REMUPP – a tool for investigating musical narrative functions

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Abstract. The changing conditions for music as it appears in new media was the starting point for the project *"NIM – Narrative Interactive Music"*. The overall aim was to explore interactive potentials and narrative functions of music in combination with technology and other narrative media – such as in film or computer games. The software REMUPP was designed for investigating various aspects of the musical experience and allows for experimental non-verbal examination of selected musical parameters in a musical context. By manipulating controls presented graphically on the computer screen, participants can in real-time change the expression of an ongoing musical piece by adjusting structural and performance-related musical parameters such as tempo, harmony, rhythm, articulation etc. The music can also be combined with other media elements such as text or graphics. The manipulations of the parameter controls are recorded into the software and can be output in the form of numerical data, available for statistical analysis. The resulting music can also be played back in real time, making it possible to study the creative process as well as the aural end result. A study utilized the REMUPP interface to explore young adolescents' knowledge about, and use of, musical narrative functions in multimedia. Twenty-three participants were given the task of interactively adapting musical expression to make it fit different visual scenes shown on a computer screen. The participants also answered a questionnaire asking about their musical backgrounds and media habits. Numerical data from the parameter manipulations were analyzed statistically. After each completed session, the participants were also interviewed in a 'stimulated recall' type of sitting. The results showed that the participants to a large degree displayed a collective consensus about certain narrative musical functions. The results were also affected by the participants' gender, musical backgrounds and individual habits of music listening and media use.

1 New musical functions

A characteristic feature of modern society is the increased interaction between man and technology. New technology requires new kinds of skills and knowledge – but is also the source of new knowledge. This new knowledge concerns not only technology itself, but also various societal and cultural phenomena related to the technological changes.

Kress (2003) has described how, in this new 'age of media', the book is being replaced by the screen as the dominant medium for communication – changing the basic conditions for the concept of literacy. The centuries-long dominance of writing is giving way to a new dominance of the image. But this new literacy of course does not only involve visual communication. Rather we are in the new media today making sense, or trying to make sense, out of an intricate assortment and multimodal combination of different media: images, written and spoken text, video, animations, movement, sound, music and so on. What creates meaning is above all the complex interplay of the different modes of expression involved. At the same time new technology involves an including quality, emphasizing elements of interactivity and active communication as the contemporary information society is gradually abandoning the communicational model of 'from-one-to-many' in favor of 'from-many-to-many'.

In the emerging multimodal and multimedial settings, the study of the role of sound and music is so far largely a neglected field. Remarkably so, since music and sound are often important expressive and narrative elements used in contemporary media. In formal music education, narrative music, as it appears in film, television or computer games (henceforth referred to as *media music*) is typically a blind spot and is rarely discussed at depth (Tagg & Clarida, 2003). However, considering the high degree of exposure to this kind of music in our everyday life, there are good reasons to assume that media music contributes to shaping knowledge and attitudes concerning communicational, artistic and interactional musical issues.

The changing conditions for music as it appears in new media was the starting point for the project *"NIM – Narrative Interactive Music"*, performed in collaboration between the Interactive Institute's studio Sonic and the School of Music in Piteå. The overall aim of the project was to explore interactive potentials and narrative functions of music in combination with technology and other narrative media such as image, text or sound – such as in film or computer games. This article will describe the use of the interactive analysis tool REMUPP ('Relations Between Musical Parameters and Perceived Properties'), which in the project has been used in several quasi-experiments (Cook & Campbell, 1979) to investigate the participants' knowledge and creative use of music's narrative codes and conventions.

1.1 Musical narrative functions

Before describing the use of REMUPP, the concept of *musical narrative functions* will briefly be discussed. In the process of defining a theoretical foundation for the project, a categorization of musical narrative function was commenced. The purpose was to provide a framework examining and defining *what* narrative functions are. This framework was aimed to serve as part of a theoretical and referential basis for further exploration of *how* the narrative functions are experienced, used and achieved. Since film is a medium with an established narrative tradition, having developed sophisticated musical narrative techniques and codes during the past century, the narrative functions of film music was the chosen focus for this categorization.

