

> Some knowledge of Gestalt theory shows that every sound event is perceived as one whole and that the ear makes a synthesis which is the more compressed, the more the causality of it is evident and the aesthetic end of it is classical. (Schaeffer, cited in Palombini 1993:100)

Hence I think that a way of approaching the manner in which sound is able to articulate an 'obtuse' meaning is considering what engenders a particular *conceptualization* of music. In this thesis I work from the presumption that one aspect of music determining the extent to which strong concepts are drawn from music is found in the inherent properties of sound, in the sense of the extent to which clearly defined forms and patterns can be comprehended in sound. Therefore the subject matter of this thesis is the intrinsic properties of sound, seen from a point of subjective *conceptualization*.

The following can be said to be a matter of the ontology of musical material, here meant in the sense of what is considered as musical material in a given paradigm of music theory. Understanding musical material from an ontological perspective is the conceptual approach here because I am discussing material that is not necessarily thought of as musical material or where its function is not clearly understood, and one wants to access this material and make use of it in a meaningful way.

A 'sonic ontology'

An ontology affording an understanding of the dynamic nature of signification in music can be found in the 'sonic ontology' presented by philosopher Christoph Cox. Drawing on materialist ontologies of Nietzsche and Deleuze, Cox (2011) outlines an approach to understanding music that is neither idealist nor socio-cultural. Grounding his argumentation in an ontology not of object or concept but of event, of what Nietzsche terms a state of 'becoming', Cox promotes the value of thinking of sound as process rather than as concept on the grounds that sound, through its non-static nature, is especially well suited to articulating this ontology of event to the listener.

Cox is however, as it may seem, not ignoring the cultural processes involved in music , like signification. Cox' approach is born out of the problem of how to engage in aesthetic discussion of electroacoustic music, some of which can seem to be void of cultural reference and formal structure and thereby difficult to theorize from a textual viewpoint. His solution is including notions of symbolization and signification — notions generally considered to inhabit separate domains of cognitivism or idealism — into a materialist ontology of perpetual change. Signification and symbolization are thus considered as processes rather than as ideas or concepts. They are by Cox considered to be "particular manifestations of a broader differential field: the field of nature and matter themselves" (Cox 2011:157), however in a very slow time frame, therefore only appearing to be static. Cox is thus demonstrating a way to engage in culturally meaningful play with the inherent, visceral aspects of sound — by shifting the conceptual focus from a textual reading of the more or less static symbols of sound organization, to a 'sonic', dynamic understanding of sound organization. In such an understanding of music, instability is given and of inherent value, and symbols and signification are non-static, continually evolving concepts.

What Cox proposes is in effect a radically materialist, realist ontology, leading to a strictly 'sono-centrist' and non-anthropocentric outlook. I will not be following Cox through his full argumentation here. The adoption of Cox' approach will here function as a conceptual source of inspiration rather than as a statement of a radically materialist outlook. The

perspective of this thesis is humanist, with the sound character as experienced being the matter of interest. Cox' 'sonic ontology' is in this context offering a fruitful alternative to traditions of musicology that has, simply stated, been first mostly concerned with issues of form and later mostly concerned with socio-cultural issues, and therefore occupied with a more static conceptualization of sound rather than with concept and symbol as ever fluctuating processes.

Signifying as process

There is, however, the need for a conceptual tool set for detailing *how* signification, best discussed in the textual domain, can be appropriated by Cox' 'sonic ontology' of process. As mentioned in the first chapter, one can, in the experimental linguistic theory of Kristeva and Barthes, find a notion of a complex field of pre-symbolic meaning that cannot be captured in a more static system of signification.

In her critical writings on linguistics, Julia Kristeva (1986) suggests that there is, in what she terms a *signifying process*, a dynamic relation between a complex, visceral, pre-symbolic field of all possible meanings, termed 'genotext', and the more static symbols and systems of signification drawn from this field, the 'phenotext'. The *phenotext* is associated with cultural constraints:

> Multiple constraints — which are ultimately socio-political — stop the signifying process at one or another of the theses that it traverses; they knot it and lock it into a given surface or structure; they discard *practice* under fixed, fragmentary, symbolic *matrices*, the tracings of various social constraints that obliterate the infinity of the process: the phenotext is what conveys these obliterations.(Kristeva 1986:122)

Therefore, the dynamism of a signifying process depends on whether the conditions of this process are engendering more or less of a consolidation of the pre-symbolic into more static signification. Music, among other types of *signifying practices*, holds a special function in that music can articulate the pre-symbolic field of the 'genotext', whereas the textual domain tends to solidify symbols:

> [...] semiotics can do no more than postulate this heterogeneity: as soon as it speaks about it, it homogenizes the phenomenon, links it with a system, loses hold of it. Its specificity can be preserved only in the signifying practices which set off the heterogeneity at issue: thus poetic language making free with the language code; music, dancing, painting, reordering the psychic drives which have not been harnessed by the dominant symbolization systems and thus renewing their own tradition [...] (Kristeva 1986:30)

In the same vein, but more specifically concerning the field of art, Roland Barthes (1977) differentiates between the obvious meaning in art — what is given by the natural and traditional systems of signification — and an 'obtuse' meaning. Such meaning is not easily apprehended in text but appears in other mediums, in the less obvious traits of a medium.

> Are not the traits which I indicated [...] just like the blunting of a meaning too clear, too violent? Do they not give the obvious signified a kind of difficultly prehensible roundness, cause my reading to slip? (Barthes 1977:55)

This diffuse, pre-symbolic meaning appears in music as a certain quality associated with the bodily, before musical systems are constituted. This quality is by Barthes termed 'grain'. Although Barthes here speaks specifically of singing, I will here argue that some form of 'grain' can be found in sound in general, in a sense of a texture or a visceral movement, that can only with difficulty be apprehended as clear symbol and system. I will in the next section demonstrate how such a discussion of the 'grain', or the 'genotext' in sound is engendered by certain events.

2.2 Conditions engendering a discussion of the ontology of sound

As we have seen, the manner in which a *signifying process* works is dependent on the cultural paradigm in which the listener is situated. Therefore, a critical step on the way to

understanding the constitution of the current musical values is an awareness of how these constraints are constituted. I find it useful here to view the deconstruction of Western music tradition in the eyes of Schaeffer, as his theories of sound will feature prominently throughout the rest of the thesis.

Detailing Schaeffer's motivation for developing the *Traité*, Godøy notes that the *Traité* can be seen in the light of extensive structural changes to Western society at the time of its conception (Godøy 1984:122). The discovery of non-Western systems of sound organization has led to the realization that the traditionally strong musical values of Western music are not universal values. This realization has been engendering an attempt at a deeper understanding of sound organization, thus leading to experimenting with new aesthetic ideas in Western art music.

While discovering new methods of instrumental sound organization through non-Western musics does lead to the realization that the common musical values are simply some among many possible musical values, I am here considering Denis Smalley's argument that experiments with acoustic instruments has some limits considering how such experiments "... are rooted in the umbilical security of instrumental source-cause coherence and directly apprehended sound-making gesture. This equates not with a burning desire to explore timbre, but with a hesitant reserve about cutting loose in order to pursue a freer exploration." (Smalley 1994:47) Here Smalley is considering the possibilities of new developments in music technology that are engendering unique ways of theoretical and practical experimentation. As noted by Emmerson:

> The initial impact of recording in the last part of the nineteenth century was thought of as profound and yet some of the consequences are only just becoming apparent; the telephone dislocated in space the cause of sound from its perception, to which recording added dislocation of time. In the early part of the twentieth century the first synthesis removed the need for the mechanical causality of sound altogether. These three dislocations effectively modified all the standard relationships of body to sound - it did not replace them altogether, but extended and challenged them. (Emmerson 2000:197).

However, in spite of this technology having been widely available for many decades and the impact of it being described as profound, Emmerson here notes the lack of understanding of this opportunity, with the new tools being used for simply augmenting existing systems or simply not being well understood. The point here is that some possibilities of music technology for rethinking the hierarchy of musical value have not been seized upon fully.

The implications of the introduction of recording and synthesis techniques into musical practice has facilitated methods of focusing on and manipulating sound independently of human physical input and limitations of instrument. Consequently, fueled by the rupture of the strong traditional link between gesture and instrument, one is bringing the entire sound field into play as potential object of interest. One is bypassing traditional cultural and cognitive links, opening different cognitive avenues for exploration. Chion points out how there is in traditional music theory little need for concern with the many possibilities inherent in sound:

> "This traditional music theory, enacted "after the event", within the framework of a collectively constituted and assimilated system, can approach the description and the definition of sound material in very sketchy terms, since it has reference to a code of practice. The system functions very well without any need for a very precise perceptual or physical definition of its sound materials, these being always produced by a limited number of instruments with known timbres." (Chion 2009:99).

I want to use timbre here in the meaning of the various aspects of sound not related to abstraction of note but to the visceral, complex, 'concrète' element of sound. However, I am coming from inside the paradigm of Western tonal music, with its strong emphasis on the pitched, discrete note as musical atom, where timbre is merely a feature of the dominant concept of the note. The subject of the deconstruction of Western music tradition will therefore be the note, for its strong position as a prominent value of musical organization. When the traditional bonds between human gesture, instrument and acoustics are severed, along with the concept of the note, one is initially left with timbre itself. However Smalley notes that:

> "One trouble with timbre is that it existed before electroacoustic music, and we therefore have to spend much time and intellectual energy extending or combating notions which were not necessarily designed for the music we make." (Smalley 1994:35)

The term timbre has, in tonal art music, sometimes simply been used for describing the difference between instruments, as a way of identifying different instruments: "that attribute of auditory sensation in terms of which a listener can judge that two sounds similarly presented and having the same loudness and pitch are dissimilar." (American National Standards Institute (ANSI), quoted in Smalley 1994:36). When timbre is used in a more qualitative sense, it simply describes the character of the note. As Chion notes, "In the traditional musical system, timbre was, as it were, the 'concrete' cladding of the abstract values indicated on the score." (2009:51)

This relegation of timbre to a supporting role is quite understandable considering the workings of traditional instruments: Most orchestral instruments, as detailed by Rossing (2002), sound by being bowed, struck or blown, the physical movement of the player being strongly related to the sound of the instrument. Consequently the sound of the instrument is having a discrete starting point, finite duration, predictable tone and amplitude curve, and the pitched tone of controlled articulation and finite duration is the dominant musical value. As such the note can represent the stable pitch and finite duration of the plucked or blown excitation of an instrument fairly accurately. Timbre in the sense of the spectral character is then closely related to the movements of the player, as well as inferred from the established traditions of performance. As described by Chion one can easily imagine approximately how a violin part in a particular style of music is going to sound: "... reading a non-instrumentalised score allows us to colour the pitch and duration values written on it with an imagined and generalized generic timbre, based on materials furnished by the memory." (Chion 2009:91).

2.3 Making sense of the new material

Recognizing the wealth of new material that comes from the above detailed deconstruction of traditional musical values is one thing; making sense of the new possibilities is another matter. Trying to navigate this conceptually chaotic field of severed ties and new possibilities, some are finding value in new possibilities for sonic realization of concepts, like adding previously unplayable complexity to the score. Schaeffer cautioned against what he termed "prose composition" (Chion 2009:36), where the composer is giving little weight to the importance of the qualities of the sound itself. Others again are discussing mainly the new sociocultural conditions for music. While sociocultural factors can be argued to be essential in the understanding of music, I am noting a relative lack of discussion of how the more diffuse aspects of sound inform a sense of meaning. As has been argued above, the inherent properties of sound are not simply qualitative aspects but closely linked to sociocultural ideas, and therefore an integral part of the totality of music perception.

In the next chapter I will turn to Schaeffer and the theories discussed in his work *"Traité des Objets Musicaux"*. I have chosen to follow Schaeffer's approach because of his emphasis on a deconstruction of the traditional systems of abstraction layered upon sound through habit and through necessity but now becoming available through new ideas and through technology. Furthermore, with his emphasis on the sound material rather than on concept as a starting point for discussing music, I am finding in Schaeffer a link to Cox' 'sonic ontology' as well as to Kristeva's *signifying process* and Barthes' *grain*.

Chapter 3

A method of deconstruction

In the following chapter I will be detailing what is at the same time a theory and a method of accessing the new material afforded by the conditions described in the previous chapter. I am here drawing heavily on Schaeffer's ideas, employing a humanist perspective of subjective — or perhaps inter-subjective — listening as the focal point of the following discussion. Traditional and culturally formed ways of listening will be set against a *reduced* listening brought on by practical methods of recording, cutting, looping and processing sound. These methods will be shown to aid in the deconstruction of traditional musical values, by disturbing the natural and cultural structures of conceptualization that happens with easily recognizable material.

