"Root motion analysis of chord progressions of selected jazz compositions written between 1980 and 2000"

การวิเคราะห์การเคลื่อนคอร์ดโดยหลักการเคลื่อนที่ของรูทในบทเพลงแจ๊สในระบบอิงกุญแจเสียง คัดเลือกจากปี พ.ศ. 2523 ถึง พ.ศ. 2543

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บทคัดย่อ

ผลงานวิจัยชิ้นนี้ใช้หลักทฤษฎีการเคลื่อนที่ของรูท อ้างอิงจากงานเขียนของ อาโนลด์ เชิน-แบร์ก เป็นจุดเริ่มต้นด้านการวิเคราะห์ เพื่อนำมาประยุกต์ใช้ในการวิเคราะห์ บทเพลงแจ๊สในระบบอิงกุญแจเสียง เขียนในช่วงปี พ.ศ. 2523 ถึง พ.ศ. 2543 ผู้วิจัยได้ถอดโน้ตและวิเคราะห์การเคลื่อนคอร์ดตามหลักทฤษฎีของ อาโนลด์ เชิน-แบร์กจำนวน 1332 คู่ โดยใช้สัญลักษณ์เลขโรมันหลัง จากนั้นได้แบ่งการดำเนินคอร์ดเป็น 3 กลุ่มหลัก ได้แก่ การดำเนินคอร์ดขาขึ้น การดำเนินคอร์ดขาลง และการดำเนินคอร์ดแบบใกล้ โดยแต่ละกลุ่มแบ่งย่อยเป็น 2 กลุ่มรอง การวิเคราะห์ข้อมูลแสดงให้เห็นถึงความถี่ของการดำเนินคอร์ดประเภทต่างๆ ที่เป็นประโยชน์ต่อวงการวิชาการดนตรี เมื่อนำผลการวิเคราะห์ ข้อมูลไปเปรียบเทียบกับข้อมูลการวิจัยดนตรีตามแบบแผนในศตวรรษที่ 17 ถึง 19 และดนตรีประเภทร็อกพบว่าบทเพลงแจ๊สในระบบอิงกุญแจเสียงมีการใช้การเดินคอร์ดขาขึ้นที่เรียกว่าแบบขั้นคู่ 4 น้อยลง และมีการใช้การดำเนินคอร์ดแบบใกล้มากขึ้น เมื่อเทียบกับดนตรีตามแบบแผนในศตวรรษที่ 17 ถึง 19 และจากการศึกษาข้อมูลเพิ่มเติมพบว่า จำนวนของการดำเนินคอร์ดขาลงในบทเพลงแจ๊สในระบบอิงกุญแจเสียงมีประมาณครึ่งหนึ่งของจำนวนการดำเนินคอร์ดขาขึ้น ซึ่งในดนตรีประเภทร็อคจะมีการดำเนินคอร์ดขาขึ้นและลงในจำนวนที่เท่าๆ กัน

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Abstract

As its analytical starting point, this study used root motion theory based on the writings of Arnold Schoenberg and applied them on a set of jazz compositions written between 1980 and 2000. Schoenberg wrote: “There are three kinds of root progressions: (1) strong or ascending progressions, (2) descending progressions and (3) super-strong progressions.” In this study, 1332 chord progressions extracted from tonal jazz compositions were analyzed in terms of their root motion. The chord progressions were transcribed and analyzed using Roman numeral symbols after which they were grouped according to their root motions category. The data was compiled and then analyzed revealing the most frequent root motions and common chord progression patterns. The results were also compared to root motion data done on music from other styles. This article discusses some of the results.

Keywords: Jazz / Chord Progression / Root Position

Root motion theory

Jazz music of the last 6 decades absorbed influences from various musical styles, being it serious music or popular music. These influences are being expressed in harmony, rhythm, melody, form, instrumentation, orchestration etc. Here we focus on the harmonic aspect of those changes. Contemporary jazz is often associated with the use of non diatonical, non functional harmonies and avoidance of a cadence to the tonic chord many times resulting in ambiguous key areas.

