Dixieland-Gamelan Band? Encounters of an Algorithmic Kind

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Abstract: Improvising musicians from jazz and other cultures engage quite naturally in rhythmic practices that are often extremely complex. The fluidity that is produced by gradual tempo changes, moving away from the pulse, off-beat syncopations, etc. sounds compelling in performance, but is difficult to model or emulate in notated music. The limitations of notation contribute to this problem. This paper describes one attempt to develop a flexible notation in order to create polyphonies and heterophonies of melodies, rhythms and tempi. The computer algorithm used to generate the music is based upon a generative chaotic function. The range of output from perfectly regular to completely irregular matched the aim of the project very well.

1. Introduction

Having come of age as a jazz musician, rhythmic fluidity has long fascinated me. The flexibility of phrasing and tempo of jazz performers from the most traditional to the most modern, is a phenomenon at once beguiling and highly complex. In addition, the interaction of the performers within an ensemble—the laying back, or pushing forward; the syncopations and counter-rhythms—that often occurs in reference to an underlying pulse that may not even be explicitly articulated, is often of an extreme order of intricacy.

Other cultures, too, have developed elaborate rhythmic forms and practices, the Indonesian gamelan being a noteworthy example. The complexity of gamelan music is of another type, found more in the intricacy of interaction in creatingocket-like patterns. The degree flexibility in the overall ensemble, particularly in undertaking rapid tempo changes, is also impressive.

While not undertaking to model such phenomena in any strict sense (work in this domain has been reported in [4], [1], and [5]), such music has served as inspiration for a series of compositional rhythmic studies. Each piece explores a particular problem, but central to my concerns has been the search for ways to create continua between regularity and irregularity on different levels, from the note-to-note rhythmic structures to metric groupings, to contrapuntal interaction.

2. CHAOTICS

The basis for my compositional work has been developed in conjunction with algorithmic tools based upon 'chaotic' generative functions (discussed in more detail in [2] and [3]). Essentially, numerical data generated by the nonlinear functions are mapped onto a network of compositional parameters, ranging from pitches and durations to global structures of one form or another. CHAOTICS remains a set of modules, reconfigurable for each composition or musical problem.

Obviously, one attraction to the nonlinear behavior of chaotic functions is the possibility to obtain a wide range of date, from completely regular patterns or pulsations to unpredictable 'noise.'

3. Rhythmic Flow

In the instrumental domain, when one is dealing with written scores, the conventions of notation exert an important influence. A jazz musician, for example, has no problem playing off the beat; jazz phrasing tends to emphasize off-beats and weak beats in order to avoid too 'square,' or vertically accented, a rhythmic feel. In transcribing jazz improvisations (or editing MIDI input in a notation program), one often finds polyrhythms such as triplets beginning on the off-beat. This is a pattern that the musician would generally be at-ease performing. When one writes it down, however, then such material starts to appear 'difficult.' Anything more elaborate, such as beginning a triplet on a sixteenth subdivision of a beat, can be paralyzing, if the performer is playing within an ensemble context requiring coordination with the other players. The generally duple, beat-oriented, bar-oriented nature of music notation inherently renders certain kinds of rhythmic gestures difficult to perform because they are difficult to notate and thus to read. And, this is the case even when the musician may easily be able to perform
such material if they learned it by ear, or improvised it.

In wanting to emulate the rhythmic flow of jazz (and other) music and to create polyphonies or heterophony in which individual players would shape phrases in part by moving in and out of tempo, it became necessary to solve the notational problems such that the musicians would not be overly constrained by the score, but would also be able to coordinate their playing with the other performers in the ensemble.

4. Notation

There are, of course, various solutions to ameliorating the constraints of traditional music notation, a number of which are discussed in [6]. I will describe an approach adopted for one project, along with some considerations of the design of the compositional algorithm used for that piece.