Deconstructing listening

The central premise affording Schaeffer's development of his conceptual apparatus is finding in recording technology a practical method of experiencing a deconstruction of musical structures inherent in Western society or naturally present. To this end, Schaeffer appropriates parts of Husserl's phenomenology, in particular the notion of a suspension of habitual structures of culture and of natural inclinations, or what Husserl (1983) terms *reduction*. In Husserl's *reduction* Schaeffer finds the theoretical basis of his "experiment in interruption" (Chion 2009:14). Looking for a way to set aside the natural way of viewing

one's surroundings, in order to view this natural state of experience from some distance, and thereby perhaps seeing one's surroundings in a new light, one must find a method of holding the natural view at some distance:

> Husserl identifies the natural standpoint (or attitude) with a commonsense view of the world: a world immediately available or "on hand," where I am surrounded by objects and things of which I have immediate knowledge; where I operate habitually and often without reflection; where things possess significance and utility in relation to my interests and goals; a world that has spatial and temporal extension, and to which I am bound through everyday involvement. (Kane 2014:23).

The disconnect of traditional bonds between observed source and resulting sound, brought about through radio and by recording, is by Schaeffer termed an *acousmatic situation* (Chion 2009:11), with Schaeffer tracing the term *acousmatic* to ancient Greek thought[1]. In this *acousmatic situation* Schaeffer sees a tool for practicing Husserl's *reduction*. Chion notes that the acousmatic situation does not necessarily prevent an interest with source of sound, and that we might in such a situation even get an increased concern with source (Chion 2009:12). However, this is not seen as a problem here. An increased concern with source cause can be thought to function as a catalyst for a phenomenological reduction, by one's awareness of the issue of source cause identification making the listener more aware of one's own perceptual activity.

In addition to this *acousmatic* situation, Schaeffer utilized the possibilities afforded by recording technology by taking advantage of the malleability of the sound stored on phonograph disks. He found that by simply creating a *closed groove*, wherein a small portion of the record is repeated indefinitely, one is able to erode the trace of natural causality in a played note or found sound in a recording. Source identification is thereby more difficult, and one is perhaps able to shift focus to the inherent details of the sound. In this way one should be able to find more detail by each pass. Later, with the availability

[1]Kane has recently argued that although employing the term *acousmatic* is useful for conveying an air of timelessness and of truth surrounding an argument, there is difficulty in tracing the origin of this term and its exact meaning (Kane 2014:45).

of magnetic tape, another, complementary technique used by Schaeffer was that known as the *cut bell*, in which the attack portion of a sound is cut. Again source identification is made harder, and the internal properties of sound can be studied in more detail. This method is shown in (Schaeffer 1998:41). Together these techniques function "As an 'experiment in interruption', isolating a sound from its context, manipulating it, and thus creating a new sound phenomenon which could no longer be traced directly to its cause" (Chion 2009:14). This is how Schaeffer aimed to practice the phenomenological concept of *reduction*.

Thus, recording technology is for Schaeffer more than a simple matter of practicality. This disruption of source cause is, for Schaeffer, seen as a key opportunity to present a unique set of problems and opportunities regarding how listening works. Schaeffer is emphasizing the opportunity for the listener of becoming more aware of one's own perceptual activity, both with regards to constructs of tradition, and to a natural state of listening. By disrupting the natural inclination of the listener of seeking to make source-connections, one is able to bracket out these modes of listening. By this suspension of traditional inclinations one can gain access to the underlying complexity of sound material, finding new musical material of value obscured by natural inclination towards certain material, or by cultural tradition.

At this point it should be noted that there is some contention regarding Schaeffer's use of phenomenology. This issue stems from Schaeffer's use of phenomenological language of the early Husserl, which can be argued to be an idealist form of phenomenology; hence with Schaeffer using this terminology he is appearing as an idealist. Godøy (1984) has pointed out that phenomenology is by Schaeffer used as a methodological framework rather than as an ontological framework of natural science in the idealist style of Husserl. I am here choosing to read Schaeffer in a non-idealist sense regarding this issue, suggesting that Schaeffer could, despite the apparent idealist style, be read in a non-idealist manner, always situated within one's cultural paradigm, and not void of cultural reference.

This reading is inspired by the way in which Cox is viewing cultural concept and sonic movement as of the same ontology of process. Therefore, rather than blocking cultural reference, Schaeffer's *reduction* is seen as a tool helping with awareness of the totality of

such reference.

3.1 Listening modes

Following a *reduction* of a natural attitude of listening, by practicing Schaeffer's "experiment in interruption", should appear an awareness of what one's listening activity is directed towards. The subject of listening is vast, but in the context of this thesis some particular aspects of listening are of greater relevance.

I am here positioning our listening intention along an *abstract/concrete* axis, where natural and cultural tendency to abstract certain features from sound is seen as the *abstract* pole of listening, whereas an attention towards the totality of incoming sound is seen as the *concrete* pole. Setting an *abstract/concrete* axis as the central aspect of a discussion of listening is fitting here considering the above discussion of the nature of conceptualization of music. Here a deconstruction of the abstract modes of listening is equaled to a consideration of the 'sonic ontology' of Cox, the 'geno-text' of Kristeva as it relates to sound, and the 'grain' of Barthes. The following section will be an explication of listening as it relates to the abstract/concrete axis, by Schaeffer finding various degrees of abstraction in different modes of listening.

The natural listening intention

What is the intention of natural listening is noted by Kane:

> When we are in the natural attitude, we immediately posit the objects presented to us perceptually as really existing — there is no reflection on the manner in which the objects are intentionally constituted or upon the variety of their modes of givenness. (Kane 2014:27)

Kane here notes the lack of reflection regarding the nature of concepts drawn from a natural listening intention which is a defining characteristic of a natural listening intention. Smalley has created a detailed conceptual apparatus, introducing the term *source*

bonding, in order to describe the natural tendency of trying to find a link between sound and source. Smalley describes how this bond is strong in traditional acoustic music:

> Prior to the electroacoustic period music always involved identifiable sources. The listener could spontaneously link sound both to a sounding body and a human, physical cause. Gesture not only activated the source but could, through breathing and bow control, and techniques of touch, maintain and continue the sounding of the vibratory system. Traditionally, therefore, there is an inherent, culturally imbedded, stable *source bonding* in music. (Smalley 1994:36)

Regarding how to view a natural intention, there is the question of whether to emphasize the reference to concrete objects or the act of abstraction drawing from a perceived reality. An example given by Schaeffer in this regard is the violin, as to whether one is considering the violin as physical object or rather the general notion violin abstracted from a notion of an existing particular violin (Chion 2009:23). Depending on what aspects of natural listening one is focusing on, the natural mode of listening might therefore be considered to deal with either the *concrete*, meaning occupied with the real causes of sound, or the *abstract*, concerned with conceptualization of objects. Schaeffer, as detailed by (Chion 2009:23), is early in the *Traité* focusing on the concrete in natural listening, e.g. the concrete source of the sound. However, later in the *Traité*, Schaeffer is focusing on the abstract nature of the natural listening intention by the listener identifying a sound source by categorization. This is how the natural listening intention is viewed in this thesis: I therefore adopt the latter view, and consider natural listening as an abstract listening mode, focusing on our tendency to categorize and abstract from source, in what Smalley terms source bonding.

Through a *reduction* of the natural attitude, there should then be an awareness of intention of listening towards identifying source in one's physical surroundings. As it concerns music, one should have an understanding of the identification of instruments obscures a more neutral apprehension of the full sound field.

Cultural listening

In addition to a natural mode of listening detailed above, in which the listener is concerned with identifying source, another mode of abstract listening can be found in one's tendency to attempt to abstract symbolic meaning from a sound source. Schaeffer describes this in the way in which one "turns away (...) (without ceasing to hear it) from the sound event and the circumstances which it reveals about its source and uses it as a means to comprehend a message, a meaning, values" (Schaeffer, cited in Chion 2009:26).

What Schaeffer terms cultural listening, I am choosing to see as attending to a *phenotext* detailed above, and an attentiveness to the obvious meaning identified by Barthes, who identified the distinct modes of listening in much the same manner as Schaeffer does. The issue with a cultural mode of listening is detailed by Barthes as follows:

> For as soon as attention is deliberately concentrated in a certain degree, one begins to select from the material before one; one point will be fixed in the mind with particular clearness and some other consequently disregarded, and in this selection one's expectation or one's inclinations will be followed. This is just what must not be done; if one's expectations are followed in this selection, there is the danger of never finding anything but what is already known (Barthes 1986:253)

Through the above discussion I have wanted to highlight the passive nature of the selection that occurs in natural and cultural listening modes, viewed as passive modes of listening as far as the listener not being concerned with questioning one's *intention*. Contrasting the natural and cultural listening modes is what Schaeffer termed a *reduced* mode of listening. This mode comes from a questioning of one's listening intention, being able to more freely direct one's *intention* towards *objects* constituted by one's intention.

Reduced listening

In contrast to natural and cultural listening modes, a reduced listening mode emerges as a consequence of applying Schaeffer's theories of *reduction*. This means putting oneself

in an acousmatic situation, utilizing non-musical sound material, and altering the sound material in order to obfuscate recognition of source or context. Godøy offers a description of how this practical method of reduction results in the elements of source and of symbol being cut:

> In a more extended sense, Schaeffer makes a number of cuttings not just along the temporal axis, but also along the different axes of signification and existential levels. [...] the acousmatic position of the musical object could be considered the first such cutting in the chain of causal signification, whereas the "écoute reduite" could be considered a further cutting, now also from the "anecdotical"-significative chain of the musical object, in order to focus on the internal fabric of the object. (Godøy 1993:61)

Having in this manner turned one's listening intention away from a natural and culturally determined occupation with signification of symbolic meaning or source identification, back towards one's own awareness of these listening intentions, what emerges can be understood as a *deconstruction* of natural and cultural listening modes.

This means that one is searching not for readily identifiable and expected 'musical' objects within one's tradition, but rather searching the entirety of the raw sound material, for intentional objects of interest, based not on their recognizable function in traditional music but on their function in any greater perspective.

I should here point out that usage of the term *deconstruction* might suggest a sense of chaos or a nihilist outlook. The term is not used in this meaning here, with deconstruction here being a tool for gaining insight into traditional and natural structures, and perhaps restructuring them.

Practical viability of a reduced listening

An issue with this direction of one's listening intention is the difficulty with which such cognitive control is to be exercised. Even with the help of practical techniques such as putting oneself in an acousmatic situation, and by using cut bell and closed groove

techniques, there remains the question of whether the listening intention can be deliberately controlled to a such degree. This view, that a reduced listening must be observed categorically, and in isolation, I argue, comes with a reading of Schaeffer and his use of Husserlian concepts as an idealist exercise, of seeing reduction as the end goal in which to find ideal objects. However, this reduced listening intention does not mean a disregard for natural and cultural listening modes. In the words of Chion,

> ... reduced listening as defined by Pierre Schaeffer does not consist in invalidating "natural" listening modes (of sound as index or sign) or calling them an "illusion", but in unravelling the various intentions of which it is composed and turning these intentions back on to the sound object, the carrier of the perceptions which use it as a vehicle, and so defining it through a new specific intentionality, reduced listening. (Chion 2009:31)

One is now not, as may seem to be the case, disregarding natural or culturally determined listening intention. I am here returning to the above discussion of the sonic ontology presented by Cox, where the forms of sound are no different from cultural symbols. Through a sonic ontology, I choose to view Schaeffer's reduced listening as a way of softening the symbols associated with music, in much the same way as Kristeva and Barthes are doing in linguistics.

In the work of Schaeffer similar terms can be found regarding this subject in the term 'musical', one of them being a description of content containing easily recognizable elements of music in the traditional sense of tonality, form and familiar instruments with a certain timbre. Such content is affording a traditional listening situation, listening for tonal relationships, instruments and their timbre. Conversely, 'non-musical' content, meaning mostly void of reference to musical tradition, affords a different type of listening termed *musicianly* by Schaeffer:

> "... we no longer want to hear the over-musical sound quality of the Stradivarius, we want to practise musicianly listening to the most crude of objects, and we discover this mode of listening by doing it" (Schaeffer, quoted in Chion 2009:40).

3.2 The sound object

Schaeffer uses the term *sound object* for what becomes the object of a reduced listening intention. The concept of sound object will be the conceptual basis of which the following chapter, concerning detailing the sound object, is based on. Due to use of the word object eliciting a sense of materiality, finality, delineation, and even objectiveness that is misleading in how it functions in this thesis, a clarification of what a sound object means in the scope of this thesis, and how it might differ from Schaeffer's original concept of object, is in order.

