Improvisation in Jazz: "Stream of Ideas"-Analysis of Jazz Piano-Improvisations

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ABSTRACT

The "stream of ideas"-analysis embodies a new way to analyze jazz improvisations. The core of the "stream of ideas"-analysis, which was developed within an empirical research, is to translate an improvisation on a mid-level to a sequence of melodic phrases/patterns (="ideas"). On the basis of methods of qualitative content research and grounded theory an expendable and differentiable dynamic system of categories was created to represent every kind of melodic phrases, which occurred within the 30 examined improvisations. The underlying improvisations were the result of an experiment with five jazz pianists, who were asked to improvise in several sessions on the same collection of different jazz tunes. Afterwards each improvisation was categorized according to the "stream of ideas"-analysis and presented as a sequence of used "ideas". After analyzing the 30 improvisations, the system of categories consisted of nine main categories (="basis-ideas"), which covered every appearing melodic phrase. The nine "basis-ideas" are defined with regard to either aspects of melodic contour or intra-musical aspects (variation of the theme, creating motifs etc.). Furthermore the "stream of ideas"-analysis makes it possible to compare improvisations objectively between different musicians or tunes by using statistical methods (e.g. by dealing with frequency distributions). It could be shown that each of the five participating pianists used a quite similar combination of preferred "basis ideas" (individual vocabulary) to create his different improvisations (takes) on the same underlying tune. In addition, a connection between the different tunes and the amount of certain "ideas" was recognized.

I. INTRODUCTION

Improvisation is a process that happens in countless situations of everyday life. Although the word and its meaning is familiar to many people, the process is not easy to describe and to explain as a whole. In the large field of arts, improvisation is not only a general aspect of human behavior, but embodies a widespread stylistic tool. Besides certain kinds of poetry, theatre and visual arts, improvisation has a long history and significance in music. Improvisation is a phenomenon that occurs in many different musical cultures, styles and epochs. In jazz, improvisation plays an important part and, to a certain extent, even defines this kind of music. But even in the context of jazz, there are many different concepts and possibilities to deal with improvisation (e.g. the improvisations during New Orleans-Style differ clearly from improvisational concepts used in Bebop or Free Jazz).

Regarding the research on musical (jazz) improvisation in the past decades, the large amount of published studies can roughly be separated into two domains. On the one hand there are many studies concentrating on the personal style of the examined musician by transcribing and analyzing his improvisations in a "classical" hermeneutic way (e.g. Owens 1974). Although extracting individual concepts of musical improvisation leads to interesting results, these studies mainly concentrate on personal stylistics of improvisation. In this way aspects concerning the general process of musical improvisation have not been considered satisfactorily. Obviously there are also publications, which combine these two points of view. The standard work of Paul F. Berliner (1994) needs to be mentioned as an example in this context. On the other hand, a large amount of studies was published focusing on general aspects of musical improvisation. Some of these studies used methods of (cognitive) psychology and neuroscience. Among the many publications the works of Pressing (1984), Behne (1992) and Limb & Braun (2008) represent interesting observations. However the achieved results are hard to link with specific improvisations being outcomes of musical performances of certain artists. Furthermore the underlying experimental designs of neuroscientifical studies often implicate a lack of external validity.

II. AIMS

With regard to the situation mentioned above the ambition for my research mainly consisted of two points:

1. To develop and establish a new and alternative method to analyze jazz improvisation. In this way the analysis method should proceed from the specific improvisation examined in each case. Besides identifying the individual style of the improvisation the analysis method should also make it possible to compare different improvisations in an objective way. This is quite important to gain results concerning the general process of musical improvisation.

2. By using this new method central questions in the field of jazz research should be tried to answer: How is a jazz improvisation structured? Are there any repetitions or similarities between the different improvisations (takes) by each jazz musician on the same underlying tune? To sum up these questions the underlying hypothesis is: The creative effort of the jazz musician during the process of improvising is to a large extent not the creation of new melodic material, but the selection, combination and arrangement of already existing /learned melodic material/patterns. In other words, the recourse to an existing vocabulary of already learned and established melodic gestures and patterns plays a large part in jazz improvisation. Therefore, the analysis of different improvisational takes of the same jazz musician on the same underlying tune is focused, as well as the connection between the improvisations and their underlying musical references (tunes).

