

Computational Methods Applied to Motivic Analyses of Jazz Improvisation

Can pattern-finding algorithms tell us about jazz performers' improvisatory styles?

LEE KONITZ ON CHARLIE PARKER

"[Parker] had a very prolific vocabulary. I have what I think of as a more flexible vocabulary."

"[Parker] puts good phrases together... [I] start from a blank slate¹."

Konitz's statements relate to two theories of jazz improvisation:

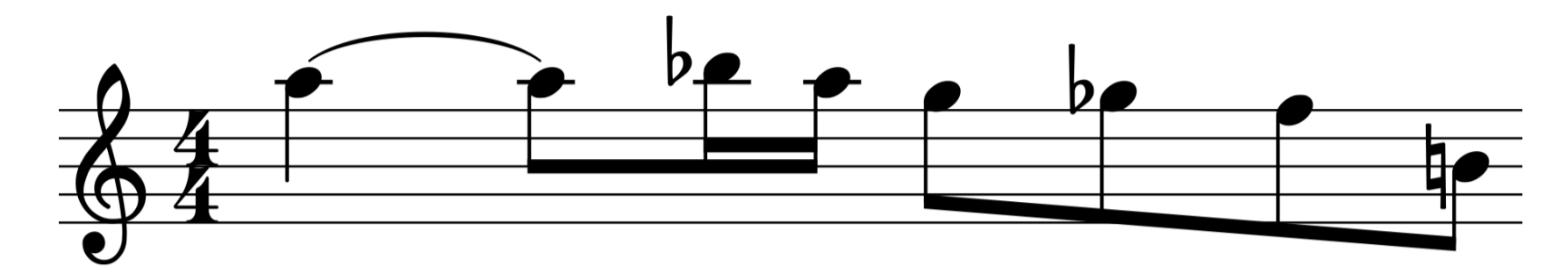
1. Improvisers put together practiced formulas or "licks" or...
2. Improvisers develop musical material in real time.

Can we use computational analyses of solos to distinguish the two styles?

METHODS

For motivic analysis, we use a *Multiple Viewpoint Method*², operating on **simplified versions** of the musical surface

1. Calculate multiple viewpoints on each note onset of a piece
2. Define **similarity** between two solo excerpts by comparing viewpoint sequences
3. Get similarity **between all possible excerpts** of a solo. Clusters of similar excerpts are motifs
4. Tune until results **match a jazz improviser's judgment**



Viewpoint	Note #						
	1	2	3	4	5	6	7
Duration	1.5	0.25	0.25	0.5	0.5	0.5	0.5
Duration Contour	-	-1	0	1	0	0	0
Pitch	A	Bb	A	G	Gb	F	B
Diatonic Pitch	A	B	A	G	G	F	B
Interval	-	m2↑	m2↓	M2↓	m2↓	m2↓	dim5↓
Diatonic Interval	-	2↑	2↓	2↓	2↓	2↓	5↓
Pitch Contour	-	1	-1	-1	-1	-1	-1
Is Skip	-	0	0	0	0	0	1
Has Accidental	0	1	0	0	1	0	1

Table 1: A brief excerpt of music along with its representation as multiple different viewpoints. When finding patterns, we select a few different viewpoints and match excerpts of music based on those. This lets us tailor our pattern-finding to focus on a specific subset of qualities of the musical surface.



Figure 1: Excerpts from Konitz's solo on "Donna Lee," with a single motif found by our algorithm highlighted, using the viewpoint set [*Duration, Duration Contour, Pitch Contour*]. Not all occurrences found are musically relevant, but Nos. 9 and 10 were initially missed by our jazz expert, who noted that they add to the coherence of the solo overall.

¹ Hamilton, Andy, and Lee Konitz. "Lee Konitz: Conversations on the Improviser's Art." University of Michigan Press, 2007.

² Conklin, Darrell, and Christina Anagnostopoulous. "Representation and Discovery of Multiple Viewpoint Patterns." In Proc. of the Int. Computer Music Conf. Havana, Cuba. 2001.

