INTERFACES FOR SOUND: REPRESENTING MATERIAL IN POP MUSIC PRODUCTIONS

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ABSTRACT

Sound is the foundation of music composition in contemporary popular cultures. As the medium of popular music, sound is an important dimension in which artists establish their identities and become recognizable. This presents a radical departure from the focus on written notation and a pre-set corpus of instrument timbres found in classical Western-European music. To create in the medium of sound, contemporary composers utilise digital production systems with new interfaces, many of which are built upon the waveform representation as their cornerstone. This waveform representation is an interesting bridge between the analog world, from where it borrows its appearance as a seemingly continuous line, and the digital world in which it exists as a visualisation of a digital model describing continuous audio material in discrete sample points. This opens up possibilities to augment the waveform representation with interactions for algorithmic transformations of the audio material. The paper investigates the cultural implications of such interfaces and provides an outlook into their possible futures.

1. INTRODUCTION

Sound is the main component of contemporary music composition and production in popular styles. Whereas throughout the last centuries of Western music history, the temporal arrangement of notes and the timbre with which they became audible were separate considerations, these two realms have folded into one in most of pop music in the late 20th and early 21st century. Thus, contemporary music composition has firmly entered the era of sound. However, the realm of music composition technology has not yet fully followed suit, and instead remains centred around representational paradigms of the pre-sound era, as will be demonstrated. Composers and performers have found ways to deal with this situation, but the lack of actual representations of sound aspects in the creative environment may well be a dampening factor especially in the development of new musical creative talent.

In this paper, I will first investigate cognitive-cultural aspects of sound and in the second part analyze current representation forms in successful offerings of music technology.

2. SOUND IN CULTURE

In many ways, sound is not a new phenomenon or even cultural discovery. Traditional music cultures in Asian as well as African traditions have relied on sound all along [5, 11]. It was mainly in Western music cultures of the last centuries that note and timbre became separate aspects [4]. Notation was the driving force behind this separation, itself of course being a tool to enhance division of labor between a composer and the performer interpreting a written composition, giving it a voice in the form of expressive timbre. The boundaries were not that clear from the beginning, and we can find numerous attempts to exert tight control on timbre from a score, as well as attempts to free the interpretation by the instrumentalists from the shackles of an all to clear written composition. Non-Western music traditions have typically not relied on written notation for their compositions, but instead have nurtured canonization through collaborative practice, i.e., imitation and oral tradition. The resurgence of sound in contemporary global popular music cultures has led to a marginalisation of written notation, giving rise to alternative techniques and strategies that seem more appropriate for the needs of composers.

Culture in general and global pop culture in particular is driven by the dynamics of artist identities and their influence on the publics they reach. Popular artists define their way of doing things, broadcast by mass media and disseminated via social media, and this is then reacted on by those who feel addressed. In the past as well as the present, this has spawned fashion trends in clothing and hair cuts, and generated a wide variety of imitators. Next to the visual dimension of popular culture, it is the sound of the music productions by those artists that carries their identity in making them unique, yet at the same time promising the possibility to imitate. Sound and visual aspects combine to form a strong concept that can be recognised in all forms of communication. When one recognises a certain song or a piece of music as the work of a particular artist, the overall sound of the recorded or performed music often plays a central role. Sound as a concept is amazingly context-invariant, as Wicke points out [16], meaning that recognition of an artist or style works even when perceived in different spaces, on different devices, or in varying social contexts, where the actual frequency pattern of the acoustic phenomenon can be very different. It appears that sound is a recognisable entity that is greater than the sum of its parts, mainly being note frequency and duration as well as timbre. Sound

transcends those individual aspects and has become an overarching, unifying phenomenon that serves as a great source of identity for artists operating within popular cultures.

3. SOUND IN MUSIC PRODUCTION

The ephemeral, yet clearly recognisable character of sound as a phenomenon presents a considerable challenge for music production technology. After all, if the medium of recorded and performed music in popular cultures is sound rather than harmonic structures or timbre, then compositions have to be written in this medium. How, then, is this medium represented in today's instruments for music production, and which strategies can be identified for developing future representations?

The process of music production is usually hidden away from public visibility, but the duality of sound and visual representation is present there as well, albeit on another level, and has to be dealt with by the creators themselves. The semantic structure of a digital music production system is still very closely related to the technical setups of the analog world. The notion of signals flowing through an audio path is defining much of the layout of software interfaces, with individual elements of the interface mimicking the layout and the look of analog devices such as mixer boards, effects units, and recorders. On the instrument side, the picture looks similar. Analog synthesizers are often modelled in software form, with their interfaces being skeuomorphic representations of the original analog devices. The only truly digital representation of musical information found in music software are usually the note editors, which fit the bill of revealing information in discrete and numbered steps using a limited language of symbols. However, the typical representation style of the piano roll has that name because it has been used for the rolls holding the compositions for player pianos since the late 19th century, a technology which itself built upon barrel organs that had been available some 200 years earlier [7, 8]. Thus, this genuine digital representation has a history that is much longer than that of the music software it is a part of.