The perception of changing harmonies is an essential part of the listening experience. Music theorists such as Rameau, Schoenberg, Tymoczko and Meeus have used root motion theory as a method of explaining chord transitions and its perception in tonal music. In his book “Structural functions of Harmony” Schoenberg

wrote: "The structural meaning of a harmony depends exclusively on the degree of the scale. The appearance of the third, fifth, or seventh in the bass serves only for greater variety in the second melody Structural functions are exerted by root progression. There are three kinds of root progressions: (1) strong or ascending progressions, (2) descending progressions and (3) super-strong progressions."[2]

Tymoczko writes: "One of the principles of root motion analysis is *the principle of scale-degree symmetry.* This principle asserts that *all* diatonic harmonies participate equally in the same set of allowable root motions. It is just this principle that distinguishes root-motion theories-which focus on the *intervallic distance between successive harmonies*-from more conventional views, in which individual harmonies are the chief units of analysis."[3]

Practically, Schoenberg classified root progressions in 3 main groups: 1) ascending (or strong progressions) 2) descending and 3) super-strong progressions (or stepwise progressions). Each group is divided into two sub categories, leaving us with a total of 6 groups. It is this root motion classification which will be used for analysis throughout this project.

Fig. 1 Root motion classification

Progression	Root Motion	Example[4]	Abbr.	Effect
Ascending	4^{th} up	CM7 - Fm7	A4	Predictable, sense of moving forward
	3^{th} down	Gm7 - E♭M7	D3	
Descending	5th up	Am7 - Em7	D4	Regression, moving

[2] Arnold Schoenberg, *Structural Functions of Harmony* (New York: W.W. Norton, 1954) 6-7.

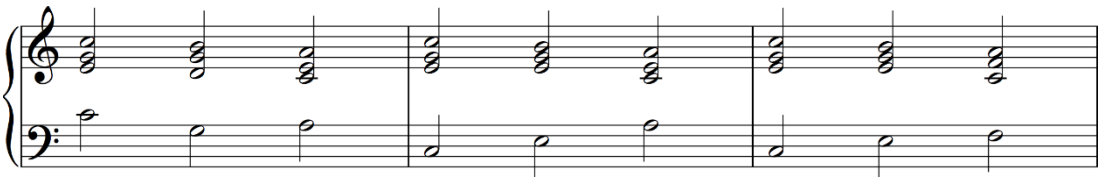
[3] Dmitri Tymoczko, "Root Motion, Function, Scale-degree," accessed July 11, 2017, http://dmitri.mycpanel.princeton.edu/files/publications/tonaltheories.pdf.

[4] CM7 is C major with a major seventh, Fm7 is F minor with a minor seventh.

	3th up	FM7 - A♭M7[5]	A3	backwards
Super-strong	2nd up	B - C♯m7	A2	Very strong forward movement
	2nd down	E♭M7 - Dm7	D2	

Schoenberg wrote the following on the practical use of the 3 main progressions: (1) "Ascending progressions (strong progressions) can be used without much restriction, super-strong progressions may be considered too strong for continuous use[6]" (2) On descending progressions Schoenberg explains: "they (descending progressions) do not possess the conquering power of the ascending progressions. On the contrary they promote the advancement of the inferior notes. In I V, IIm VIm, IIIm VIIdim, the fifth of the first note always advances to become the root of the second. And in descending progressions going up a third (he says): "a note of inferior importance, the 3rd, becomes the root of the second."[7] He therefore concludes that descending progressions are better used in a combination of three chords resulting in a ascending progression between the first and third chord.

Fig. 2 Recommended use of descending progressions.



[5] The harmonic movement from one chord to another can involve chromatically altered chords, a F major seventh chord could move to a A♭ major seventh chord. It was therefore necessary to include all chromatic roots to allow for equal participation.

[6] Arnold Schoenberg, *Structural Functions of Harmony* (New York: W.W. Norton, 1954) 6-7.

[7] Ibid.

Descending root progressions in which the second chord falls on the stronger beat of the measure are rare in common practice period except in cases in which they are used as mere interchange, resulting in more 'static' harmony. (Fig. 3)

Fig. 3 Static harmony

| I V | V I | I V | V I |

Continuous descending progressions are discouraged in his textbooks and quite rare in common practice music.

Fig. 4 Continuous descending progressions

| IIm | VIm | IIIm | etc.

Interestingly these progressions are nowadays much more common, especially in today's pop music.

The importance of Schoenberg's root progressions lies in the use of analysis of music and the effect the root motions in a composition has on the listener. The frequency and the interaction between those 3 types of progressions have a profound effect on the composition. This and the interaction with the melody is what resonates strongly with a listener of tonal music.

