

MeloSpyin' the Trane.  
Exploring the Improvisations of John Coltrane  
with MeloSpySuite

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(HfM Weimar / The Jazzomat Research Project)



## Overview:

1. Style analysis in jazz research – methodological considerations
2. John Coltrane – a short introduction for “non-jazzies”
3. Transcriptions in the *WeimarJazzDatabase*
4. Examining pitch, harmony, and melody with *MelFeature*
5. Examining musical time with *MelFeature* (rhythm, meter, microtiming)
6. Looking for patterns and motivic development with *MelPat*
7. Outlook: perspectives for jazz style analysis with *MeloSpySuite*

## Style analysis in jazz research – methodological considerations

“(...) analysing and interpreting the features of a given improvisation demands that the analyst takes into account everything he has learned from other improvisations by the same musician. The significance of general pronouncements on the stylistic features of an improviser, from whom one has just a single solo at hand, is minimal, while the likelihood of drawing false conclusions is very great” (Ekkehard Jost: *Free Jazz*, NY 1975: 14).

-> Include as much data as possible!

-> Analyse all data and

-> unfold all details of the analysis process as well as all results!

-> Give everybody access to the data as well as to the analysis tools!

1. Explorative usage of the *WeimarJazzDatabase* and *MeloSpySuite*
2. Testing claims – from your own listening and from jazz studies.

John Coltrane (1926-67)



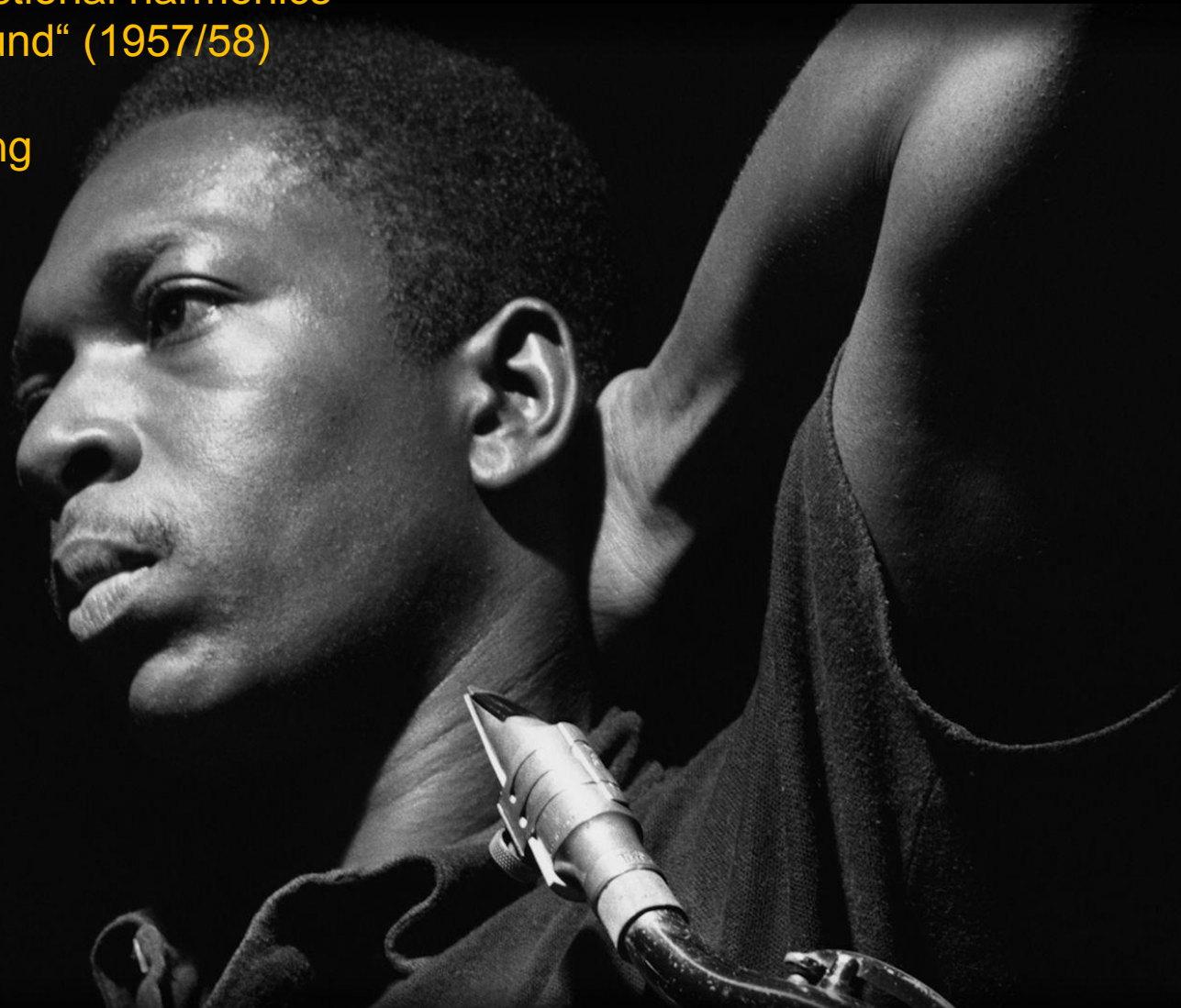
John Coltrane (1926-67)

Three stylistic periods:

until 1959: hardbop/ functional harmonics  
- „sheets of sound“ (1957/58)

1959-1965: modal playing

1965-67: free playing

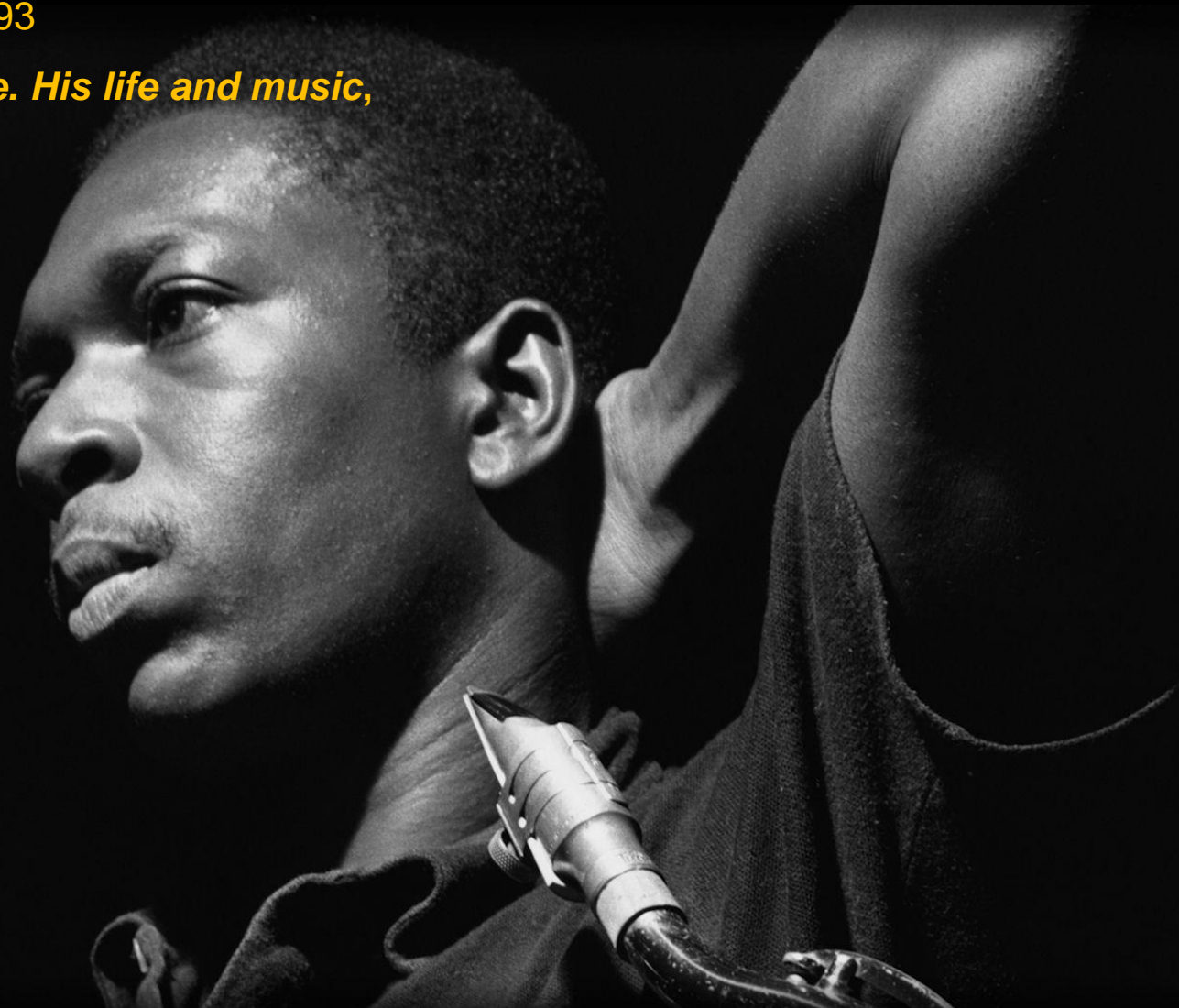


**Research on John Coltrane, among others:**

David Baker: *The Jazz Style of John Coltrane. A Musical and Historical Perspective*, Miami 1980