Another representation is an interesting mix of analog and digital: The waveform display and the tools offered to interact with it. Essentially, the waveform display is giving the false impression of being the representation of an analog continuum, by showing the form of a continuous wave. A very similar waveform would be drawn if one would measure the current flowing to the loudspeaker at the end of the musical signal chain, or actually the movements of the loudspeaker cone exciting changes in air pressure. However, on the computer screen this seemingly continuous line is drawn by individual pixels, and in a similar way, the corresponding signal is in reality only described by a finite number of individual samples, with no information as to what is in between. What makes this representation interesting is that, although it is rooted in the analog domain and could be produced there as an image, it becomes the foundation for new interactions that are only possible in the digital world. Here, algorithms can be devised that generate or extract information from the description to allow for interactions that would previously have required a human listener to be conceived of. These interactions with the description of the signal can be described as reproduction media turning into musical instruments, as Großmann has pointed out [3].

4. INTERFACES

In actual systems, we encounter a mixture of note-based and waveform-centric interfaces. For example, in a production software, or digital audio workstation (DAW) like Steinberg Cubase, we see both note-based and waveform-based tracks, operating with different data formats, MIDI for notes and audio files for waveforms. These are the classic representations of these data formats, and they also represent the aforementioned traditional "Western" separation between notes and timbre.

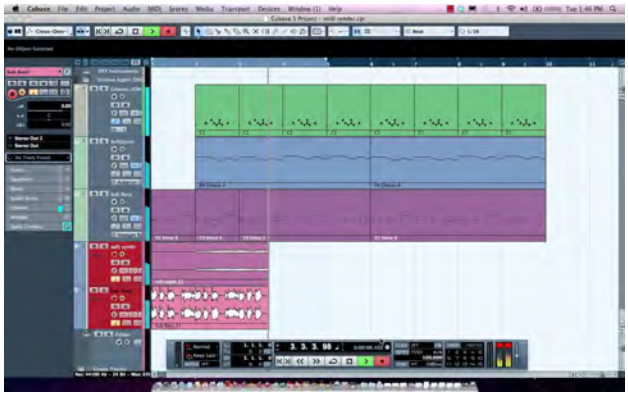

Figure 1. Note-based and waveform tracks in Cubase.

Representations such as those shown above are the baseline standard in most current music production systems. However, they have often been augmented with additional interactions that try to add more sound control to the editing of notes on the one hand, and on the other bring event-type editing control to waveforms.

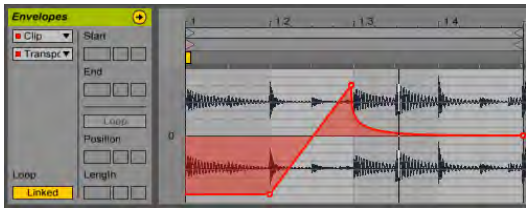

Figure 2. An envelope that controls a sound parameter in direct relation to the audio waveform in Ableton Live.

Figure 3. A waveform that has been split into its tonal components and mapped to a piano roll representation in Melodyne DNA [10].

There are examples of systems that go even further than this. The first would be the DJ software Traktor DJ for iOS, which established a paradigm of playing the waveform directly with the fingers, similar to how notes would be entered traditionally.

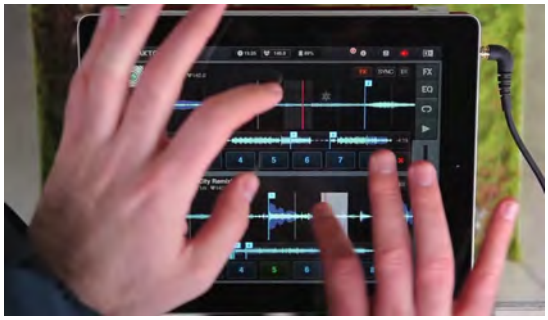

Figure 4. DJ Shiftee playing Traktor DJ in "Freeze Mode", where the waveforms have regions that can be played in realtime by touching them [6].