*Kaleidarray* was composed in 1994 for a seven-piece ensemble based in Toronto, Arraymusic. The instrumentation—clarinet, trumpet, violin, double bass, piano, two percussion—suggested, to my jazz-influenced ears at least, a combo of some sort. I eventually decided to limit the percussion to vibraphone and marimba, and to drop the bass in favor of a small set of Thai gongs. Together with the piano, this quartet served as a gamelan-tinged rhythm section, and I decided to create a music for them that would explicitly draw upon that influence. At the same time, the ‘front-line’ trio, extremely heterogeneous in instrumentation, suggested a Dixieland band, or perhaps a klezmer or other Eastern European folk-group. My aim was to treat this trio as independent of the rhythm section, and at times independent of each other.

The way I opted to do this was to allow the trio to follow their own tempos, shifting from one to another in order to convey rhythmic flexibility. The music was completely notated; in other words, there was no improvisation. The phrases, though, were composed without reference to any barlines, and the three instruments were treated as separate entities, for the most part. There were times, however, when they were required to play together, in unison or in rhythmic synchronization. These moments were written as cues, with one player bringing the other(s) in at the appropriate time.

The notation solution eventually adopted was to create a quasi-spatial notation for the trio, with the rhythm section being completely noted in synchronization with the conductor. Above the staves of the trio’s parts, the tempo, meter, and beat structure that the conductor would be following is notated on a cue line. The parts themselves, with their capricious changes of tempo and rhythmic density, were calculated graphically in order that the rhythms, at whatever tempo they happened to be in, would fit proportionally with the tempo and beat of the conductor’s cue-line. Each member of the trio thus could play with a degree of freedom, but would also be able to remain more or less coordinated with the rest of the ensemble.

5. The Compositional Algorithm

In trying to organize the temporal flow of the composition, there were a couple of constraints. One was that a background harmonic progression, controlling the pitch content throughout the piece, required a relatively tight degree of ensemble cohesion so that no part could get out of harmonic sync. The other was that, for the trio, the creation of their material needed to proceed in parallel, so that the shifts to coordinated or unison playing would arrive at the same point for each player. In this way, even if one or other player had gotten somewhat off as the music proceeded, they would still be in the right vicinity, and could pick up the cue to join the other(s) relatively easily.

In order to take these factors into account, the music needed to be generated according to a universal time-code. Clock time turned out to be convenient enough, and all changes of tempo were calculated as ratios in reference to chronological time. A shift, for example, from sixteenth notes at MM=60 (where the succession in the computer program would be read as 0.00, 0.25, 0.75, 1.25, etc.) to eighth-notes at MM=72 would be implemented as 60/72, with the succession calculated as additions of the basic durational unit of that tempo (e.g., 0.4167, 0.8333, 1.25, etc.). In this way, even though the changes of tempo for the individual parts may occur at any point, with no reference to meter or beat, the chronological reference remains in effect. It was also on this basis that the proportional notation was worked out for the score and the individual parts.

All parametrical or compositional changes that are implemented in the piece (tempo changes for the rhythm section, durations of segments, harmonic changes, synchronized passages, pitch-range shifts, dynamics, etc.) could be ‘used’ by means of the time-code. The program, written in C, controlled the succession of operations by means of an integer counter linked to the time-code. It was, then, relatively easy to generate an extremely complex score, full
of various kinds and degrees of interaction between parts.

6. Implementation/Performance

For the ensemble, Arraymusic, Kaleidarray certainly presented some challenges. However, as the musicians got used to their parts, and gained experience watching the conductor without necessarily following along (in the case of the front-line trio), they became more comfortable with the score. For their part, the musicians of the rhythm section had an easier time of it, though the gamelan-inspired material, made up of figuration involving repeated notes and neighbor tones, often at quite a rapid pace, was not always idiomatic.

Arraymusic performed the piece a couple of times, and recorded it for broadcast. Each time they played it, in rehearsal and in concert, the music gained in interpretative energy. The notation proved to be utilitarian and, given the complexity of the music, practical.

7. Conclusion

It is not necessary to take the traditional conventions of music for granted. Music notation is already highly complex and evolved, but it also has a number of assumptions and biases programmed into it. If certain kinds of musical material is natural to the performer, but awkward to notate, then composers are faced with a problem to solve in order to realize their intentions in the best way possible.

In this case, with the aid of a custom-designed computer program, it was possible to solve the rhythmic/ensemble problems that arose from a jazz-inspired musical conception that did not fit the conventions of rhythmic notation.

8. References