First of all it should be made clear that the sound object is not an object in the material sense of being a physical object, the source of the sound or a physical wave. Nor is the sound object a static, pre-existing idea or form. The sound object is the element of perceived sound chosen by the listener when attending to the temporal and spectral features of sound. Therefore the sound object is constituted in the mind of the listener. What constitutes this identity can be perceived even through changes in perceived sound. It is considered to have a complex totality of features of which one is intending towards certain features. Schaeffer's conceptual apparatus detailing the type and properties of sound objects will be covered in the following chapter.

Shift of discourse since Schaeffer

Since the publication of the *Traité*, there can be said, simply put, to have been a turn of general discourse, from a sense that there is an underlying structure to uncover, to a distrust in there being any sense of objective system, as evident in the above referenced works of Kristeva and Barthes. For this reason I find it relevant, when utilizing Schaeffer's work, to view Schaeffer's work in light of such a post-structuralist turn. Palombini has presented a description of the sound object according such thought:

> ... the sonic object is not an aesthetic product but a signifying practice, not a structure but a structuration, not an object but a work and a game, not a group of closed signs but a volume of traces in displacement, not signification

> but the signifier, not the old musical work but the Text of Life (Palombini 2002:439)

Here Palombini draws from the ideas of Kristeva and Barthes, showing how Schaeffer's reduction can be seen as a method of allowing for a complex reading of sound, not limited to traditional symbols in what Kristeva terms the *pheno-text*, but operating in the unstructured, visceral, pre-symbolic *geno-text*.

Interest in the constitution of sound is then not a formalist activity, but an attempt to reinforce an at times missing link in music theory, between the physical properties of sound and its formalization or signification. This is why the deconstruction of the listening process is of importance, and at the same time why it is not a-cultural, but always cultural. The next chapter is detailing Schaeffer's typo-morphology, a manner in which the totality of aspects of a sound object can be examined.

Chapter 4

Typo-morphology

In this chapter, a conceptual tool set for identifying and characterizing various aspects of the sound object that results from a reduced listening situation is detailed. This conceptual tool set, together with the reduced listening discussed in the previous chapter, is functioning both as theoretical framework and as practical method. Thus, the following chapters, first a theoretical tool set, then practical implementation of these ideas, are closely related.

In this conceptual discussion of on what basis to select from raw sound material objects of inquiry I am, in broad strokes, following Schaeffer's theory on the subject. A rich conceptual apparatus for discussing sound objects can be found in be Schaeffer's typology and morphology, or *typo-morphology*, of sound. With typo-morphology is meant the identification and categorization of sound objects based on some basic formal criteria of general type, as well as several criteria of expected suitability for musical use. As will be discussed, the use of these concepts might lead to the impression that sound is easily and absolutely quantifiable according to its musical function. However, there can in a discussion of music hardly be said to exist immutable categories and systems of what is of musical meaning. Therefore I am here considering Schaeffer's typo-morphology to be a somewhat subjective value system. Consequently I will use a somewhat modified typo-morphology, according to what I am attempting to find in sound.

As will be shown, I will be deviating from Schaeffer where he ventures to formalize his

theory into what Palombini (1993:181) argues amounts to an attempt to "bring a new classicism into bloom". As will become clear, I deviate from Schaeffer's hierarchy of typology by focusing on the outer limits of his hierarchy of objects. I find that there is some similarity between the balanced and 'well-suited' sound objects of Schaeffer and traditional note and gesture systems. In the context of this thesis I am rather concerned with the value of what Schaeffer terms *eccentric* sound objects, because such sound objects can, by their complex constitution, articulate a more diffuse field of musical meaning.

4.1 Typology

Identifying sound objects: selection criteria

As the basis of Schaeffer's project is understanding the sound object as a discrete conceptual unit, the first consideration in a typo-morphology is the matter of what is selected, from a continuous stream of sound, as the object of inquiry. Although I do not doubt that some quantifiable systems of selection are to be found, in this thesis selection of sound objects is seen from a phenomenological and non-idealist standpoint, and is not based on any absolutely quantifiable system.

With Schaeffer creating his system, he is initially doing a value-judgment of what type of object he deems most suitable for music. Such judgment is articulated through some initial criteria on which such an identification is based. Being that these criteria are based on value judgment, this identification of sound objects can not be said to be value-neutral.

Schaeffer sees in linguistics what he considers a musically neutral tool for considering the selection of sound objects. However, Schaeffer is noting a problem in linguistics similar to that of the note. With the listener being partly occupied with the meaning of the sounds according to the system as a whole, there is limited attention to the sonorous structure of the syllables, meaning the sonorous characteristics of the vowels and consonants of which a syllable is constituted, by their energetic profile. Contrasting the acoustic or phonetic

with the phonological, Chion compares this to the listener's ability to identify a note in widely differing sonorous material:

> The criteria for segmenting into units, in linguistics, are not purely phonetic or acoustic, but phonological, i.e. deduced from analysis taken from the whole system. Similarly, in traditional musics, it is our acculturation to the system which allows us to isolate as "notes" sound objects as dissimilar, from an acoustic point of view, as a piano note in a virtuosic passage and a violin note in a melody. (Chion 2009:126).

Inspired by phonetics, then, for Schaeffer, dominant criteria determining selection of sound objects of interest are determining whether there is seemingly a distinct, "energetic event" (Schaeffer, cited in Chion 2009:125), called *articulation* by Schaeffer, similar in function to a consonant, and *sustenance*[1], similar in function to a vowel. This pair of criteria being dominant will result in a cutting of a sound stream into distinct units based on them displaying a clear start (consonant) and moderate duration(vowel), in other words being "well-formed".

I argue that these criteria of selection, although functioning as musically neutral and functioning in the reduced listening sense of disregarding meaning, can still be argued to be a continuance of the gesture/note thinking. Consequently this will produce note-like objects, engendering a traditional organization of music, a sort of "new classicism", in the words of Palombini (1993:181).

In this thesis, the dominance of these criteria of "well-formedness" are challenged, encouraging selection of sound objects of ambiguous attack, uncontrolled sustain, or even no discernible sustain or attack. Objects selected from the sound stream are selected on the basis of the general quality of variation, and of *grain*, meaning a sense of visceral, material complexity, not on a clearly identifiable articulation/stress profile. As I will demonstrate below, this type of complex sound object can perhaps be classified in typology as either *sample* or *accumulation* (See 4.1), both of which would be classified as eccentric objects, and as such considered unsuitable for further use by Schaeffer.

[1] I am using the translation of Palombini of the french *appui*

By implication, this means that I am not viewing as dominant the structuring of sound objects into greater forms, but rather the possibility of listening in a more or less disconnected manner, where the morphology of sound objects is the dominant feature. Thus, although accepting the idea of cognition by distinct objects I am positing that there is aesthetic value in attempting to blur the lines of such objects as well as their internal features, by obscuring the formal features in raw sound material thought to engender perception of distinct objects.

Categorizing sound objects

Once a sound object is is identified according to the above discussed criteria, a general analysis of its formal aspects is done in order to consider its potential usefulness in a musical context. This general analysis is based on a crude form of the morphology proper which is detailed below. This is because identification and qualification of the general type of sound objects must necessarily arise from a qualification of its internal aspects: there can be no identification without at least a crude analysis of the inner aspects of the sound object. Just like the initial selection of sound objects is based on some formal aspects judged to be most suitable for use in music, their further categorization according to general type is also drawn from a judgment of what are useful categories.

I will throughout this chapter refer to the *Tableau Récapitulatif de la Typologie*, or TARTYP, a summary diagram of Schaeffer's typology, included here as figure 4.1. Schaeffer operates with a complex of several interrelated axes of qualification of sound objects. In making a diagram detailing his typology, Schaeffer fits these six axes into the two axis summary diagram in figure 4.1, making for a concise appearance but rather complex reading of the diagram. In this table, so-called *balanced* objects can be seen to occupy a central position, not only graphically but in the sense of the value given to them by Schaeffer, with so-called *unbalanced* or *redundant* objects located on the fringes of Schaeffer's typology. These balanced objects, as we shall see, are of a medium duration, clear amplitude curve and has a stable pitch.

It should here be noted for the sake of clarity that the notion of "well-suitedness" of a

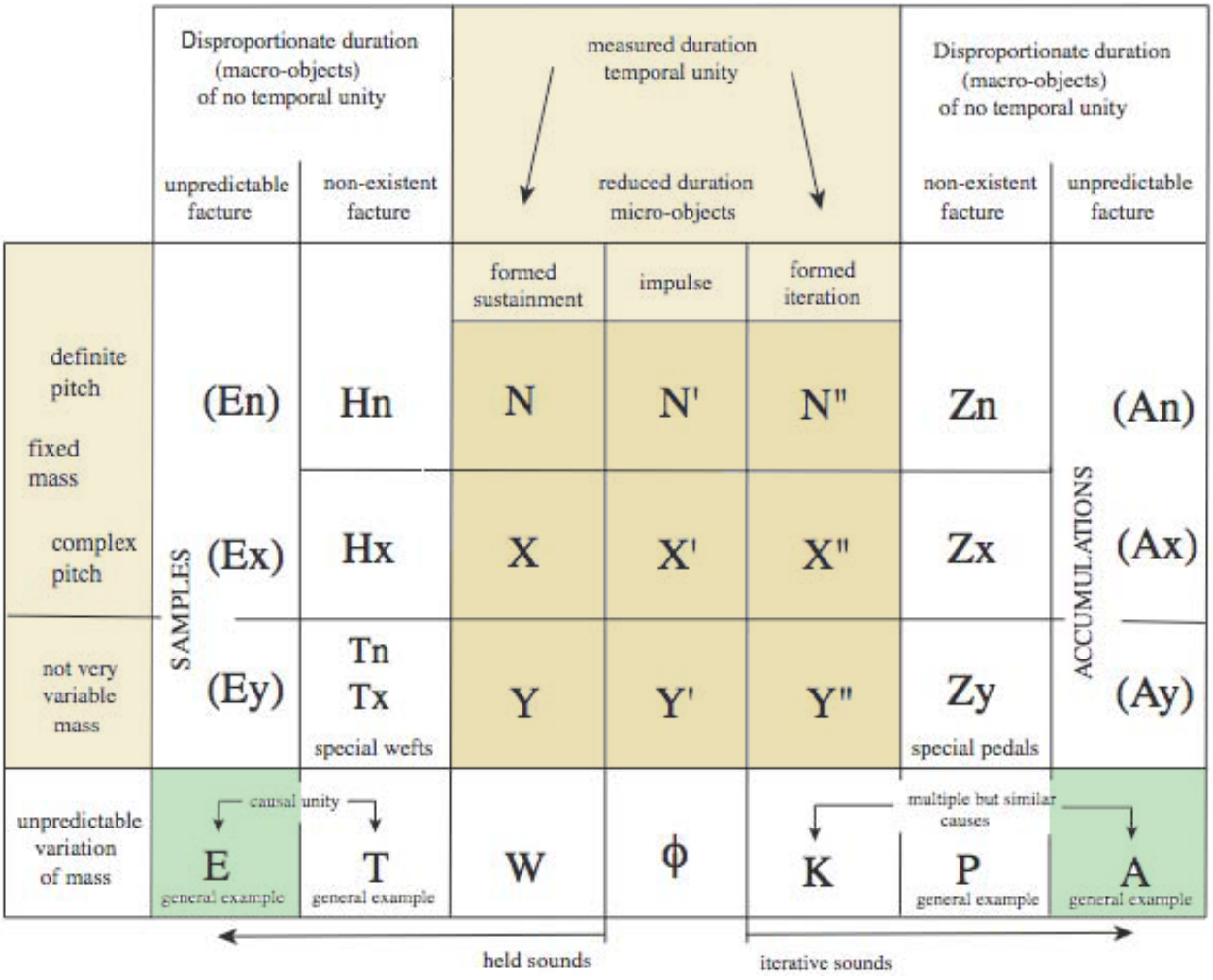

Figure 4.1: Summary diagram of Schaeffer's typology, with "suitable" objects (center) and the criteria determining their suitability (left/top) highlighted in orange. The eccentric objects of special interest in this thesis are highlighted in green.

sound object is not entirely commensurate with the notion of *balance*, a concept that holds a prominent position in Schaeffer's typology. Although Schaeffer is stating that "The sound objects most suitable for music are apparently those which fulfill the criteria in the nine central boxes" (Schaeffer, cited in Chion 2009:107), the two terms are not completely correlated. In the words of Chion:

> [I]t would seem likely that suitable objects would be the 9 types of balanced objects of typology. But the notion of suitable object is an abstract and general notion whose concrete definition must remain open, whereas the balanced object is defined by precise typological criteria. A suitable object might at a pinch not be balanced, and vice versa. (Chion 2009:106)

The notion of the suitability of a sound object is thus relative. Godøy emphasizes the relativity of suitability according to the changing context: "It is important to see that this notion of the suitable object [...] is *relative to the structural context* at any given time" (Godøy 1993:232). *Balance* can be fairly accurately defined whereas the notion of *suitability* is context-dependent, and can be used for an object of an eccentric type if it is functioning well according to its context.