Around 40 different musical narrative functions were taken as a starting point and divided into six narrative classes: (a) the

Emotive class, (b) the *Informative* class, (c) the *Descriptive* class, (d) the *Guiding* class, (e) the *Temporal* class and (f) the *Rhetorical* class. These classes were in turn subdivided into altogether 11 (later 12) different categories.

The *emotive* class includes the *emotive category* – which is a general category, present to some degree in most cases where music is used in film (including functions such as *describing feelings of a character, foreboding* and *stating relationships*).

The functions of the *informative* class achieve meaning by communicating information on a cognitive level rather than on an emotional level. The class includes three categories – *communication of meaning* (such as *clarifying ambiguous situations* and *communicating unspoken thoughts*), *communication of values* (such as *evocation of time period, cultural setting* or *indication of social status*) and *establishing recognition.*

The *descriptive* class is related to the informative class in certain aspects, but differs in that the music is actively describing something rather than more passively establishing associations and communicating information. It is also different from the emotive class, in that it describes the physical world rather than emotions. In this class there are two main categories – *describing setting* (such as *physical environment* or *atmosphere*) and *describing physical activity* (such as *movement of a character*).

The *guiding* class includes musical functions that can be described as 'directing the eye, thought and mind'. It includes two categories, the *indicative category* (such as *pointing out details* or *establishing direction of attention*) and the *masking category.*

The *temporal* class deals with the time-based dimension of music. Two categories are included: *providing continuity* (*shorter-term* or *overall continuity*) and *defining structure and form.*

The *rhetorical* class includes the *commenting* as well as *contrasting categories*. Some functions in this class spring from how music sometimes steps forward and 'comments' the narrative. Rhetorical functions also come into play when image and music are contrasting, making visible not only the semiotic codes of the music but also the effect of the narrative on how we perceive the meaning of the music.

In a given situation, several narrative functions typically operates simultaneously on several different levels, the salient functions will quickly and dynamically change. A more detailed discussion of the musical narrative functions is found in Wingstedt (2004, 2005).

1.2 Changing roles

During the larger part of the past century, we have gradually gotten used to the role of being consumers of text, images and music. We have progressively accustomed ourselves to the objectification of media – by the means of books, magazines, recordings, films etc. Making media mobile has led to a re-contextualization and personalization of medial expression and experience. This in turn has affected how we establish visual, aural and musical codes, metaphors and conventions. The growing interest in mobile phone ring tones, the use of 'smileys' in SMS and e-mail, the codification of the 'SMS-language' – are manifestations of evolving technology-related media codes.

Before the modern technologization of media, experiencing drama or listening to music can be said to always have involved a certain degree of interactivity and variability. A live music concert will always respond to the "unique necessities of the individual time, place and people involved" (Buttram, 2004, p. 504), and never be repeated twice exactly the same way. Cook (1998) observes how music detached from its original context, assimilates new contexts. New musical contexts continue to evolve as technology and society changes. Viewing the individual listener and the musical sound as being active dimensions in the defining of the context also implies the listener as being interactively participating in the act of music. Rather than just talking about 'listening', Small (1998) uses the term *musicking* to emphasize a participatory view of the composer and performer - as well as the bathroom singer, the Walkman listener or the seller of concert tickets. In computer games, where the dimension of agency is salient, there is a potential for affecting the musical expression of the game music by interacting with the gaming interface.

The dimension of interactivity in the new media challenges the traditional pattern of '*Creator-Performer-Receiver*' (Fig. 1) – as well as the conditions for traditional institutionalized learning. The conventional progression of the musical communication process (as seen in western traditional music) is then challenged. Rather than what has traditionally been seen as a one-way communication model we get a situation where the distinction between the roles gets more ambiguous and new relations emerge between the actors involved (Fig. 2). This can be thought of as the music process increasingly getting participatory and inclusive rather than specialized and exclusive.

Figure 1: Traditional view of the musical communication chain.

