COMPOSING FOR NETWORKS

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ABSTRACT

Debuting in 1999, Quintet.net has grown from a networked multi-timbral sampler with a simple real-time notation engine into a full-blown multimedia environment sporting numerous features such as spatialized audio engines, real-time composition and notation, video processing and sophisticated mapping of control and sensor data—while staying true to its original concept: a quintet on the Net under the control of a conductor.

Being one of the very first environments for telematic music performance, countless pieces have been realized by more than two dozens composers and multimedia artists. My presentation will give an overview of the first Internet performances at the turn of the millennium as well as the gradual shift towards local network music performance spawning the foundation of the European Bridges Ensemble in 2005. In 2007, I went back to including acoustic musicians in the mix of musicians and started to focus on networks of sight-reading classically trained performers reacting to scores generated on the fly, as exemplified in my pieces Ivresse '84 and Schwer...unheimlich schwer.

Two major multi-national projects have given us—the European Bridges Ensemble and the Hamburg Hochschule für Musik und Theater—the opportunity to refine the environment: The Hungarian-German Bipolar project as well as the CO-ME-DI-A project funded by the European commission. Within the framework of these projects some very useful tools facilitating network music performance have been developed. CO-ME-DI-A also focused on philosophical questions of making music on the Net/in networks as well as on technical questions concerning the standardization of network music performance.

I will conclude my presentation with the a discussion of the role of the participants in NMP and debate whether the hierarchical division of labor, which was typical for the orchestras of the 19th Century, has indeed made way to a more democratic, flat hierarchy of independent "proformers" (producer/performer).

1. INTRODUCTION

In my paper "Der Computer als Inspirationsquelle für Komponisten" (the computer as a source of inspiration for composers) I have mused about the development of digital music as a co-evolution of musical and technical means spurred by the creation of the first digital computers in the 1940's [[1]]. While something analogous could probably be said about any music instrument, from bone flutes to the Moog synthesizer, some consider calling a computer network a musical instrument somewhat of a stretch. Yet, as soon as networkable computers became available at an affordable price, musicians have at once begun to explore the sonic and social possibilities of such meta-instruments [[2]].

Overcoming one's physical limitations, creating a remote presence, connecting minds and sounds over long distances was a strong motivation which made musicians first turn to telephone and satellite lines before leveraging the power of the Internet (the potential of making connections ultimately also motivated NASA to include the Golden Record in their Voyager space craft). Jérôme Joy's NMSAT timeline reflects the exponentially increasing number of networked music events that have been enabled by the enormous technological advances of the past decades [[3]].
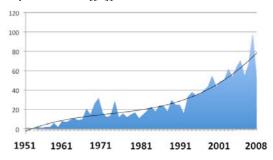

Figure 1. The NMSAT (Networked Music and Sound Art Timeline) by Jérôme Joy shows an exponential increase of related events.

When I started the development of Quintet.net in 1999 [[4]], I had to deal with a rather barren "technotope" mandating specific solutions in comparison to today's technological ecosystems, which in terms of bandwidth and speed seems to be only limited by the velocity of light and the non-standardization of software. In the following I shall outline how technological advances have led to the development of tools that have noticeably changed the nature of network music performance and ultimately enabled us to realize what McLuhan referred to as *global embrace* [[5]] while stressing

the advantages that local settings may still offer to us.

2. THE MODEM ERA

When the composers' collective *Musica Elettronica Viva* celebrated its 25th anniversary at Mills College in the winter of 1991/92, MEV member Richard Teitelbaum was snowed in by a blizzard and was not able to be present in person. To save the event students of the Center of Contemporary Music had worked all day to create a modem connection that would enable him to remotely play a MIDI keyboard while listening to the performance over the telephone. In October of 2000, when I directed the first Quintet.net performance (between Münster, Amsterdam, Wiesbaden, Boston and San Franscisco Bay Area), the situation had changed with the advent of Max signal processing and the OpenSoundControl objects, yet, still, 3 of the 5 players had to use dial-in connections to go online. Low bandwidth, long latency and considerable network jitter had serious implications which necessitated the adoption of a particular compositional approach which I'd like briefly outline [[6]]:

- Fear of the void (cenophobia) due to the physical absence of participants necessitates guided improvisation
- Phrase sampling to preserve rhythmic accuracy of performance
- Chat and verbal instructions as means to further guide musicians
- Visual clues by displaying MIDI notes in (near) real-time on the computer screen to facilitate interaction between players

Searching for existing compositions that would suit such conditions, I stumbled across John Cage's number pieces, constituting an ideal compositional paradigm for this kind of setting. His composition *Five*, therefore, was one of the first pieces ever realized with Quintet.net. Its 35 events can be performed by the five players at any time within the given time brackets.
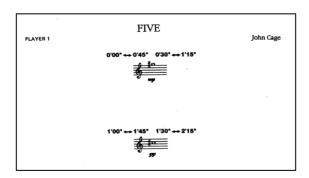

Figure 2. Notation of Five by John Cage. An ideal piece for realization in a low bandwidth, high latency setting.

