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Contents

Maxim Müller Chapter 3

Interactive Ambient Music Generation

Abstract When it comes to composition and performance, conventional music is limited to the physical presence of competent musicians and their instruments. If nothing else, this kind of music is unique, not easy to reproduce and restricted in time and storability; not to mention interactivity. This work introduces a concept for Ambient music creation. An insight into the history of the Ambient genre and the analysis of representative songs reveal their specific properties. With the help of four music generation paradigms, those findings lead to a song synthesizer consisting of five song elements, each playing a specific role in the polyphonic composition. To provide an interactively changeable composition algorithm and a great variety of expressive characters as many controllable musical parameters have been built in. The music generated in this way is potentially infinite and non-repetitive. The concept not only allows for an experimental exploration of the expressive potentials of the composition algorithm, but also provides the storage of expression related parameter sets. Thus it is able to adapt to interactive contexts, e.g. video games.

3.1 Introduction

Music is more than the sum of its parts, it develops in different ways and always depends on the listener's mind. That is because our brains are not only capable of evaluating sound objectively in its acoustic nature, but also to interpret it in an emotional way. This interpretation is highly subjective because it depends on the context of the music's appearance and the listener's experience. However, some musical properties are linked to physical aspects of the human

body, e.g. rhythm of heartbeats and breath. This allows a universal consensus (Kungel 2008) and makes music one of the most beautiful forms of emotional communication. This particular ability of music has its price: it is time consuming; not only the listening (a) or the effort to understand, also—and especially—the creation (b). Two essential requirements for the creation of music are an adequate amount of musical education and physical presence. Despite all this effort, music is—once composed—finite, unique and without expert knowledge not appropriately controllable or editable (Berndt 2011): a disadvantage even digital storage technologies could not leave behind. These problems were first addressed by algorithmic music generation also called generative music (b). The desire to provide a listener with high-quality music that does not stress his attention (a) led to the birth of a new genre called Ambient music.

The aim of this work is to create a concept for flexible algorithmic Ambient music creation. It is based on previous work of Müller (2013) and Berndt (2014). The algorithm itself should not only be changeable in its emotional character of expression, but also realtime interactive in as many musical features as possible. That is what differentiates this concept from related work.

The first aim of this chapter is to provide a deeper understanding of the yet rather unexplored typicalities of Ambient. Therefore, several Ambient pieces have been studied and rules for their generation identified. In the following showcase pieces of Brian Eno will be analyzed in detail. In section 3.3 an introductory overview of music generation approaches will be given and discussed in the context of interactive Ambient generation. Further related works are presented in section 3.4. Our approach to this is then detailed and discussed in the remainder of this chapter.

3.2 Characteristics of Ambient

This section analyses exemplary Ambient pieces in order to determine necessary clues for the generation of ambient music.

Between 1978 and 1982 Brian Eno, former member of the band Roxy Music and an exponent of John Cage's philosophy of Noise music, created his albums Ambient 1–4. These provide a genre-defining musical abstract of the whole genre. With Ambient Eno gave a revival to Eric Satie's *musique d'ameublement* / furniture music (Schulze 2000, Collins & d'Escriván 2007) who wanted music to not only get integrated in the daily routine, but also to provide a fixed function like a bed or a chair depending on its spatial context.

This is a reading sample!

3.7 Discussion

This chapter introduced a concept for generating interactive Ambient music based on the results of the analyses in section 3.2 and the discussion of generative paradigms in section 3.3. A modular synthesizer was the first part of the concept. The unit generator patch provides the creation of different instrument timbres depending on the combinations of input parameters. This way it is not needed to change the structure of the system when creating a new timbre at runtime, but it also means that the system is not scalable. The timbres can be stored and loaded at runtime. The described sound synthesis is, however, limited, especially regarding the provided polyphony and timbres. If more is needed, the music playback should be streamed into external synthesizers (e.g., via MIDI). This functionality could be a gainful future extension of the system.