III. EXPERIMENT

Running an empirical experiment pursued the aims and questions mentioned above. Therfore data for testing the new analysis method ("stream of ideas"-analysis) was collected. Furthermore the empirical experiment was designed to follow the expressed hypothesis.

A. Subjects

Five jazz pianists participated in the experiment. Four of the five musicians were professional or semi-professional jazz pianists. To collect information about the participating subjects, they were asked to fill in a questionnaire that was designed for the experiment. Some important information regarding jazz specific skills and expertise of the subjects is shown in the following table:

Table 1. Musical background and jazz specific skills and expertise of the participating subjects.

Item	Mean	Range
Age	38,4 Years	24-47 Years
Previous Musical Experience	29,6 Years	12-40 Years
Current Extent of Musical Activity	22,4 Hours/Week	6-40 Hours/Week
Previous Musical Experience in Playing Jazz	24,2 Years	10-40 Years
Individual Assessment of Knowledge in the Field of Jazz (Scale form 1-7; 1=None, 7=Very High)	6,2	5-7
Individual Assessment of Musical Skills in Playing Jazz (Scale form 1-7; 1=None, 7=Highly Professional)	5,7	4-7

B. Experimental Setup and Procedure

During the experiment each participating jazz pianist was asked to improvise in three sessions on the same collection of four given tunes/standards. The three recording sessions were realized in an interval of at least five days to avoid that the tunes were remembered too precisely. To avoid sequence effects the order of the tunes within the different sessions was changed. Among hundreds of available jazz standards the four tunes were selected with regard to certain characteristics:

1. The tunes should not be too well known to avoid the effect that the subjects had already established an individually standardized improvisation on the underlying tune. Therefore famous jazz standards like for example "Autumn Leaves" could not be used. To be certain that this demand could be granted the subjects were asked how familiar they are with the selected tunes. With one exception all the subjects either did not know the tunes or they listened to/played them very seldomly.
2. Because the tunes were supposed to be mainly unfamiliar the harmonic and melodic complexity of the themes could not be too high to allow improvisations without previous rehearsal.
3. The chosen tunes represent common harmonic, formal and stylistic clichés, typical in jazz.
4. The four chosen tunes differ in tempo, style and form and represent a cross-section of common jazz standards (one jazz blues, one ballad, one up-tempo tune, one modal tune).

During each of the three recording sessions the subjects played accompanied by exclusively for the experiment created backing tracks consisting of bass and drums. The pianists were asked to first play the theme of the tune followed by one (ballad) or two choruses of improvisation. Besides this no further limitations were set to allow the subjects to improvise in their individual style and habit. The jazz pianists played on a digital piano (Casio Privia) with a full sized keyboard and weighted keys. The musical performances were recorded as MIDI files using a sequencing software (Cubase). The sound of the piano was mixed together with the sound of the backing tracks to present the subjects a feedback in real time. The sound of the piano was generated by using a VST plugin. Before the recording started each pianist had been given time to get familiar with the digital piano. Adjusting the volume of the piano sound and the backing track within the feedback mixdown, as well as adjusting the sound produced by the VST plugin seemed to be important to ensure each pianist felt comfortable with his individual sound. The feedback sound was according to the preferences of each subject either provided by headphones or PA system.

The recorded performances covered a total of 60 improvisations (approximately 4000 bars of musical improvisation; five subjects, four tunes in each session, three recording sessions). These improvisations represent the basis of the following "stream of ideas"-analysis.

IV. "STREAM of IDEAS"-ANALYSIS

This new method to analyze jazz improvisation is inspired by the pilot study of Lothwesen & Frieler (2011). I extended their approaches and developed an own system called the "stream of ideas"-analysis. The improvisations recorded during the empirical experiment were the data, which formed the basis for the analysis. Because of the large time exposure 30 (all improvisations on the blues tune "Kenny'll Make It" and on the modal tune "Little Sunflower") of the 60 improvisations were first analyzed by using this method.