In this sense, wanting to operate on the fringes of Schaeffer's typology does not entail that I am categorically abandoning the notion of 'well-formed' objects, or musically suitable objects. It does however mean that I am hesitant to accept a notion of musically usable sound objects having to have a clearly discernible function. Sound objects will here, firstly, be rather difficult to identify as distinct objects, and second, will have a set of inner features that can only with some difficulty be clearly classified.

Since, as will become clear, I am valuing other categorizing criteria than Schaeffer, the usefulness of doing this categorization comes from highlighting the difference in value of a traditional system of classification of sound objects, valuing well-formedness, contrasted with eccentric sound objects.

Mass/facture

Whereas an identificatory morphology is concerned with determining the outer temporal limits of the sound object, a second morphology is concerned with the inner workings of the sound object. This entails characterizing in broad strokes the temporal development of the spectral content of a sound object, in other words its amplitude and pitch over the course of its duration. This crude characterization allows Schaeffer to inform the typology of the sound object.

The identificatory criteria of *articulation* and *sustenance*, by their selection as criteria, tends to present "well-formed" objects. Having a clear, not too complex articulation and not too complex spectral content, the criteria relating to articulation and sustenance presented here serve to determine the general character of such objects, and thus whether their execution and pitch is rather too complex in order to have a clearly defined function as building blocks in a musical language.

The criterion characterizing articulation is here called *facture*, and the criterion characterizing sustenance is termed *mass*. Facture and mass are constituting the top and left sides of figure 4.1, respectively. Schaeffer details various forms of facture depending on the type and quality of the energetic source of the sound: whether it is an impulse, sustained or and iterated sound. By consequence sound objects displaying unpredictable facture, or no discernible facture, are deemed to be not very well suited for use in a musical system due to their not having a clearly discernible function. In much the same way, the criterion of *mass* engenders categorization according to the stability of pitch, with "unpredictable variation of mass" given a fringe position in Schaeffer's typology and termed an eccentric object.

Duration/variation

Further qualifying the general shape of the facture of a sound object, the criterion of *duration* delineates the duration of the sound object. Not equal to a measurable duration, neither to an ideal, abstract time interval, this rather the perceived duration. What is

the point here is whether the duration is experienced as too long and thereby not being experienced as one coherent object but perhaps as several objects.

The criterion of duration relates to this thesis in identifying that it is exactly when objects are slightly too long, or too variable, and there is difficulty in finding clear abstract systems from the sound, that I find aesthetic value in an ambiguity, a deconstruction of the systems engendered by abstraction, hence why I am here moving towards the edge of Schaeffer's TARTYP. Nevertheless the TARTYP is crucial in gaining an awareness of the concept of there being more or less "well-formed" sound objects and the implications of such properties.

In much the same way as duration is a qualification of facture, the *mass* of a sound object is further qualified by the criterion of *variation*, meaning the variability of its mass. It should be noted that the relationship between mass/facture and duration/variation is rather more complex than it appears from the above discussion. The point of discussing the variability of mass is for being able to determine whether a sound object is too variable for having a clearly perceived function in organized music.

Balance, originality

A sense of the "well-formedness" of a sound object can be derived from the relation between what is expressed by Schaeffer in the concepts *balance* and *originality*. A balanced sound object has not only a good form and a somewhat coherent mass, but it is also of not too long a duration for the listener to lose grasp of the unity and completeness of the object. It is neither too varied for it not to be clearly understood in terms of its function in a musical setting. Hence, while objects of stable, clear mass and well-formed facture are deemed suitable for further use, objects of unpredictably complex mass, unclear or non-existing and varying pitch, and unclear form are categorized as eccentric objects and not very suitable for musical use. Again, the objects of interest in this thesis are those of complex, varying mass and unstable facture.

Towards eccentric sound objects

As we have seen above, the identification and selection criteria in use by Schaeffer, although partially based on experiments in psychoacoustics, are partially based on personal preference, on what Schaeffer expects to be able to put to musical use. This is in effect a somewhat subjective value judgment. Criteria for selection of sound objects are a critical point in the ontology of musical material, as they determine what, in a stream of sound, is considered as the musical material.

I read Schaeffer's definition of well-formed sound objects as first and foremost a welcoming of the note into his typology, perhaps for the sake of giving legitimacy to the theory of sound objects in relation to traditional music discourse, and not as categorically valuing 'balanced' sound objects more highly than eccentric sound objects. However, I have questioned the privileged position given by Schaeffer in the TARTYP of so-called well-formed objects rather than to eccentric objects. Criteria promoting "well-formed" sound objects tend to produce sound objects resembling traditional notes. Focusing on the balanced type of sound objects can, I argue, be seen as missing a chance to fully utilize the potential of Schaeffer's theory. In short, I am reluctant to accept typology outright as a value-neutral structure. Therefore this chapter includes a different approach to typology as tool set on which to base a music theory. It is in the so-called eccentric sound objects that my interest lies. It is in the eccentric objects, or seen in the light of my upbringing into the art music paradigm, in the shift from well-formed to eccentric sound objects, that I expect to find a meaningful music theory of instability.

4.2 Morphology

While a typology of sound objects is about identification of the general type of sound objects, Schaeffer's *morphology* details the inner structure of a sound object. As with typology, the conceptual apparatus of morphology is not here used as a precise grading tool of quantitative values — we are here in the domain of phenomenology, of subjective or perhaps inter-subjective perception. Morphology of sound objects holds a central position

in this thesis, for it is, as will be shown, by certain criteria of morphology which the *concrète* aspects of the sound objects can be articulated. Therefore morphology will be used as a tool of discourse for setting the performer in a certain state of aesthetic affordance, where working predominantly with detailed timbral features of sound is promoted.

Morphological criteria

Morphological criteria are, in Schaeffer's conceptual apparatus, considered in relation to a three-dimensional perceptual field of pitch, intensity and duration (Chion 2009:117). This formal space of conceptualizing music engenders thinking of sound objects as having predominantly a spectral mass that varies in pitch and intensity over time.

Recognizing the difficulty of accurately positioning many of the morphological criteria except a clear pitch accurately in a three-dimensional perceptual space, the quality of these dimensions is considered in the more ambiguous terms site, representing the position in the three dimensional perceptual field of either pitch or amplitude, and calibre, representing the size of the criterion (Chion 2009:118). We are thus moving away from a relatively quantitative field and into a more qualitative field. In this three-dimensional space Schaeffer defines a selection of criteria of morphology, together describing many aspects of the perceptual matter of sound in detail, while noting that this selection of seven criteria is a somewhat arbitrary selection of descriptors. Being that this thesis is about the *concrète* pole of the sound object, some of these criteria will be shown to be given more focus.

Mass

Being the spectral matter on which all other criteria function, mass can vary in width and complexity from a pure sine tone through the clearly defined but harmonically rich tones found in traditional instruments, through to the ambiguous mass which is difficult to locate in pitch and can be found in nature, to white noise. A sound object can be thought to consist of one or many more or less distinct nodes of mass, the cohesion of such

a sound objects depending on whether such nodes appear as an integrated whole.

I here consider sounds of stable pitch to potentially be a result of wanting to express an abstract idea. Therefore, it is of interest in this thesis to examine the way in which an instrumental or synthetic mass can be pushed more in a direction of complex, wide mass, or set of masses, as to obscure the obvious function of the sound object.

Dynamic

The criterion of *dynamic* describes the manner in which a sound object is shaped dynamically over time. Schaeffer places emphasis on the attack phase of the sound as crucial in determining the perception of the sound object as a whole (Chion 2009:174). Since attack is in this thesis considered as a sign of an abstract thought behind the excitation of a sound, I here want to obscure the clarity of the attack phase, as the goal here is moving more towards the concrete pole of the sound object. In considering the criterion of dynamic, the goal is a move towards a complex dynamic rather than the clear attack/sustain type that is found in a typical orchestral instrument.

Mass profile, melodic profile

The movement and width of masses in the spectral dimension is delineated by the criteria of *melodic profile* and *mass profile*, respectively. In the term *melodic profile*, one can again find reference to instrumental tradition. This criterion has more relevance to instrumental tones and is therefore not of great interest here except as a tool for pointing out the presence of such melodic content in sound, as clear melodic variation can be perceived as perhaps a result of an overly controlled production, meaning a production sourced from an abstract source like a note rather than being an articulation of complex origin. As will be shown below, one aim of the processing in the practical implementation of these ideas is obscuring distinct melodic variation.

Mass profile is the internal spectral shaping of masses, concerning, for example, the development of a tonic into a complex mass, in the words of Chion "an internal variation

of the sound mass which is, as it were, “sculpted” in the course of its development, by modifications which cause it to become thicker, thinner etc. E.g. a tonic sound developing into a thick sound of complex mass" (Chion 2009:185). Therefore mass profile is a central criterion for the description of moving towards a more complex mass.

Allure and grain

Schaeffer's morphological criteria of *allure* and *grain* hold a key position in this thesis because, as described by Schaeffer, these criteria can be thought of as the *concrète* part of the sound object:

> I have preferred to reserve a special chapter for the solfège of allure and grain, considering that, whilst mass and dynamic profile originate in the abstract pole of the object, that is, its effects, the perceptions of grain and allure, on the contrary, reveal the concrete pole of the objects, closely linked to the energetic history, which recounts the genesis of each instant of the sound" (Schaeffer (1966:547) , translation by Palombini (1993:152)).

In this way, by examining the *concrete* in the sound object through the criteria of allure and grain, I find expression of the materialist sonic ontology of Cox: in the allure and grain of a sound object, its material properties become apparent. In the complex variation apparent in certain sound objects, a constant instability appears, disturbing clearly defined, stable tones and shapes, or the abstract pole of the sound object.

Further illuminating this shift from abstract to concrete, or as I choose to interpret this axis, from static ideal or symbol to complex, obscure process, I see in the *grain* of Barthes an articulation of the value of focusing on and of valuing the concrete part of a sound object. Although to do so is a considerable simplification I am here venturing to compare Schaeffer's *grain* with Barthes' *grain*. There is crucial similarity in that both concepts are concerned with a bodily, complex source, and are difficult to quantify and make distinct abstractions from. Thus, occupying oneself with the grain of the sound object, I suggest, can be seen as weighting one's musical intention towards Barthes' grain,

engendering a signifying process that is leaning more towards Kristeva's *geno-text*. Hence the importance given to the criteria of allure and grain in this thesis.

The criterion of allure

As it functions in Schaeffer's morphology, *allure* is the way in which the more abstract criteria of mass and duration vary, and thereby discloses the bodily, material, complex manner of excitation involved. I have not attempted to translate Schaeffer's use of the french term *allure*, thus confusion might ensue regarding its very different etymology in the English language. The *allure* of a sound object, as used by Schaeffer, "reveals what the agent of its energy is, and whether this agent is living or not" (Schaeffer, quoted in Chion 2009:179).

The criterion of allure is thus classified depending on the presumed source of the effect, and the three types of 'mechanical regularity', 'supple periodicity', or 'unpredictable' irregularity" are used for identifying, respectively, a mechanical, human or natural source. By consequence, the criterion of allure is a central criterion by which to value sound objects in this thesis. Allure is evident already in typology, by the sense of variability of mass or of unpredictable form, appearing as its most extreme at the fringe of the TARTYP in figure 4.1. The 'suitable' sound objects I choose from will therefore reside towards the fringes of the TARTYP, as this is where allure is at its most extreme and unpredictable, hence showing signs of not being a concrete expression of abstract idea, but of being a concrete process from which to abstract meaning. In contrast to sound objects exhibiting complex allure, sound objects exhibiting no allure, or a very mechanical allure, can be seen as evidence of an abstract idea. Hence we have established another guiding principle, or typo-morphological criterion, of well-suited sound objects for use in this prototype.