It should not come as a surprise that utilising waveforms as the representation of the audio material for performance purposes is found in DJ applications like Traktor DJ. After all, DJing as a cultural and artistic practice has been built on the foundation of dealing with recorded music in its phonographic form as material in the sense described by Großmann and Hanáček [2]. A similar tradition can be found in the sampling practices of hip hop, where devices like Akai's MPC are offering features to slice waveforms into small regions, which can then be played directly from pads on the hardware.

Figure 5. Akai MPC 500 with "Chop Shop" waveform slicing activated. Regions of the waveform seen in the display can be played back directly from the grey pads in the middle of the device [9].

On the desktop, DJ applications like Serato DJ or Traktor Pro have another enhanced waveform representation, where the energy of different frequency ranges within the audio material is visualised together with its absolute level. This makes sense especially for many electronic music genres, where it becomes possible to identify parts of individual instruments, e.g. see when a hi-hat line comes in or when a bass line switches to a different pattern [1, 12].

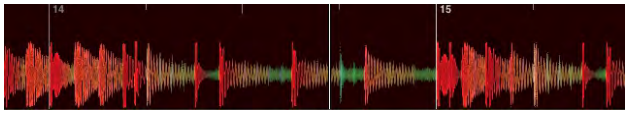

Figure 6. A multi-coloured waveform in Serato DJ.

Another example that greatly expands the waveform-based representation of sound is the "Drummer" feature in Apple's Logic Pro X production system. Here, a cultural context can be invoked by selecting a drummer-persona, which then makes available a prototypical variety of drum grooves supposedly expected from a drummer in this context. This high-level representation is interactive, as the user can change parameters like loud/soft or simple/complex, set complexity ranges for individual instruments, and also set a "Humanize" factor. This in itself is an interesting new representation, as it incorporates cultural semantics in an algorithmic rhythm generator, but it goes further by rendering the results of the rhythm generator as both note and waveform material into the main production environment. There, it can be subjected to further transformations in either domain, thus creating a highly flexible, integrated means of handling sonic material in an abstracted form.

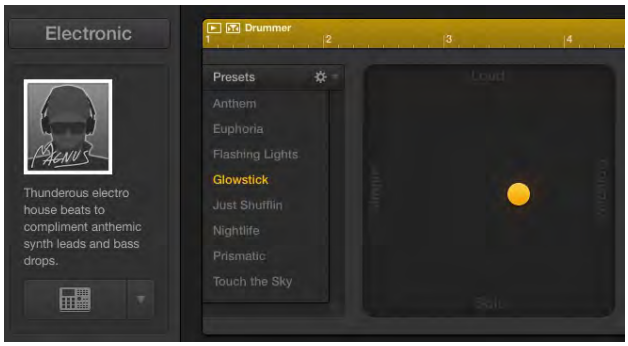

Figure 7. The "Drummer" instrument in Apple's Logic Pro X, with the persona "Magnus" loaded [13].

The "Drummer" in Apple's Logic music production system presents a far-reaching abstraction in the direction of representing sound by integrating high-level semantics from music practice with the more technological interfaces of interactive notation and waveforms. Even so, its approach also highlights the limitations of a design that tries to mediate between a simplistic approach of mapping various rhythmic variations onto four dimensions of parametrical freedom and the flexibility of full editing of the generated note material and its result in the audio domain. The cultural semantics used in this design are highly stereotypical, up to an outline of the drummer persona's head with visual cues such as headphones and sunglasses for the "Magnus" persona in the "Electronic" genre. Practices in popular cultures are well-versed in methods of cultural sampling, where semantics or even stereotypes are re-contextualised in other genres. However, whether a reductionist approach such as the Logic "Drummer" will indeed be taken seriously in established cultural practices remains questionable, at the very least.

5. CONCLUSIONS

The interactive waveform representation, with its additional enhancements, has become a mainstay in interfaces for music production in contemporary popular culture. Here, the phonographic material becomes accessible to instrumental practice and production techniques that would be impossible without digital technology, where audio material is sampled and thus laid open to algorithmic processing. Defining the degrees of freedom offered by this algorithmic processing by means of cultural semantics is an interesting and promising field, which is still in its infancy. The challenge here is that both realms have to be taken seriously not only in the technological configuration, but also in the design and presentation of interfaces for users. Notation editors and interactive waveform views are well-established instruments in the practice of electronic music genres, but so is the method of cultural sampling. In this latter area, definitions of styles and genres have been developed into a highly differentiated and dynamic field of cultural semantics, and their appropriate usage is paramount to the success of a technology being credible and thus acceptable for creative practices in popular cultures. Reductionist approaches may be adequate for the sake of easy adoption, but only when they are the result of adaptive fine tuning, taking the cultural context of its use cases into account. The level of differentiation in the offer will then be reflected in the depth of cultural specification in the contexts of its use.

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