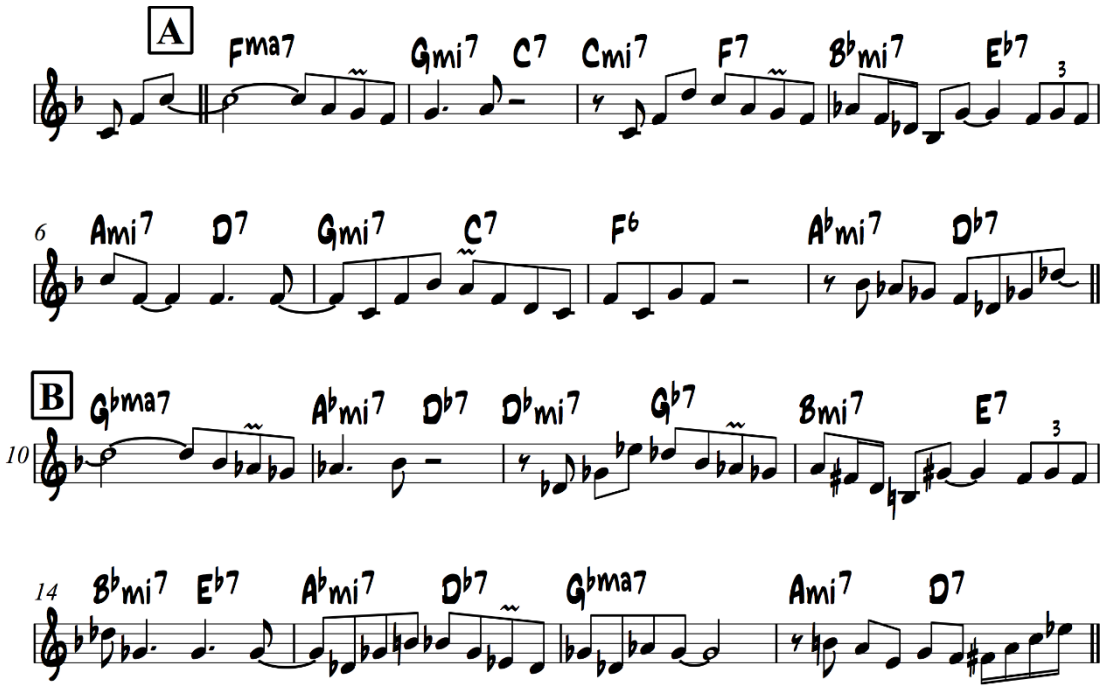
A typical composition from the common practice period shows high numbers of ascending progressions, especially fourths up (fifths down). Tymoczko analyzed the root motion of Bach chorales and concluded that ascending progressions accounted for more than 74%.[8] Although the harmonic language in popular music and jazz grew out of the harmonic norms used in common practice tonality, there have been many changes that can't be ignored. Everett writes: "These norms (of the common practice

[8] Dmitri Tymoczko, "Root Motion, Function, Scale-degree," accessed July 11, 2017, http://dmitri.mycpanel.princeton.edu/files/publications/tonaltheories.pdf.

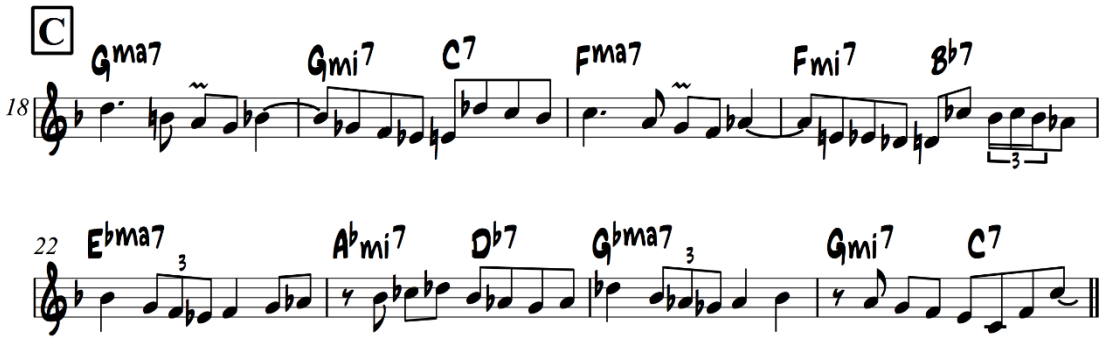
period) are still adhered to, in varying degrees, in most current popular music, although we also find today many competing approaches to "normal" tonality. This current multiplicity is likely in part a reflection of the increasingly diverse social identities represented by today's listeners as opposed to the more homogeneous audience of a half-century ago."[9]

The Bebop composition "Joy Spring" by Clifford Brown, written in 1956, is a good example of traditional harmony. Indeed, 75% of the chord progressions used in the A B and C section of "Joy Spring" are ascending progressions, only 4.6% are descending. Although this piece has a very high number of II V pairs it is common to see a high frequency of ascending progressions in the Bebop and Swing repertoire.