Schaeffer goes on to describe *genres* of allure: In addition to the general type of allure, the intensity and speed of the allure can be detailed. The intensity of the criterion of allure can be be described with the notion of *calibre*, meaning the magnitude of pitch or amplitude variation (Chion 2009:181). The speed of change in oscillation of the allure

is termed *module* by Schaeffer (Chion 2009:182). Other than whether the character of allure informs perception of whether there is abstract intention behind the sound, the inner morphology of allure will not be detailed further, as we would then be moving towards a more precise classification of *genres* of allure, which is not the point here.

Grain

The criterion of *grain* is similar to that of allure in that, as with the criterion of *allure*, we have a criterion informing an aspect of the concrete nature of the sound object. Schaeffer describes grain as the "overall qualitative perception of a large number of small irregularities of detail affecting the 'surface' of the object" (Schaeffer, quoted in Chion (2009:171)). Thus, in the same way that allure is articulating the manner of excitation, grain is articulating the material quality of the sound. Thus, grain can be difficult to abstract distinct forms from.

As with allure, in grain can be read the mode of materiality in play, whether natural, corporal, artificial, or abstract, in the sense of no discernible grain present. The general level of grain present can be discerned already at the level of typology, with more unpredictable facture and pitch having more grain. Therefore, as with allure, sound objects containing more complex grain might tend to reside towards the fringes of Schaeffer's typology.

How typo-morphology is used in this thesis

This section marks the end of the theoretical framework for this thesis. However, since Schaeffer's theory went further, I should mention why I am not going further into Schaeffer's theoris here. We have at this point only managed, to a degree, to deconstruct music. We have done so through awareness of natural and cultural listening intentions, and through an unraveling of the different aspects of the sound object. Schaeffer, although not completing it (Chion 2009:2), attempted a reconstruction, or rediscovery, of abstract systems of music, utilizing the building blocks of typo-morphology.

Whether an overly strict reading of Schaeffer, his concern with system has led to suggestions that Schaeffer is trying, in the words of Palombini, to "... bring a new classicism into bloom" (Palombini 1993:181). In a similar vein, Field points to a possible reason for Schaeffer's occupation with system be perhaps to seeking approval among for his ideas, by the new sonic object being construed in a sense using concepts not far removed from those of the Western art music, leading Field to suggest that: "by compartmentalising real world sound into objects and suggesting that listeners might focus their attention solely on the timbral activity within a sound, Schaeffer had effectively invented the electroacoustic equivalent of the note" (Field 2000:37).

I am reading Schaeffer rather more positively, finding in the *Traité* first and foremost a source of articulating a richness and complexity in musical material. Nevertheless this is the point at which I would perhaps deviate from Schaeffer. Perhaps this is a consequence of a general shift of discourse since the publication of the *Traité*, from one of trying to discover underlying systems to one of distrusting the concept of system altogether. In the words of Palombini:

> ... times have changed: the end of the century has witnessed the decline of systematic constructs, even among their most ardent supporters. From an explication of Mr. Schaeffer's text, a paradigm of *musicalness*, as opposed to *musicality*, is likely to arise, illuminating the postmodern condition (Palombini 1999:95)

Palombini is here referring to Schaeffer's concepts of *musical* and *musicianly*, with the musical implying a sense of tradition and system, and musicianly being a playful curiosity (Chion 2009:39). Consequently it is the eccentric sonic objects, or rather the move from 'suitable' to eccentric objects, that is of interest in this thesis. The above discussion of background and motivation for Schaeffer's theory along with a clarification of some issues regarding his theory leads into the remaining chapters, where I will be detailing Schaeffer's typo-morphology as it applies to this thesis. The aim of the practical implementation detailed in the following chapters is engendering this *musicianly* playful, open-minded exploration of the non-musical aspects of sound.

Chapter 5

Practical implementation

Considering the crucial role that practical exploration of music technology plays in Schaeffer's research in general and in the development of the theories contained in his *Traité*, I find it natural that part of this thesis consists of a practical application of the ideas discussed in the preceding chapters. I hope, in this way, to put myself in a position of doing Schaefferian phenomenology, so as to inform the above discussed issues.

This chapter is therefore a discussion of the practical application of the above discussed issues of conceptualization of sound. On the background of the impact that digitalization of sound can have on our understanding of sound organization, and of the potential of this technology being partly untapped, I have chosen to approach the ideas discussed in the preceding chapters from a focal point of digital audio. First, I will discuss some unique ways in which issues regarding Schaeffer's concepts of abstract and concrete can emerge in a practical case of digital sound organization, and how Schaeffer's theories can therefore be of use in such a discussion of digital audio. My identification of digital control data as an area which potentially overly abstract will then be detailed. Lastly there will be a discussion of the workings of the resulting audio processing tools on which to do a Schaefferian phenomenology in order to inform these issues.

5.1 The goal of the implementation

The intention of the discussion leading up to this chapter was that of pointing to the mechanism of music cognition by which certain *values* are drawn from the sound material at hand. My concern has specifically been with how the inherent aspects of sound as articulated in the typo-morphology of sound objects are engendering the cognition of distinct values of a clearly defined function. I have argued for the possibility of a less clear typo-morphology engendering attention to the totality of the inherent aspects of sound material more than to distinct objects of cognition.

In order to articulate this issue of musical values, Schaeffer introduced the terms *value* and *characteristic* (Chion2009:74). *Value* is the the distinct units of musical organization, whereas the *characteristic* of a sound is the complex of morphological features present in the sound material, but not given a distinct musical function. It is the characteristic of sound that I want to set into focus here. I suspect that there will in the characteristic of sound be aspects that are not considered as musical values, or not *thematized*, a term used by Godøy (1993) in noting his concern with a common "non-thematization", or a failing to consider aspects of the sound object that should perhaps be considered as relevant. Noting a motivation for such considerations, Godøy is pointing out that, in one's meeting with non-western culture "the world may be sliced into entirely different chunks than what we usually do, and that such alternative structurations may be very revealing about the biases of our own structurations" (Godøy 1993:110).

I have shown how this discussion is also engendered by the possibilities introduced by use of those aspects of technology that allow for storage and manipulation of sound independently of the traditional music performance where there are intrinsic couplings between gesture, instrument and performing space and sonorous result. In digital audio such links are mostly arbitrary, determined in the design of the interface. The music technology in use here is thus not merely a neutral tool, but a prerequisite examining these questions of sound organization. However I want to focus on the issue of this opportunity of digital audio not necessarily being seized on by the designer of digital interfaces.

Value and characteristic in traditional and digital lutherie

I argue here that the possibilities afforded by music technology regarding what are the predominant *values* in an instrument, is not seized on fully, with music technology sometimes seen as simply a tool for the continued development of traditional systems. As will be shown, the construction of an instrument or interface helps to determine what is the musical reality created, hence at the same time what is to be overlooked. Therefore, an initial description of how musical values are constituted in traditional lutherie is useful here.

I view the piano as an example of a symbol of and an archetype of the traditional Western musical system, engendering a certain kind of abstraction and idiom. Therefore I am here using the piano as the example of how the concept of *value* functions in the design of traditional instruments. Although the timbre of the piano is certainly important, the piano can hardly be said to be built primarily for its *characteristic*, or its sonorous character, but rather for a concern with certain distinct musical *values*. In the case of the piano, strong values determined by its construction are the tempered scale of discrete pitches, and its "well-formed" articulation, usually putting the resulting sound objects squarely in the center of Schaeffer's TARTYP. As such the piano can be said to be built with an abstract intention, engendering a certain ontology of musical material.

The sonorous end result is of course always *concrete* in that it is a sounding thing, and therefore one sound cannot be said to be more abstract than another. Therefore I do not doubt that the piano in many cases can be heard as rich in *characteristic* rather than clearly delineated *value*, and the listener perhaps chiefly attending to other values than pitch system. There is nevertheless a sense of intention, real or imagined, to be drawn from the sonorous result. The precise nature of this reading of an intention is, especially for the acousmatic listener, where no source is seen, at best somewhat inter-subjective. However the value in at least considering a balance of *abstract* and *concrete*, or the strength of *value* versus *characteristic*, should be clear.

There are examples of modifying the values to be drawn from the piano in the acoustic domain. When John Cage modifies the mechanical and acoustic properties of the piano,

disturbing the sense of a distinct *value* of the tempered pitch and "well-formed" articulation, there is more room for freely exploring features of the *characteristics* of its sonorous result; one has to search for other patterns of organization. This is an example from the acoustic domain.

In digital audio these experiments can be drawn further, since there is no inherent links between performer, instrument and sounding result. However, it is not given that developers of digital interfaces recognize the profound possibilities offered by digital audio technology. One can, for example, see a tendency to operate with similar values to those of the piano in the commonly used amplitude envelopes of sound generators: A distinct start, fairly linear decay and finite duration, with perhaps some modulation of timbre. Such an interface can be thought to afford listening for traditional musical values and structure. Therefore, instead of starting from the totality of possible values choosing objects of interest from this totality, the result is predetermined to an extent, or abstract.

5.2 The practical implementation

On the background of the problem of what *values* to promote in developing an instrument, and thus what type of abstractions are engendered when operating and discussing the resulting instrument, I argue here that maintaining an ambiguity of *value* in an instrument is conducive to a potentially more open-ended perception of music. Hence I am here leaning towards the *concrète* end of this axis, by promoting the potential value of starting with *concrète* material from which values emerge as opposed to starting from predetermined abstractions.

Concrète/abstract data source

Schaeffer's notion of the *concrète* was originally used in practice regarding sound material. However, one manner of which an excess of the abstract can emerge, I argue, is in the design of the algorithms controlling digital audio playback and processing. If the *concrete*

is limited to the internal constitution of sound fragments but does not appear in the control of the excitation and continuation of sound fragments, something is missing. As such I suggest that when working with the problem of the balance of the *abstract/concrete* axis, it would be of value to consider if the control structures involved were also taken into consideration as to their balance of abstract/concrete.

Because we are considering the totality of the sounding result, the abstract nature of this manner of playing back concrete fragments might become apparent by the use of some common idioms of programming. With some central idioms of programming being *boolean* values, having a binary state of either on or off, and *for* loops, naturally creating linear functions, the natural state of digital audio programming is of an abstract nature. Therefore, as an approach to avoiding the common abstractions of digital audio programming, I want here to bring the *concrete* into the domain of digital control data. I thus consider control data taken from concrete sources to be useful when wanting to expand the concrete pole of a project, where the abstraction of meaningful values is starting from a sonorous vantage point.

In this thesis, armed with the power of digital sound processing not available to Schaeffer, I am therefore expanding the reach of Schaeffer's *concrète* to also include control input determining playing back and processing of digital sound. I want to show here how a shift away from static playing back of sample fragments according to abstract notion of "pressing play" engenders a shift towards the concrete. The next section will detail the practical implementation of this idea. To this end I am applying in the domain of control data Schaeffer's ideas of the concrete, the acousmatic situation, "cloche coupée", "sillon fermé", engendering a shift towards the concrete. The resulting sound will be analyzed as to whether its morphology shows this in its complexity, again, balanced objects considered here sign of abstract source.

5.3 The programming

About the tools used

Max, a visual programming language commonly used in audio prototyping, is chosen as development platform for its suitability as a modular prototyping platform. In addition there is substantial use of Java and JavaScript through Max's application programming interfaces (API), allowing for a combination of visual prototyping together with the advantages of text-based programming for tasks that are not very well suited for a visual programming language.

For best to understand the concepts discussed in this thesis, opening and experimenting with the included programs, hereafter referenced by the term *patch*, which is the commonly used term for a Max program, is recommended. Version 7 of Max is used in development, and best results will be seen if using Max 7, available for download at https://cycling74.com/max7/. Java version 6 or newer is also required.[1]

Additionally, although the general functioning of the patches is detailed here, the patches and the Java and JavaScript code contains supplementary, contextualized comments, clarifying the detailed functioning of the patches. Fully understanding the descriptions included within the Max patches and the Java and JavaScript code requires some understanding of the Max language, the Java and JavaScript programming languages or similar object-oriented programming languages, and of Max's Java and JavaScript APIs.

5.4 The control patch

The intended function of this patch is facilitating a turn towards the concrete pole of sound, thus adjusting an *abstract/concrete* balance that is perhaps overly weighted towards the abstract. This is done by loading *concrete* data sets into the patch. What is meant by concrete in this setting is a data set sampled from non-musical real-world

[1] Due to both Max and Java being available in 32- and 64-bit versions, one should make sure that both Max and Java are either the 32 or 64 bit version.

