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A Microstructural Investigation into Jazz Syncopation:
The Effects of Selected Musical Variables on Note Dynamics

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The purpose of this study was to empirically determine what selected musical factors affect the acoustical properties (i.e., note dynamics) of eighth notes in jazz performance. Eighth notes (N = 231) were sampled from four unaccompanied solos performed by American saxophonist Chris Potter. Note dynamics were simultaneously regressed on metrical beat placement, melodic character, intervals, articulation, range, underlying harmony, and tempo. The omnibus test was statistically significant ($R^2 = .223; F_{(9, 221)} = 7.06, p < .001$). The independent variables combined to account for 22.3% of the variance in note dynamics. Tempo ($\beta = .408, t_{(6, 427)}, p < .001$) was found to have a statistically significant effect on note dynamics.

Keywords: dynamics; expression; jazz; microstructure; syncopation

One of the most fundamental elements in jazz performance is swing rhythm (Berliner, 1994; Collier & Collier, 1996; Friberg & Sundström, 2002; Schuller, 1968). However, it is one of the least discussed elements in jazz education because of its elusive nature. Syncopation is a defining construct of swing rhythm and serves as an expressive tool that is underscored through the most prevalent subtactus metrical level in jazz: the eighth note (Liebman, 1997). A jazz performer's subtle manipulation of note dynamics, or the acoustical loudness of a given eighth note, engages the listener in the feeling of tension and release, rest and unrest. Perceptually, syncopation is responsible for the forward moving, rhythmic drive described in jazz performance

A problem, however, lies in the lack of ability to describe, capture, and notate expressive qualities in music performance. Therefore, the rich variety of nuance found in jazz has traditionally been taught through performance practice and learned aurally. Pedagogically, the aural imitation approach to learning jazz nuance engages the learner in a manner where perception and conceptualization is freed from the limitations of categories. A strict aural approach to teaching the nuances inherent in jazz rhythm, however, inhibits important instructional dialogue pertaining to prescriptive, preventative, and aesthetic aspects of the educational process. Previous empirical studies have investigated the role of jazz rhythm in terms of eighth note length and ensemble synchronicity (Benadon, 2006; Busse, 2002; Cholakis & Parsons, 1995; Collier & Collier, 1996; Collier & Collier, 2002; Poval, 1977; Reinholdson, 1987; Rose, 1989). However, no empirical studies have investigated the effects of musical factors on the acoustical properties of jazz syncopation.

The aim of this study was to empirically determine the musical factors that affect syncopation in jazz performance. A more complete understanding of the microstructural elements of jazz syncopation is necessary for the improved pedagogy of jazz rhythm. More importantly, it can provide a more fundamental understanding of the underlying structure in jazz performance. The empirical testing of jazz syncopation may provide valuable insight into identifying, diagnosing, and prescribing solutions to problems pertaining jazz phrasing and time-feel.

METHOD

Participants

Eighth notes (N = 231) were sampled from four unaccompanied solos performed by American saxophonist Chris Potter (*Confirmation, 26-2, It Could Happen to You, Rhythm Changes)*. Chris Potter was selected as an exemplar because his performance of eighth note lines is performed in a clear manner in all registers of the saxophone and his performances are based upon a strong rhythmical foundation rooted in the jazz tradition.

Materials

The data designated by the variables of note duration, tempo, and beat emphasis were analyzed using MATLAB, created by Mathworks,™ with the utilization of MIR*toolbox* 1.3.3 (Lartillot, O., & Toiviainen, P., 2007; Lartillot, O., Toiviainen, P., & Eerola, T., 2008).

Procedure

Upon examination of jazz research literature, musical variables effecting syncopation (i.e., individual eighth note dynamics) were identified. The variables were examined for redundancy, appropriateness, and testing feasibility. The identified variables included (a) articulation, (b) interval preceding, (c) interval succeeding, (d) interval direction preceding, (e) interval direction succeeding, (f) metrical placement, (g) instrument range, (h) tempo, and (i) underlying harmonic character. An a priori power analysis was run in order to calculate the appropriate sample size in order to achieve the desired power of .80, with an alpha level of .05. The relative signal energy for each individual eighth note performed was calculated utilizing MIR*toolbox*'s *mirrms* (root square mean) function. The data indicated that 211 units of analysis were needed. The data was analysed by utilizing reliability, correlation, and regression sub-routines in the Statistical Package for Social Sciences (SPSS).

RESULTS

Note dynamics (n = 231) were simultaneously regressed on metrical beat placement, melodic character, intervals, articulation, range, underlying harmony, and tempo (See Tables 1 and 2). The omnibus test was statistically significant ($R^2 = .223; F_{(9,221)} = 7.06, p < .001$). The independent variables combined to account for 22.3% of the variance in note dynamics. Tempo ($\beta = .408, t_{(6,427)}, p < .001$) was found to have a statistically significant effect on note dynamics.

Table 1. Summary of the Simultaneous Regression Analyses

Variable	*b*	*SE*	β	*p*	*VIF*
Variables Predicting Note Dynamics					
Sax_Range	.012	.006	.145	**.029**	1.241
Sax_Metrical_Placement	-.001	.002	-	.500	1.082
Underlying Harmony	-.007	.006	-	.201	1.163
Sax_Interval_Preceding	.002	.002	.06	.355	1.322
Sax_Interval_Suceeding	.005	.002	.00	.974	1.096
Table 4.6. Summary of Intercorrelations, Me	.004	.006	.05	.450	1.383
Sax_MelodicCharacter_Succeeding	.010	.006	.10	.090	1.085
Sax_Articulation	.002	.00	.01	.829	1.144
Tempo	.002	.00	.43	**.00**	1.177

Note. R^2=.223 (p < .001).

DISCUSSION

The results indicate that acoustically, only tempo has an effect on the note dynamics in jazz performance. Therefore, it can be assumed that the perception of jazz syncopation may play more of an important role than acoustical happenings in how the listener experiences a jazz performance. By using an acoustical understanding as a foundation, further investigation into the relationships between one's perception and the true acoustics of a jazz performance may broaden our perceptual, pedagogical, and theoretical understanding of jazz rhythm.

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