Gerhard Putschögl: *John Coltrane und die afroamerikanische Oraltradition*, Graz/Austria 1993

**Lewis Porter: *John Coltrane. His life and music*, Ann Arbor, Mich. 1998**



the data:

<b>Titel</b>	<b>year</b>	<b>tones</b>	<b>average tempo</b>	<b>form</b>	<b>instr.</b>	<b>key</b>
Blue Train	1957	971	140.8	12 bar blues	ts	C-min
Countdown (original take)	1959	868	337.4	16	ts	Bb-maj
Giant Steps (1st solo)	1959	1172	290.3	16	ts	Eb-maj
Giant Steps (2nd solo)	1959	201	301.0	16	ts	Eb-maj
Mr. PC	1959	1163	258.3	12 bar blues	ts	C-min
So What	1959	479	142.1	32 AABA	ts	D-min
26=2	1960	693	193.9	32 AABA	ts	F-maj
My Favourite Things (1st)	1960	744	179.3	open	ss	E-min
My Favourite Things (2nd)	1960	723	178.9	open	ss	E-maj
Impressions	1961	4956	293.4	32 AABA	ts	D-min
Impressions	1963	1955	279.5	32 AABA	ts	D-min
Nature Boy	1965	1292	186.6	open	ts	E-min



the data:

blues – cycle of thirds – modal

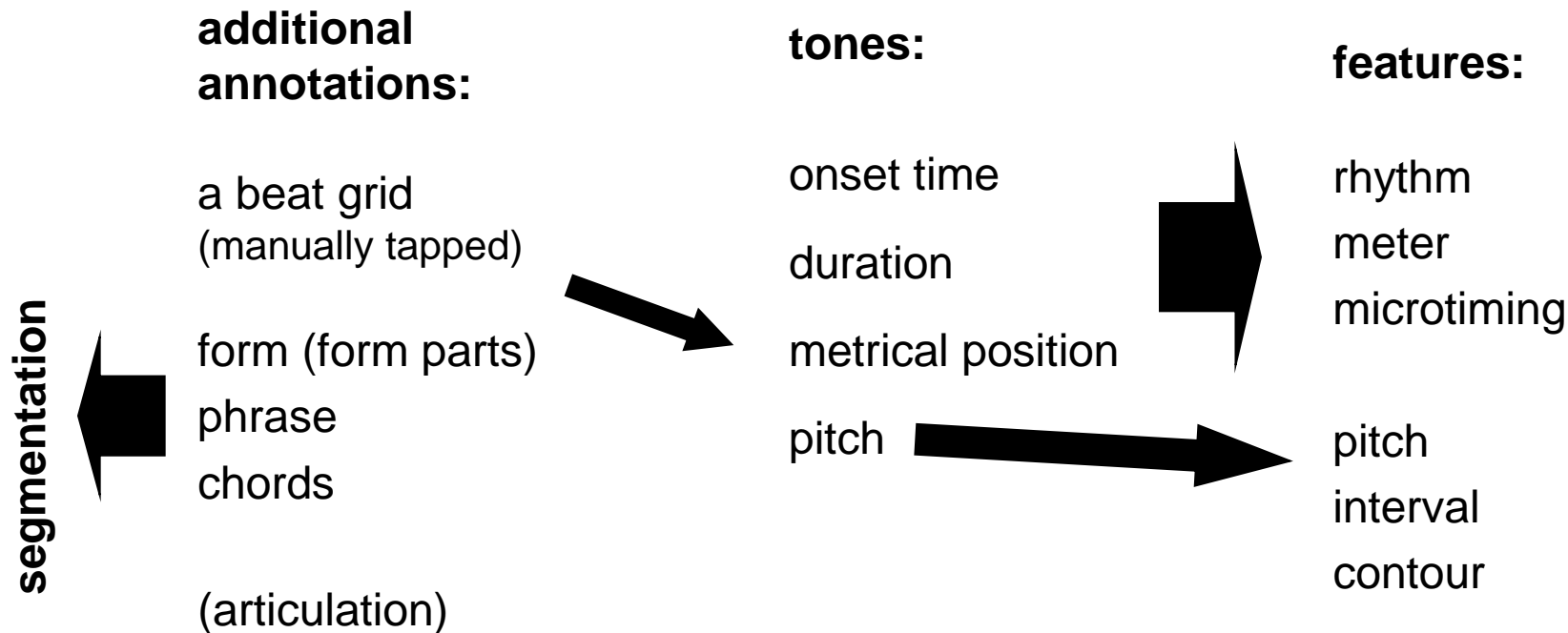


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# Transcriptions in the *WeimarJazzDatabase*



*MelFeature*: frequency distributions, statistical values  
sequences of features (2grams, 3grams)  
structure and dramaturgy of a solo

*MelPat*: patterns (repeated tone sequences), motifs

Examining pitch, harmony, and melody with *MelFeature*

(see: [http://jazzomat.hfm-weimar.de/commandline\\_tools/melfeature/melfeature.features.htm](http://jazzomat.hfm-weimar.de/commandline_tools/melfeature/melfeature.features.htm))

**Absolute pitch (*pitch\_features*, *pc\_hist*)**

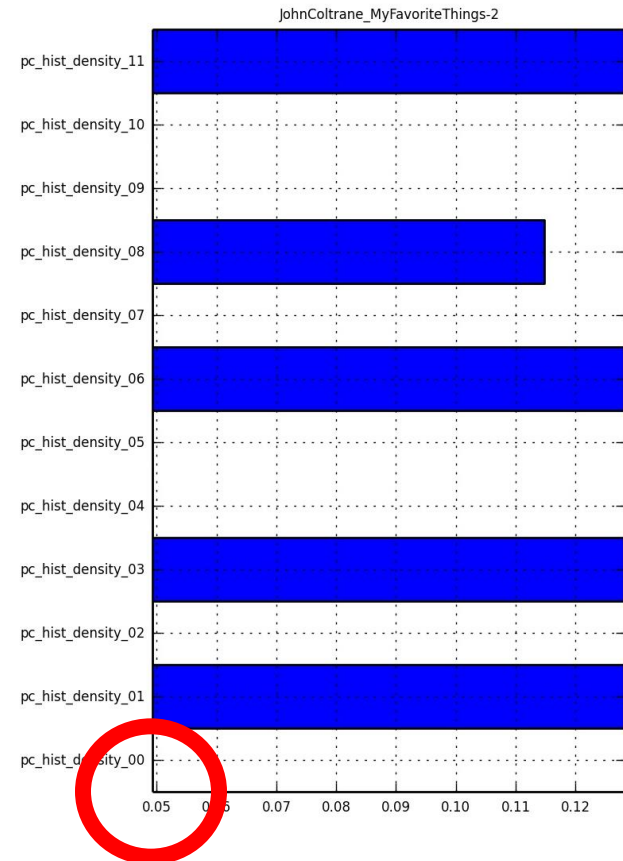
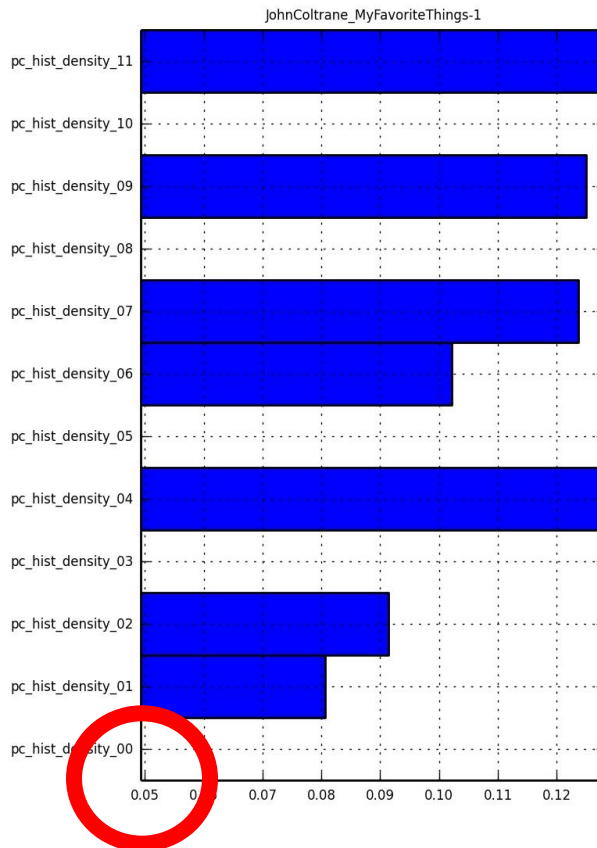
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Absolute pitch (*pitch\_features*, *pc\_hist*)