The main concept of the "stream of ideas"-analysis was to translate the improvisation into a continuous sequence of melodic phrases (="ideas"). Figure 1 on the following page shows an example of the "stream of ideas"-analysis. Therefore the analysis worked on a mid-level and not by focusing on the single pitches. The encoding process is inspired by the methods of grounded theory (Strauss & Corbin 1996) and qualitative content analysis (Mayring 1995). This led to a dynamic encoding process: Each melodic figure/phrase was isolated and defined as a certain "idea". This "idea" was, according to its characteristics, assigned to the suitable main category (="basis ideas"). If no category fitted a new one was created. After expanding the system of categories, each improvisation was checked again by using the new system. Shifting between encoding the data and creating categories allowed a very precise and complete analysis and a strong link to the underlying improvisation. Having encoded some of the improvisations the created system of categories consisted of nine "basis ideas", which made it possible to specify every melodic phrase occurring in the analyzed 30 improvisations independently from the individual musician. The so called "basis ideas" constitute as main categories the highest hierarchy of the system of categories.
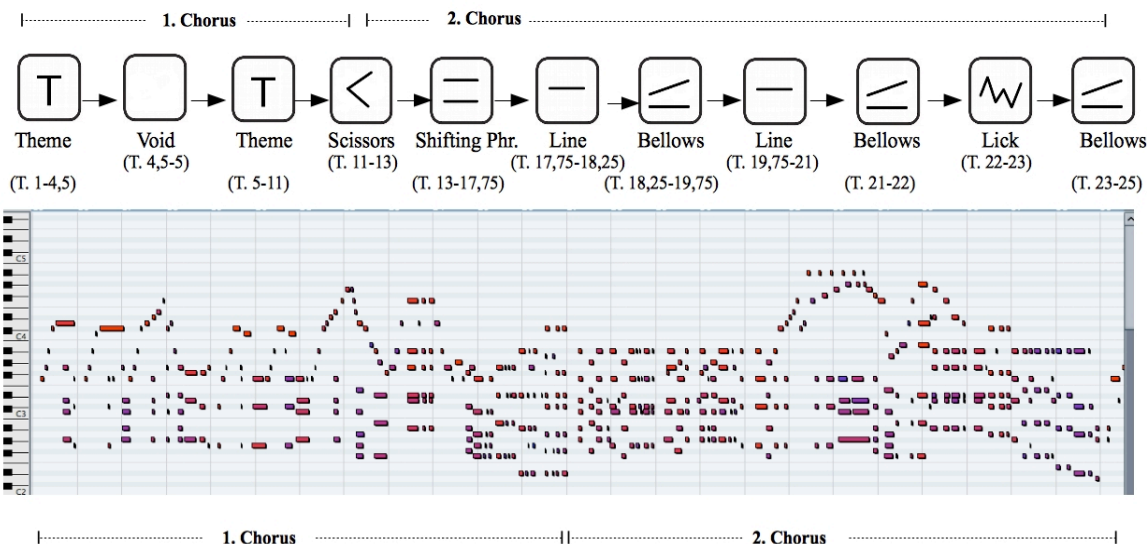
Figure 1. Example of the "stream of ideas"-analysis. Two choruses of improvisation on the 12-bar blues tune "Kenny'll Make It".

