Electronic, aesthetic and social factors in Net music

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This article presents results of a study on 'Net music' that was initiated in 1996 and presented in 2002 as a doctoral dissertation at Martin-Luther-Universität Halle-Wittenberg in Germany (Föllmer 2005). Since no scholarship encompassing the whole field as defined by the term 'Net music' has been published until recently,[1] the study involved the collection and analysis of a broad spectrum of musical projects that employ the Internet in very different ways. Around seventy examples considered to be classifiable as Net music were chosen to represent the scope of different approaches to how electronic networks can be used for making music. The first part of this article describes three outstanding examples of Net music and their interplay with particularly important characteristics of electronic networks. The second part discusses a possible typology of Net music.

1. THREE PROBLEMS OF NET MUSIC AND THEIR RESPECTIVE SOLUTIONS

The term 'Net music' comprises all formal and stylistic kinds of music upon which the specifics of electronic networks leave considerable traces, whereby the electronic networks strongly influence the process of musical production, the musical aesthetic, or the way music is received. Three examples of Net music are described here to delineate the scope of different artistic approaches currently being practised on the Internet. Each example is discussed in terms of its interplay with a specific problematic of electronic networks, namely the contexts of space, presence and machine.

1.1. The problematic of space

One of the characteristics of the electronic space of the computer and the Net is that perception and orientation are not based on Euclidian, three-dimensional space. While two- and three-dimensional models of space are frequently used, spatial factors are essentially irrelevant for the structural relations inside the Internet. Spatial dimensions are nothing but a metaphor meant to help cognition do the shift from our well-known three-dimensional world into the electronic world of indefinite dimensionality inside the computer and the Internet.

The computer desktop is the most prominent metaphor of this kind. However, depending on the purpose – for example in making music – other metaphors can be more helpful. Musicians are therefore experimenting with different kinds of metaphors and possibilities for the representation and transformation of phenomena from the three-dimensional into the electronic world and vice versa.

The networked installation *Global String* by Atau Tanaka and Kasper Toeplitz (1999) connects two or more simple steel strings in dislocated spaces by means of a technical metaphor. Visitors of the installation pluck a string in their space while players in other locations pluck their own physical strings (see figure 1). However, all players hear only the sound of the same single string. Tanaka and Toeplitz use physical modelling synthesis, simulating physical vibrations induced by visitors in multiple spaces on one central computer (Tanaka and Bongers 2001). Using this principle they are able to bring the virtuality of electronic space to the foreground of the mind, since it is capable of mapping the actions of all connected users onto one single virtual string.

1.2. The problematic of presence

Another important characteristic of Net music derives from the space problematic itself: where there is no physical space, leaving users no way to encounter each other physically, users can only confirm the actual presence of each other by taking a specific action. The action would thus relate previously unrelated elements in such a way that a group can establish a collective meaning.

An example illustrating this phenomenon can be found in the networked performances by the League of Automatic Music Composers, founded in 1977 at Mills College in Oakland (Bischoff, Gold and Horton 1978). Using the first privately affordable microcomputer, the Commodore KIM-1, the League connected their computers in such a way that players were able to intervene into each other's playing (see figure 2), hence

[1] In September 2004 a CD-ROM (Föllmer 2004) was published that includes audio and video clips, screenshots and other graphic material, texts by the artists and project descriptions (in German and English), as well as running code of these Net music examples (executable software in different formats).