**Pitch classes (*pc\_features*): 0 = c, 1 = c#, 2 = d usw.**

**Example: „My Favourite Things“ (solo 1 in e minor, solo 2 in e major)**



## Examining pitch, harmony, and melody with *MelFeature*

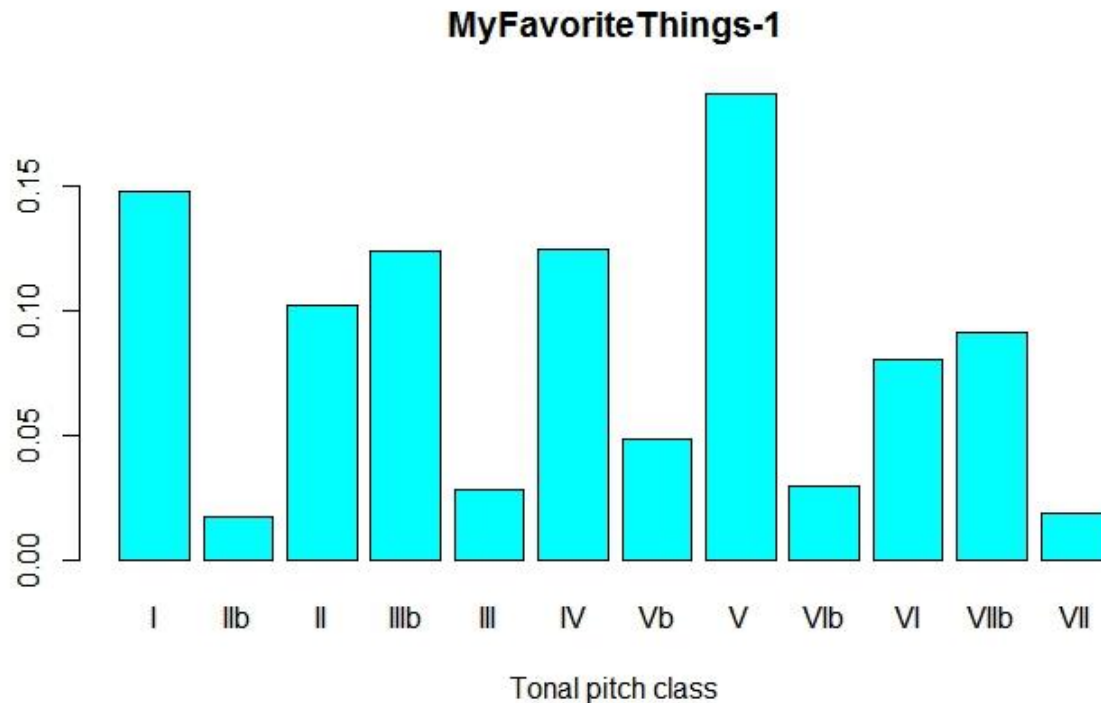
(see: [http://jazzomat.hfm-weimar.de/commandline\\_tools/melfeature/melfeature.features.htm](http://jazzomat.hfm-weimar.de/commandline_tools/melfeature/melfeature.features.htm))

Absolute pitch (*pitch\_features*, *pc\_hist*)

Pitch classes (*pc\_features*)

**Tonal pitch classes (*tpc\_features*): key / tonal center = 0**

**Example: „My Favourite Things“ (solo 1 in e minor, solo 2 in e major)**



## Examining pitch, harmony, and melody with *MelFeature*

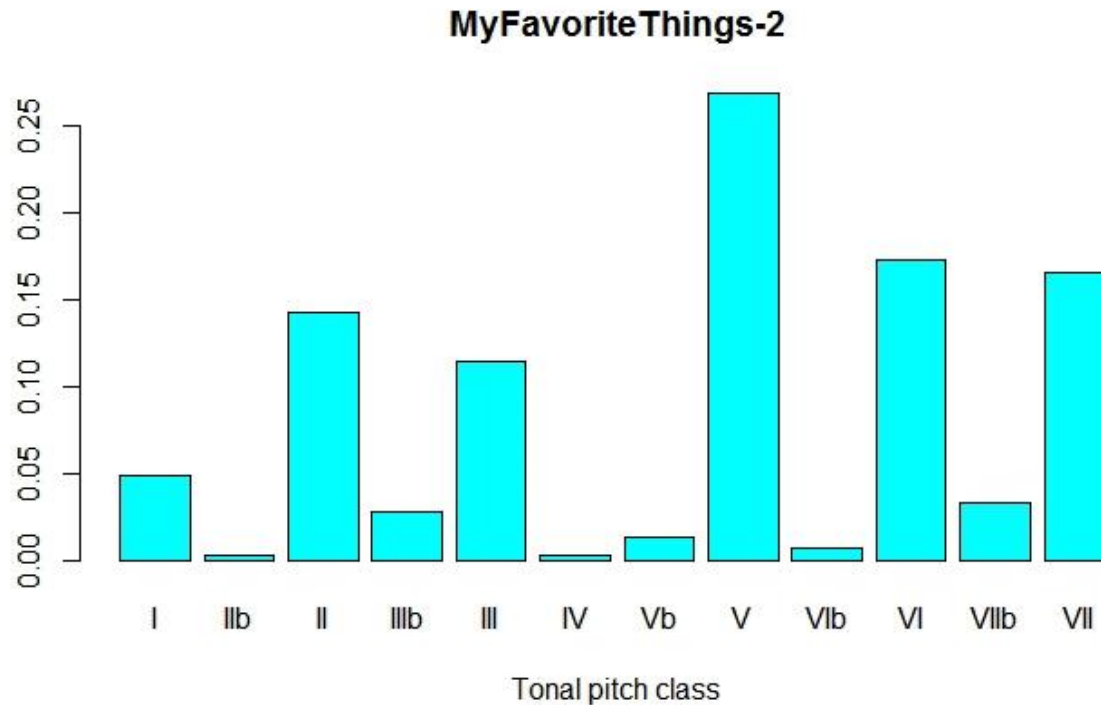
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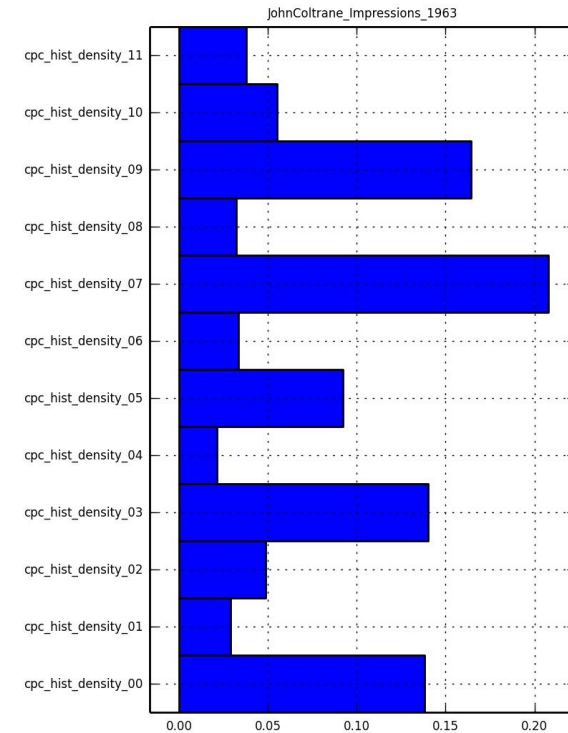
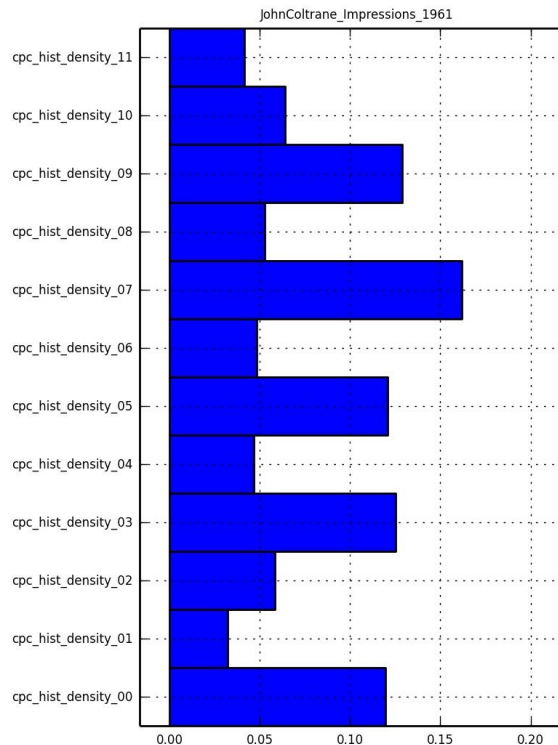
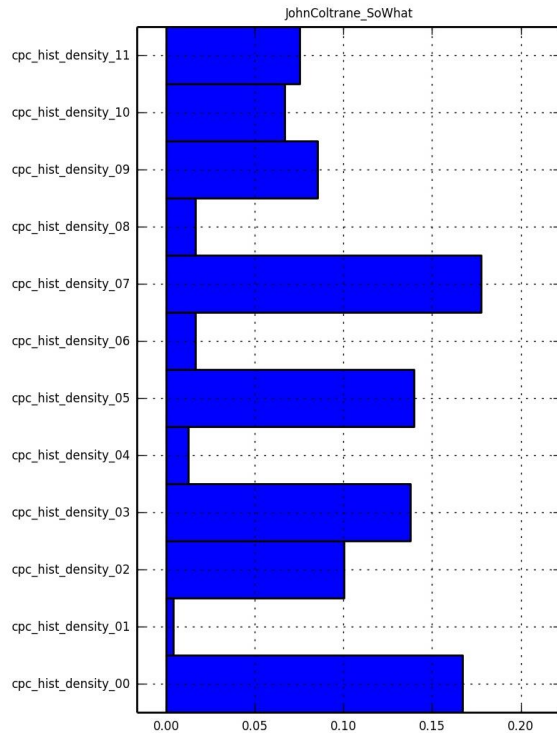
Absolute pitch (*pitch\_features*, *pc\_hist*)