Fig. 5 The A B and C part of "Joy Spring" by Clifford Brown.



[9] Walter Everett, "Making sense of rock's tonal systems," *Music Theory Online* 10, 4 (2004): 3.



However, many jazz composers from the eighties and later verged away from the predictable harmonies of the Bebop and swing era and incorporated rhythms and harmonies of other musical styles including pop music, Latin music, African music and World music.

Objective

In this study the goal was to analyze root motions, using the root motion theory of Arnold Schoenberg and apply them on a set of jazz compositions written between 1980 and 2000. We then deduced common chord patterns and compared the data with of other scholars. We chose 20 compositions from 4 composers: Pat Metheny, Russell Ferrante, John Scofield and Ralph Towner. All compositions were transcribed and analyzed in terms of Roman numerals and all the chord inversions were reduced to their root position. The use of tensions of any kind does not change the structural function of the chords, thus were ignored. We deducted the intervallic distances between the root of every chord of each composition, collected chord quality data and entered the data in separate Excel files.

The root movement is expressed in intervals. Dm7 to FMaj7 represents a root motion of a rising third, which belongs to the descending progression group as classified by Schoenberg. Chord progressions were limited to those used during the theme only, chord progressions for improvisation sections were not considered, as often use the same chord progression. The data was presented in separate MS Excel

sheets for each composition and later consolidated. The first left column represents the initiating chord, the first row represents the target chord. The numbers in the cells represent the amount of progressions from initial chord (row) to target chords (column).

As an example let's look at a part of the root progressions of a composition by R. Ferrante. In Fig 6. we have 4 descending progressions starting on II going to IV, which are going up a third. They are "descending progressions" because the root motion is a third up.

Fig. 6 Visual representation of root progressions

	I	♭II	II	♭III	III	IV	♯IV	V	♭VI	VI	♭VII	VII
I			9			17		8				
♭II												
II					2	4		6	8	1		
♭III												
III										6		
IV	14		3		4			10		2	1	1
♯IV												
V	15		4			9						6
♭VI								8				
VI	2		3			2		5			2	
♭VII	2					2						
VII										6		

Conclusion

Of all 1332 progressions analyzed in this study, 39.2% were ascending, 20.8% were descending and 39.9% are step-wise chord progressions. Comparing data from

Bach chorales by Tymoczko revealed a decrease of ascending progressions, namely root motions up by a 4th and an increase in step-wise progressions, but descending progressions (third up and fifth up) were almost the same.

Fig. 8 Root motion data from this study.

Root Motion		Amount	% of total	Total
Ascending	Fourth up	352	26.43%	1332
Ascending	Third down	171	12.84%	1332
Descending	Fifth up	139	10.44%	1332
Descending	Third up	138	10.36%	1332
Stepwise	Second up	290	21.77%	1332
Stepwise	Second down	242	18.17%	1332

Fig. 9 Bach chorales root motion data.[10]

Root motion	Down	Up
Fifth	1842 (35%)	510 (10%)
Third	682 (13%)	533 (10%)
Second	318 (6%)	1354 (26%)

One of the interesting facts is to see what common harmonic patterns emerged from this data. As suspected, the most frequent chord patterns involved the I, IV and V chords. The most frequently used chord pairs that stood out from the rest were I - IV , followed closely by the V - I and IV - V progressions. Interestingly the II - V transition, often associated with traditional jazz, was used to a lesser extent than the IV - V.

[10] Dmitri Tymoczko, "Root Motion, Function, Scale-degree," accessed July 11, 2017, http://dmitri.mycpanel.princeton.edu/files/publications/tonaltheories.pdf.

