Music education and digital design: 
An interactive approach to structure

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Background in Music Education. Musical structure is regarded as an integrated part of the music education curriculum. Nevertheless, understanding structure is generally considered a subject area for more advanced students, especially when it comes to complex pieces of music. From a pedagogical point of view, it is a basic assumption that the act of listening to music is linked to understanding music (Helms et al 1997). Thus, analysing the structure for its basic compounds and details is an important task during music lessons (Lemmermann 1978). Students can achieve this deductively (“Which instruments do you hear? Where do you find contrasts?”) or inductively (taking a detail as a starting point for more complex observations). Language is often considered an important medium to describe music. Therefore, many professionals try to teach a richer vocabulary to their students. Yet other means of analysing music exist: dance, acting, painting etc. (Colwell et al 2002). Repeated listening is the basis for a better understanding as well as the ability to actively listen to music. The latter is often in contrast to listening habits of students, as they would rather consume music than listen to it actively.

Background in Musicology & Digital Design. A lively debate on music that describes non-musical contents began in the 18th century and is continued until this day. Composers of programme music have traditionally had to stand harsh criticism of their work. “More an expression of perception than a painting”, states Beethoven beneath the first edition of his sixth symphony in an attempt to ensure that nobody interprets his symphony as “Malerei” (Painting). But even in the 20th century, this very symphony is criticised for its programmatic contents by composer Debussy (1921) and musicologist Dahlhaus (1987). For artistic professionals or theorists, programme music is an ideal basis upon which to build works of art that discuss music. Examples from various media exist: from Disney’s animated picture Fantasia (1940) to Ann Rachlin’s ballet stories on CD, to more recent computer-based works, such as Subotnick’s and Sibelius’ educational CD-ROMs. These works give programme music a new meaning and allow for a modern approach to a traditional form of art.

Aims. Our goal is to teach children the complex sonata structure of a symphonic movement within a playful interactive environment specifically tailored to young learners with little previous knowledge of musical analysis. Whether this can be achieved with our programme will be empirically verified in a follow-up project.

Main Contribution. Our project joins the long tradition of combining visual arts, literature and music, as seen in Greek theatre or Italian opera. With the development of the new media in the 20th century, further forms of this musical experience are being created that allow the new feature of interactivity. The challenging task of instructing younger children in complex musical structures is thus being made possible in a new shape. Investigating research from subject areas including musicology, polyaesthetics, games-based learning, music education and interactive design, we are developing an interactive computer game based on the first movement of Beethoven’s sixth symphony (Pastoral), using the powerful tools provided by digital design, in particular visualisation, gameplay, and, of course, interactivity. Including findings from the field of e-learning and other related research topics, we expect to achieve this primarily through:

• synergies from the combination of sound and image
• multi-channel learning
• relating to students’ altered way of perception in today’s world of technology and media
• self-regulated learning by the student (e.g. time required)
• the evaluation of previous interactive music projects

Implications

In order to play an instrument and gain an advanced appreciation of challenging compositions, it is indispensable to understand musical structure. Analytical abilities are particularly relevant to a younger audience that traditionally has not been targeted, as musical analysis is commonly considered too difficult an area for beginners.

Introduction

Can musical form as complex as the sonata structure be taught to children? Setting out from this question, e-learning is an immediate possibility with its ability to combine digital design with learning. Especially in the subject area of Music, a congruous relationship of visuals and sound can be easily established by the computer.

The tradition of e-learning is, for obvious reasons, rather short compared to other schools of thought on learning and education. Nevertheless, some key concepts and findings can be presented in order to explain in what way our interactive project relates to them.

Empirical evidence concerning e-learning has yet to reach a general consensus on its advantages and disadvantages, and the term itself lacks an unequivocal definition. What definitions and their implications have in common, however, is that e-learning allows new ways of teaching and learning that have – to a certain extent – not been possible before. Moreover, the roles of students and teachers have become subject to change (e.g. Baler 2001).

Without undermining critical perspectives on this issue, the main advantages of interactive design (and e-learning in general) that form the theoretical basis of our project are:

• synergies from the combination of sound and image (Knolle 1999)
• multi-channel learning: learning through more than one sensory channel is believed to be more efficient (a key concept of Polyaesthetics, cf. Mayer 1993).