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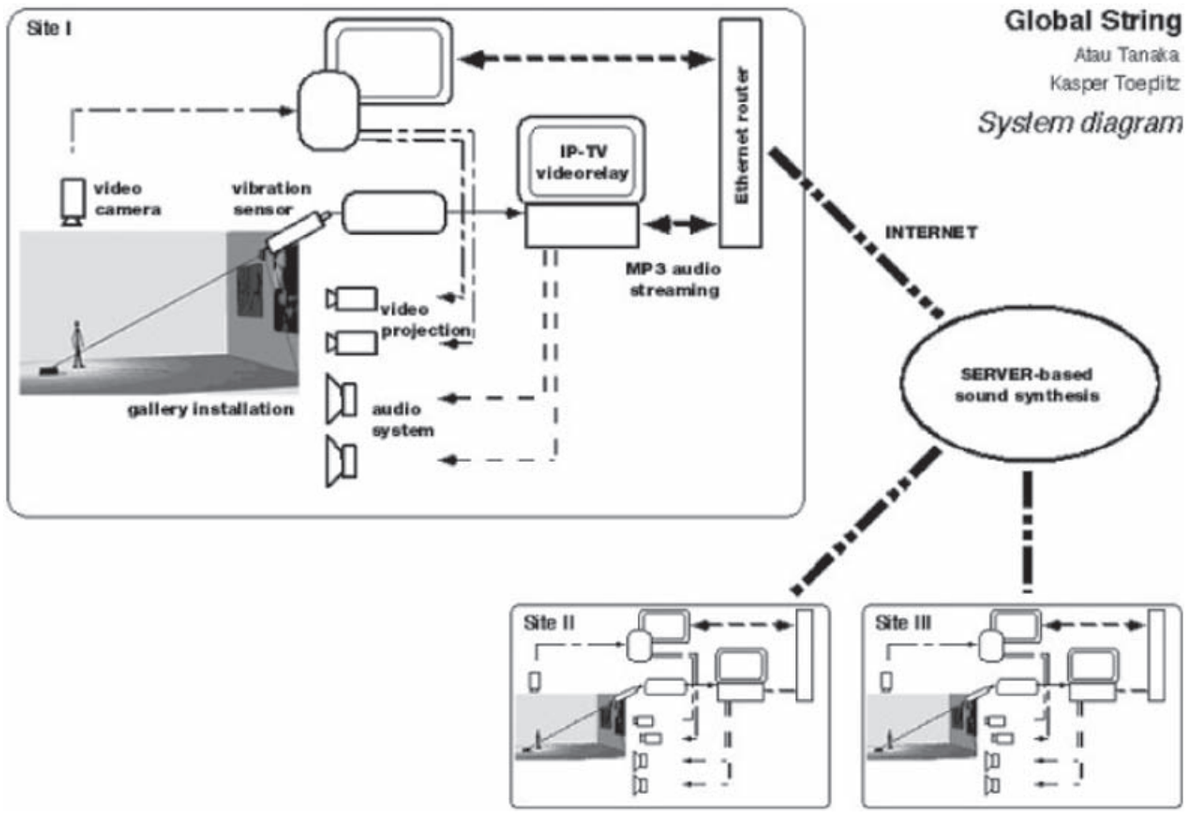

Figure 1. Functional diagram of *Global String* by Atau Tanaka and Kasper Toeplitz. Visitors play their section of the string, knowing that the string that produces the vibrations actually heard is hosted on a networked computer. Hence, the traditional attribution of the terms 'real' and 'virtual' is reversed; the piece of steel in front of a visitor is only one of many possible representations of a single electronic structure. Source: http://www.sensorband.com/atau/globalstring

enabling them to 'intra-act'. The concept of 'intra-action' (Moore and Place 2001) describes processes in musical systems wherein single players' actions intercede into those of the other players, thereby establishing a strong presence. Like all of the performances by the League, this one from 1978 did not use the Internet itself but relied on a local network configuration (Bischoff and Brown 2002).

1.3. The problematic of machine

The third characteristic of electronic space is based on the fact that the networked computer is not a 'machine' in the traditional sense of the word. First, the computer is not a clearly defined apparatus, but rather a universal machine (Grassmuck 1995) capable of representing a different machine every other moment depending on the data it processes or receives, for instance over the Internet. Second, the computer is not only capable of emulating so-called trivial machines which react identically when receiving the same input over and over; instead, it can also represent non-trivial machines that change their behaviour plan according to hidden rules (Foerster 1993). Such a non-trivial machine exceeds the narrow borders of a reactive system. It can show traces of autonomy within a certain framework. As long as the scheme of behavioural change is not obvious to the user, the machine represented by the computer cannot be controlled completely, but it can only be partly regulated within the context of its own inherent development. For music, this difference is essential as evidenced by the fact that the step from concepts based on processes of regulation – as in most forms of communal and ritual music – to those dominated by score-based control or conducting – as in major parts of Western art music – is understood as a key development in music history (Kaden 1996).