Fig. 10 Scale degree table of chord progressions. (Starting chord in the left column, target chord in the first row)

	I	♭II	II	♭III	III	IV	♯IV	V	♭VI	VI	♭VII	VII
I	0.0%	0.1%	3.2%	1.1%	1.0%	5.9%	0.5%	3.0%	3.5%	0.5%	1.0%	0.8%
♭II	0.3%	0.0%	0.5%	0.0%	0.0%	0.1%	0.4%	0.1%	0.2%	0.0%	0.0%	0.0%
II	2.8%	0.5%	0.0%	0.2%	0.6%	0.5%	0.2%	2.6%	0.6%	0.7%	0.8%	0.3%
♭III	0.2%	0.2%	0.5%	0.0%	0.0%	0.4%	0.1%	0.2%	1.5%	0.3%	0.3%	0.0%
III	0.5%	0.0%	0.4%	0.3%	0.0%	0.5%	0.3%	0.2%	0.2%	1.7%	0.6%	0.2%
IV	3.2%	0.2%	2.0%	0.2%	1.6%	0.0%	0.2%	5.6%	0.1%	0.8%	0.9%	0.1%
♯IV	0.2%	0.0%	0.4%	0.5%	0.0%	0.7%	0.0%	0.1%	0.2%	0.0%	0.0%	1.1%
V	5.7%	0.2%	0.3%	0.4%	0.4%	2.7%	0.4%	0.0%	0.8%	2.4%	0.2%	0.7%
♭VI	2.8%	0.0%	0.3%	0.2%	0.1%	0.6%	0.0%	1.8%	0.0%	1.6%	2.1%	0.2%
VI	0.8%	0.2%	1.7%	0.2%	0.6%	2.2%	0.0%	1.1%	0.8%	0.0%	0.7%	0.0%
♭VII	1.7%	0.6%	0.0%	0.8%	0.3%	1.3%	0.2%	0.2%	1.2%	0.3%	0.0%	0.2%
VII	0.8%	0.0%	0.5%	0.2%	0.5%	0.3%	0.4%	0.2%	0.1%	0.5%	0.3%	0.0%

Fig. 11 Other often used chord patterns (in order of frequency)

1. I ♭VI	2. IV I	3. I II	4. II V
5. I V	6. ♭VI I	7. II I	

The frequent use of the ♭VI chord is a result of modal interchange, borrowing from parallel minor mode. Almost all ♭VI chords were either major seventh or seventh chords. Compared to the common practice period, there was a much higher use of chords build on the chromatic scale degree, especially the ♭VII and ♭III are used more often. Also a higher degree of non functional harmonies were found.

Shoenberg's theory on root progressions was first published in 1911, using mostly musical examples from common practice tonality. In this study, we examined root progressions in modern tonal jazz from 1980 till 2000. The amount of each type of root progression used and the chord patterns that were used, revealed stylistic harmonic differences of the period analyzed when compared to other periods or styles.

This data is useful in an educational context, be it for analytical purposes, composition, ear training or instrumental classes. Furthermore these harmonic differences are noticeable for the non-musician, a piece with a high number of descending progressions would sound very different than a piece with mainly ascending progressions. It is the frequency, the balance or imbalance and the interaction between those 3 types of progressions that makes a composition sound harmonically different from another.

In general, ascending progressions produce a sense of "forward" movement in music and do not bring upon much surprise movements, they "go with the flow" and are very common. There are a few exceptions. In the key of C major
| Em7 Cmaj7 | and | Bm7♭5 G7 | are both ascending progressions but do not sound as forward moving transitions but sound rather static, as they can be viewed as substitutions for each other. Descending progressions are less predictable and tend to move against "the flow", especially 2 or more following each other. Again the exception would be a descending progression starting from the I chord:
| I V | I | or | I V | VIm |

Root motion theory analyses chord progressions from the chord's root. All chords are reduced to the core sound, inversions are reduced to root position and tensions are excluded. I believe this is its beauty and strength. It does not claim to explain the inner movement of voices or the melody/harmony relationship, other

analytical methods are more suitable for that purpose and should be used for deeper analysis, but it is useful when doing macro analysis of a composition.

Furthermore, there is no need to define a key center in order to do root motion analysis. The type of root progression used can give us an understanding, a "preview", of the motion from one chord to the next and especially its effect in terms of predictability. This is useful in a classroom situation when analyzing music with an ambiguous key area or works that avoid the predictability of a root motion up a perfect fourth (ascending), sometimes seen in contemporary jazz composition.

The advantages of root motion analysis in education is that it is rather easy to apply and therefor not limited to higher education. It does not leave much place for interpretation as is sometimes the case in traditional functional analysis. It can reveal harmonic changes on a macro level and harmonic patterns independent of musical style or time period and can be used to analyze pieces with ambiguous key areas.

This project focused on music selected from 1980 till 2000 and does by no means pretend to give a complete picture of that period, more data will be available soon.

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