Pitch classes (*pc\_features*)

Tonal pitch classes (*tpc\_features*)

**Chordal pitch classes (*cpc\_features*): chord roots = 0**

**Example: „So What“ vs. „Impressions“ (1961, 1963)**



# Examining pitch, harmony, and melody with *MelFeature*

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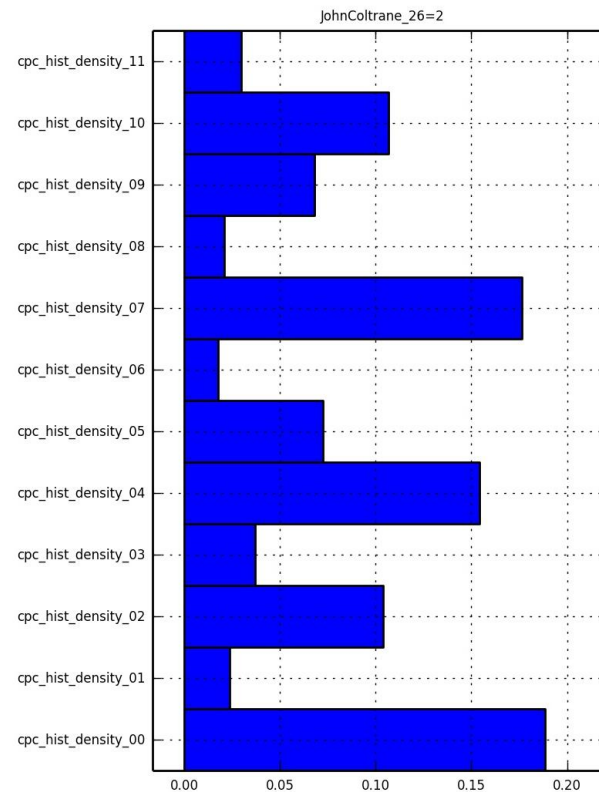
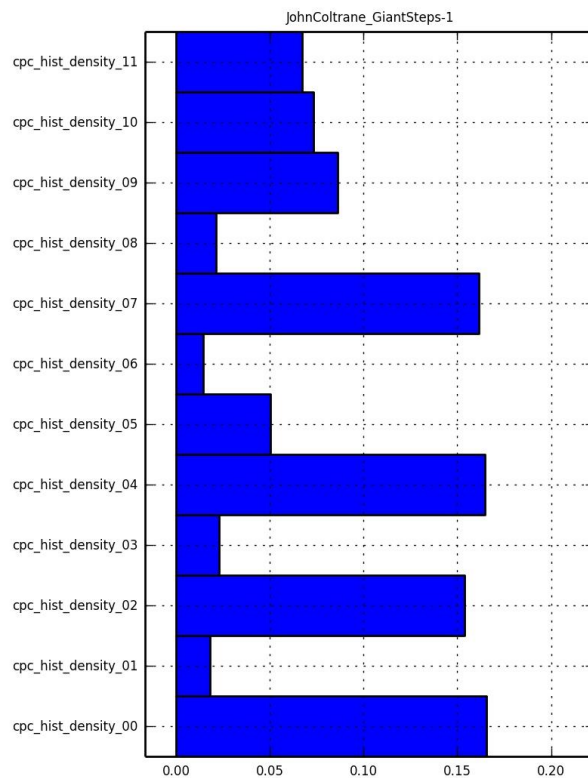
Absolute pitch (*pitch\_features*, *pc\_hist*)

Pitch classes (*pc\_features*)

Tonal pitch classes (*tpc\_features*)

## Chordal pitch classes (*cpc\_features*)

Example: „Giant Steps“ vs. „Countdown“





# Examining pitch, harmony, and melody with *MelFeature*

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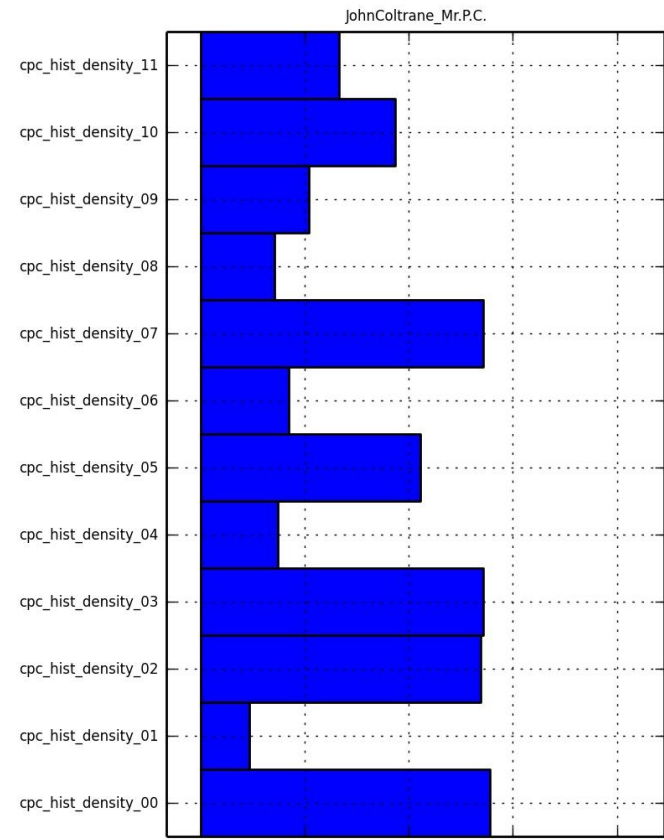
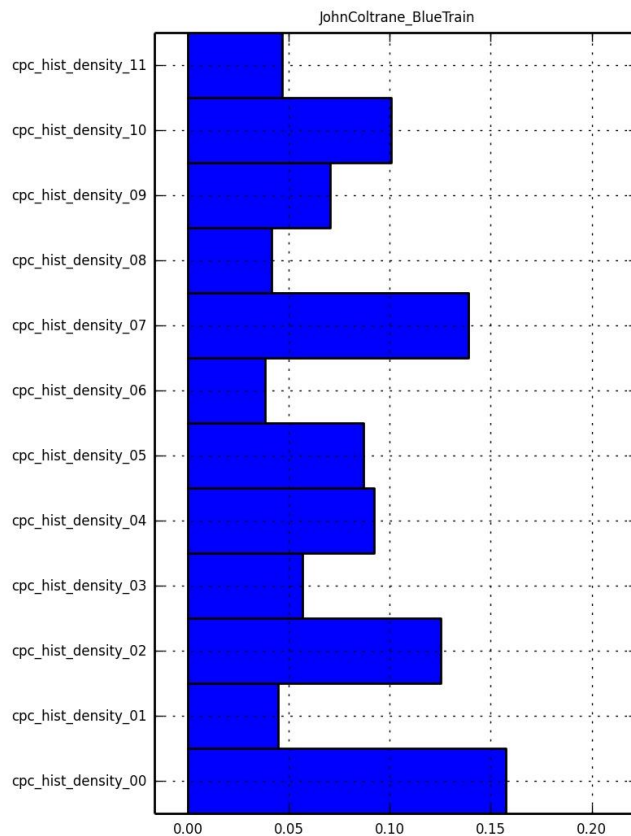
Absolute pitch (*pitch\_features*, *pc\_hist*)

Pitch classes (*pc\_features*)

Tonal pitch classes (*tpc\_features*)

## Chordal pitch classes (*cpc\_features*)

Example: „Blue Trane“ vs. „Mr. PC“



## Examining pitch, harmony, and melody with *MelFeature*

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Absolute pitch (*pitch\_features*, *pc\_hist*)

Pitch classes (*pc\_features*)

Tonal pitch classes (*tpc\_features*)

Chordal pitch classes (*cpc\_features*)

### Chordal diatonic pitch classes (*cdpc\_features*)

root = 1, third = 3, fourth = 4 etc.,

**T**: tritone

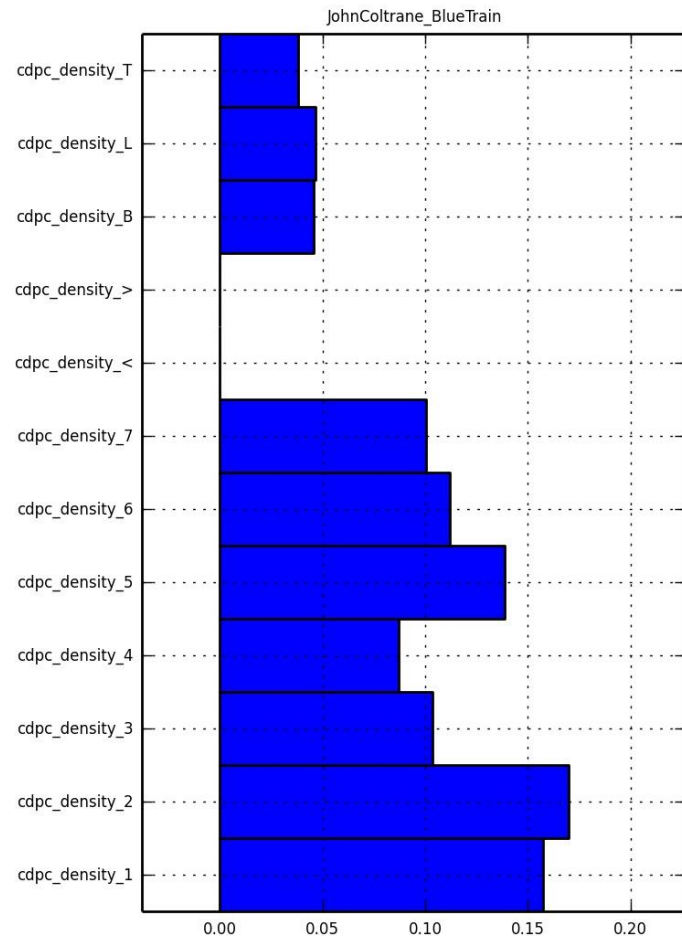
**B**: minor 3rd over major,

**>** major 3rd over minor,

**L** major 7th over minor,

**<** minor 7th over major.

### Example: „Blue Trane“



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**Interval classes (*fuzzyint\_features*):**

