COMPOSITIONAL USE OF DIGITAL AUDIO EFFECTS

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ABSTRACT

This article tracks the composers' desire for increased control over continuous musical variables through examples for music from the last few centuries. Examples are given on the development of notation and orchestration. A special focus is provided on electroacoustic music as a natural continuation of this development, and typical types of timbral development and structural discourse are brought forward in an attempt to explain which parameters composers of electroacoustic music are considering in their work.

1. INTRODUCTION

The focus of composers has shifted through centuries and across continents, but whatever the composers' ambitions and intentions have been, they have worked with sound. Parameters like pitch, meter, rhythm, dynamics, articulation, timbral coloring and space have had the composers' attention, and we can say that digital tools for detailed and refined signal processing are logical extentions of the composers' working with sound, with spectra, with spectral changes in time.

While digital signal processing is common in all kinds of recording and mediation practice today, this type of use of digital tools fall outside of the scope of this article, which limits itself to deal with the compositional use of the tools - not the purely reproductive aspects.

2. A HISTORICAL PERSPECTIVE ON THE TREATMENT OF TIMBRE

Since the beginning, musical composition has always been deeply intermingled with technical and technological know-how. This know-how has spread from conceptual techniques (such as, for example, counterpoint - cf. [1], [2]) at the time of vocal polyphony, to instrumentation technology and techniques (cf.[3]), to current state-of-the-art psychoacoustic knowledge and signal processing (cf., for example,[4] and[5]).

Therefore it is to be expected that digital technologies and techniques devoted to musical timbre manipulation would get the attention of composers. What is far from trivial, however, is to grasp to the fullest extent the historical path that has lead composers to digital techniques and the compositional approaches derived from them. We will try to analyze it through some musical examples.

Since vocal polyphonic music was at the root and beginning of occidental music, it is easy to understand that early techniques were devoted to developing polyphonic music so that voices could

Figure 1: The first page of the first edition of the Kunst der Fugue by Johann Sebastian Bach (1750)

somehow easily sing together, because this was the earliest and primal function of music in the western world. Such techniques go under the name of counterpoint and they are basically conceptual techniques dealing with pitch in the first place, and subsequently with rhythm and meter [1]. All other parameters (dynamics, articulation, timbre, space, etc.) are present in the sounding music, but they do not enter the realm of composition because their scope is still too limited to the vocal world alone.

The underlying technology was music notation, whose function at that time was to facilitate reproduction of musical works. Historically, notation started with approximate pitch, then precise pitch, then precise attack and duration, etc. This can be seen as the essential reason why a complex work such as the Kunst der Fuge by Johannes Sebastian Bach hardly carries any other information but pitches and rhythm in the original score. The first page of the first edition of the Kunst der Fugue (Fig.1) shows that Bach's primary interest is the display of the four-part thematic writing without other further indication, to the extent that the rest of the page is filled with textual information and even graphic ornaments.

Less than two hundred years later, the attention of composers has undergone a radical shift. Anton Webern, in his beautiful 1935 orchestral transcription of the Fuga Ricercata of Bach's Musikalisches Opfer [6] shows the great care taken in defining dynamics,

Figure 2: The first page of the Fuga Ricercata transcription by Anton Webern (1935)
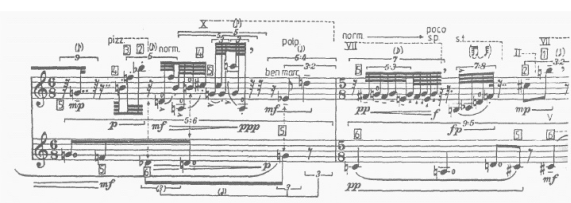

Figure 3: Brian Ferneyhough, Kurze Schatten II for guitar n.4, mm.26-27

articulation and first and foremost, timbre (Fig.2). The excerpt shows not solely a static quality of timbre (that is, assigning each part to a particular instrument or combination of instruments), but rather a dynamic compositional process where a timbral development for each voice is defined (for example, the first five notes of the first theme are presented by the trombone 'con sordina' first, then next two notes by the French horn, then the trumpet, etc.). Underlying technologies are multiplied: notation has evolved, instruments have developed and evolved, and the compositional thinking as well. The klangfarbe-quality of this score is well suited to illustrate the composers' readiness for timbre manipulation some decades before its actual feasibility. The evolution of music composition does not concern timbre exclusively. In a third (rather extreme) example, the Kurze Schatten II (1985-88) by English composer Brian Ferneyhough [7](Fig.3), we can see that while pitch has definitely reached an almost complete chromaticity (which is the closest approximation of the frequency continuum in a classical notation and instrumental context), all other parameters are rapidly shifting from discrete segmentations of their parametric space to a continuous evolution in time. The desire for treatment of continuous variables is easily fulfilled by digital audio manipulation.

