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KromoZone: A Platform for Networked Multimedia Performance

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Abstract

Kromozone is a networked, interactive/intra-active, computer-based realtime performance system. All elements are interconnected via ethernet interfaced within the Max/MSP/Nato environment. This allows for information at any station to be passed to any other station for control, monitoring, reinterpretation, and processing. An audio station's parameters can effect the manipulation of video at another station for example. This creates not only interaction between performers, but intra-action where performers can actually get 'inside' each other's instruments and directly affect the output. In some performances, stations are placed throughout the audience, who is invited to participate. In using the KromoZone performance system, we have explored the implications of networked performance, the use of alternative sources for signal and control input, the design and use of non-standard performance interfaces, and the inclusion of live-manipulated video projections as a viable and integral part of a performance.

Introduction: What is networked performance?

Networked performance, as we are defining it, occurs whenever a performer's instrument receives input from a source other than the performer herself, or the performer's instrument behavior is modified by an outside influence. This definition distinguishes the type of interaction that we will be discussing from a violinist whose tempo lags in a cold room, or jazz players whose improvisations are inspired by listening to each other during a performance.

The Hub, a group of composer/performers who were among the first to practice network music, describe their system:

> The Hub is a computer network band. Six individual composer/performers connect separate computer-controlled music synthesizers into a network. Individual composers design pieces for the network, in most cases just specifying the nature of the data which is to be exchanged between players in the piece, but leaving implementation details to the individual players, and leaving the actual sequence of music to the emergent behavior of the network. Each player writes a computer program which make musical decisions in keeping with the character of the piece, in response to messages from the other computers in the network and control actions of the player himself.
>
> The result is a kind of enhanced improvisation, wherein players and computers share the responsibility for the music's evolution, with no one able to determine the exact outcome, but everyone having influence in setting the direction. The Javanese think of their gamelan orchestras as being one musical instrument with many parts; this is probably also a good way to think of The Hub ensemble, with all its many computers and synthesizers interconnected to form one complex musical instrument. In essence, each piece is a reconfiguration of this network into a new instrument. (Perkis)

KromoZone embraces much of this spirit. Our goal is to continue the exploration of the possibilities made available by the conjunction of performance software and networking software.

What is KromoZone?

The title of our platform, KromoZone, embodies the goals of its development. KromoZone is a compound of Kromo: itself a blend of “chroma” (Latin, color) and “krono” (Greek, time), and Zone: a demarcated physical or conceptual area, also a term from computer networking. The whole word also resembles "chromosome," a large unit in genetics that contains the instructions for how to create a living organism. What we are building relates to all of these meanings: we are attempting to (literally) create a computer-network for distributing and processing color and time, though the use of video and audio, with the hopes of creating an end result that is nuanced and organic.

To realize this artistic vision, we developed the KromoZone Intermedia Performance System, a set of software modules which networked performance. The network can be a Local Area Network (LAN) or it can be distributed globally via the internet. The KromoZone Intermedia Performance System (KIPS) is distributed in three packages: the system core, performance modules, and the documentation. Currently, the KromoZone software runs on Macintosh PPC computers only.

The system core consists of a server application and a client object built for the MAX multimedia-programming environment. The current server implementation can host up to twelve clients logged-in at any given time. Programs, or "patches," built in MAX with the client object can be compiled into standalone applications to create performance modules. A client and server can both run on the same host computer, and a special proxy server object can be invoked to enable a larger system of computers.

Performance modules perform a variety of functions in the system beyond the generation of audio and video signals. These include time synchronization, spatialization control, spatialization rendering, audio-matrix routing, proxy-servers, and almost any other situation-specific function imaginable. Custom performance modules built in MAX allow for a variety of instrument interfaces which can be optimized for different performance situations. The pre-built modules, meanwhile, allow for basic functionality. The separated spatialization control and spatialization rendering, for example, allows the performer who is controlling the spatial diffusion of the sound to be located virtually anywhere, regardless of where the reproduction hardware (multi-channel audio interface) is physically located.

A series of performances has helped clarify the implementation of this system, gradually improving the complexity of the relationships between improvising performers, while becoming technically less convoluted. The first prototype performance, Free Speech, occured at the Society for ElectroAcoustic Music in the United States (SEAMUS) 2000 National Conference in Denton, Texas. Two main features of the system met with some degree of success in this prototype performance: audience participation to control various aspects of the live signal processing, and rough time synchronization. A system clock was implemented on the server and broadcast to each client. This allowed each performer to think in terms of shape within predetermined time constraints. The audience was given domain over aspects of the performance such as the saturation of the video image, or the pitches of the carrier signal for a vocoder (while one of the on-stage performers controlled the excitation of the vocoder). (Moore and Place)

A number of shortcomings were immediately obvious: the lack of a truly dynamic means of routing audio between various performers before sending it out to the audience, a lack of "tight" timing of events where desired, the spatialization performer was located on stage – thus unable to accurately monitor the room, and despite the presence of live video manipulation, there was a lack of gestural action and correlation on the stage. Our second performance, Barmicide, at the 2000 Kansas City Electronic Music Festival, solved many of these implementation problems. Our sound source was a live instrument (rather than a buffered sound) giving the performance an immediate sense of live gestural action. We separated the spatializer into two parts to allow the performer to sit in the center of the hall. We locked key events to specific agreed to times by correlating cues in

individual performance MAX patches to the server's clock. Finally, we developed a network-controlled audio matrix which allowed any amount of any signal in the system to be sent anywhere else in system. The result was a much tighter performance, and a musically controlled result to our improvisation. However, we were still using the network in a utilitarian manner, and not in a way that significantly changed the nature of our interactions.