A musical example focusing on this characteristic is *nebula.m81* by Netochka Nezvanova (Nezvanova 2000). This software autonomously downloads HTML pages from the Internet, converts them into audio files by changing the file header, and then plays them, giving the user only a limited means of regulation using the mouse and a selection of buttons. The same data is used to configure automatic processes of

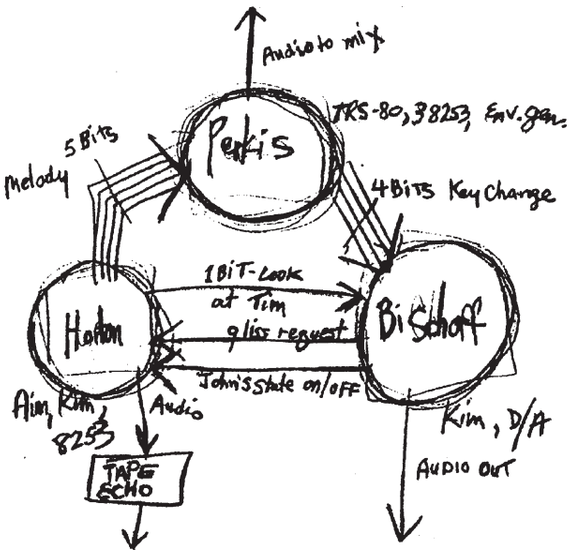

Figure 2. Structural diagram of a networked performance by the League of Automatic Music Composers from 1978 that included David Behrman as a guest performer. On each of the four computer-controlled systems, sounds are produced according to individual rules. In some cases the execution of these rules is influenced by digital data received from co-players. In other cases playing builds on audio signals received from others. Graphic: Rich Gold.

graphic synthesis (see Figure 3). The main influence on the visual and acoustic output is a result of machine-based, mostly non-transparent processes. Thus, *nebula.m81* cannot be played under the control paradigm of standard musical instruments. Using this software is more akin to navigating an open score as, for instance, in John Cage's indeterminacy pieces or Joel Chadabe's concept of 'interactive composing' (Chadabe 1997: 293). However, those concepts are extended here by distinct autonomous activity of the machine, employing unknown data from the Internet.

2. A TYPOLOGY OF NET MUSIC

Systematic analysis of all examples surveyed in the study led to the identification of twelve types of Net music and an inductive extraction of three criteria describing a three-dimensional space of characteristics. Rating the strengths of these criteria for each example of Net music helped describe the twelve distinct types more precisely and group them into five clusters. The three dimensions were determined to be:

(1) 'interplay with network characteristics', which describes the extent to which structural characteristics of electronic networks shape the resulting music,
(2) 'interactivity/openness', which relates to the degree of interactivity offered to the listener, i.e. the extent to which a type of Net music is open to activities by whoever wants to use it, and
(3) 'complexity/flexibility', which defines the degree of musically effective complexity and variability.

Figure 4 lists the twelve types of Net music. Their names identify the main purpose or general conceptual-structural characteristic of a type of projects. The figure also illustrates their grouping into five clusters. Names of the clusters refer to general principles prominent in the types grouped inside the respective cluster.

The cluster 'The Forum' (I) contains three types of projects (A/B/C) in which the Internet does not directly intrude into the production process. Instead, members of interest groups use 'Discussion Forums' for the exchange of information on the development of software instruments or experimental performance projects. 'Remix Lists' employ the Internet for the exchange of sound files to be modified consecutively, resulting in musical pieces that evolve over time. In 'Archive Projects', new forms of archiving and accessing audio files are developed that organise the data in decentralised, non-hierarchical manners and insist on keeping the archived cultural products open for public use. Music production linked to these types does not normally take place online, but in private space.

