Cognition in Jazz Improvisation

David Mendonça (mendonca@njit.edu)
Information Systems Department, New Jersey Institute of Technology
323 Martin Luther King, Jr. Boulevard, Newark, NJ 07102 USA

W.A. Wallace (wallaw@rpi.edu)
Department of Decision Sciences and Engineering Systems, Rensselaer Polytechnic Institute
110 8th Street, Troy, NY 12180 USA

Jazz improvisation is a continuous and serial process that requires a player to think creatively under time constraint as a performance unfolds. This study examines patterns in temporal and creative thinking among duos of improvisers performing a jazz standard and a free improvisation. *Temporal* types of cognitive processes involve thinking about performance events that are happening currently (*orientation*), have happened in the past (*retrospection*) or may happen later (*prospection*) in the performance. C*reative* types of cognitive processes pertain to the *generation, development* (i.e., elaboration) or *evaluation* of musical ideas (Finke, Ward, & Smith, 1992).

Playing different tunes may require improvisers to employ different temporal and creative strategies. The well-known tune "I Got Rhythm" (Berliner, 1994) may allow improvisers to think ahead and to generate more ideas, while a free improvisation is composed on the spot, perhaps making prospection difficult but requiring idea generation.

As a first step in modeling cognition in improvisation, the present research assesses the variability in improvisers' temporal and creative cognition. Using data from performances of "I Got Rhythm" and a free improvisation, three questions are addressed:

Q1. For a particular tune played by given group, the probabilities of occurrence for at least one type of process vary between the players.
Q2. For a given group, the probabilities of occurrence of at least one type of process vary for at least two tunes.
Q3. For a given tune, the probabilities of occurrence of at least one type of process vary for at least two groups.

Methodology

Three duos of professional improvisers (a trumpet player and either a bass or piano player) participated. Participants first practiced giving both concurrent and retrospective verbal protocols (Ericsson & Simon, 1993) then began playing the tunes, all of which were audio- and video-taped. Approximately two minutes after the performance of each tune, participants went to separate isolation booths and reviewed a tape of their performance while saying out loud what they had been thinking while playing the tune. These protocols were recorded, transcribed and segmented, then coded by independent coders for both temporal and creative cognition. As an example, the first ten temporal codes from the trumpet player in Session 1 for the tune "I Got Rhythm" were {P,R,P,O,R,O,O,O,O,P}, reflecting five instances of orientation (O), two of retrospection (R) and three of prospection (P).

Results

An encouraging result of this work is that temporal and creative strategies did not vary significantly, suggesting that it may be possible to build cognitively-grounded, flexible models of improvisation. For temporal processes, no significant differences were found for Q1, Q2 or Q3. For creative processes, no significant differences were found for any of the questions except Q3. Players can be therefore be said to have reasoned similarly regardless of instrument, tune or the group to which a player belonged. This result is particularly surprising for between-tune differences, since groups were expected to approach IGR and Free quite differently; indeed, the recorded performances of the tunes by any given group, while sharing certain elements (e.g., stable key signature and meter within each performance) nonetheless sound quite different.

To develop a model of improvisation, future work will focus on further analysis of the protocol data, combined with analysis of performance artifacts such as recordings (Palmer, 1997). Future studies may explore differences between experts and novices during improvisation.

Acknowledgments

This research was supported by National Science Foundation Grant CMS-9872699. Additional support was provided by Neil Rolnick and the iEar Department at Rensselaer Polytechnic Institute. We thank the musicians who participated in this study and the personnel at Max Trax Recording Studios.

References

Berliner, P. F. (1994). *Thinking in jazz.* Chicago: University of Chicago Press.

Ericsson, K. A., & Simon, H. A. (1993). *Protocol analysis* (Revised ed.). Cambridge, MA: The MIT Press.

Finke, R. A., Ward, T. B., & Smith, S. M. (1992). *Creative cognition: theory, research and applications.* Cambridge, MA: MIT Press.

Palmer, C. (1997). Music Performance. *Annual Review of Psychology, 48,* 115-138.