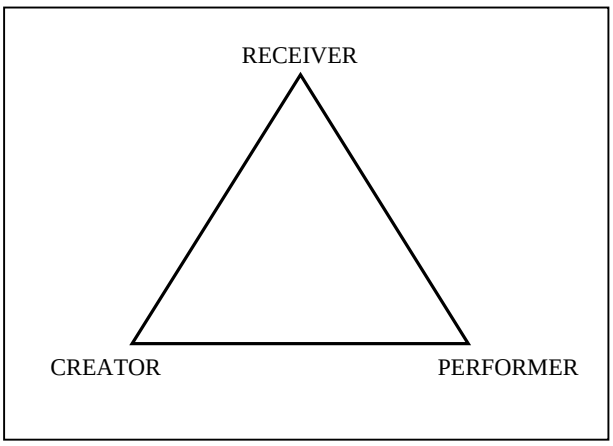

Figure 2: A relational view of participants in act of music.

2 Controlling musical expression

One solution to the challenge of achieving a higher degree of adaptability in music used in narrative interactive situations, is to facilitate user influence of the music at a finer level of detail (Buttram, 2004). This can be done by representing the music on a component or parameter level where the parameters are

accessible for control via the application, directly or indirectly influenced by user interaction. The concept of *musical parameters* is here defined as attributes of the musical sound: *structural elements* such as tonality, mode (e.g. major or minor mode), intervals, harmonic complexity (consonance – dissonance), rhythmic complexity, register (low or high pitch level) etc. - or *performance-related elements* such as tempo, timing, phrasing, articulation etc. (Gabrielsson & Lindström, 2001; Juslin, 2001). By altering musical parameters in real-time, the musical expression will, directly or indirectly, be affected by the listener/user in ways that is traditionally thought of as being the domain of the composer or performer, as discussed above.

Modifying musical expression by controlling musical parameters, directly accesses communicational and expressional properties of the music on a level that goes beyond the genre concept. Alteration of the musical performance can be accomplished without disturbing the musical flow and continuity, at the same time as it provides variation and dynamic expressive changes. Regardless of style, the same set of parameters can be made available, only their settings will be changed – e.g. the parameter *tempo* is a component of any kind of music and by using it to alter the speed of a musical performance it will at the same time alter some aspect(s) of the musical expression.

It should be noted that a basic assumption of the project is the view that the musical sound itself (or a certain musical parameter value) is not typically expressing a specific 'meaning' – but rather represent a *meaning potential* (Jewitt & Kress, 2003). The more specific musical meaning making is depending on contextual factors – like the interplay with the situation (including socio-cultural factors), the dramaturgical context and the interweaving with other narrative modes such as the moving image, sound effects and dialogue.

To explore the potentials of affecting musical expression by the alteration of musical parameters, the software REMUPP (Relations between Musical Parameters and Perceived Properties) was developed (Wingstedt, Berg, Liljedahl & Lindberg, 2005; Wingstedt, Liljedahl, Lindberg & Berg, 2005).

2.1 REMUPP

REMUPP (fig. 3) is designed for investigating various aspects of the musical experience and allows for experimental non-verbal examination of selected musical parameters in a musical context. The musical control is put into the hands of the experiment participants, introducing elements of creativity and interactivity, and enhancing the sense of immersion to a test situation.

Figure 3: REMUPP – an example of the user interface.

By manipulating controls presented graphically on the computer screen (as knobs or sliders), participants can in real-time change the expression of an ongoing musical piece by adjusting structural and performance-related musical parameters like tonality, mode, tempo, harmonic and rhythmic complexity, register, instrumentation, articulation, etc. The basic musical material, as well as the types and number of musical parameters included with REMUPP, can be varied and tailored by the researcher according to the needs and purpose of the study at hand. The music can also be combined with other media elements such as text or graphics.

