The Distributed Real-Time Groove Network
A System for Real-Time Musical Collaboration on the Internet

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Abstract
The Distributed Real-Time Groove Network (DRGN) is a system which allows for the creation of music, in real-time, from within MOOs (MUD, Object Oriented), text-based, virtual reality environments residing on the internet. The DRGN uses MOOs as its servers, responsible for disseminating musical commands and information to all "clients" connected to a given "groove session". Users participate in the DRGN through the use of a Max patch which is responsible for both communication with the MOO (via a telnet connection) and the generation and transmission of musical events.

Introduction
One of the most interesting properties of the internet is its ability to bring together people from all over the world. Using the Net, a person in Chicago can get in touch with someone in Norway as easily as their next-door neighbor. With this power at hand all sorts of interesting social possibilities are brought to light.

Since immediacy of response seems to be an important factor in developing a social connection, this power is most clearly seen in real-time applications. For many reasons however (primarily network bandwidth and time lag problems), real-time interactive, internet services do not seem to have flourished as quickly as other non-real-time services, such as the World Wide Web. Up until quite recently, real-time interaction on the internet had been primarily restricted to Inter-Relay Chat (IRC) services - a sort of internet party line - and MUDs (Multi-User Domain/Dungeons) or MOOs (MUD Object Oriented), text based virtual reality environments. These services rely only on low-bandwidth transmission and reception of text data and thus are not significantly affected by the internet bottleneck.

Despite technical limitations however, new interactive systems have started emerging. CU-SeeMe (see "CU-SeeMe Welcome Page" URL http://cu-see.me.cornell.edu/), for example, allows people to send video and audio data all over the world. The Distributed Real-Time Groove Network (DRGN - pronounced "dragon") is an attempt to bring a musical dimension to real-time, interactive, internet services.

Background of the DRGN
In designing the DRGN system two objectives were seen as being important. First, users have to be able to get the sense that they are interacting with a tangible environment. We did not want people to get the sense of being just "in" the system, that the music was disembodied. Users have to be aware that the DRGN's music is the result of the interaction of people's intentions, not computer's. Secondly, the system has to be user extensible, allowing for flexibility in the way that the music is generated and for future expandability. We wanted people to be able to implement algorithmic processes in the DRGN, as well as normal "jamming". In addition to these primary objectives, network limitations require that the system work with the low-bandwidth data transfer rates.

In order to meet these requirements, MOOs are used as the DRGN servers, the impetus for which was work done designing software for use with the Communal Groove Machine, designed by Caron Becker (Wolman, and Becker ICMI, 1994). MOOs, developed by Pavis,Curtis at Xerox, Parc (Curtis, "LegoMooMOO Programmer's Manual"), are text-based virtual reality environments residing on the internet which allow users to log in and interact with each other and the environment in the form of avatars. MOOs fit perfectly with the DRGN concept as they are a wonderful media for interaction and building social relationships. People have actually met their spouses on a MOO. In addition to being environments for interaction, MOOs are user extensible. Users are able to program new objects in the MOO, extending its environment and functionality, in turn meaning that the functionality of DRGN can be extended.
The DRGN Client Software
In order to translate and generate musical information locally, each user needs to run the DRGN client software. This software, which was written in Max, has two primary responsibilities:

Network Communication: The DRGN software establishes and maintains a connection with a MOO through an implementation of the standard telnet protocol, provided by a Max telnet object.

Generation and Distribution of Musical Events: The DRGN software is responsible for the actual generation of the music on the user's local computer. The sound itself is generated by a multi-channel MIDI synthesizer drive by the computer. The DRGN software also allows users to generate and record music to be added to the "groove session". This musical data is coded into an ASCII format which is sent to the MOO. The MOO records and processes the data before echoing it out to all the other participants.

In addition, the client software allows for normal MOO interaction by way of a simple chat interface and allows users to graphically edit rhythm patterns.

It is important to note that the repetitive rhythmic style of music currently implemented in the DRGN is particularly appropriate for the non-real-time nature of the Internet. The local Max patch handles the metronomic timing of the music, while the network component of the application only communicates changes to the other sites. These changes generally involve new rhythm or melody patterns that are updated at the receiving sites only on measure boundaries.

The Future of the DRGN
Because the DRGN's musical information is conveyed from the MOO server to its clients via a simple, text-based protocol, any MOO programmer can create objects which both respond to and generate musical events. This means that the network is limited only by the imagination of interested MOO programmers. The currently implemented scenario involves "jamming rooms" with virtual instruments. A user from Germany can play the bass with someone in Canada playing the drums and a person in the US playing the melody. Users can form virtual bands, etc. In the future we expect people will build algorithmic composition tools for the DRGN. We can even envision an Inter-MOO/DRGN radio service, with "stations" and "receivers" which broadcast and receive the musical inspirations of DRGN musicians.

Conclusion
The DRGN is an attempt to provide a tool for global music-making. It has proven, in its use so far, to be an enormously powerful tool for building not just music, but social relationships. Music is so powerful a communicator that the DRGN's users seem to meet, almost instantaneously, at a "soul" level. It is hoped that the project stands as a testament to the power of the Internet as a tool for breaking down the barriers of distance and culture.

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References:
"CU-SeeMe Welcome Page" URL: http://csee.ee.cs.cornell.edu/