After World War II, when electronics started to become viable means for music composition, composers were instantly aware of the importance of electronic (and later digital) technologies for their work. The German tradition of electronic music, with Stockhausen as a well known composer, utilized such tools with great ambition and vision. The French concrete music took another route, and the point of departure there was an exploration in depth of existing sounding material, perhaps with Pierre Schaeffer and Pierre Henry as the most known composers from the early years.

After the initial enthusiasm for the nearly boundless possibilities opened faded out, the functional and structural aspects modified by the new technologies started to appear clearly. Currently, the compositional use of digital technology can be categorized as follows:

1. *A different, deeper and total control over timbre*: indeed, this is the most important musical aspect opened by digital audio effects, and it is one that will be developed further in the next paragraphs

2. *Complete access to, and control over, all continuous musical processes*: as we already wrote, this has been an evolving process long before electroacoustic tools became available to composers. However, the new technologies introduced new quantitative aspects and explicit means of control (i.e. mathematics for one) directly into the compositional work.

3. *The hiding/modification/cancellation of the connotational aspects of instruments*: this is a deeper (perhaps more secret) function attributed by composers to digital technologies; the sound connotation of instrumental writing is certainly one of the major limitations to innovative compositional issues (cf.[8],[9]): it is easy to see that present-day composers fight the "weight of literature" of instrumental writing by all means (e.g. changing articulation, changing performing techniques, etc.); digital audio technologies are certainly welcome tools to provide new solutions to this problem.

4. *Modification/evolvement of rules for orchestration or instrumentation*. Simple sound reproduction has played a very important role in the way music is perceived (and therefore composed) - it has allowed for the imagination and building of musical and orchestral structures in a completely different manner than what was possible with purely physical means. Also, digital signal processing has allowed the simulation of new spatial contexts, sound movement and a spatial imagery that was previously impossible, and currently many composers writing is affected because they take into account the digital live-electronics transformations of the sonic space available today[10]

3. ELECTROACOUSTIC MUSIC

It is within electroacoustic music that digital tools are at the center of the composers' attention. Since before the inception of electroacoustic music, composers have envisioned new, radical music breaking away from traditional contexts and timbres, and pointing towards a future the composers saw as liberating, more open and desirable (also for political reasons). In the beginning of the twentieth century the futurists envisioned music based on industrial noise, which would be a cultural mirror of the strong forces at work molding society into modern shape. After WWII one discussed "nie erhörte Klänge" in Germany at roughly the same time as Pierre Schaeffer wrote his studies for the famous Concert de Bruits in Paris[11]. These important thoughts for the development of music for the future relied totally on technical means for both creation and performance, although their compositional aims were different. Current technology-based composition, loosely labeled computer music is equally dependent on technological means, which have also opened up whole new domains for compositional use -

through cross-disciplinary mapping and new media where the de-limitations between composition, teaching and mediation can dissolve. Digital data can be considered as raw material in itself.

In aesthetic terms, electroacoustic music has become a highly diverse field, but use of tools is largely shared between the genres. The art genre of electroacoustic music can be described as electronic, concrete, and acousmatic music, and the terms can loosely be gathered into the more enveloping term computer music. Overlapping in the direction of other art forms are soundscapes and music for multimedia - interactive with varying degrees of user influence. Bordering in direction of popular music there is electronica a new rebellious wave of noise-music - and within popular music there is techno, electronic new age, ambient etc. The diversity between styles is huge, and the terms are many.

Music in the mind of the composer, however, is different from music in the ear of the listener, and the objections to electroacoustic music as a style makes it evident that electroacoustic music is about something rather different from music for instruments.