Having the participants manipulate the music, makes REMUPP a non-verbal tool where the participant responds to the musical experience within 'the medium of music' itself, without having to translate the response into other modes of expression such as words or drawings. By responding to the musical experience in this way, the user will directly influence the musical expression – and thereby to a certain degree control his/her own experience. Managing the parameter controls requires no previous musical training. In a typical REMUPP session, the controls will be presented without any verbal labels or descriptions, making for an intuitive use of the parameters with a focus on the actual musical sound.

The possibility to have several variable musical parameters simultaneously available opens up for studying not only the individual parameters themselves, but also for investigating the relationships and interplay between the different parameters. Furthermore, combining the music with other media such as text or video makes visible the relationships between music and other modes of expression – making it possible to study specific meaning making factors appearing as the result of multimodal interweaving.

In REMUPP, the participants' manipulations of the parameter controls are recorded into the software and can be output in the form of numerical data, available for statistical analysis. The resulting music, including all the manipulations on a time-axis, can also be played back in real time, making it possible to study the creative process as well as the aural end result. The various ways to handle data, and the possibility to combine different data types, makes the REMUPP tool potentially available for use within several different types of research disciplines. As well as being a source of quantitative statistical data, REMUPP is also suited for use with more qualitatively oriented methods (such as observations or interviews) – or for combinations of different techniques.

REMUPP offers an environment, providing control over certain selected musical parameters, not including the finer level of the user selecting each individual note. Limiting the control in this way, affects the creative process as well as the final outcome. The participant might be described as being more of a co-composer (or maybe a performer), rather than a composer in a traditional sense.

2.2 Musical implementation

The concept and functionality of the REMUPP interface causes special demands to be put on the structure of the basic musical material involved – and thus on the composer of this musical material. Since the technical and musical designs will be interwoven with and interdependent on each other, the construction and implementation of the musical material becomes as important as the technical design. Unlike music created for more conventional use, the 'basic music' composed

for REMUPP must in a satisfactory way accommodate the parameter changes made by a participant. The desired expressional or narrative effects must be distinctly achieved at the same time as the overall music performance should remain convincing. Special consideration also has to be taken of the complex interaction of different parameters working together, since the perceived effect of any selected parameter change will be affected by the prevailing settings of the other parameters available. The musical material can thus be thought of as an algorithm, where each parameter is put in relation to all the other parameters in a complex system interacting on many levels. The composer must therefore carefully define and tailor the basic musical material to fulfill the demands of expressional situation at hand – as well as take into account the technical framework of REMUPP. These conditions form the basis for the formulating of artistic strategies that allows for a certain freedom of musical expression and development of musical form – leaving room for the decisions and actions of the listener/user. Rather than ascribing the detailed function of each individual note, the composer will define rules and conditions determining a range of possible musical treatments for a given situation.

3 Experimental studies

To better understand the properties of musical expression resulting from parameterization, several experiments, or quasi-experiments (Cook & Campbell, 1979), have been carried out. Initially, two pilot-studies were performed. The first study investigated selected parameters' perceived capability to change the general musical expression; the second study examined how the parameters can contribute to express emotions. These studies are described in several articles (Berg & Wingstedt, 2005; Berg, Wingstedt, Liljedahl & Lindberg, 2005; Wingstedt, Berg et al, 2005).

A larger study, *"Young Adolescents' Usage of Narrative Functions of Media Music by Manipulation of Musical Expression"* (Wingstedt, Brändström & Berg, 2005), utilizes the REMUPP interface to explore young adolescents' knowledge about, and use of, musical narrative functions in multimedia. Twenty-three participants, 12-13 years old, were given the task of interactively adapting musical expression to make it fit different visual scenes shown as 3D-animations on a computer screen (fig. 4). This was accomplished by manipulating seven musical parameters: *Instrumentation* (3 different instrument sets, 'Rock', 'Electronic' and 'Symphonic', were available), *Tempo* (beats per minute), *Harmonic complexity* (degree of dissonance – consonance), *Rhythmic complexity* (rhythmic activity), *Register* (octave level), *Articulation* (staccato – legato) and *Reverb* (effect amount). The study took as a starting point one of the descriptive musical narrative functions discussed earlier: *Describing physical environment*.