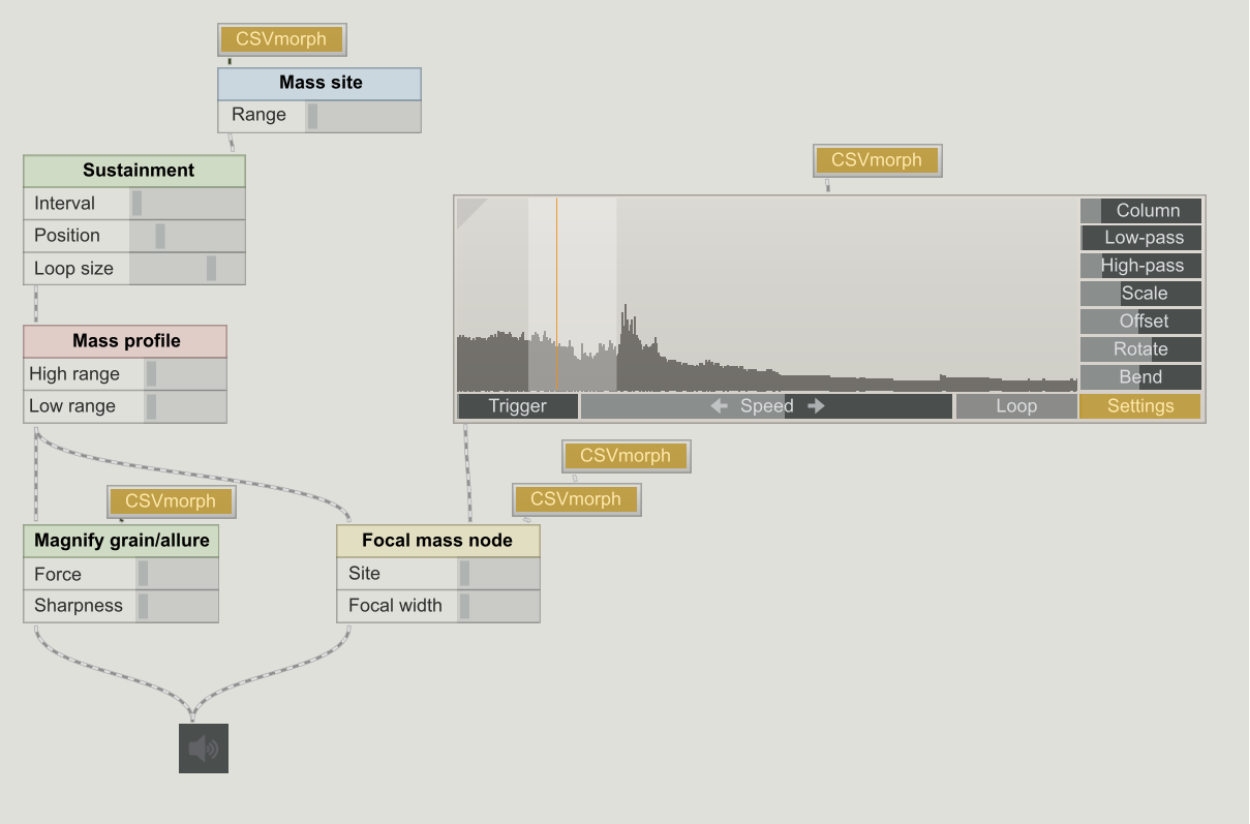

Figure 5.1: An overview of the main Max patch, showing the different processing modules, connected with so-called "patch-cords", and the control data patches named "CSVmorph", in orange color, in their minimized layout. To the middle right is an instance of the control patch in its maximized layout, showing a representation of the imported concrete data set, and various parameter controls.

sources, the data set thus being void of trace of traditional musical system or any other abstract system. The effect of this use of concrete data sets is the ability of starting from the concrete from which to extract, by listening, values, rather than starting from set values.

Source files

The patch allows for extraction of data from any source file containing a number of lines of comma-separated data, in the CSV (comma separated values) format. A portion of the raw data set of daily stock trading data for Hailun Piano company can be seen in figure 5.2, each row starting with the date of measurement and succeeding with various

measurements made on that date. The patch will recognize data fields from which a single number can not be easily extracted, such as entries in a date format, and set the value of such fields to a default value of zero.

```
2016-07-26,19.89,20.12,19.89,20.05,3395700,20.05
2016-07-25,20.13,20.18,19.90,19.95,4107500,19.95
2016-07-22,20.25,20.38,20.07,20.11,5278800,20.11
2016-07-21,20.29,20.55,20.00,20.30,6437700,20.30
2016-07-20,20.42,20.45,20.10,20.20,5033500,20.20
2016-07-19,20.28,20.40,19.96,20.35,5391500,20.35
2016-07-18,19.98,20.33,19.81,20.25,5582900,20.25
2016-07-15,20.08,20.24,19.92,19.98,4546600,19.98
2016-07-14,20.40,20.72,20.04,20.19,8545500,20.19
2016-07-13,20.16,20.42,19.92,20.30,7892600,20.30
```

Figure 5.2: A portion of the raw data set of daily stock trading data for Hailun Piano company, each row starting with the date of measurement and containing various measurements made on that date.

The data set is collected into the patch, and organized into sets of columns. Extracted into individual columns, the movement through time of a particular measurement can be extracted as a potentially musically usable temporal shape. Figure 5.3 is a graphic representation of a column of the data set detailed in the next chapter. As can be seen, a complex shape is emerging, containing both fluctuations that can perhaps be characterized as noise, or grain, and larger shapes, and what can perhaps be perceived as somewhat distinct events.

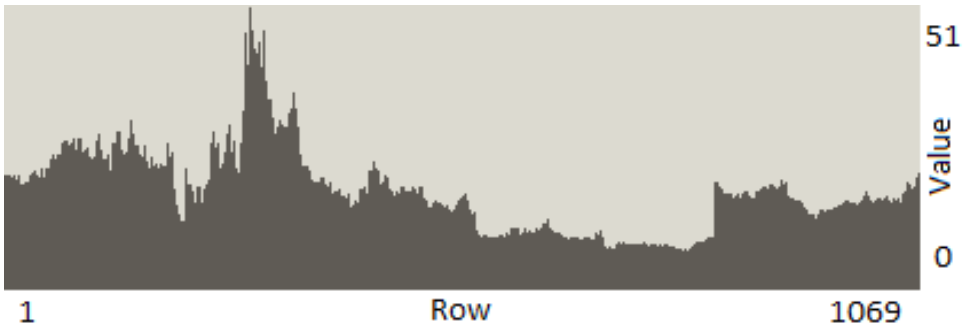

Figure 5.3: Graphical representation of values from all rows in the first column of the Hailun Piano data set. A mixture of noise and larger forms can be seen.

From discrete to continuous

Since this is a discussion concerning concrete material, the implications of a digitally sampled data-set in a CSV format being of a discrete nature should be noted. Although the source of the data might be of a continuous nature, a sampling at discrete intervals has taken place, presenting the problem that the abstract nature of the sample intervals might become apparent when applied to sound processing.

Therefore, the data set is subject to interpolation in order to construct a continuous, curved line through all data points, allowing for a fluidity of the data set. The interpolation used is of the cubic spline type, for achieving a result approaching a sine curve and therefore little quantization noise when applying the data set to sound processing. This operation is done in Java. The code for this operation can be read in the "CSVmorph.java" file.

A concern remains, however, that by interpolating the data set, an artificial, abstract dimension is added to the data set. However the interpolation is here considered musically neutral, as the reasoning for doing the interpolation is not bound to any musical system. Furthermore, the interpolation can not be heard as a feature of the data set.

Cut bell/closed groove reduction of the data set

In designing the algorithms to be applied to the data set, I am here tracing Schaeffer's path to typo-morphology, and applying Schaeffer's ideas to the handling of a data set. Whereas the initial extraction of the data set from its intended use is considered similar to putting oneself in an acousmatic situation, tools made available in the patch for cutting and looping of a section of the data set is similar in function to the *cut bell/closed groove* techniques, as a way of facilitating a reduced listening situation by avoiding obvious recognizable structures in the data set. As can be seen in figure 5.1, the opaque area of the graphical representation of the data set can be manipulated by dragging the mouse across the area of interest. The keyboard modifier keys shift, cmd (ctrl in Windows) and option (alt in Windows) allows for shifting the edges of the selection, shifting the entire

selection, and expand or shrink the selected range, respectively.

Here one must consider the issue that creating such a loop can be considered to be a form of abstraction, and hence not very useful when trying to shift towards the concrete. Therefore the abstract nature of setting rather firm limits on the selection will be loosened by letting another instance of the control patch control the edges of this selection, allowing for a less mechanical sounding, less abstract result. For this reason a core functionality of the control patch is that of having the output from one instance of the control patch control almost any parameter in another instance of the control patch. In figure 5.1 the control patches can be seen chained together in this way.

Adumbrations: modulation of the data set

Having done the above described *reduction* of the data set, one should now be able to experiment more freely with the morphology of sound objects. To this end, the CSVmorph patch includes algorithms allowing for modulation of a set of aspects of the data set. These algorithms are all designed in order to engender a continuous changing of perspective from which the data set is viewed, bringing out various aspects of the data set.

The background for constructing the patch this way is Schaeffer's adoption of Husserl's phenomenological concept of 'adumbrations', where one is continually changing perspective, through various outlines of the sound object, in order to get a grasp on the object at hand, as described in (Kane 2014:20). Through subjecting the data set to operations of moving average filtering, arithmetic operations and trigonometric functions, one is able to alter the "viewing angle" from which to view the sound material at will, focusing on fine details or larger shapes in order to discover the significant features of the data set.

A way in which the abstract nature of digital audio may present is in the playing back of a sound, with the idiomatic method of playback by means of the typical 'for' loop being a linear progression from start to finish. Therefore there is affordance in the patch for read position and speed of reading to be determined by the output from other instances of the control patch. The result will be a complex reading rather than proceeding in a

predetermined linear manner; in other words a less abstract operation.

Programming the modulation

The modulation is programmed in Java. The details of the Java code can be studied in the CSVmorph.java file, which is readable as plain text. These operations are, crucially, taking place in the audio level by accessing Max's audio processing signal network, with the effect that processing is perceived as continuous and finely grained. Were protocols such as MIDI to be used, a sense of discontinuity might be perceived due to the limited speed, resolution and temporal stability of such signals. In the audio signal domain, typically tens of thousands of samples per second are taken of the interpolated data set, meaning there might be no discernible sign of the discrete nature of the digital technology involved. The controls for these operations can be seen on the right in the control patch in figure 5.4.

Applying high- or low-pass filtering to the data set allows for highlighting certain aspects of the data set by dampening the finer or the courser features of the data set. This is done by a moving average, in effect a low-pass filter, and its opposite, a high-pass filter. This infinite-impulse-response (IIR) single-pole variant, chosen for simplicity rather than for a specific character, is an implementation of the following algorithm:

`y[i] = y[i-1] + (x[i] - y[i-1]) *` α

Here, y is the output, x is the input, i is the current value, *i-1* is the previous value, and α is the smoothing factor. A high-pass filter is implemented by subtracting the result of this low-pass filter algorithm from the data set.

Furthermore, there are simple arithmetic operations for scaling and for offsetting the values in the data set. Rotation and bending along the lateral axis of the graphical representation seen in figure 5.4 are also available, implemented with the use of trigonometric functions. All of these operations are considered tools for changing the perspective from which to listen to the sound object.

However, having these operations be simply controlled by linearly set static values, there

will be an abstract element to the operation of the control patch. Therefore, a central function of the control patch is allowing for all of the above described operations to be controlled by other instances of the control patch, avoiding the overly abstract nature of setting linear faders to a static position.

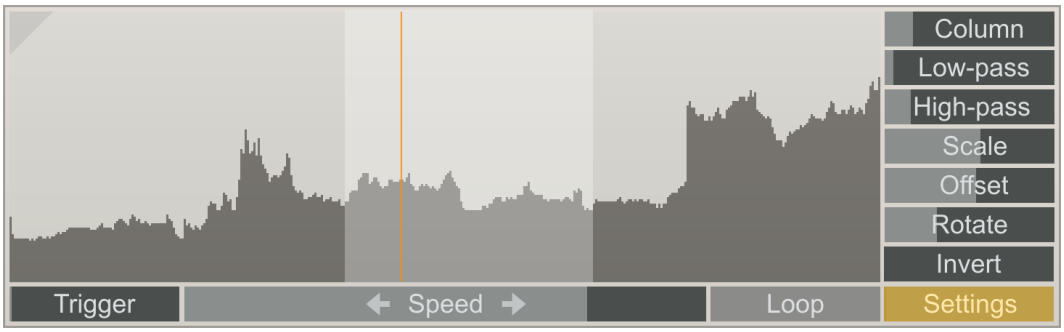

Figure 5.4: Graphical representation of the control patch, dominated by the representation of the data set. The orange line is the play head, the opaque section is the loop section. Shaping algorithms are on the right, play controls on the bottom.

