

Musical Agents and Musical Acts

Social Musicians and Music as a Communication Language

David Murray-Rust

D. S. Murray-Rust@sms.ed.ac.uk

Introduction

Music is of interest to agent research, as it provides a non-effacious, polysemic domain in which to explore social interaction:

"For each child in a group ostensibly involved in a cooperative musical activity, that musical activity can mean something different yet the singularity of the collective musical activity is not threatened by the existence of multiple simultaneous and potentially conflicting meanings [1]"

This fact - that several people can play together and each may have different attitudes to the music being played, yet the participants are engaged with each other and have a sense of collaboration - suggests that an analysis of this aspect of music making will aid the investigation of artificial societies.

On a more pragmatic note, a framework which allows virtual musicians with different capabilities and architectures to create music together will allow for a wide variety of computational musical systems, and provide an environment for deploying novel algorithms.

Speech Acts

Speech Acts were proposed by Searle and Grice [3, 4], to cover certain utterances which have an effect on the world - statements such as "I now pronounce you man and wife" or "I bet you five pounds that . . ." have a direct consequence when certain conditions are met. The theory has been applied to the domain of agent interaction, for example the FIPA ACL [2], where a message between agents consists of a performative, such as INFORM, PROPOSE or REJECT and one or more propositions. This allows for structures of interactions to be specified independently of content - the development of *interaction protocols*.

Musical Acts

The theory of Musical Acts is an analogous system to describe the actions of musicians when engaged in ensemble playing. It allows for musical gestures to take on a contextual "meaning", without the common problem of what exactly a piece of music means.

We make two assumptions; firstly that each musician has a high-level, partial representation (schema) of the piece which is being played. Secondly, we assume that there is a goal between the agents to work toward a common schema.

Musical Agent System

The musical agent system acts as a layer of "Musical Middleware" for composers; to create a piece, the composer specifies a high level structure and a lexicon - a set of fragments and constraints on their usage - to the system, along with a set of general style libraries for the particular style of music being created. From this score, the musical agents can create an interaction plan, so they know what rôles they take at different points in the piece; in order to fulfil this plan, taking into account the output of the other participants, a layer of musical acts is created, which is finally realised as music.

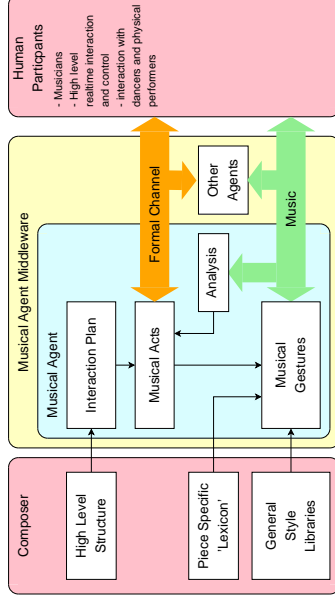


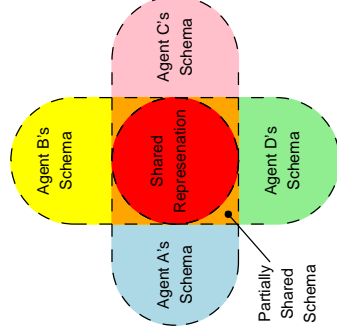
Fig. 2 - Musical Middleware

A formal channel is provided for two reasons. Firstly, it allows for a skeleton system to be experimented on before the musical analysis section has been completed. Secondly, it allows specific musical acts to be injected into the system. This means that the physical cues which human musicians use to be emulated, and supports a high level interface, allowing a performer to control the output of many agents in a musically understandable manner.

References

- [1] Ian Cross. Music, cognition, culture and evolution. *Annals of the New York Academy of Sciences*, 930:28-42, 2001.
- [2] FIPA Specification. <http://www.fipa.org/repository/bsubject.html>.
- [3] H. Grice. Logic and conversation. In Cole and J. Morgan, editors, *Syntax and Semantics*, volume 3. Speech Acts. New York: Academic Press, 1975.
- [4] J.R. Searle. *Speech Acts*. Cambridge University Press, 1969.

Fig. 1 - Shared Representation



A direct musical act consists of an agent informing other agents of some aspect of it's schema; depending on the context, this may take the form of a suggestion for some part of the schema which has not been agreed upon, an extension to an idea which is already being used, or a disagreement with the playing of another agent. An indirect (or meta) musical act is a negotiation between agents about their rôles in the improvisation - for example preparing to take a solo, or initiating some "set piece" where several agents play specific musical fragments.

Example Musical Act analysis

This is a fragment of an analysis of "Little Blue Frog", by Miles Davis, performed by ear, using a possible set of musical act performatives. In this section, three melody instruments are playing over a relatively stable backing, which allows the structure of their interaction to be clearly seen.

Time	Instrument	Performative	Description
2:00 - 2:13	Trumpet	INFORM	A spiky, stabbing phrase, based on scale (B)
	Clarinet	CONFIRM	briefly seems to agree with the trumpet.
2:13 - 2:29	Bass clarinet	CONFIRM	Confirms scale (C)
	Trumpet	DISCONFIRM	ignores bass clarinet, and continues with stabs
	Clarinet	DISCONFIRM	ignores bass clarinet, and continues with lyricism in scale (B)