Previous Music Projects

Technology-based music projects aimed at children have been available for decades. Disney’s Fantasia (1940) is an early example of design and music, which successfully reached an unspecialised audience. The short educational introductions by conductor Leopold Stokowski offer some insight into the music, but are not integrated into the design aspect of the movie.

Ann Rachlin, whose audio-cassettes on classical music have been published since the 1980s, shows an entirely different approach to teaching music. Though this technology forgoes visuals, Rachlin’s method is unique in its field. Rather than relying on technical terms or the chronological story of a composer’s life as is the case in most other music-based CDs for children, she extracts
the story from the music itself. In the case of a ballet, this may be fairly straightforward, but many of the compositions she chooses have little more than a title to work with (e.g. Manuel de Falla's *Nights in the Gardens of Spain*, Rachlin 1983). This evasion from pure theory is noteworthy.

So far, very few interactive projects have achieved a creative implementation of music and theory. Subotnik (*Making Music*, 2003) uses design and navigation in a simple yet graspable manner, making text superfluous. The main feature, however, where the user paints random colourful lines onto a digital canvas, leads to nonsensical music that may prove difficult for a child to grasp.

A prominent example, Sibelius’ *Groovy Music* (2007) teaches musical form and composition in a more stylised fashion. A great effort has been put into both the design and musical contents, rewarding children with instant results and thus sustaining the user’s attention.

While most of these interactive projects concentrate on composition, compendiums of musical instruments, or aural training, an evaluation of their qualities, especially the relationship between design and music, contributes to the development of a project with more specific contents.

Though it is advantageous for musical learning to have the possibility of side-by-side presentation of music, text, and still and moving images, the feature that sets computerised interpretations apart is interactivity with its implications of user control and non-linear presentation. These two elements will form the basis of our programme.

### The Pastoral Symphony Project

Before deciding on a visual interpretation of Beethoven’s music, the first movement needs to be analysed. As a sonata comprising two main and two side themes, the following (simplified) structure can be determined:

1. **Exposition**
   - Bars 1 – 66 1st Theme
   - Bars 67 – 115 2nd Theme
   - Bars 116 - 134 Extra Theme
   - Bars 135 - 138 Coda

2. **Development**
   - Bars 139 – 278 Variations of 1st Theme

3. **Recapitulation**
   - Bars 279 - 345 1st Theme

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**Choice of Music and Learning Objectives**

The principal aim of the proposed project is to test the ability of interactive design to explain complex musical structures. The format chosen for this project is to be understood as a teacher-assisted computer programme. After a basic introduction to the sonata structure by the teacher, the programme is to be employed as a theoretical and cultural in-depth exploration of musical form.

The first movement of Beethoven’s Pastoral Symphony is suitable for interactive purposes for several reasons. First, it represents a sophisticated sonata structure, owing to the scope of the musical piece (a movement of a classical symphony played by a full orchestra and lasting approximately twelve minutes). Second, the theme of the pastoral – derived from the ancient Greek and Latin poetry describing idyllic Arcadia and its shepherds’ everyday life – allows a harmonious visual interpretation. The third reason is that musical history can offer abstract theory an applied, meaningful context.

The expected learning outcome of the so-called *Pastoral Symphony Project* should embrace an extensive understanding of the sonata structure, including the overall structure of the movement (Exposition, Development, Recapitulation), the first and second themes and any supplemental themes. Facilitating this learning process, the musical material must be made aurally recognisable and distinguishable to the student. Furthermore, various sub-games should teach additional musical skills.
Taking Beethoven's title into consideration (Awakened cheerful feelings upon the arrival in the country), a pastoral countryside appears as the most obvious visual surrounding for this symphonic movement. It is important to avoid allowing the visuals to detract from the main purpose. Music – in this case musical structure – needs to remain at the core of the computer programme. A simple pastoral setting is chosen for the Pastoral Symphony Project, consisting of a conspicuously shaped landscape and various objects that roam the area (Fig. 1).