3. THE DSL ERA

Less than two years later, in May 2002, when Quintet.net was used in a Munich Biennale opera production, all participating locations either used Digital Subscriber Lines (DSL) or local-area networks to connect to the Internet. An attempt at using an audio/video stream of the Munich opera stage (which was connected by a 2 Mbit Internet link) was hampered by the 40 second latency of the Real broadcast[1].

The gains in terms of bandwidth, latency and jitter enabled us to use:

- Rudimentary audio/video streaming (high latency) while focusing on low latency control messages, including the use of microtones as well as note-event and video-effects processing
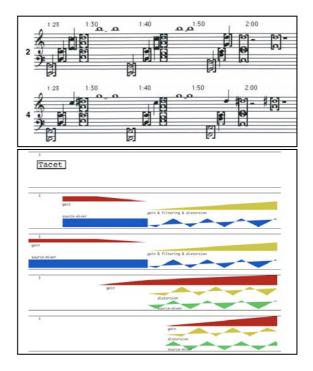- Display of pre-composed scores in addition to "performance" notation

Figure 3. Notation of a section of *Bridges* composed by Andrea Szigetvári (top) and *185* by Ádám Siska (bottom). Typically, EBE pieces consist of a mix of composed and improvised elements (an approach which has also been dubbed comprovisation).

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1 As Real would charge an exorbitant $50,000 for the luxury of licensing their streaming server, broadcasts were rare and almost exclusively performed by commercial enterprises. This all changed of course when Apple made their Darwin Streaming Server widely available at no costs.

4. THE INTERNET2 ERA

While in 2000, most networked music projects focused on the exchange of control data, the SoundWire group at CCRMA group started to explore the possibility of using the Internet2 to stream uncompressed audio with very low latency between distant locations [[7]]. This culminated into the development of JackTrip which, in 2005, was also used in a transatlantic concert between CCRMA (Stanford) and SARC (Belfast)[2].

In 2007, the European Culture 2007 multi-annual collaboration project CO-ME-DI-A, set out to investigate the effectiveness of existing networking technology in various scenarios, ranging from telematic concerts to synchronous robotic events in multiple locations [[8]]. Quintet.net evolved to complement these advances in audio and video streaming by integrating MaxScore, a powerful Java-based object for real-time composition and notation [[9]] as well as creating a plug-in structure for the transmission and mapping of continuous control messages, originating from sensors and standard and non-standard controllers (such as the AudioCube) [[10]].
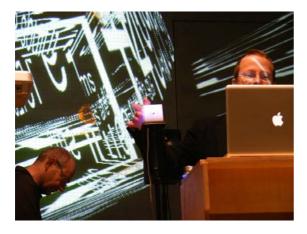

Figure 4. European Bridges Ensemble members at a rehearsal of the piece isms by Jacob Sello.

At the 2008 ICMC in Belfast, a Greek project named DIAMOUSES was presented which featured the first integrated solution for network music performance, ranging from audio and video streaming to music notation and text chat [[11]]. Subsequently, I experimented with adding low-latency audio streaming to Quintet.net via the Apple AU technology but became discouraged by

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2 In the meantime, in 2003 iChat AV and Skype became available for low-latency video streaming between two locations. Currently, multiuser applications such as the Unreal Media Server and AccessGrid are being favored by the organizers of network music performances for their flexibility.

the results. Latency grew as time passed, and we ended up with delays of several seconds even in local-area networks.

My conclusion from the CO-ME-DI-A project and my own experiments is that, currently, it's not advisable to create integrated systems. Even if a well-endowed group or company took on such a feat, the commitment would be enormous and probably, in the long run, not worthwhile.

Instead, as it was practiced in most projects I participated in, it is preferable to combine various specialized software applications, granted that these systems have to be tuned before every single concert.