Three different visual scenes were presented, depicting different physical settings: *City Night* (a dark hostile alley under a highway bridge), *In Space* (inside a space ship looking out to planets and other space ships through a giant window) and *Picnic by the Lake* (a sunny day by a small lake with water lilies and butterflies, a picnic basket on a blanket). There were no people in these environments, to keep the focus on the actual settings. The graphics were realized as animations, but with the movements used sparingly, so there was no visible plot or story – they could be thought of as 'moving still images'. The idea was to give an impression of these places being alive, ongoing, in process – representing 'present tense'.

Each visual scene was presented three times, each time with a different 'basic musical score' as accompaniment (the presenting order of the altogether 9 trials was randomized). The initial values of the seven musical parameters were randomized to avoid systematic errors resulting from the initial musical sound. The instruction to the participants was to 'adjust the musical expression to fit the visual scene as well as possible'. The controlling faders were presented without any written labels, to make the participant focus on their functions only by listening to their effect on the musical expression when moved.

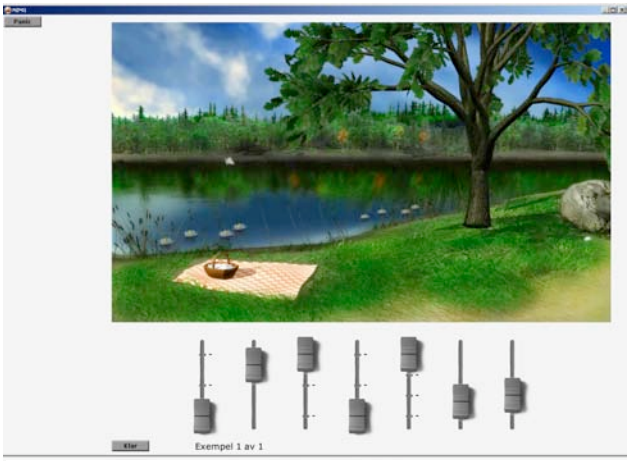

Figure 4: An example of REMUPP's test interface – a screenshot of a 3D animation depicting a 'physical environment' (Picnic by the Lake) and below the faders controlling musical parameters.

The participants also answered a questionnaire asking about their musical backgrounds, and habits of listening to music, watching movies and playing computer games. Numerical data from the parameter manipulations were analyzed statistically to search for tendencies within the group with regards to the preferred values of the musical parameters in relation to the different visual scenes.

After each completed session, the participants were also interviewed in a 'stimulated recall' type of sitting, where they got to watch and listen to their process as well and results, and discussed and commented on their creative decisions in relation to the musical and narrative expression experienced and intended. Additionally, they got to rate their favourite version of each of the three movies ('which one are you most satisfied with?'), based on how well they thought the music fitted the visuals.

They also discussed the perceived functions of the seven parameters being used, and the experience of interactively controlling the musical expression.

3.1 Results

The results from the statistical analysis of the parameter settings, combined with the questionnaires, showed that the participants to a large degree displayed a collective consensus about certain narrative musical functions. This intrinsic consensus can, in turn, be interpreted as mirroring extrinsic norms – a knowledge about existing conventions that we encounter in film, computer games and other narrative multimedia.

A short interpretation, summing up the results of the participants, goes as follows: The pastoral scene by the lake is expressed by the group of participants by the use of the

'Symphonic' *instrumentation* consisting primarily of flute, strings and harp – a classic cliché for expressing pastoral settings in Western musical tradition. The darker and more hostile urban City scene, as well as the more high-tech and mysterious Space scene, are portrayed using electronic instruments. In the two latter scenes the *register* is also generally lower, producing darker and more sombre sonorities than in the brighter Lake scene. The basic *tempi* of the Space and Lake scenes are kept relatively low, reflecting the tranquillity of these situations – although the *rhythmic activity* in the Lake scene is higher, maybe expressing the movements of the fluttering butterflies. The tempo of the City scene is slightly higher, although with a low rhythmic activity, which can be seen as reflecting a higher degree of suspense. The more confined locations of the Space and City scenes are portrayed by the use of more *reverb* than the open air, and less dramatic, Lake scene. The *articulation* of the music for the Lake scene is also shorter, although not down to a full staccato, providing an airy quality allowing more 'breathing' into the musical phrasings.