The clusters 'The Game' (II) and 'Algorithm and Installation' (III) have certain similarities: all of the types included are accessible online and can be used interactively without special expertise. However, ratings of the dimensions 'Interplay with network characteristics' and 'Complexity/Flexibility' both differ strongly between the two clusters. The two types of 'Soundtoys', on the one hand, employ concepts closely related to conventional, user-friendly musical instruments with a restricted repertoire of sounds, thus often leading to simple musical results. The types in the cluster 'Algorithm and Installation', on the other hand, tend to restrict the range of interactivity to some degree, while at the same time relating more explicitly to the specifics of electronic networks and expanding the complexity of sound production and structuring executed by the software. Examples of 'Hypermusic', for instance, can be described as fields of sounds that are not so much 'played', but 'navigated through' by the listener. 'Real/Virtual Space Installations' probe musical effects of transitions between physical and virtual space. 'Algorithmic Installations' offer sensual experiences or critical reflections of the properties of electronic space.

The group 'Instrument and Workshop' (IV) includes software-based 'Instruments' and 'Authoring Software' based on new conceptions of musical instruments or possibilities to design such instruments by oneself. As opposed to musical instruments classified as soundtoys, these types offer significantly higher

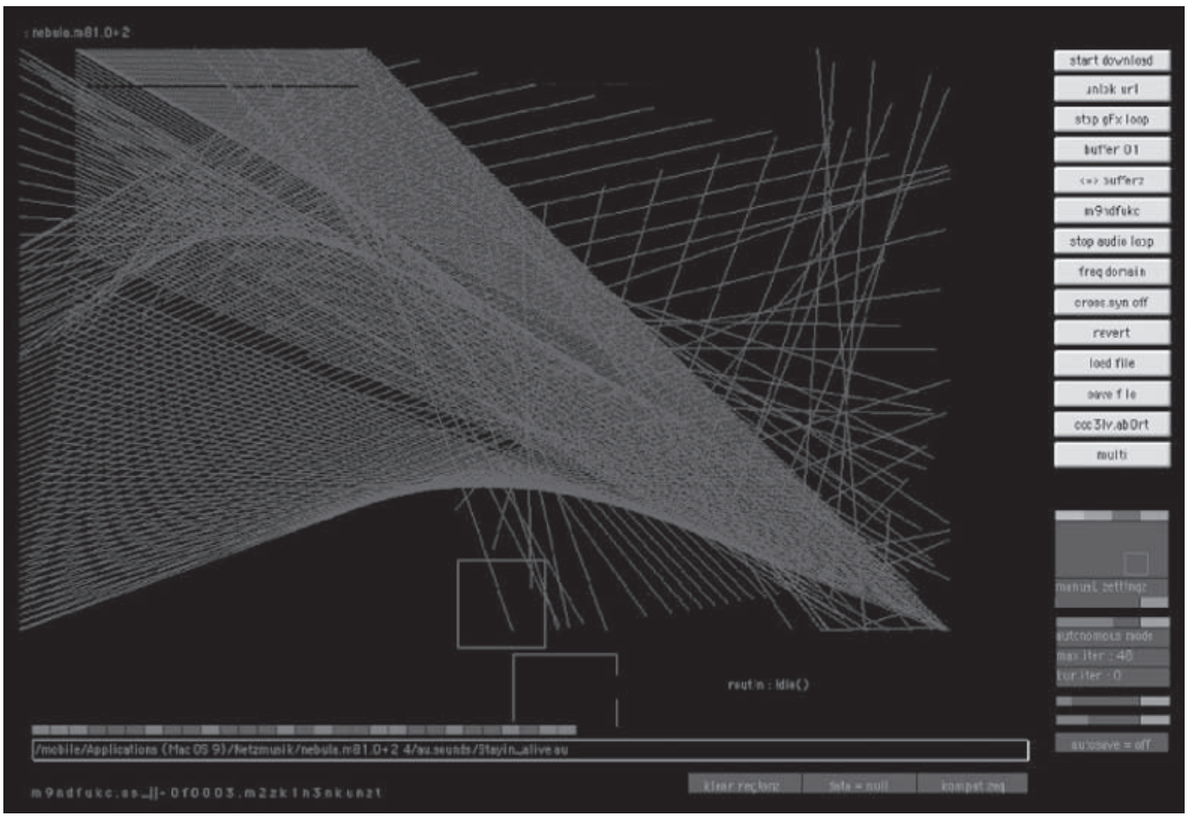

Figure 3. Graphical output (main area) and control interface (bottom and right) of *nebula.m81* by Netochka Nezvanova (screenshot).