The nine "basis ideas" and possibilities to differentiate the system of categories by adding different levels of hierarchically ordered sub categories are shown in Figure 2.
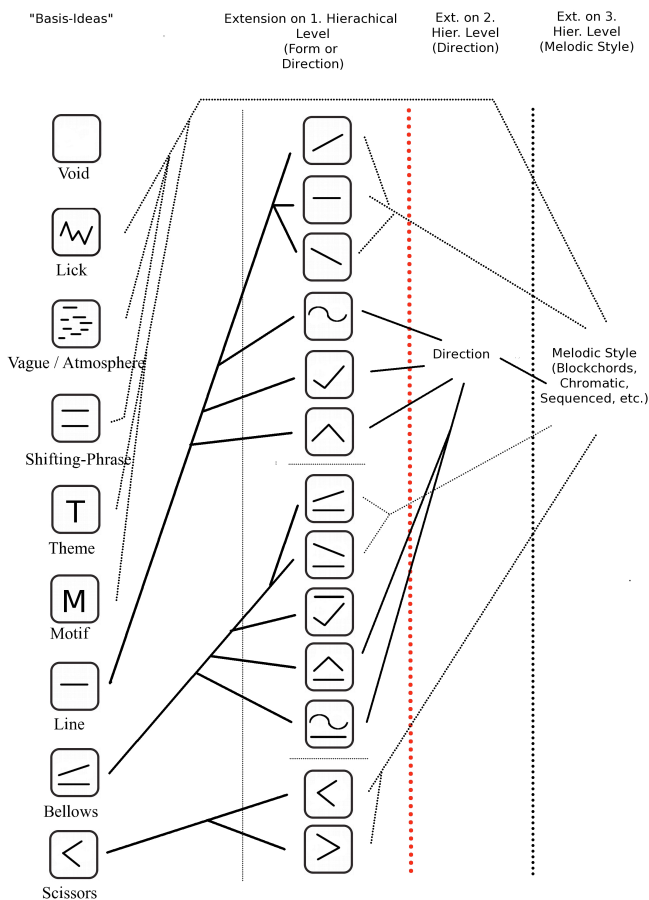

Figure 2. Scheme of the nine "basis ideas" and possible extensions (levels of sub categories).

A. Definitions of the "Basis Ideas"

The nine "basis ideas" were mainly defined with regard to either melodic contour or intra-musical aspects. Dealing with musical performances produced by pianists, polyphonic gestures were as well taken into account. In general there was no distinction whether a melodic phrase was presented in single notes or in a polyphonic way (e.g. as block-chords or in two voices). However, the typical self-accompaniment that a jazz pianist usually uses (above all the actual given chords of the theme) was not regarded as a part of the particular "basis idea". If the accompaniment contrasted clearly with the typical expected accompaniment, it would be considered as a part of the particular "basis idea". A short definition of each "basis idea" is given below to explain to which categories melodic phrases can be assigned:

- "Void": The "basis idea" "void" is used to name breaks between consecutive melodic phrases, unmated chords functioning as standardized accompaniment or sustaining tones at the end of an idea.
- "Lick": The "basis idea" "lick" describes a mostly short melodic phrase with a diversified rhythmical form. It is often based on well-known Bebop-licks and presents an individually established melodic figure, that sounds well on a certain underlying chord or situation.
- "Vague/Atmosphere": Musical phrases without any recognizable context, direction or form are assigned to this "basis idea". These melodic phrases are often used as stylistic devices to create a sound effect or a (impressionistic) sound ambience.
- "Shifting-phrase": This "basis idea" describes a repeated (sometimes periodical) shifting between two tones or (block-) chords.
- "Theme": Melodic phrases, which pick up or vary the melody of theme of the underlying tune in a clearly recognizable way are assigned to the "basis idea" "theme".
- "Motif": Melodic phrases that occur several times within an improvisation (repeated or varied) or a repeated

melodic figure forming one entire phrase are called "motif".

- "Line": This "basis idea" is doubtlessly the most frequent one. It describes a sequence of tones proceeding in small intervals of pitch and heading in a certain direction (ascending/descending/horizontal) or forming a more complex shape (e.g. convex, concave or wave-like).
- "Bellows": This "basis idea" is one of the most complex ones. It describes the phenomenon when two separate "lines" simultaneously form a melodic phrase. If one of these "lines" stays horizontal, whether the other heads in a certain direction or forms a complex shape, this phrase will be called "bellows".
- "Scissors": This "basis idea" is quite similar to the one explained previously, but describes the special case of two separate "lines" heading in opposite directions.

By using these nine main categories every melodic part of each improvisation recorded during the empirical experiment could be categorized.