**Figure 1. Main Scene**

The most immediate concern is to represent the overall structure of the sonata: ABA. The landscape is thus divided into three parts: two lower fields (A) and a hill (B) dividing them. As a visual aid, dotted lines are drawn around these three sections, with the titles "Exposition", "Development" and "Recapitulation". The lower section of the landscape is reserved for a schematic representation of the four themes. In the beginning, they are uniformly grey. In the student's mind, the names of the themes have no specific meaning. As the game evolves, the themes acquire various colours, but for the time being the student is incited to concentrate on the shape of the landscape.

The initial attention is claimed by means of an introductory window that invites the students to participate in the musical exercise. Remaining within the pastoral theme, they are confronted by a shepherd, who asks for their help in driving the sheep to the river. A lesson is already hidden here: A classical symphony has more than one movement. The second movement of Beethoven's Pastoral Symphony is, of course, entitled Scene by the Brook. Agreeing to help the shepherd, the student presses the "Go!" button and delves into the main scene.

In the main scene, we find the shepherd and his sheep standing in the pastoral landscape. Four additional elements (a pond with bamboo, a cloud, a tree, and a horse and carriage) represent the four musical themes. Clicking on these elements refers the students to a separate game for each theme, upholding the user’s attention and giving the music meaning. To facilitate and visualise this process, each theme is assigned one colour.

The first musical theme (yellow) is archetypical for pastoral music, with its prominent woodwinds representing the flutes carved by shepherds. Pan, the god of Arcadia, wears a pan flute and the student solves a game of hangman, where the clues are the instruments heard in the orchestra. (Fig. 2).

**Figure 2. Theme 1**

The second theme (blue) is more vital and complex than the first. To reflect this quality, chaos and diversity assume the shape of clouds floating across the screen in synchrony with the music. The students’ rhythmic abilities are tested as they attempt to capture these clouds. (Fig. 3).
The third theme (purple), named "Extra Theme" to stress its optional status within the sonata structure, is played softly by two sections of the orchestra: the strings and the woodwinds. A butterfly tile game, stresses the delicate yet fragmented nature of this theme. (Fig. 4).

The fourth theme (red) – dubbed “Coda” for its position in the sonata structure – is an ostinato repetition of a triple figure. The rotary movement of a wheel reflects this music fittingly. The students are presented with five different tempi of the same theme, from which they need to select the correct one: Presto, Allegro, Moderato, Andante, or Largo. (Fig. 5).

Once the students successfully solve a puzzle, they are rewarded with an object (a pan flute, wispy feather, purple shirt and wheel). Directed back to the main landscape, the acquired theme is lightened up in its given colour – the finer structure of the sonata begins to make sense.

The overall structure and navigation of the Pastoral Symphony Project answers a potential question about difficulties of combining non-linear methods with the linear nature of music. To offer the student more interactivity, the four themes may be explored in any succession. Once they have been solved, they appear in a schematic structure below the landscape. This structure is a linear, left-to-right representation of all sections and themes. Clearly dividing the main scene into a non-linear and a linear representation is an easy way of avoiding confusion.

After having unlocked all four themes, the student is congratulated by Daphnis. Rounding off the lesson, the teacher will listen to the entire movement while the student follows Daphnis’ progress on a print version of the pastoral landscape.

Conclusion

The principles of music education and music theory can be implemented by simple use of image and sound in a digital environment, as shown in the interactive Pastoral Symphony Project. The main ambition of this approach is to enhance the students’ control over the project (both within their chosen pace and
order of learning). The implicit musical qualities that design can express (e.g. chaos in music by the hurried drifting of clouds) is to be regarded as a key factor in using visuals to their utmost extent.

In a next step, the success of this theoretic foundation will be tested in a school environment in order to monitor whether the students’ enthusiasm is heightened in comparison to language-based instructions, and to determine the musical learning outcome achieved by the interactive digital setting.

**References**


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1 Some authors, however, synonymously use the term *machine-based learning* and thus describe a tradition going back to the 16th century.

2 This research aims not to propose the new medium as a replacement for taught lessons or to appeal to the supremacy of computer-based learning.