Layout of the CSVmorph interface

Because it has been an important feature of the control patch to have many instances of the patch operating simultaneously, connected to each other in complex ways, there is the option of minimizing the fairly large graphical interface of the patch, by clicking on the upper left triangle, seen in figure 5.4. This functionality is programmed in the included JavaScript program "CSVmorphResize.js", included with this thesis and readable as plain text. Instances of the patch can be minimized and restored as needed, allowing for many instances of the patch to be active while maintaining a good overview.

Furthermore, as communicating drawing messages to the graphical elements of the patch, and the drawing itself, is computationally expensive, the minimized layout does not communicate drawing messages, and is therefore less computationally expensive. In addition, the settings section of the patch includes a setting of drawing interval, to be set higher if experiencing overly high resource usage.

5.5 Processing

Although the focus is on the control patch, a set of simple playback and processing patches is included, in order to demonstrate the effects of the control data. It should be noted that the language used in these patches is deliberately not referencing traditional music theory, in order to avoid abstract or cultural language, and in this way functioning as a reduction of sorts. For example, there is no talk of space, of tonal system, of rhythm. The naming of these patches and their parameters is inspired by the ideas of Schaeffer, so as to highlight the typo-morphological focus of this project. The manner of processing is not exotic; only in the Schaefferian naming of parameters used is the processing unusual.

Playing digital sound files: processing_sustainment.maxpat

While the idiomatic mode of playing digital sound files is a linear playing from start to finish, I have chosen an approach to playing sound files based on Schaeffer's notion of *sustainment* of sound (Chion 2009:128), for affording a sense of there being a dynamic way of affecting the nature of playing sound files.

The patch named 'sustainment.maxpat' makes available a dynamic method of playing back a section of a sound file, through control by the control patch. This is made available by having access to the length of the played fragment, the position in the sound file from which to start playback, and the speed and regularity of repeated triggering of sound fragments. By adjusting the parameters by the *concrete* control data, it is possible to move from a "well-formed" sound object to an eccentric sound object of the *accumulation* or *sample* type, in this way adjusting the balance of the resulting sound object. This patch can be studied by opening it, where additional comments are also available.

Melodic profile: processing_massSite.maxpat

For controlling the *melodic profile* of a sound object, there is the patch named 'processing_massSite.maxpat', controlling the speed with which the sound file is played back and thereby the movement of the entire spectre of a sound object. Controlled by the *concrete*

data of an instance of the control patch, the function of this patch is a spectral destabilizing of distinct tonal mass nodes, affording a moving of the type of a sound object towards an eccentric type, by introducing more variation of mass.

Mass profile: processing_massProfile.maxpat

The inner *mass profile* of the sound object is controlled by the patch named 'Mass profile', containing a low-pass and a high-pass filter. The cutoff point of the respective filters is controlled by instances of the control patch, affording a complex movement of the inner mass profile of a sound object, once again destabilizing the mass of the object, moving it towards the edge of Schaeffer's typology.

Harmonic timbre: processing_magnifyGrain.maxpat

For controlling the harmonic timbre of a sound object, a hyperbolic tangent function is applied to the sound, with the sounding effect of harmonic distortion when the signal is approaching maximum, by a steepening of the sound curve. Also, a low-pass filter is implemented so that it dampens harmonic timbre of the sound object for low values of incoming control signal.

Magnifying mass nodes: processing_massNode.maxpat

In order to have control of individual *mass nodes*, a resonating band pass filter is used. As such this module can bring out specific pitches or general wide nodes from the sound material. The point is again the dynamic nature of this effect: controlled by the CSV control patch, the frequency, strength and focal width of the module can be modulated, affording a movement towards or from the center of Schaeffer's typology.

Conclusion of the implementation

The goal of the practical implementation detailed here is, by the use of *concrete* control data, to move towards the edges of Schaeffer's typology. This process is to be analyzed in the following chapter, where the sounding result and the typo-morphology of the resulting sound objects is detailed.

Chapter 6

Typo-morphology of the resulting sound objects

In this chapter I will present an analysis of the practical implementation detailed in the previous chapter. As my concern in development of the control patch has been with the idiomatic characteristic of digital control data being overly abstract, what I want to examine here is how the abstract/concrete balance is affected by the use of the control patch.

The method of analysis in use here is one of employing Schaeffer's idea of reduced listening for a phenomenological analysis of the typo-morphology of the resulting sound objects. Based on my impression that sound objects being of a balanced type can be perceived as a possible indication of an underlying abstract, well defined intention, whereas eccentric sound objects are showing more of their concrete pole, typology will be used in order to determine the type of the sound object. Furthermore, morphology will be used in order to articulate in more detail the concrete pole of the sound objects. Most weight will be given to the *allure* and *grain* of the sound objects, for these criteria are, as discussed in chapter 4, the concrete pole of the sound object: these are the aspects revealing a concrete, complex, non-abstract origin.

Subject sound material

Because I am here concerned with a *concrete* approach to sound processing, sound material on which the control data functions is here concrete recordings. However, I want here to play with a balance of the abstract/concrete axis from within culture rather than starting anew, recognizing my position of being already in tradition, and the limited value of a complete reset of tradition. Thus, rather than utilizing concrete sound material as a way of starting with somewhat of a "tabula rasa" in the style of Schaeffer's "musique concréte", I am not using what could be considered completely musically neutral material, in the sense of the material not showing signs of traditional musical values. The sound material used here is displaying some balance of the abstract and the concrete, engendering a dialogue between tradition and new ideas.

Since I consider the piano to be an archetype of the traditional Western musical system, of abstraction, of idiom, the piano is used for articulating the abstract, or *musical* aspect of sound. The subject sound fragment on which the processing is to work is the the ending chord of Claude Debussy's 'Clair de Lune', played by Arthur Rubinstein and recorded onto phonograph disk and later transferred to tape, hence subject to distortion that is not part of an original musical intention and therefore having a strong *concrete* dimension. I hope that utilizing recordings of a piano with both musical and non-musical aspects as the subject of this demonstration engenders a fruitful meeting of the abstract and the concrete.

Typo-morphology of subject sound material

I am in the recorded sound fragment ('chord.wav', included with the thesis), focusing on a sound object spanning almost the entire duration of the recorded fragment, including the entirety of the articulated piano tone, sustained to its natural end. Its type can be said to be "well-formed" and balanced, having a definite pitch and well-formed facture. Its type can thus be identified as what is by Scheffer termed the 'N' type, as seen in figure 4.1. However, there are signs of the instability of this balanced sound object. Its facture does not present as naturally dynamic. This dynamic flatness is perhaps caused by the

phonograph and tape technology not allowing for a full reproduction of dynamics of a natural facture. Furthermore, the facture is somewhat unpredictable, as if the mechanical and electronic distortion destabilizes the facture and mass of this sound object. There is, then, signs of this sound object being somewhat unstable.

As for its more detailed morphology, there is a clarity of the attack of the tone, and fairly stable *tonic nodes*, with these properties seen as sign of the *abstract* pole of this sound object. However, with the substantial amount of *grain* that envelops the played note, being of a chaotic nature, and allure that is showing in the undulating instability of the tonal nodes and in the noise, the morphology of this sound object is, then, strong in unpredictable variation, the object thus having a strong concrete pole.

It is this starting point of a sound object having some balance of concrete and abstract that will be played back and processed by concrete control data in order to skew it towards the fringes of Schaeffer's typology, by account of my impression that moving towards certain eccentric types is a sign that there is a strong concrete pole to the sound object.

Subject control material

In the same way that sound material can present more or less sign of abstract intent, this can also be seen, I argue, in the algorithms controlling the processing of sound. Therefore something is missing, in a pursuit of a stronger *concrete* pole in music production, if the processing of sound recordings is of an abstract intent.

What is meant by an abstract intent here is whether there is, before listening commences, a certain intent that is guiding the design and the control of control parameters so that the behavior of sound processing is predetermined to an extent. My impression is that there is in digital control algorithms a continuance of the use of a certain type of abstractions that resemble the note, producing balanced sound objects. Such 'musical' control input appears in digital music production as, for example, a curve of reasonable length, clear start and finite duration, linearly decaying, thus facilitating a note-like structure.

The control patch detailed in the previous chapter is built so that concrete data files must be loaded into the patch; there is no predetermined control data. Furthermore, control of this concrete data is not predetermined. This design is meant to engender a fluid consideration of what type of control data one wants to use, and how, always from a listening perspective.

Hailun Piano company

The control source in use here is a time-line of day-by-day stock market quotes of the Chinese piano manufacturer Hailun. Stock quotes are here used for their function as an example of an articulation of a complex of cultural and natural processes, an extension of the traditional piano and piano performance according to the 'sonic ontology' detailed in chapter 2.

Included with the thesis is the file 'hailun.csv'. This file contains a history of various daily stock data of the piano manufacturer Hailun, extracted from Yahoo Finance [1]. This particular data set is chosen for its mixture of noise with traces of form, hence a balance of elements reinforcing distinct values and more obscure aspects depending on what aspects of the subject sound material one wants to bring out.

In terming this data set *concrete*, I do not suggest that it is a concrete thing in the sense of it existing as a physical entity: the data is partially a result of abstraction. It is, however, not created with a musical intention, and as such is here considered musically neutral. There is little or no initial musical content in the traditional sense in such a structure, and finding objects of interest in such a structure demands attentive listening and trial, thereby shifting listening focus from organization of abstract values into searching concrete material for interesting abstractions.

[1] http://finance.yahoo.com/quote/300329.SZ/history accessed 7/26/16

Expanding the cultural/material dimensions of a piano

Having discussed the role of instrument design and of performer I am now somewhat closer to articulating what I am intending here with a shift towards the concrete. My goal here is that by seizing on the opportunities made available with digital sound processing, one is able to reconsider traditional notions of what is the role of the performer and what is an instrument, expanding the notions of instrument and of performer, for accessing other types of value of musical organization from what is traditionally conceptualized as musical structure, but suspected to be of value.

In the case of this thesis, I am expanding the notion of piano in both the cultural and the material dimensions, to include the wider field of the cultural and material idea of piano. In this way I am demonstrating an example of how the sonic ontology of Cox works: This expanded notion of piano resides in a complex of material and cultural processes, where cultural and material processes are not differentiated.

The intention of data sonification

Because the data set used here is from outside the traditional musical realm, it should here be noted for the sake of clarification that the goal of using non-musical data for input is not extracting or abstracting information regarding the nature of stock trading or information of this company, as might be the case if I was doing data sonification.

In the same way that the train sounds in Schaeffer's 'Étude aux chemins de fer' were not being chosen for their symbolic meaning or for extracting information about trains, but simply for their non-musical origin, stock data is similarly chosen here not for its specific symbolism of human nature or economy, but simply for being a non-musical control source. Another way of articulating this issue is through Cox' sonic ontology: I am here not doing sonification of non-sonic data but rather already working in the sonic domain, however in a slower time frame.

6.1 Typo-morphology of the resulting sound objects

I will in this section demonstrate the type and morphology of the sound objects that result from using the control patch. The aim of this analysis will be commenting on the balance between abstract/concrete evident in the sonorous output as it shifts due to use of the control patch.

Sustainment

The *sustainment* of a sound, to use Schaeffer's concept of, in Chion's words, "the energetic process which maintains it (or not) in duration" (Chion 2009:128), is a central element in determining whether the typology of a sound object is balanced. A well-formed sustainment will tend to occupy the central nine boxes of the TARTYP as seen in figure 4.1. I have argued that the idiomatic manner of articulation in digital audio programming, with the binary *boolean* values and linear *for* loops, typically creating a linear movement, being central features in programming languages, can typically generate sound objects of a balanced type. Therefore, I want here to examine how playing with concrete control data will affect the sense of unpredictability associated with eccentric sound objects.

As described above, the sound recording chosen for this case (chord.wav) is a recording of a traditionally triggered piano key, sounding to its natural conclusion. My impression here is that through this type of sustainment the source intention for the production of the sound is perceived to be an abstract idea: a note. As mentioned above this is connected to the lutherie involved, with the piano being built for these being the prominent values. I am here taking advantage of the possibility that in "digital lutherie" articulation can take boundless form, as it is not bound by a physical link between performer, instrument and acoustic properties of the instrument. I want here to move its typology towards the *eccentric*, hence I am aiming for an unpredictable sustainment.