**big jump up/down (+/-4), > fifth**

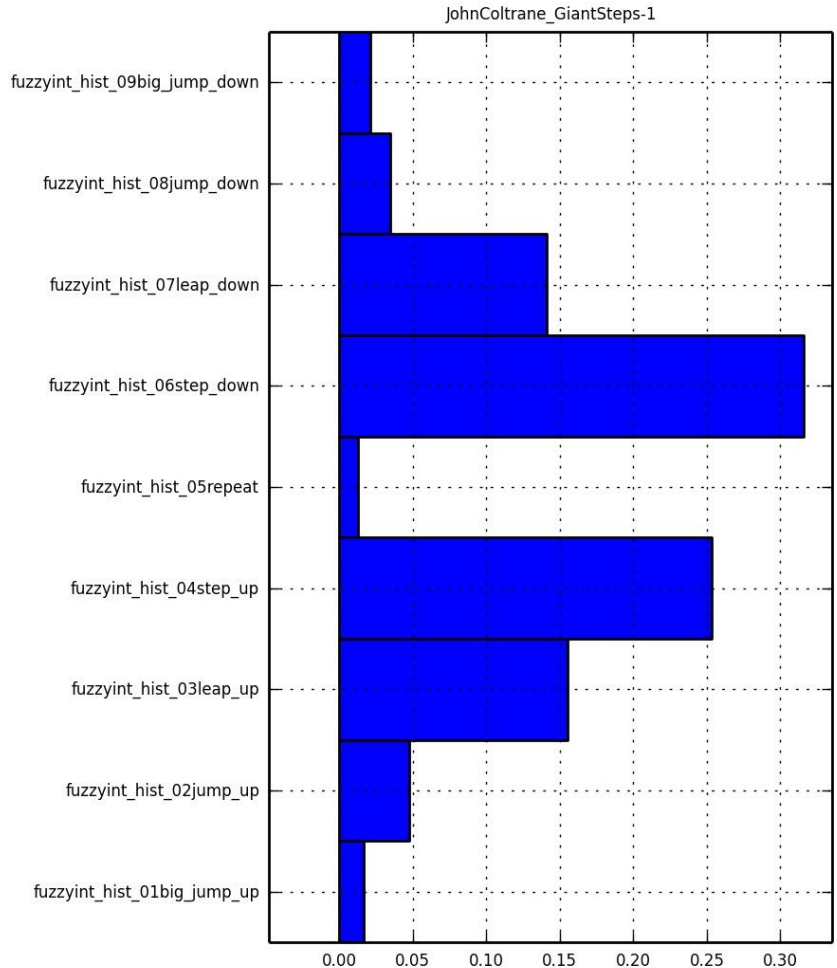
**jump up/down (+/-3), fourth/fifth**

**leap up/down (+/-2), thirds**

**step up/down (+/-1), semitone / whole tone**

**repetition (0)**

### Example: „Giant Steps“



## Examining pitch, harmony, and melody with *MelFeature*

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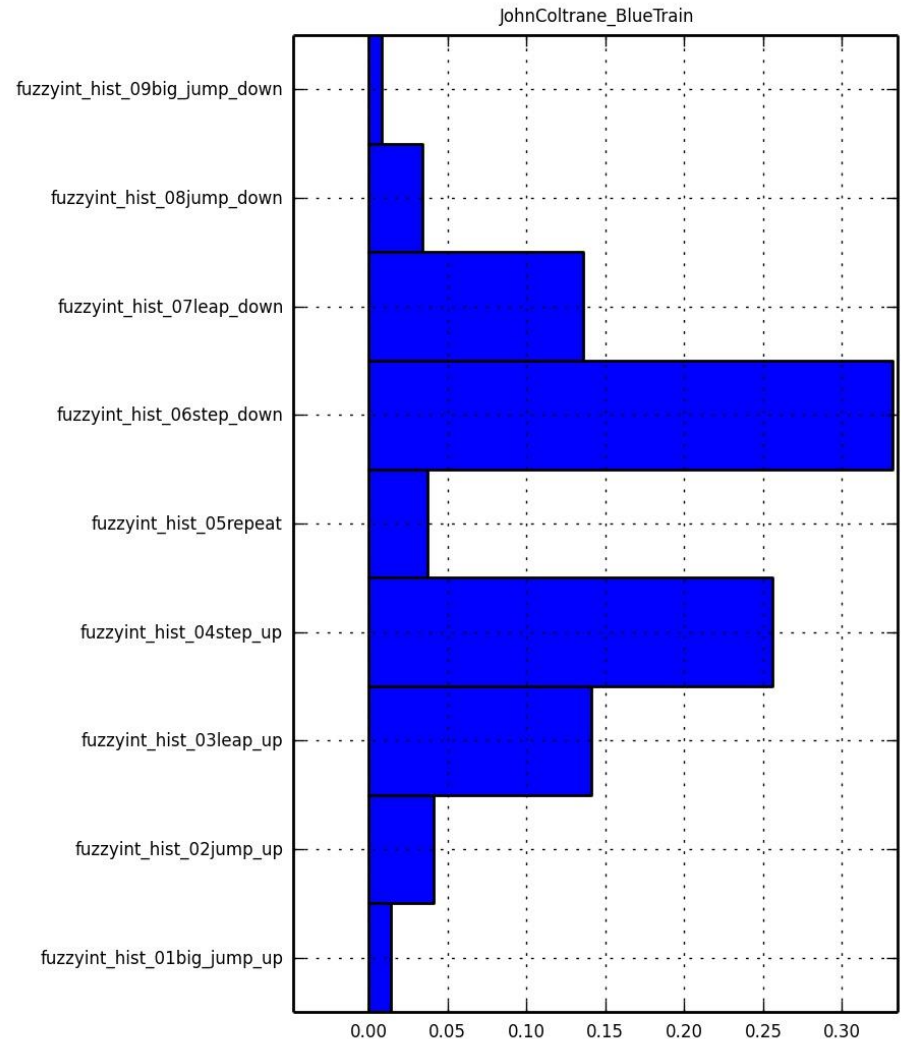
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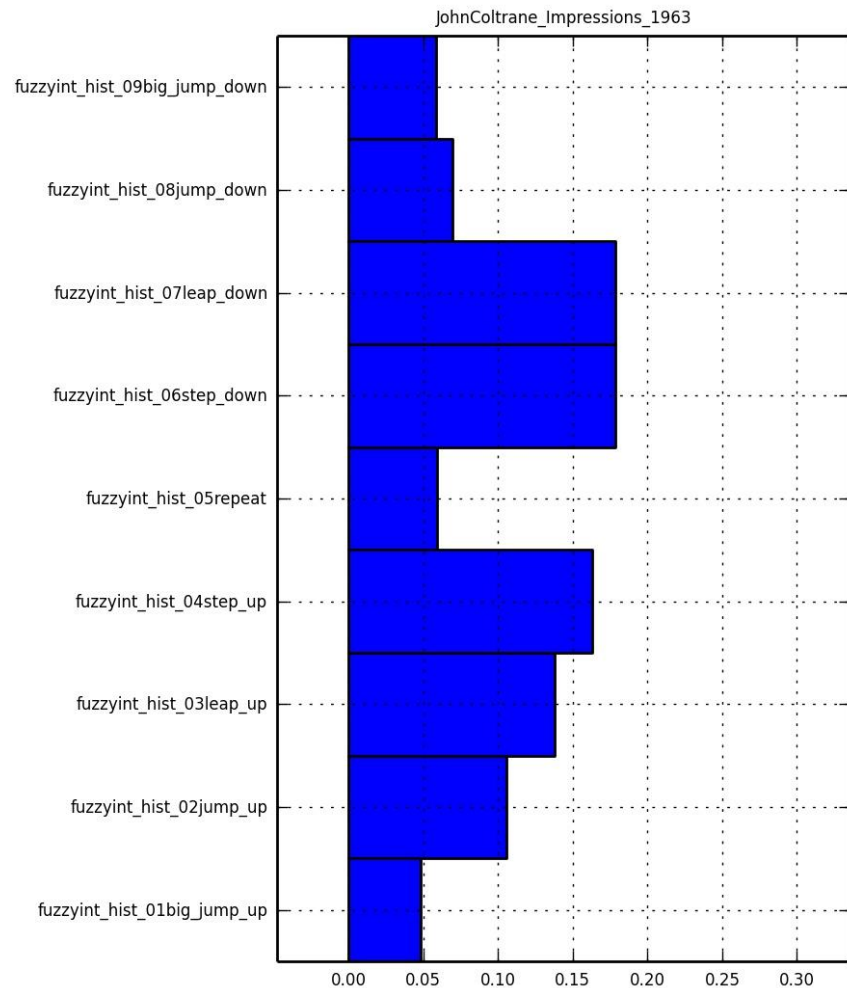
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**leap up/down (+/-2), thirds**