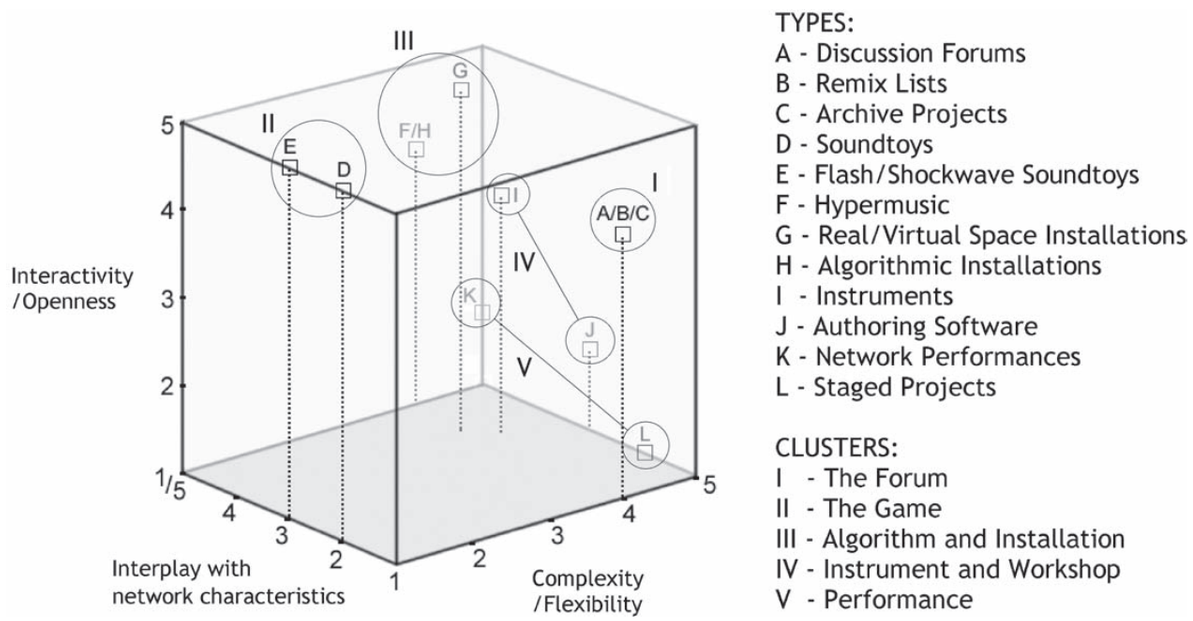

Figure 4. Spatial order of the twelve types of Net music (A–L) in relationship to the three dimensions 'interplay with network characteristics', 'interactivity/openness' and 'complexity/flexibility', scaled from 1 to 5. Types are rated on the basis of averaged ratings of single projects. In mapping the types, the clusters I–V are formed. Graphic: Mathias Hühn / Golo Föllmer.

degrees of complexity concerning the sound material as well as the possibilities to control them, for example by the involvement of 'control sharing' between multiple players or between players and machines.

The cluster 'Performance' (V) concentrates on performance in front of an audience that includes the listeners in the process of musical production only to a minor degree. However, relating to general discussions about how networks can (or even should) open cultural production to all parties involved, projects of these types strive to expand the possibilities of using participatory models while at the same time protecting musical quality by engaging experienced performers. 'Network Performances' develop a large range of structural solutions for this problem, albeit with different effects. The existing examples of 'Staged Projects', on the contrary, concentrate on thematising the problem in the context of a libretto instead of effectively involving the audience in the work's structure.

The distinction of the twelve types illustrates that the term 'Net music' does not represent a group of phenomena with similar features and goals, nor stemming from a particular aesthetic tradition. Instead, it encompasses a field of highly diverse technical approaches, communicational concepts, and musical aesthetics and styles.

The specific electronic structures of the Internet are playing a vital role for networked music making. They offer new possibilities, including easy access to complex music software and simple instruments, ensemble playing between dislocated players, and the option to play in intra-active system setups.