B. Further Analysis of the Encoded Improvisations

The main achievement of the "stream of ideas"-analysis is to provide the possibility to compare different improvisations in an objective way, irrespective of the individual musician or the underlying tune (e.g. by using statistical methods). In that context each improvisation is represented as a sequence of "basis ideas" and a frequency distribution of used " basis ideas". Dealing with this kind of data, different aspects were investigated:

First of all, the comparison of the three takes of each pianist on the same underlying tune focused on the search for similarities. This happened by using a chi-square-test. Although being aware of transgressing the requirements of this statistical test by dealing with dependent samples, I still decided to run it because of the lack of proper alternatives and to underline the descriptively recognized trends in a heuristic way. Secondly the "basis ideas" of all 3 takes of each pianist on the same underlying tune were summarized to a single frequency distribution and compared with the ones of the other pianists by again using a chi-square-test. In addition, the influence of the underlying tune, as the main reference for the improvisations, was investigated. Finally, the aspects mentioned above were included into one further test, by calculating Euclidean distances between each sequence of "basis ideas". In doing so, a matrix of distances was developed, which was the basis for a multidimensional scaling.

V. RESULTS

The encoding process of the "stream of ideas"-analysis offers a new way to analyze jazz improvisation. By being able to categorize each melodic phrase within the 30 examined improvisations, it represents a precise mid-level-analysis, that makes further investigations of the improvisations possible without focusing exclusively on only one individual musician. Besides the method of analysis itself, it helps finding answers to interesting questions concerning the process of jazz improvisation. Results of the further analysis of the encoded jazz improvisations are:

1. The comparison of the three improvisations (takes) of each pianist on the same underlying tune: The three related frequency distributions of each pianist were quite similar. Chi-square-tests have shown no significant differences in any case. Each pianist used an individual but similar combination of "basis ideas" to create his different improvisations (takes) on the same underlying tune (with the exception of pianist no. 3). In other words, each subject used a preferred and mainly constant vocabulary of "basis ideas" to create his improvisations on the same underlying tune and represents in this way a fingerprint of repeated melodic phrases (see Figure 3).
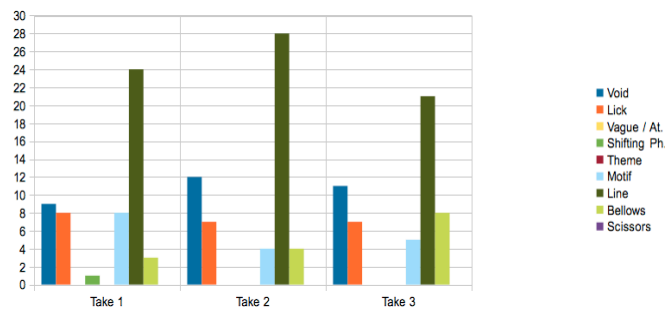

Figure 3. Improvisations (three takes) of pianist no. 5 on the modal tune "Little Sunflower". Frequency distribution of used "basis ideas" for each take are shown.

2. Comparison of the five different pianists: Although the combination of used "basis ideas" of the three improvisations of the particular subjects on the same tune were quite similar and constant, the summarized frequency distributions among the pianists differ significantly (shown by chi-square-tests). Thus, each pianist used an individual vocabulary of preferred "basis ideas" to create his improvisations on a certain tune.

3. The MDS, used as an alternative, reflected these results partly. A difference between the improvisations on the blues tune and the modal tune could be recognized. This aspect will be taken up again below. Clear clusters of the three belonging takes of each pianist appeared partly. For showing the differences between the pianists a MDS does not seem to be the best method, because of the omnipresent strong influence of the "basis idea" "line".
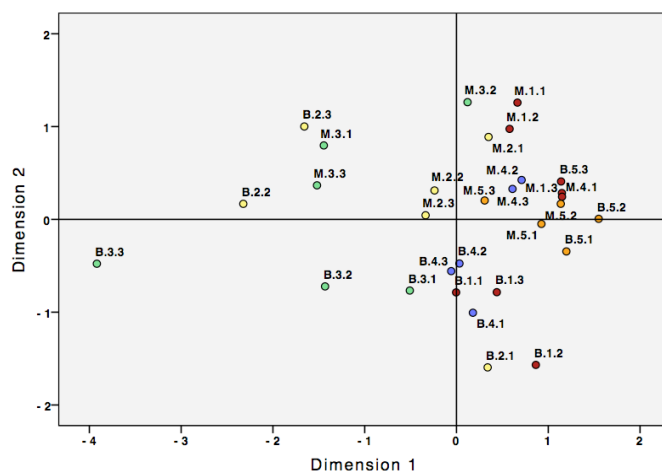