**step up/down (+/-1), semitone / whole tone**

**repetition (0)**

### Example: „Impressions“



## Examining pitch, harmony, and melody with *MelFeature*

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Absolute pitch ( <i>pitch_features</i> , <i>pc_hist</i> )	JohnColtrane_26=2_PREFINAL.sv	0.79200
Pitch classes ( <i>pc_features</i> )	JohnColtrane_BlueTrain_PREFINAL.sv	0.88687
Tonal pitch classes ( <i>tpc_features</i> )	JohnColtrane_Countdown_PREFINAL.sv	0.85931
Chordal pitch classes ( <i>cpc_features</i> )	JohnColtrane_GiantSteps-1_PREFINAL.sv	0.92346
Chordal diatonic pitch classes ( <i>cdpc_features</i> )	JohnColtrane_GiantSteps-2_PREFINAL.sv	0.92157
Interval classes ( <i>fuzzyint_features</i> )	JohnColtrane_Impressions_1961_PREFINAL.sv	0.9604
	JohnColtrane_Impressions_1963_PREFINAL.sv	0.93776
	JohnColtrane_Mr.P.C._PREFINAL.sv	1.0726
	JohnColtrane_MyFavoriteThings-1_PREFINAL.sv	0.93923
	JohnColtrane_MyFavoriteThings-2_PREFINAL.sv	0.84759
	JohnColtrane_NatureBoy_PREFINAL.sv	1.07143
	JohnColtrane_SoWhat_PREFINAL.sv	1.17391
	CharlieParker_Billie'sBounce_PREFINAL.sv	0.77246
	CharlieParker_DonnaLee_PREFINAL.sv	0.79412
	CharlieParker_Ornithology_1946_PREFINAL.sv	0.69027
	CharlieParker_ScrappleFromTheApple	0.79195
	DavidLiebman_Pablo'sStory	1.05152
	DavidLiebman_Pendulum	0.93694
	DavidLiebman_SoftlyAsInAMorningSunrise	1.00382
	DavidLiebman_ThereWillNeverBeAnotherYou_	0.99461

## Examining pitch, harmony, and melody with *MelFeature*

(see: [http://jazzomat.hfm-weimar.de/commandline\\_tools/melfeature/melfeature.features.htm](http://jazzomat.hfm-weimar.de/commandline_tools/melfeature/melfeature.features.htm))

Absolute pitch ( <i>pitch_features</i> , <i>pc_hist</i> )	JohnColtrane_26=2_PREFINAL.sv	0.45022
Pitch classes ( <i>pc_features</i> )	JohnColtrane_BlueTrain_PREFINAL.sv	0.34398
Tonal pitch classes ( <i>tpc_features</i> )	JohnColtrane_Countdown_PREFINAL.sv	0.38134
Chordal pitch classes ( <i>cpc_features</i> )	JohnColtrane_GiantSteps-1_PREFINAL.sv	0.37201
Chordal diatonic pitch classes ( <i>cdpc_features</i> )	JohnColtrane_GiantSteps-2_PREFINAL.sv	0.33333
Interval classes ( <i>fuzzyint_features</i> )	JohnColtrane_Impressions_1961_PREFINAL.sv	0.46196
Interval direction ( <i>parson_up_down_ratio</i> )	JohnColtrane_Impressions_1963_PREFINAL.sv	0.49232
	JohnColtrane_Mr.P.C._PREFINAL.sv	0.39209
Statistical values:	JohnColtrane_MyFavoriteThings-1_PREFINAL.sv	0.26075
<b>Extrema / changes of direction</b>	JohnColtrane_MyFavoriteThings-2_PREFINAL.sv	0.50207
<b>(<i>pitch_waviness</i>)</b>	JohnColtrane_NatureBoy_PREFINAL.sv	0.42647
<b>Ratio: changes of direction vs.</b>	JohnColtrane_SoWhat_PREFINAL.sv	0.35491
<b>all notes</b>	CharlieParker_Billie'sBounce_PREFINAL.sv	0.39934
	CharlieParker_DonnaLee_PREFINAL.sv	0.42162
	CharlieParker_Ornithology_1946_PREFINAL.sv	0.37949
	CharlieParker_ScrappleFromTheApple	0.36667
	DavidLiebman_Pablo'sStory_PREFINAL.sv	0.44663
	DavidLiebman_Pendulum_PREFINAL.sv	0.43131
	DavidLiebman_SoftlyAsInAMorningSunrise	0.47086
	DavidLiebman_ThereWillNeverBeAnotherYou	0.36546



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Absolute pitch ( <i>pitch_features</i> , <i>pc_hist</i> )	JohnColtrane_26=2_PREFINAL.sv	0.09104
Pitch classes ( <i>pc_features</i> )	JohnColtrane_BlueTrain_PREFINAL.sv	0.08866
Tonal pitch classes ( <i>tpc_features</i> )	JohnColtrane_Countdown_PREFINAL.sv	0.09112
Chordal pitch classes ( <i>cpc_features</i> )	JohnColtrane_GiantSteps-1_PREFINAL.sv	0.06661
Chordal diatonic pitch classes ( <i>cdpc_features</i> )	JohnColtrane_GiantSteps-2_PREFINAL.sv	0.06
Interval classes ( <i>fuzzyint_features</i> )	JohnColtrane_Impressions_1961_PREFINAL.sv	0.07731
Interval direction ( <i>parson_up_down_ratio</i> )	JohnColtrane_Impressions_1963_PREFINAL.sv	0.02919
	JohnColtrane_Mr.P.C._PREFINAL.sv	0.06196
Statistical values:	JohnColtrane_MyFavoriteThings-1_PREFINAL.sv	0.03365
Extrema / changes of direction	JohnColtrane_MyFavoriteThings-2_PREFINAL.sv	0.06648
( <i>pitch_waviness</i> )	JohnColtrane_NatureBoy_PREFINAL.sv	0.06042
<b>Percentage of Chromatic Passages</b>	JohnColtrane_SoWhat_PREFINAL.sv	0.06067
<b>(<i>Int_chromatic_sequences_ratio</i>):</b>	CharlieParker_Billie'sBounce_PREFINAL.sv	0.11258
<b>interval sequences of semitones</b>	CharlieParker_DonnaLee_PREFINAL.sv	0.11382
<b>with at least</b>	CharlieParker_Ornithology_1946_PREFINAL.sv	0.08763
<b>three notes in succession</b>	CharlieParker_ScrappleFromTheApple	0.08922
<b>in the set of all passages</b>	DavidLiebman_Pablo'sStory_PREFINAL.sv	0.18284
	DavidLiebman_Pendulum_PREFINAL.sv	0.15828
	DavidLiebman_SoftlyAsInAMorningSunrise_	0.165
	DavidLiebman_ThereWillNeverBeAnotherYou	0.08271

# Examining rhythm and meter with *MelFeature*

(see: [http://jazzomat.hfm-weimar.de/commandline\\_tools/melfeature/melfeature.features.htm](http://jazzomat.hfm-weimar.de/commandline_tools/melfeature/melfeature.features.htm))

“Around 1959 often uses sheets of sounds; later he prefers eighth-note-runs alternating with more concise rhythmic patterns.” (Porter 1998)

## 1. Duration and IOI classes

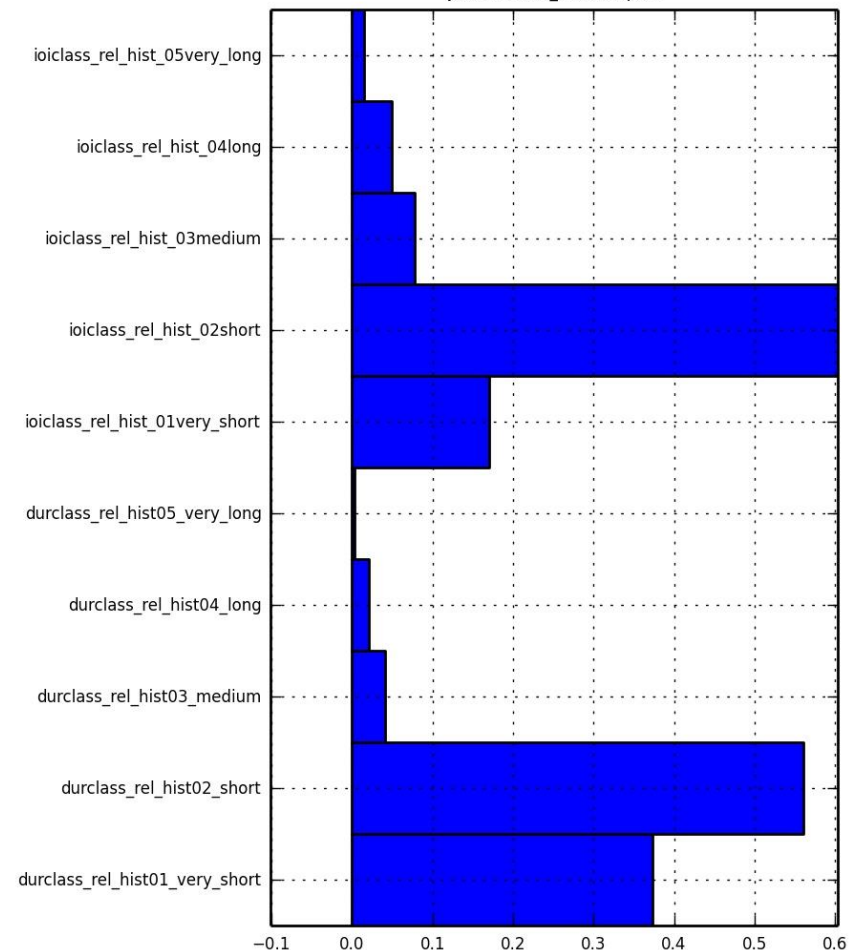
(*durclass\_features*, *ioiclass\_features*)

Class name	Class borders
very short	<35%
short	35%-70%
medium	70%-140%
long	140%-280%
very long	>280%

according to the beat level (relative)  
or to 0.5 s (absolute).