A third performance was a modest step toward expanding our palette of interactions, while a refining step in other aspects of our performance technique. The Nature of Contingency, performed at the 2000 Seoul International Computer Music Festival, brought the musicality and real-time video production to much more refined artistic expressions. It also afforded us the chance to integrate the gestures of several performers with each other in real-time. For example, the live performer in this piece plucked and strummed the needles of an amplified cactus while a video camera attached to a performance computer tracked the locations of the various fingers of the performer. The information from this image-tracking then drove the spatializer in real-time across the network. The piece also included possibilities for the concept of displaced performance. By separating the live-video-manipulator controls from the live-video-renderer, we had the opportunity to have one performer located in the United States participating in the concert in Seoul, South Korea.

What is the future of KromoZone?

The most profound possibilities enabled by the KromoZone platform have yet to be explored. Most interesting is the possibility of "Intra-action" – a form of interaction that

happens internally to the sound producing system. Intra-action could make use of the KromoZone network to allow actions of one instrument to directly modify the actions of another instrument. This can get particularly interesting in improvisation where the interactions between two performers are fundamentally changed; the performer does not have complete control over the output of their instrument.

This model may also produce a viable means to the inclusion of audience members in the live performance/improvisation. To give the audience their own "instruments" would likely lead to an uncontrolled cacophony. Giving them controls that modify the output of an instrument under the control of a primary performer could perhaps provide a musical solution. By assigning this control in ways that allow competition between audience members, new network game-based models could also give rise to novel, musical experiences hitherto unexplored.

The primary issues that remain are practical ones. The KromoZone network software is capable of all of the aforementioned possibilities, provided that there are enough computers available for the performance. For every person who wishes to participate, a computer is required. These computers need not be state-of-the-art necessarily, provided that they can handle the desired input device(s), have an Ethernet connection, and can display properly what the composer desires. However, newer computers do offer more possibilities, thus facing any composer with tradeoffs. In the next five to ten years this may become a non-issue. With growing popularity of Personal Device Assistants (PDA) such as the Palm VII, which includes wireless networking capabilities, there may come a

time when every concert-goer will be carrying a sufficiently powerful computer in their pocket.

It seems only a matter of time before every audience member could then participate in the performance of intra-active (or game-based) compositions. The possibilities for newer game-based intra-action models in musical performance are in largely uncharted territory; as games and technology develop, composers and their music will continue to reflect these developments. In the process, they can offer concert audiences unique experiences; possibly even reviving the recital hall as a relevant venue to our culture and society by including the audience in the process of creating new music.

We see the creation of a flexible, user-friendly, easily distributable platform for this sort of work as the first important goal towards establishing intra-active music as a viable mode of art-making. Others have realized this need as well. The researchers at Waag Labs, developers of the KeyStroke system, have proposed a similar goals for their project. In the manual for the beta test version of their performance platform, they assert that

> KeyStroke combines multi-user with dynamic cross-media synthesis, providing the tools for extensible forms of telecommunication and collaboration. KeyStroke's ability to dynamically synthesize media from up to five users in a common workspace, makes it a powerful live and/or performance tool for interactive and interdisciplinary work. (Waag Labs)

The ultimate goal of the KromoZone project is to build software/hardware instruments, create works, and enact performances that explore the possibilities of intra-activity, particularly its implications on composition, instrument/interface design, and performance practice. In our estimation, the effect that intra-activity could have on each

of these areas is profound. For the composer, the "ensemble" paradigm can be fundamentally altered — a group of performers could be thought of and addressed as a single instrument that is played with a multitude hands and feet, as a series of semi-determinate data-processors with marginally predictable output, or as an otherwise traditional ensemble where the slightest nuance in one each performers' performance has an effect on all the others' output, to name a few. For the performer, new horizons open up when considering the possibility of an instrumental interface that allows visual/tactile feedback to monitor others' actions, or a shift in performance practice that changes from being a part of ensemble to being part of an organism; no longer acting as one person in a group of people, but as one interdependent in a group of systems that make up a singular audio/visual being.

As the composers and the performers are often the same people, the result of this line of research for those involved in it is a complete rethinking of the parameters within which music can be made, and a reformulation of the role of the musician. Far from obsoleting any existing musical practices, KromoZone promises to add to the possibilities of multi-media expression.

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