

Malleable Mobile Music

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ABSTRACT

We present a system for collaborative musical creation on mobile wireless networks. The work extends on simple peer-to-peer file sharing systems towards ad-hoc mobility, streaming, and collaborative creation. It extends music listening from a passive act to a proactive, participative activity. The system consists of a network based interactive music engine and a mobile rendering player. It serves as a platform for experiments on studying the sense of agency in collaborative creative process, and requirements for fostering musical satisfaction in remote collaboration.

Keywords

Mobile music, wireless ad-hoc networks, peer-to-peer, collaborative authoring, active listening

INTRODUCTION

Malleable Mobile Music takes social dynamic and mobility as inputs to an audio re-composition engine enabling communities of listeners to experience familiar music in new ways. The system consists of mobile terminals, sensor subsystems, geographic localization simulator, and music re-composition engine. A community of listeners chooses to listen to a single piece of adaptive music. No longer a fixed entertainment medium, the music becomes a malleable content form fostering *shared experience*.

The system demonstrated extends upon work in collaborative computing [1], real world-WWW interfaces [2], and ad-hoc playlist exchange [3]. Listener action while listening: grip intensity, and tapping rhythm in time, drive time-domain re-sequencing of song form and frequency-domain tempo altering algorithms. The system extends algorithmic composition [4] to non-musician applications. *Personal bodily* data combines with *community geography* to determine the evolution of a familiar song.

Each listener selects a part in the music to be his *musical avatar*. The music is no longer a predetermined structure, but a malleable form that can be molded to fit the length of a train ride, or shaped to respond to the movement of friends about town. As people become closer, their parts are

heard more clearly, creating a *social re-mix*.

SYSTEM COMPONENTS

The system consists of a mobile music client, a server-side generative music engine, and localization simulator.

Mobile Terminal

The handheld device is a PDA modified to be a mobile terminal device for music. User input is captured by a sensor sub-system and audio is delivered over the wireless network interface. The sensors allow *involuntary* input to the system. Force sensing resistors (FSR) capture grip pressure, while accelerometers sense gesture and motion in three-dimensional space. This allows expressive information more typically associated with musical instruments to be used by the music generation engine.



Figure 1. A PDA as mobile terminal with sensor subsystem

The graphical user interface displays *community* information – the “friends” within range, and a representation of their geographical location.

The terminal is a network audio streaming client, capable of invoking multiple channels of MP3 format audio streams from the music generation engine.

Malleable Music Engine

Gestural input from the group of connected users arrives via XML/OSC messages [5]. The engine reconciles the multiple control inputs, generating parallel music channels that are streamed up to a standard streaming server.

Modules that make up a musical piece include rhythms, fragments of sequences, and samples. Time domain re-sequencing of elements is applied at multiple musical levels. The low level re-sequencing allows user actions to intuitively create variations in rhythm and melody. High level re-ordering allows song structure to be *malleable*, to

match the corresponding social activity that drives the progress of the music [6].

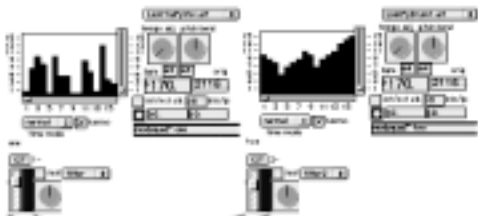


Figure 2. Malleable Music Engine

These techniques are applied to standard popular songs and assume a constant meter and tempo. Existing music is rendered interactive by the system, giving listeners new ways to listen to familiar music.

Gestures and Localizer

The evolution of the music comes from *sub-conscious* as well as volitional actions of the listeners. The intensity with which a listener holds the mobile device is translated into brightness of the music. The rhythm the user makes as he swings along with the music is captured and drives the tempo through time-stretching techniques. The relative geographies of users in the group drives the mixing of the different musical modules. As a listening partner gets closer, their part is heard more prominently in the mix.



Figure 3. Onscreen interface and localization simulator

SOCIAL DYNAMIC

Participation

The system extends on work in collaborative authoring [7], music groupware [8], and shared cultural asset creation [9]. Instead of participating in an iterative process of contribution, review, and improvement, users of the current system constitute a community contributing to the creation of a single musical stream in real time. The dynamic we seek to create is a live musical interaction. We seek to recreate as much as possible the qualities of music making channeled through the activity of listening.

Agency and Satisfaction

The ultimate test of such a system is the music it produces. Rather than create experimental new media forms, the goal here was to arrive at a result as enjoyable to the listener as a static (or *legacy*) piece of music. The time-domain restructuring techniques proposed maintain familiarity of known music while making it a flexible form.

While network latency cannot be eliminated, it can be exploited to maintain musical satisfaction [10]. Two needs, one of immediacy and the other of representing distance, are diametrically opposed. One serves to provide the user a sense of *agency* of their contribution to the music. The other serves to distinguish and give a *sense* to the remote partners' input. To attain musical satisfaction, these two needs must be met. This points out needs for the further development of the current rendering engine.

CONCLUSION

We demonstrate a network based hardware software system for group music making. The system exploits ad-hoc wireless networks and mobility to allow a community of users to participate in the real-time creation of a single piece of music. It seeks to encourage music listening not as a passive act of consumption, instead proposing a proactive participative activity. This is facilitated by detection of involuntary gestures and geographic location. This raises issues of agency, representation, and musical satisfaction that will be addressed in future studies.

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