WHAT IS NEEDED TO BRIDGE THE GAP BETWEEN REAL BOOK AND REAL JAZZ PERFORMANCE?

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INTRODUCTION

We are interested in modeling cognitive processes underlying complex musical activities that involve both real-time constraints and sophisticated reasoning. In this context, we concentrate our work on the problem of simulating a jazz improvisation and accompaniment from a given a chord grid (real-book like score).

Ames has used statistical models to generate music in various styles [Ames & Domino 92]. Regardless of the musical results obtained, this approach cannot provide an accurate understanding of the cognitive processes associated to jazz performance. Other approaches (e.g. [Steedman 84]) have been devoted to designing representation frameworks that adopt a systematic logical standpoint. Musical knowledge is represented in terms of concepts and inference, and emphasis is made on formal properties and relations holding between concepts .

Our work departs from these various attempts to formalizing musical knowledge. Because we simulate musical *activity* and not formal *reasoning*, we favor an explicit representation of musical actions, versus an implicit representation of causal and logical relations. In this sense, we aim at building a framework based on *simulation* rather than on *inference*.

POTENTIAL ACTIONS

In a previous work [Pachet 91] we proposed the notion of "PACT" as the basis for representing musical knowledge used in live performance. PACTs represent musical "potentional actions" that are activated according to the current chords of the chord grid or to the context events. These PACTs include "play loud", "play diatonic scale in the ascending direction", "play this lick transposed one step higher", "play bluesy", "do not play", etc. Each PACT is represented explicitly as a first class entity and corresponds to more or less abstract musical intentions. Part of our work is to build a relevant *ontology of PACTs*, and identify their structural aspects (dimensions) as well as important relations holding between them. One of the most important dimension of PACTs is their "level of playability" (e.g. "play ascending notes" is less playable than "play C E G"; similarly "play bluesy" is less playable than "play diminished fifth on the second beat").

Another important dimension of PACTs is their ability to combine to generate more complete PACTs. For instance, the PACT "Play ascending notes" may combine with "play triad notes" in a given context (e.g. C major) to yield "play C E G". This ability to combine is at the heart of the inference cycle. Each cycle is divided into three steps : selection, conflict resolution and combination. At the end of a cycle, one - and only one - fully playable PACT is produced. This PACT is then sent to a scheduler to eventually generate music. The selection phase identifies all valid PACTs according to the current context. This selection is performed by a set of rules. For instance, PACTs "Play louder", "Play ascending direction", "play descending arpeggio" and "play syncopated" may be simultaneously selected. The conflict resolution phase will detect incompatibilities and chose between conflicting PACTs. In our example, "Play ascending direction" conflicts with "play descending arpeggio". Another knowledge base containing "personal" heuristics will, say, prefer the latter to the former (because it is more playable). The last phase consists in combining remaining PACTs to produce a fully playable

PACT (which could be labeled here as “play a descending arpeggio, louder and syncopated”).

MUSICAL MEMORY

Given any given set of PACTs, it is not guaranteed that this set contains the necessary information to yield a playable PACT. This lack of information is related to the fact that musical choices are not fully explainable in terms of rule chaining. To solve this problem, we have introduced the notion of Musical Memory that exploits the principles of case-based reasoning [Slade 91]. This Musical Memory is a long term memory that accumulates the musical material (cases) the musicians listen to. These cases can be retrieved and modified to provide missing information. Because the definition of memory contents and their representation depends on how these contents are used, our Musical Memory is composed of “inert” PACTs. Building such a memory consists in taking transcription of Jazz recordings, breaking them down into PACTs and describing them through different dimensions and abstract levels such as underlying chords, rhythmic and melodic features, position within the song, etc. (Ramalho & Ganascia 94).

The retrieval of Musical Memory contents is done by a partial pattern matching between their description and the current activated PACTs. Since this retrieval mechanism is very flexible, any configuration of PACTs can be treated. For instance, adequate cases can be accessed when only abstract PACTs (such as play bluesy, play a lot of notes, etc.) are activated. Cases can be also retrieved to provide the pitches given the rhythmic pattern and vice-versa. It is important to stress that the retrieved case can carry more information than required and can be partially incompatible with the activated PACTs. In this case, either the conflicting information is ignored or it can upset or shorten the current assembling of PACT, leading to different playable PACT. For instance, when the activated PACTs carry information about pitches and envelope and the retrieved case carry information about pitches and rhythm. In this case one of the two pitches directives must be chosen. Shortening the assembling process can be provoked for example when a playable PACT is retrieved where the available information could only determine note's amplitude.

DISCUSSION

We have proposed a model based on the explicit representation of musicians' intentions or potential actions coupled with the notion of Musical Memory. Although we do not use randomness in our model, there is no predefined path to generate music. Music is generated gradually through the interaction between PACTs activated by the context and those retrieved from memory.

The notion of PACTs was early implemented to the problem of generating live bass line and piano voicing (PACHET 87). At this time, the results have been encouraging but we have encountered the problem of assembling a playable PACT for some configurations of PACTs. This first system is currently being reconsidered and re-implemented to take into account the Musical Memory and a larger repertoire of PACTs.

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