## Example: „Giant Steps“

JohnColtrane\_GiantSteps-1



# Examining rhythm and meter with *MelFeature*

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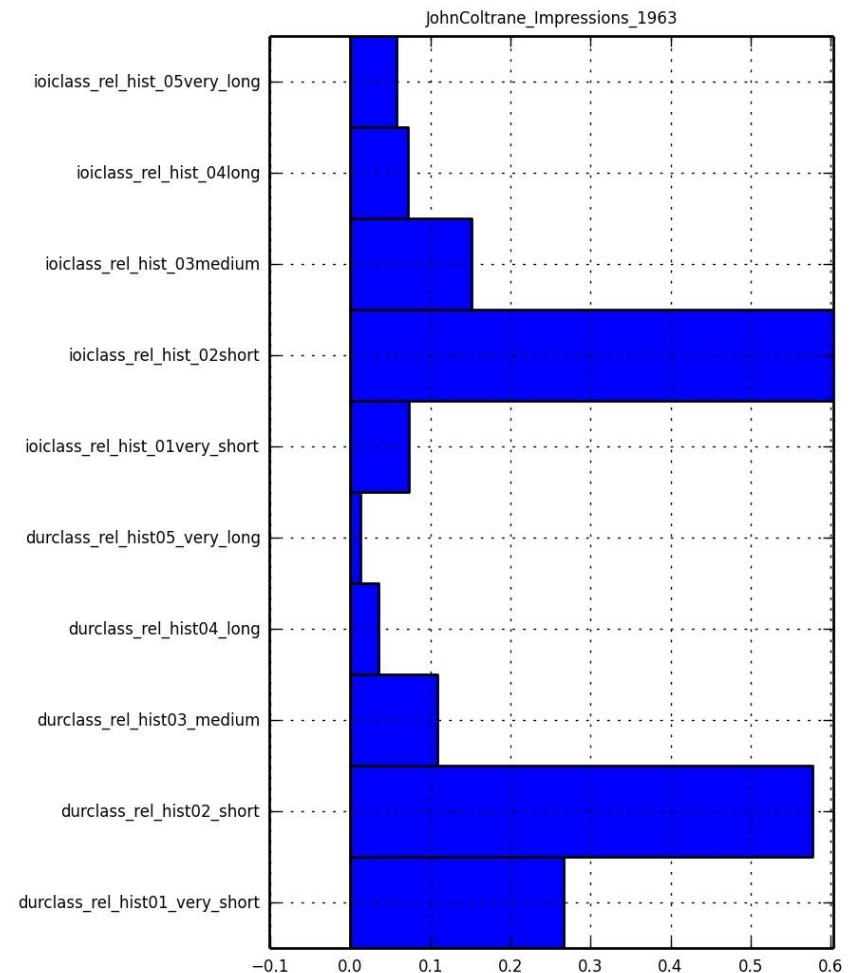
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## Example: „Impressions“



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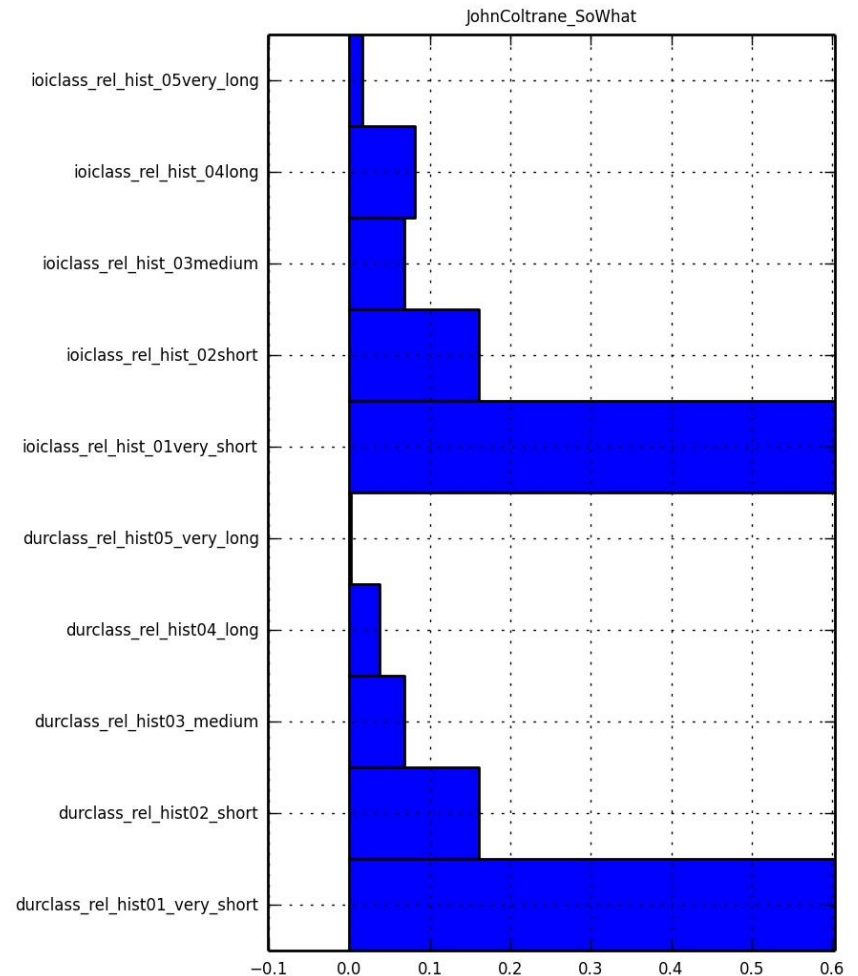
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very long	>280%

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### Example: „So what“



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## 1. Duration and IOI classes

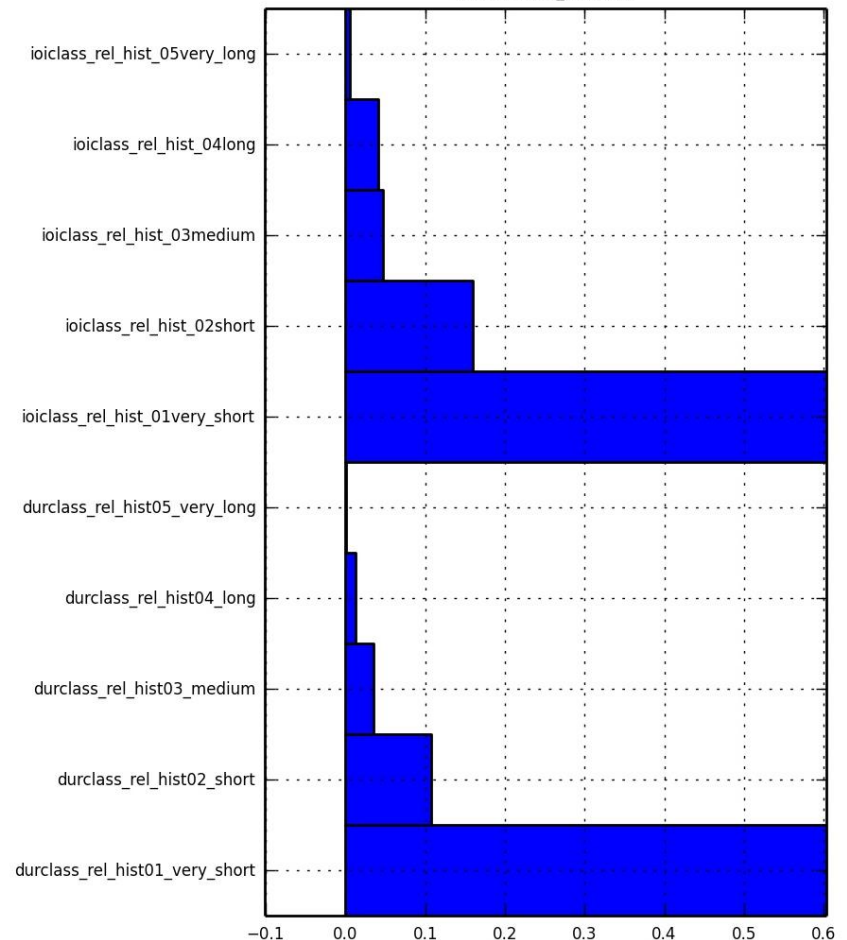
(*durclass\_features*, *ioiclass\_features*)

Class name	Class borders
very short	<35%
short	35%-70%
medium	70%-140%
long	140%-280%
very long	>280%

according to the beat level (relative)  
or to 0.5 s (absolute).