The results were also affected by the participants' gender, musical backgrounds and individual habits of music listening and media use. A general trend was that participants with a higher level of media use (spending much time playing computer games or watching movies) also exhibited a higher awareness of (and conformity to) musical narrative conventions. A more detailed discussion of these results is found in Wingstedt, Brändström and Berg (2005) and Wingstedt (2005).

The above mentioned results are drawn from the statistical material. However, at this point the statistical material can mainly indicate answers to the 'what' (what was being done) questions. In upcoming papers, analyses of the interviews will be presented – aiming to also contribute some answers to the 'why' questions and to include matters related to creative issues, including choices made (conscious or intuitive) in order to follow or deviate from narrative and expressional codes and conventions.

4 Conclusion

This interdisciplinary project has resulted in the development of a theoretical groundwork concerning topics such as narrative functions of media music, and artistic and practical strategies for composition of interactive music – and also in development and innovation of technical nature.

The various results gained in the study indicate the usefulness of the REMUPP interface as a tool for exploring musical narrative functions. In manipulating the musical parameter controls, the participants achieve meaning through 'musical actions', which is different from using language. For example, to just say that a visual setting is 'scary' is not the same as expressing it musically. To determine 'scary' by (for example) assigning a low register, setting a certain degree of harmonic dissonance and rhythmic activity, adding more reverberation and slowing down the tempo, demands a commitment to a higher degree than just saying the word.

Not only the music, but the interweaving between different modes – in this case especially visuals and music – is what creates meaning in the multimodal ensemble (Kress, Jewitt, Ogborn & Tsatsarelis, 2001:25). REMUPP provides conditions for such kind of interweaving. In experiencing a narrative multimodal situation, there is a tendency for the audience or user to treat media music on a relatively subconscious and unreflecting level since the visuals tend to achieve salience. Working with the REMUPP interface has made it possible to bring the music to the front, to make visible the implicit knowledge about musical narrative functions.

The results strengthen the assumption that high exposure to media and its associated music contributes to the shaping of knowledge and attitudes of media music. We learn, not only *thru* the 'multimodal texts' but also *about* the modes themselves, from simply using media in informal situations. This gives rise to questions about how learning takes place in pronounced multimodal settings, how we become 'multimodally literate' by using the various modes – and the role of music in such situations.

REMUPP offers a potential for investigating a range of music-related issues from new angles, presenting alternatives when compared to traditional test methods. Firstly, the non-verbal nature of the interface allows for attaining types of data that are difficult or impossible to access using verbal descriptions. Secondly, the tool provides opportunities for exploring various aspects of contextual relations, intra-musical as well as extra-musical. Thirdly, the participants' interaction and control of the musical expression, allows for investigation of aspects of creativity and establishes a deepened sense of agency for the participant. The emphasis on interactivity and the high quality music engine provides an environment resembling a computer game, which enhances immersion and effectively works against the otherwise potentially negative effects of the laboratory situation.

In describing the REMUPP interface, emphasis has been put on its use as an interactive non-verbal tool suited for research of various aspects of musical experience. It should be noted however, that the technical and musical concepts behind the interface also offer a platform for other potential applications. For example, the system provides a promising environment for the creation and concept development of live interactive music performances. Also, the technical as well as artistic concepts developed can be thought of as an embryo for a 'musical engine' to be used for computer games and other interactive situations.

By taking charge of the possibilities offered by contemporary interactive and narrative media, a new world of artistic and creative possibilities is emerging – also for the participant in the act of music traditionally thought of as the 'listener'. It is an aim of this project to serve as a platform for further studies towards knowledge and understanding of the potentials and challenges offered for music in the emerging communication media.

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