2.1. Interplay with network characteristics

2.1.1. Communication and composition

The specific relationships between Net music and artistic traditions are widely varied. In some cases, concepts and methods from existing techniques of experimental music, sound art, fine arts, pop music, and other areas of cultural production are adapted to fit the conditions of networks. In a number of other cases the reversed approach can be observed. In such instances, genuine principles of networks are adapted to the processes of sound production.

This observation leads to the identification of two opposing paradigms: a 'composition paradigm' and a 'communication paradigm'. Some examples of Net music that can be considered to be based on a composition paradigm include such projects as The Hub (Gresham-Lancaster 1998), a successor of the League of Automatic Music Composers, mentioned above, and *Quintet.net* (http://www.quintet.net), a performance tool offering different software versions for the audience, the players, and a conductor (Hajdu 2005). Structural aspects of networks are mirrored here in musical systems in order to find new compositional, improvisational or intermediate ways of creating by way of experimentation. Other examples express, for instance, the fact that the Internet represents a system that is too vast and difficult to grasp in terms of our physically based perception. Such characteristics are reflected in projects like Horizontal Radio, initiated by ORF-Kunstradio in Vienna (Grundmann 2000). In open group structures, Horizontal Radio develops a hybrid of human and algorithmic actions that pushes the technical potential of the Internet beyond its borders. The result, which includes sound, text, and visual elements, mirrors the communicative specifics of the applied system built from software and users, and concerns itself not primarily with aesthetic effects but with political and social aspects of media applications. This approach, which prioritises communicative aspects over aesthetic ones, is considered here to establish a 'communication paradigm'.

2.1.2. Space

Installation approaches to Net music, in particular, often focus on the perception of space or location. Here, a number of parallels to real-space sound installations can be found (Föllmer 1999: 225f). The 'articulation of space', a technique to be found frequently in real-space sound installations (Minard 1993), expresses size, proportions, construction material, aspects of usage, or more general elements of atmosphere of a physical space. Adapting these techniques to the characteristics of virtual network space as discussed above, the projects *Bits & Pieces* by Peter Traub (http://www.fictive.org/~peter/bits) and *electrica* by Leonid and Skop (http://skop.com/electrica) activate comparable strategies by selecting sounds based on rules corresponding to their spatial arrangement, i.e. the distribution of audio files over the Internet or inside a visual interface that is a map of a non-existent place.

'Conditioning of space' (Minard 1993) in real-space sound installations – meaning the process of colouring or shaping a space by the use of sound – is paralleled in Net music by the soundtrack, i.e. the atmospheric shaping of a website by the predominant use of sounds evolving from processes, as can be found in *NetStrings* by Tore Bahnson and William Louis Sørensen (http://www.ssshhhhh.dk/netstrings). An authoring software providing multiple possibilities for this purpose is SSEYO's *Koan Pro* (http://www.sseyo.com/products/koanpro), developed with the intellectual support of Brian Eno and also used by him for his own real-space sound installations (Eno 1996).

'Exploration' (Föllmer 1999: 225) describes a method used in real-space sound installations where the active involvement of the recipient is pushed into the foreground. The user's exploration of spatial or

systemic relations expressed in aural, visual, and other elements is the core of this kind of work. Adaptations to Net music can be found in examples of hypermusic, where the navigation through a multi-dimensional musical space is not like playing an instrument, but rather like navigating a space that gives audio and video feedback, telling you 'where' you are. An example is *nebula.m81*, mentioned above.

2.2. Interactivity and openness

The analysis of approximately seventy projects revealed a broad field of different approaches to providing interactivity for Net music's users and listeners. Largely differing scopes of action and degrees of responsibility are offered to the recipients. A systematic structuring of these different degrees of interactivity starts from a form that can be termed 'musical feedback', describing acoustical user interfaces reacting in a basic, simple way to one or more actions of the user, such as in *WebPlayer* (now offline) by Pete Everett, which played a specific sound arrangement when a URL was typed in.