Figure 4. MDS of Euclidean distances between all improvisations. Stress=0,144; RSQ=0,926. Marking: M=modal tune, B=blues; followed by pianist-ID (1-5) and take (1-3).

Table 2. Use of "basis ideas" in dependence of the underlying tunes (in total).

"Basis-Ideas"- Categories	Void	Lick	Vague/At.	Shifting Ph.	T	M	L	Be.	Sc.	Total	Duration (Ø)
The Total of used "Basis-Ideas" for all Improvisations on "Kenny'll make it (Blues)"	32	52	0	5	16	17	103	33	7	265	1,36 Bars
Percentage	12,0%	19,6%	0,0%	1,9%	6,0%	6,4%	38,9%	12,5%	2,6%		
The Total of used "Basis-Ideas" for all Improvisations on "Little Sunflower"	119	62	8	14	28	85	327	99	10	752	1,91 Bars
Percentage	15,8%	8,2%	1,0%	1,9%	3,7%	11,3%	43,5%	13,2%	1,3%		

4. Comparing all the "basis ideas", which were used to create the improvisations either on the blues tune or on the modal tune, distinct differences could be recognized (Table 2.). The higher degree of freedom when improvising on the modal tune resulted in an increased use of the "basis ideas" "motif" and "void". On the other hand more standardized "basis ideas" like "lick" or "theme" were used more often during improvisations on the blues tune, which offered a stricter formal-harmonic basis for improvisation. One main achievement of the "stream of ideas"-analysis was to show these before known assumptions both in a quantitative way and without exclusively focusing one individual improvisation.

VI. CONCLUSION & FURTHER RESEARCH

The "stream of ideas"-analysis is a new and alternative method to analyse (jazz-) improvisations on a mid-level. On the one hand this method is based on the definite musical improvisation and therefore closely linked to the actual result of the improvised musical performance. On the other hand the "stream of ideas"-analysis additionally allows, in contrast to the common methods of dealing with improvisation within the field of jazz research (investigating individual stylistics of improvising), to compare different improvisations produced by different musicians or based on different tunes.

By using this option interesting results could be shown within an empirical experiment. Besides the influence of the specific tune on the selection and use of certain "ideas"/melodic phrases to create a jazz improvisation, the comparison of different versions of improvisations produced by the same pianist on the same underlying tune was a central aspect of this study. The mainly constant individual use of similar "basis ideas" by each pianist to create the three improvisations on the same underlying tune leads to the assumption, that the combination of already learned and established melodic patterns, as well as already established concepts of performing, are very important for the process of jazz improvisation.

I continue working with the "stream of ideas"-analysis. Hereafter I focus on different points to extend this method: Since chi-square-tests and multidimensional scaling are not perfectly practical for dealing with frequency distributions and the sequences of "ideas", additional methods of analysing the already encoded improvisations will be tested.

For example the use of Levenshtein distances will be considered to compare the encoded improvisations. Secondly, different processes of validating the "stream of ideas"-analysis will be carried out. A cross-validation in cooperation with Klaus Frieler and Kai Lothwesen is being worked on. Additionally the participating jazz pianists themselves will be asked to analyse one of their own improvisations according to the "stream of ideas"-analysis. Finally these pianists will be interviewed to investigate whether the "stream of ideas"-analysis is only an alternative method to analyse jazz improvisation or reflects the actual process of improvising by thinking on a mid-level-basis. The ensuing result could be the development of a new (cognitive) model on jazz improvisation or the enhancement of an already existing one.

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