## Example: „Blue Trane“

JohnColtrane\_BlueTrain



## Examining rhythm and meter with *MelFeature*

(see: [http://jazzomat.hfm-weimar.de/commandline\\_tools/melfeature/melfeature.features.htm](http://jazzomat.hfm-weimar.de/commandline_tools/melfeature/melfeature.features.htm))

“Around 1959 often uses sheets of sounds; later he prefers eighth-note-runs alternating with more concise rhythmic patterns.” (Porter 1998)

### 1. Duration and IOI classes

(*durclass\_features*, *ioiclass\_features*)

### 2. Metric position (*mcm\_features*)

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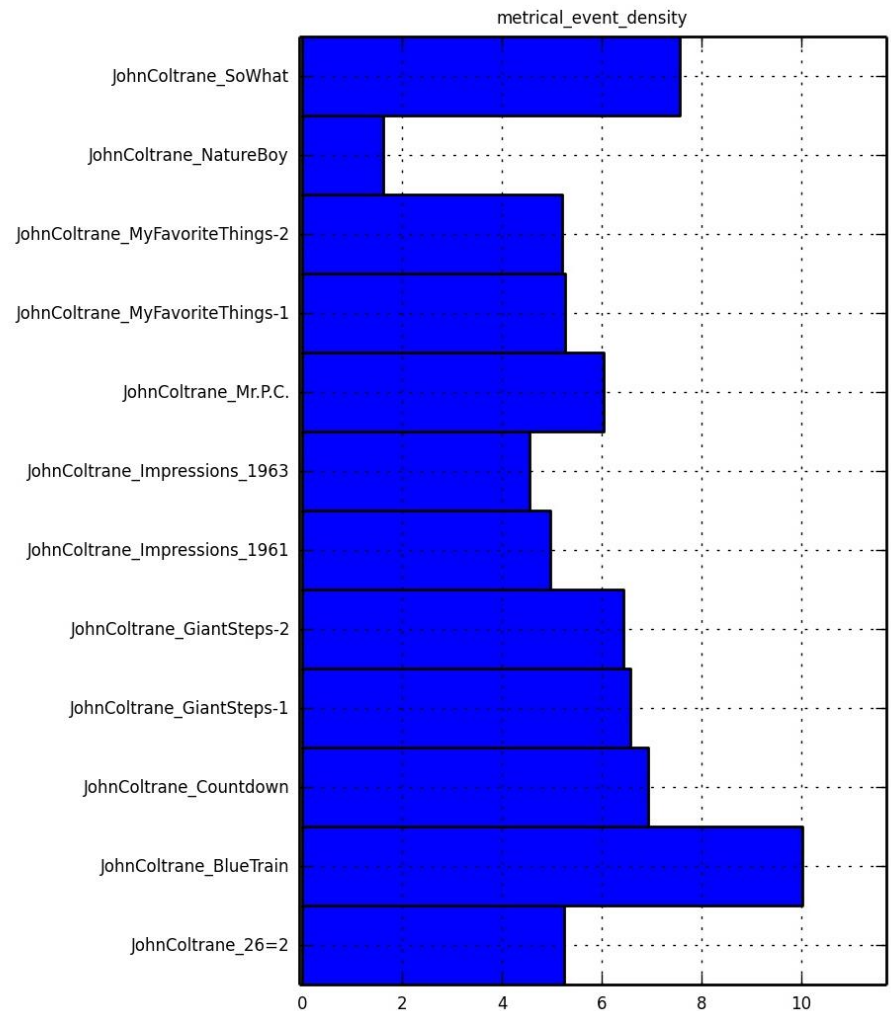
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## 3. Events per bar (*general\_event\_density*)





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(*durclass\_features*, *ioiclass\_features*)

### 2. Metric position (*mcm\_features*)

### 3. Events per bar (*general\_event\_density*)

### 4. Syncopicity (*meter\_raw\_syncopicity*)

the ratio of syncopated events

to non-syncopated events

(syncopated event = a tone on an offbeat

with *no* onbeat event following;

metric levels of beat and below)

JohnColtrane_26=2_PREFINAL.sv	0.304473304473
JohnColtrane_BlueTrain_PREFINAL.sv	0.291452111226
JohnColtrane_Countdown_PREFINAL.sv	0.299539170507
JohnColtrane_GiantSteps-1_PREFINAL.sv	0.265358361775
JohnColtrane_GiantSteps-2_PREFINAL.sv	0.303482587065
JohnColtrane_Impressions_1961_PREFINAL.sv	0.460141271443
JohnColtrane_Impressions_1963_PREFINAL.sv	0.271750255885
JohnColtrane_Mr.P.C._PREFINAL.sv	0.249355116079
JohnColtrane_MyFavoriteThings-1_PREFINAL.sv	0.327956989247
JohnColtrane_MyFavoriteThings-2_PREFINAL.sv	0.333333333333
JohnColtrane_NatureBoy_PREFINAL.sv	0.356811145511
JohnColtrane_SoWhat_PREFINAL.sv	0.327766179541
CharlieParker_Billie'sBounce_PREFINAL.sv	0.310231023102
CharlieParker_DonnaLee_PREFINAL.sv	0.235135135135
CharlieParker_Ornithology_1946_PREFINAL.sv	0.2
CharlieParker_ScrappleFromTheApple	0.285185185185
DavidLiebman_Pablo'sStory_PREFINAL.sv	0.345505617978
DavidLiebman_Pendulum_PREFINAL.sv	0.293943870015
DavidLiebman_SoftlyAsInAMorningSunrise	0.271402550091

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		mean	Std dev
	JohnColtrane_26=2_PREFINAL.sv	0.64717	0.28365
1. Duration and IOI classes	JohnColtrane_BlueTrain_PREFINAL.sv	1.1852	0.6854
( <i>durclass_features</i> , <i>ioiclass_features</i> )	JohnColtrane_Countdown_PREFINAL.sv	1.0042	0.39546
	JohnColtrane_GiantSteps-1_PREFINAL.sv	0.77318	0.30789
2. Metric position ( <i>mcm_features</i> )	JohnColtrane_GiantSteps-2_PREFINAL.sv	0.80679	0.24263
	JohnColtrane_Impressions_1961_PREFINAL	0.94074	0.39764
3. Events per bar ( <i>general_event_density</i> )	JohnColtrane_Impressions_1963_PREFINAL	0.80143	0.30608
	JohnColtrane_Mr.P.C._PREFINAL.sv	0.71609	0.25551
4. Syncopicity ( <i>meter_raw_syncopicity</i> )	JohnColtrane_MyFavoriteThings-1_PREFINAL	0.82023	0.5415
the ratio of syncopated events	JohnColtrane_MyFavoriteThings-2_PREFINAL	0.79719	0.45515
to non-syncopated events	JohnColtrane_NatureBoy_PREFINAL.sv	1.08224	0.5592
	JohnColtrane_SoWhat_PREFINAL.sv	0.67876	0.20875
<b>5. Microtiming: swing ratios</b>	CharlieParker_Billie'sBounce_PREFINAL.sv	0.61125	0.38942
( <i>general_microtiming</i> )	CharlieParker_DonnaLee_PREFINAL.sv	0.74521	0.20867
<b>relation of the IOI</b>	CharlieParker_Ornithology_1946_PREFINAL	0.61249	0.20794
<b>of the second (offbeat) eight</b>	CharlieParker_ScrappleFromTheApple	0.60586	0.30129
<b>to the first (obeat) eight (= 1)</b>	DavidLiebman_Pablo'sStory_PREFINAL.sv	0.94237	0.36844
<b>in runs of eights</b>	DavidLiebman_Pendulum_PREFINAL.sv	0.85672	0.27637
	DavidLiebman_SoftlyAsInAMorningSunrise	0.81222	0.35491

## Looking for patterns and motivic development with *MelPat*

In the 50s Coltrane “relied heavily on a personal collection of formulas, or licks as musicians call them” (Porter 1998: 121)

“It is commonly known that Coltrane relied upon a relatively small number of four-note melodic patterns in creating his “Countdown” solo. In fact, these patterns make up nearly 90 percent of the material used in the solo. These patterns also appear in numerous instances during “Impressions,” appearing almost exclusively as a vehicle for playing “outside” of the modal key center” (Lewis 1998: 225).

-> *Klaus Frielers talk this afternoon*

Motivic development / motivic improvisation ->



# Pattern search engine:

pitch (abs. or class)

57	60	57	62			
	4.0		1.0			
	+		+			

duration

metric position

accentuation

allow for transpositions:

exact

diatonic

lock accented tones

look for variations:

- add tones before , after , or in between

- omit tones

disregard order / allow for permutations

## **Outlook:**

### **Upcoming directions of style analysis within the Jazzomat Research Project:**

1. Jazz theory / analysis of tonal and harmonic relations
2. Pattern archaeology and motivic improvisation
3. Classification, annotation and analysis of mid-level units
4. Integration of audio analysis (articulation, vibrato, timbre etc.)

*if you get lost in the data ...*

*... listen to the music!*

*Thank you!*

**INTERNATIONAL  
RESEARCH WORKSHOP**

# **The Jazzomat Project**

**ISSUES, APPLICATIONS & PERSPECTIVES  
FOR COMPUTATIONAL METHODS  
IN MUSIC RESEARCH**