The processing patch named "processing_sustainment.maxpat" was designed specifically with this intention. There is in the sustainment patch no inherent algorithm for playing sound in a certain manner; input from instances of the control patch determines the

manner of sustainment in playing the recorded sound fragment. The parameters made available for control is position in sound file to start from, length of sound fragment and the optional interval of repeated iteration.

If controlled by the typical to the programming paradigm on/off and linear loops, we have the regular loop. This is an example of the abstract intention showing through the regularity of the looping. Therefore, in this example, several control patches are set up so that they are controlling the elements of articulation in a complex manner.

The general setting of each instance cannot be shown here, but can be studied in detail in the patch 'example_sustainment.maxpat'. However an idea of the complexity of concrete input configuration can be had here. This is in effect complex articulation of the data set itself.

A central cause of the diminishing of the original values of the recording obscuring the attack phase of the piano sound: as detailed by Schaeffer as a dominating feature, especially of short, percussive sound objects (Chion 2009:176), the attack portion of this sound object will dominate perception of the sound object as having a clearly defined, traditional musical role, and obscuring its inner morphology. Hence a diffusion of the articulation obscures the the attack, diminishing the values associated with a strong attack.

Control data

In selecting control data for controlling the parameters of the sustainment patch, a section of the control data is selected in the control patch on merit of its generally complex effect on the original sound material. The selection for the starting point of the sound file playback is shown in figure 6.1. The data set is adjusted using the available algorithms on the right side so that there is a general complexity of features of the data set pertaining to grain and allure and no obvious distinct forms or patterns. The chosen section, rotated along its x axis in order to flatten it across its duration, is found to not be exhibiting a clear general form, merely hinting, through its complexity of allure, at some sense of unstable form.

Figure 6.1: The concrete data controlling the interval of iterated articulation of the sample. The data set is adjusted using the available algorithms on the right side so that there is a general complexity of grain and allure and no obvious strong patterns. The orange line is the read position of the data set. In this case the read position is controlled by a separate instance of the CSVmorph patch, causing a complex articulation of the data in the data set.

Typo-morphology of resulting sound object

The result of this configuration is an articulation that has a diffuse, drawn out sustainment. The original sound objects' well-formed dynamic properties are disturbed, shifting the sound object towards a typology of *sample* or *accumulation*, depending of whether the source of sound production is perceived to originate from a single source or multiple but similar sources. This new object can hardly be called the same object as the one that results from a linear playback of the recording. Consequently the 'musical' values are obscured, with concrete aspects of grain and allure dominating. The result can be heard either by opening the patch "_example_sustainment.maxpat" or in the audio recording "sustainment.wav". In addition the included video file named 'sustainment.mp4' shows how several control patches are affecting the sustainment of the sound dynamically.

Morphology processing

Having altered, by modifying sustainment, predominantly the typology of the sound object, several processing patches concerning mostly aspects of the morphology of the sound object are also available for control by the CSVmorph patch.

Processing mass site

Several processing patches are available for processing the *mass* of the sound material. One such patch is the mass site processing patch, named 'processing_massSite.maxpat'. This patch is varying the *site* of the mass as a whole, meaning its placement in the spectral dimension. The result of complex control input here is varying the site of the mass in a complex manner.

The patch '_example_mass site.maxpat' and the included recording 'mass site.wav' show the effect of destabilising the site of the tone of the piano in the recording by a complex variation of the site of the mass. This can be seen in the video file "mass site.mp4". The sound object is here moving towards a more eccentric type, especially as more variation is introduced by the control patch, with the resulting complex variation of its mass promoting *variation* itself as a strong value, and the tonal nodes diminishing in value.

Processing mass profile

The spectral profile of the mass of the sound object can be controlled by the patch named "processing_massProfile.maxpat", in which low pass and high pass filters together control the spectral width of the general mass of the sound object. By input from instances of the control patch, a dynamic and complex modulation of the mass width is possible. The patch '_example_mass profile.maxpat' is configured in this way. This can be heard in the recorded sound file 'mass profile.wav', and in the included video file 'mass profile.mp4'. When subject to greater and more complex amounts of control input the spectral stability of the sound is here affected, skewing its type towards the fringes of the TARTYP, by introducing eccessive amounts of variation as opposed to stable values.

Processing mass nodes

The patch named "processing_massNode.maxpat" is used for saturating or diminishing mass nodes. A band pass filter is used for bringing out and reinforcing mass nodes, and a band stop filter is used for diminishing mass nodes. The patch '_example_mass

node.maxpat' and the included recording 'mass node.wav' shows the effect of a saturation and destabilization of some of the tonal nodes of the sound object. This can also be seen in the included video file 'mass node.mp4'. In this case, the tonal node found in the recording is being brought to resonance. The control input to this processing tool is of a complex manner and controlling the parameters of resonance and gain of the filter. This was done by searching through the data set for a portion of its data to exhibit a complex behavior. The result is ambiguous: at the same time a promotion of the tonal character of the sound object, and a destabilizing of the tonal nodes. This destabilization results in a rather different type of sound object, its typology moving towards the edge of the nine balanced objects in figure 4.1.

Promoting or diminishing *grain*, *allure*

The patch named 'processing_magnifyGrain.maxpat' is making available the possibility of a general magnification of grain and allure. by use of soft clipping. By processing the input signal with a hyperbolic tangent function, low amplitude, high frequency features like grain are increased in strength.

Again, control of this processing is not static, binary or linear; an instance of the control patch must be connected for the processing to function, with the result being a complex effect on grain and allure. As can be seen in the patch "_example_grain.maxpat", the control data is set to a point in the data set that shows some sign of distinct form, but also of a fair amount of allure and grain. This can be heard in the sound file 'grain.wav', and seen in the video file 'grain.mp4'. We now have a different sound object from the original, again having diminished musical values and promoted non-musical allure and grain, and thus skewed towards the concrete pole. The sound object is now considered to have less of a clearly recognizable function in musical organization.

Remarks on the analysis

The goal of this analysis has been demonstrating what types of sound object are found in such a setting: what types of sound object are afforded by the use of 'non-musical' and fluid control input and of being encouraged to search the material for objects of interest from a listening situation rather than determining control structures beforehand.

What results from this configuration is a shift from a fairly balanced sound object as heard in the original recording, towards eccentric objects of the type *sample* or *accumulation*. I am in these new sound objects not perceiving a well-formed constitution of mass over the course of its duration. In these types of sound object, the distinct values of the sound objects are not dominant features; it is in their *contexture*, in their inner morphology, in which we find their value, in the quality of their complex allure and grain aspects. Here, allure and grain are the dominant aspects of the sound objects, meaning that *variation* of allure and grain is in itself its *value*.

In the *Traité* Schaeffer outlines some ideas regarding a theory of *variation*(Chion 2009:81) because, in Chion's words,

> ...where a sound happens to vary, particularly through an unpredictable development in tessitura, it is very much more difficult to grasp its component criteria. Then the variation itself becomes the prominent phenomenon in the sound. (Chion 2009:81)

Considering this thesis has been very much concerned with *variation* as a value in itself, Schaeffer's outline of a theory of variation is perhaps one of the aspects of the *Traité* that has been of greatest interest to me.

I have in this analysis of the sound objects resulting from this project in general been pointing to a complexity but not presenting more specific thoughts of the form or function of this complexity. I do however argue that when *variation* is a prominent value of sound organization, sound is more easily articulating a fluid, complex sense of meaning, of symbol, as process rather than concept or idea.

Chapter 7

Concluding remarks

This thesis developed from a concern with the degree to which distinct values are drawn from sound, and what these values are. This was seen as a question of the ontology of music. The specific focal point of my inquiry was the algorithms controlling the playing back and processing of digital sound. This was due to my impression that the idiomatic and common ways of designing control algorithms are often of an abstract nature, with binary or linear results. This, I have argued, can limit the degree to which an exploration of the *concrete* pole of sound objects is possible.

The value of variation

Although this project involves partial deconstruction of traditional musical values, I have not here attempted to permanently dissolve all structure, nor has my intention been to simply tinker aimlessly with the crumbled fragments of tradition. My concern with the obscure aspects of sound or the *concrete* pole of sound should rather be seen as an attempt to shift the focus onto the special meaning of the value of *variation* itself as articulating a fluid perspective, a general ontology of "becoming". I do however consider a more detailed morphological discussion of the value of variation a mostly missing aspect of this thesis. This is due to Schaeffer's theory of variation mostly being an outline (Chion 2009:81) and not a complete conceptual apparatus.

On this note it should be stated that an occupation with variation does not imply that I wish to be moving towards a state of 'noise' or 'free improvisation'. I often find in music approaching pure 'noise' or 'free improvisation' that excessive variation can appear as a distinct and even static value itself, thereby gaining an abstract dimension. Hence the ideas presented here are not meant to lead to a certain style of presentation but is rather a general idea, applicable to any production and listening situation.

The epistemological scope of this thesis

Since the theories of Schaeffer, Kristeva and Barthes were developed there has been a general turn of discourse towards a realist, positivist or empirical trend. When I have chosen to produce a thesis that is perhaps positioned closer to the field of art theory, I have taken care to define the limits of the epistemological scope within which this thesis operates. This thesis should be read as an exploration of the aesthetic value of complexity, not as an attempt to inform cognitive science. When I use terms from Schaeffer and Kristeva that are also found in biology, like morphology and genotext, I do not intend to give the impression that the subjective perception of sound objects is quantifiable to the same extent. It should however be noted that Schaeffer's theories have functioned as a conceptual starting point for empirical research, as shown in (Godøy et al. 2010).

Mapping

One aspect of digital interfaces that has barely been mentioned here is the issue of the link between the gestures of the performer and the control data, or input mapping. This is to a large degree because I find the role of the human gestural performer problematic in this discussion of the concrete/abstract axis. Due to the strong role that human gesture has played in traditional instrumental music tradition, I consider gestural input to have a seemingly abstract intention. This thesis does not attempt to answer the question of how the abstract/concrete issue is dealt with in performance. I do however believe that perhaps one solution to this problem lies in the field of embodied music cognition, where other aspects of human interaction besides the overtly gestural can be used in performance

of music, with the help of various sensors, allowing for a more concrete expression.

Another aspect of mapping that has not been considered here is the visual interface of the control patch, which is dominated by a graphical representation of the temporal shape of the data set as it is shaped by the various algorithms. The implications of this visual representation is not discussed here. This is however considered a potential point of inquiry for its effect on the cognition of music.

What comes next

I have pointed to some of the areas into which the ideas discussed in this thesis could be expanded. Another subject that has been touched upon in this thesis through use of the theories of Cox is how Cox' materialist theory could have use in a discussion of the emerging discourse of the *anthropocene*, a newly suggested geological era in which humans are seen as the dominant actors on earth but by consequence also as having very much to relate to nature. Cox' theories would here be useful in understanding the function of art in articulating issues regarding a reconsideration of one's role in the world. I suspect that my move towards the concrete pole of sound could function as a possible method of articulating a relation to the world that is not distanced by the unique power of cognition but that is within a material realm where culture is very much situated.

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Appendices

Appendix A

List of files included digitally

This is a list of the files included with this thesis.

Max files:

- "CSVmorph.maxpat" - The core Max program
- "CSVmorph.class" - Java class file used in the core Max program
- "CSVmorph.java" - The readable source code from which the class file is compiled
- "CSVmorphResize.js" - JavaScript program for doing resizing operations
- "_Main.maxpat" - Main Max program, containing several instances of control patch
- "processing_sustainment.maxpat" - Patch for playing back sound file
- "processing_sustainmentPoly.maxpat" - Sub patch of sustainment patch
- "processing_sustainmentSize.js" - JavaScript code for sustainment patch
- "processing_massNode.maxpat" - Patch for processing mass nodes
- "processing_massProfile.maxpat" - Patch for processing mass profile
- "processing_magnifyGrain.maxpat" - Patch for processing grain
- "processing_massSite.maxpat" - Patch for processing mass site

- “_example_sustainment.maxpat”
- “_example_mass site.maxpat”
- “_example_mass profile.maxpat”
- “_example_grain.maxpat”
- “_example_mass node.maxpat”

Sound files:

- “chord.wav” - The original recording of a piano chord
- “sustainment.wav”
- “mass site.wav”
- “mass profile.wav”
- “mass node.wav”
- “grain.wav”

Video files:

- “overview.mp4” - A general demonstration of the workings of the patches.
- “sustainment.mp4”
- “mass site.mp4”
- “mass profile.mp4”
- “mass node.mp4”
- “grain.mp4”