The Ambient music generator, so far, works with five musical elements with altogether eleven instruments. All instruments have their own assignable timbre, except of the three instruments of the sample element, which play recorded samples from the sample database (urban, nature and electronic sounds and noises). All elements primarily play on the same main chord and are adapted to synchronization by tempo. The Markov element also provides non-chord tones, if desired. Each element has its individual way to play the five tones of the main chord, rest and continue independently after a random but interactively adjustable time. The yoyo and chord element use permutations. The Markov element uses on-the-fly-trainable Markov chains to generate Ambient song structures. The bass and sample elements decorate the song musically. All elements are locally and globally controllable via diverse parameters at runtime. The combination of the parameters constitutes an Ambient song that can be saved and loaded.

A song generated this way may be non-repetitive—provided randomized play parameters—but musically monotonous. To address this problem features are added to design dynamic song structures and selectively influence the emotional character of expression. Therefore, two approaches are devised in order to build a complex emotional repertoire over time, one fixed and empiric, the other flexible and subjective.

On the meta level, complex song progressions can be created by the user via an event scheduler that processes the event queue like a generative grammar. These schedules can also be saved and loaded. Now, the user does not need to interact all the time with the program, in order to create longterm song progressions. The

Component	**Interaction At Runtime**	**Function**
Timbre Tester	test, save, load timbre	create timbre
yoyo element	permutation, frequency of permutation	play 1 instrument
bass element	—	play 2 instruments
Markov element	select a set of training melodies, order of Markov chain	play 1 instrument
chord element	arpeggio time, pitch range	play 4 instruments
sample element	select a set of samples, frequency of played samples	play samples
all elements	volume*, ADSR-envelope*, max. phrase time* & break time*, tempo*, lowpass parameter*, reverb parameter*, tone length*, frequency factor change timbre, hold tone, Markov chain for pitches	
meta	factor for every *-interaction, tag, save, load, delete song, start, stop recording, start ,pause ,stop player	control player & elements
song dynamics	static, dynamic, chaotic, happy, sad, threatening, relaxed, bizarre	dynamics, expr. of movements
scheduler	save, load, loop queue, start, stop queue	create event, event queue

Table 3.4: All components of Ambient song player, its functions and ways of interaction

produced output signal can be recorded. Table 3.4 summarizes all components of the concept and their interaction possibilities.

Due to its realtime interactive features and the purposeful control of the character of expression the designed player is suitable for the musical scoring of interactive environments like open-world games. In those games the world is often

created algorithmically with randomized parameters and it is potentially infinite. A normal and finite music score in this infinite world and undetermined playing time would repeat rather quickly and bore or even annoy the player after a while. The on-the-fly generated Ambient music, however, would never repeat and could adapt its emotional character to the game context (daytime, spatial location, gameplay mode, etc.). The advantage of the once initialized, predetermined but non-scalable unit generator architecture is, that it demands only a fixed amount of computing resources and does not become a bottleneck later.

3.8 Conclusion and Future Perspectives

When it comes to composition and performance, non-generative music is limited to the physical presence of competent musicians and their acoustic or electronic instruments. This kind of music is unique, not easy to reproduce and restricted in time and storage. Interaction with the listener is nearly impossible. All these disadvantages are addressed by generative music with its algorithmic composition and creation. Thus, the aim of this chapter was to design a concept for creating interactive Ambient music.

Section 3.2 gave a brief insight into the history of the genre Ambient and identified its specific properties. Section 3.3 discussed several paradigms of algorithmic music generation which are suitable for Ambient music. A research of existing Ambient music generators revealed their lack of interaction on an emotional level. This is where section 3.5 ties in. The results from these sections were used to design an interactive Ambient music generator and player that is able to purposefully control the character of expression on various musical levels.

Despite the many functions the design already offers, its musical quality is still in its infancy. The introduction of further dependencies among the elements may enhance their musical coherence. Further knowledge, for instance from the movie and game industry may refine the existing emotional categories and increase their quality. Furthermore, the concept so far focussed on the musical generation and its parameters, not, however, on the interface by which it is controlled. The sheer amount of parameters and their meaning would overstrain musically inexperienced users. A good starting point would be the design of user roles and their level of interaction to provide the corresponding parts of the interface.

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