Common for all these genres of music is the consideration of timbre is an intentional process - an ideology, an attitude, and a psychological characteristic[12]. On micro-level, composers record sound, process it, and they generate new sounds and process them further. On macro-level, the composers organize material, map ideas onto the material, or extract ideas from it. The music is mixed and produced for performance by loudspeakers, and possibly musicians in combination with this material.

4. COMPOSING WITH DIGITAL TOOLS - THE NUTS AND BOLTS

How music is constituted can be considered from many viewpoints, and in order not to get too entangled in discussions of musical style and the composers' intentions, this section will discuss the music from an analytical perspective. However, this approach is not trouble-free, since the impressions of the listener must pass through a perceptual filter, much shaped by cultural background and personal tastes. Although technical considerations are the ones most easily discussed, any answer to the title of this paper must be personal and subjective.

Accounting fully for a composition is not easily done, since the composer's personal preferences and choices enter at nearly every step of a composition process, regardless of how strictly structured the music is, and/or how predominant the compositional concept is.

Composers of electroacoustic music do this with a sound palate that is often developed anew for each work or group of works. A composer of electroacoustic music processes the musical material, thus changing the content and thereby the meaning of his/her material, and this differs from the distribution of musical ideas among the familiar and established timbres of for example a symphony orchestra. The tools are different, and therefore the process becomes different in electroacoustic from it is instrumental music. Instead of discussing musical form in the sense that one does when describing music from the past, it is perhaps more productive to describe the structuring process itself, in order to escape the confines of the fixed terminology developed from work with pitch-based music. Spectra and composition Although the first use of digital tools was in ordering pitches, electroacoustic has now a much stronger focus on the timbral aspects of composition - on the micro-level. The spectromorphological aspects of sounds are well described by Pierre Schaeffer in his Traite des objects musicaux,

and in the further developments by Denis Smalley [13] and Michel Chion, among others. On a timbral level, composers work with different types of spectra (notes, harmonic spectra, inharmonic spectra), they work with morphology (how spectral changes occur in time), they work with motion (where and how sound move in space, alone and in relation to the other sounds in the composition). The sounding material is further structured into gestures and textures, focused differently through filtering and amplitude changes into more complex temporal events. Spatial considerations enter into the composition process at every point, and are normally addressed by the composer, and the final works depend on the spatial modeling of diffusion for performance and public appreciation.

Musical discourse One could also intersect the compositional use of digital tools in another way. Composing music is done through setting up and executing musical discourse. According to Denis Smalley [14], musical discourse can be divided into six types (source-cause, transformational discourse, typological discourse, behavioral discourse, motion discourse, and tensile discourse (counterpoint)). The composers use digital tools to reinterpret timbral relationships and suggest changes in connections between timbres, they transform sounds in order to focus on their similarities and differences, and these techniques support the perception of interconnections in the material, and what the sounds invoke of responses in the listener. Parallelism in the material can also be enhanced by separating the material, both through placing the emphasis in different frequency bands, and through spatial placement in accordance with principles found in psychoacoustics.

Another way of creating musical discourse lies in the extension of instrumental sounds and gestures, through processing of the timbres ands capturing of parameter values from the musicians' control. These data can be mapped onto other material, and thus make this material "speak" with another voice than it normally has. This kind of substitution can be very effective, especially when the discourse includes play with identity and mimesis, and can easily be combined with appropriation of data from extra-musical sources. Timbral characteristics can also be morphed in direction of other timbres, and in this way be "forced" to provide harmonic spectra, in order to for example relate the sound better to pitch-based context.

The discourse needs an arena, an ontological space. In addition to the sounds themselves, this space is constructed with tools for spatialisation, both during composition and performance. Layering of sounds with different functions and significance belongs to the tensile discourse, and contribute significantly to the ontological space of the work. Restructuring methods applied to material on a micro-level can also be used on macro-level, and vice versa.

5. CONCLUSIONS

Digital tools greatly enhance the composers' opportunity to work with timbre, and additional aspects of timbre than those available through non-digital means. Technology-based music like computer music is drawing on the core development of the digital tools, although the skills needed for composing music are quite different from those needed in research and engineering. Computer music thus includes a broad range of human activity, and is an art form that explores humanity's depths and boundaries like few other examples from the arts.

6. REFERENCES

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