'Musical steering' is present when the actions of the user can be influenced by more long-term planning and have a wider range of possibilities. However, musical and interactive scope are still rather restricted due to the originators' consideration that every kind of visitor to the website is meant to be able to play it without musical or technical knowledge. As Netochka Nezvanova put it in an email interview with the author, users of such systems are 'viktim o|v z!rkumztansz'. Most soundtoy works employ this type of interactivity, for instance the 'classic' *Absolut DJ*, now offline. It allows the user to arrange a choice of eight different sounds in a chessboard-like array that is continuously scanned for those sounds by two independent cursors (Föllmer 2005: 104). The pop music industry employs soundtoys to give users the feeling of being close to star performers by allowing them a sort of interaction with, say, the sounds of DJ Spooky or Madonna.

While musical steering relies on the principle of one-sided exertion of influence on a trivial machine (the listener triggers single events, the system reacts in identical patterns), 'musical regulation' is based on reciprocal influence involving humans and non-trivial machines (the listener triggers events as well as modifications of system behaviour, and his or her behaviour is conversely altered by changes in system behaviour). Net music offering this kind of interaction can be based on humans interacting via the technical means of the network with other humans or exclusively with machines. For example, the algorithmic installation *nTracker* by Margarete Jahrmann and Max Moswitzer (http://www.konsum.net/ntracker) relies exclusively on a machine interaction as it takes log files produced involuntarily by online visitors and makes them audible, while the hypermusic work *Auracle* by Max Neuhaus (http://www.auracle.org) involves multiple human players as well as non-trivial machines in electronically interpreting online vocal improvisations (Neuhaus 2004).

The greatest depth of interaction can take place when the complete musical environment, including sound material, compositional apparatus and interaction design, is open to be influenced or even constructed by the user, as is the case with authoring software. The Internet is a major factor in the perpetual broadening of the palette of music authoring software, reaching from specialist tools like *Supercollider*, *Max/MSP*, *JSyn* and *Keyworx* to more widely used ones like *Beatnik*, *Koan* and *Flash*, all of which possess special capabilities for use over networks.

The range of different degrees of interactivity demonstrates that playful and explorative handling is of great importance for Net music, while sound aesthetics, musical form and semantic content have less weight. While playful forms of music are of considerable importance in ritual and communal music (Chanan 1994: 24), Western art music and pop music as a rule have not employed play and exploration as core motivating factors. Sound installations and computer-based forms of music have re-established these aspects to some degree, but the Internet gives them a new dimension of diversity and distribution.

2.3. Complexity and flexibility

In Net music, the complexity and flexibility of a musical composition depend on the possibilities for interaction on the side of the listener, on the internal structuring of the audio engine, and on the system's connection to network structures. In soundtoys all three aspects are kept simple. In remix lists music is understood as a flexible object to be developed and modified by users collaboratively, forming a sort of 'multi-user music'. Complexity and flexibility are enhanced when a single instrument is capable of being played by several players at the same time, creating something that could be called a 'multi-user instrument', employing the intra-action concept, which can be heard in several samples of hypermusic where the flow of the music can be regulated collaboratively in a branching configuration.

3. CONCLUSION

Net music must be viewed as a complex, multifaceted phenomenon. The basic element of the Internet – the computer, a process-oriented and flexible machine – establishes the general nature of Net music in its being constructed as an open and flexible composition of

electronic processes. Close similarities between Net music and the concepts of interactive composing and real-space sound installations can be observed, but a broad range of references to the characteristics of networks marks Net music as an artistic field in its own right. The very particular characteristics of actual networks determine the production as well as the reception of this kind of music. Depending on the artistic background, different degrees of complexity and interactivity are employed, resulting in a wide variety of system structures, scopes of action, and degrees of responsibility of the users.

Two opposing paradigms of music conceptualisation divide the approaches to Net music. Following a composition paradigm, the implementation of flexible network structures is employed in a quest for new kinds of compositional structuring, musical communication, and sound aesthetics. The problematic of presence in terms of a 'deficit' in networked human interplay encourages the development of new forms of musical interaction, while easy accessibility of non-trivial machines over the Internet spreads their use in musical applications and for playful forms of music in general. Following a communication paradigm, on the other hand, music is employed in a quest for a deeper understanding of electronic networks and their impact on social interaction. Qualities of electronic space are made perceivable to the senses by taking certain relationships between virtual space and physical space and making them audible, while the communicative structure of such music probes and criticises the new possibilities of social interplay over electronic networks.

Co-translation: John Jones

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