In terms of compositional preferences, academic Gigabit networks leave very little to be desired. As long as distances don't exceed 2000 km, latencies typically stay below the acceptable threshold for "playing on the beat", as it was the case during the three-day CO-ME-DI-A showcase event in the fall of 2010.

And even at intercontinental distances, there are a sufficient number of musical styles that tolerate higher latencies. Mission accomplished—so it seems.

Figure 5. The stage at SARC, Belfast during the three-day CO-ME-DI-A showcase event in November of 2010. Two more screens on the sides showed the remote audiences.

5. GOING LOCAL

In 2005, I co-founded the European Bridges Ensemble (EBE) consisting of 5 electronic musicians, a video artist and a conductor. Our first concert connected five locations in Europe. Soon after we started receiving support by the German-Hungarian Bipolar project in 2006 it become apparent that we actually preferred to play in local networks with visual contact, limiting the online involvement to rehearsals and technical sessions.

Glancing at past network music performances, an interesting observation can be made: It seems that electronic musicians and laptop ensemble paradoxically tend to local performances while many an acoustic musician enjoys the possibilities that remote performances offer. The HUB have

offered an explanation for this apparent paradox: The difficulty of trouble-shooting a local network of computers is compounded by the limitations of the multi-modal communication between distant locations, which EBE co-founder Andrea Szigetváry impressively demonstrated during her talk at the 2010 Music in the Global Village symposium in Pécs, Hungary. Local performances also offer more possibilities to explore choreographies of gestural and spatial movements of performance by integrating novel controllers and diffusion systems.

In 2007, I turned my attention to real-time composition and notation, becoming increasingly interested in involving classically trained musicians with good sight-reading skills. In Ivresse '84 (2007) I contrasted four laptop performers with a violin. The music consists of a real-time re-composition of John Cage's first Freeman etude, to be performed by a violinist, accompanied by the laptop players doing a guided improvisation with audio samples taken from the violinist's recording of the very same piece. The formal and temporal development of the piece was controlled by myself using a Lemur touch interface, allowing me to advance to the next section whenever it seemed appropriate [[10]].

Figure 6. Violinist János Négyesy preparing for a rehearsal of Ivresse '84 by Georg Hajdu.

Figure 7. Real-time composition, notation and arrangement in Schwer...unheimlich schwer.

In Schwer...unheimlich schwer (2009, rev. 2011), a piece on German Red Army Faction member Ulrike Meinhof, I exclusively used four sight-reading musicians on acoustic instruments reacting to the notation as it unfolded. These situations posed new technical challenges that had to be met: score extraction and orchestration in real-time as the original compositional material was abstract and had to be adapted to the ranges and playing techniques of the instruments on the fly.

6. THE ALWAYS-ON ERA

In 2008, we did yet another adaptation of a piece by John Cage, Radio Music from 1956. In his original piece, 1 to 8 radio operators dial certain frequencies on the long-wave band within the six minutes of playing time. In my adaptation the radio stations were replaced by 15 podcasts created by the EBE members and randomly distributed on a simulated frequency band. The participants use rotary controllers to move the five cursors of the virtual radio.

Since Radio Music would lend itself perfectly to a realization on today's *always-on* mobile devices powered by iOS or Android, I'm planning to eventually create a version for the "transistor radios of our times".

Figure 8. Virtual radio with five dials and cursors used in Georg Hajdu's adaptation of Radio Music. Design by Stewart Collinson.

The use of Podcasts, to be created by the players of Radio Music also reflects the new roles that the practitioners of networked music have taken on. While we still employ a conductor, my role is no more that of a benevolent dictator of acoustic ensemble, but rather of a coordinator within a flat hierarchy. The players, in contrasts, have become "proformers" (producer/performer) by providing their own content. Such roles and questions of authorship have been studied by Pedro Rebelo and Franziska Schroeder under the heading of *network topologies* [[12]].

On his 100th anniversary Cage remains a point of reference who more than any other composer of the 20th century has developed compositional strategies forecasting the role of the musician in a democratic, flat, rhizome-like society, which, unfortunately, has

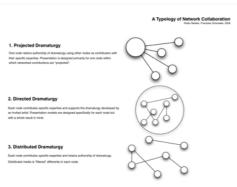recently been challenged by large corporations under the pretext of intellectual property rights [[13]].

Figure 9. Network dramaturgies by Rebelo and Schroeder.

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