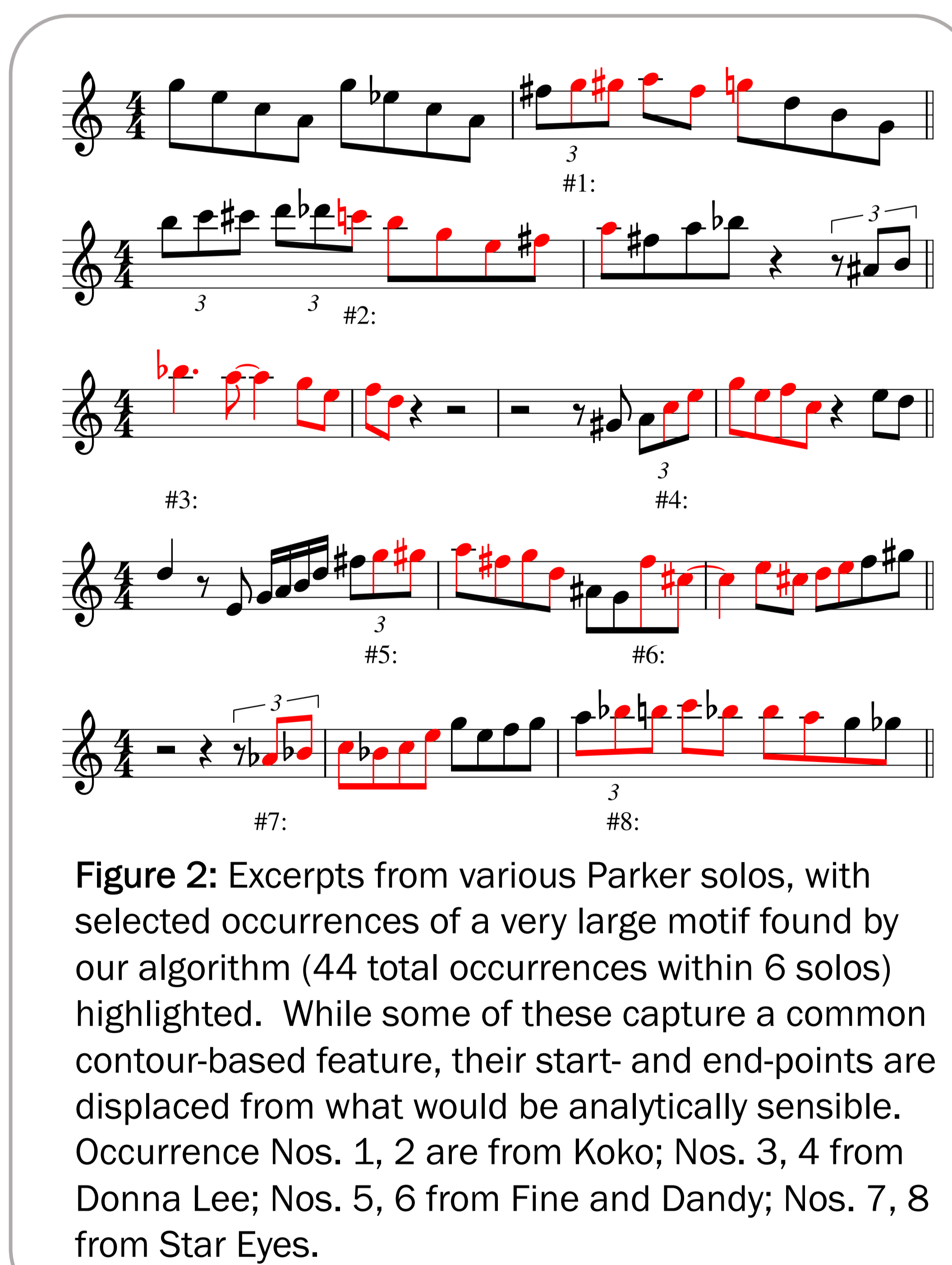


Figure 2: Excerpts from various Parker solos, with selected occurrences of a very large motif found by our algorithm (44 total occurrences within 6 solos) highlighted. While some of these capture a common contour-based feature, their start- and end-points are displaced from what would be analytically sensible. Occurrence Nos. 1, 2 are from Koko; Nos. 3, 4 from Donna Lee; Nos. 5, 6 from Fine and Dandy; Nos. 7, 8 from Star Eyes.

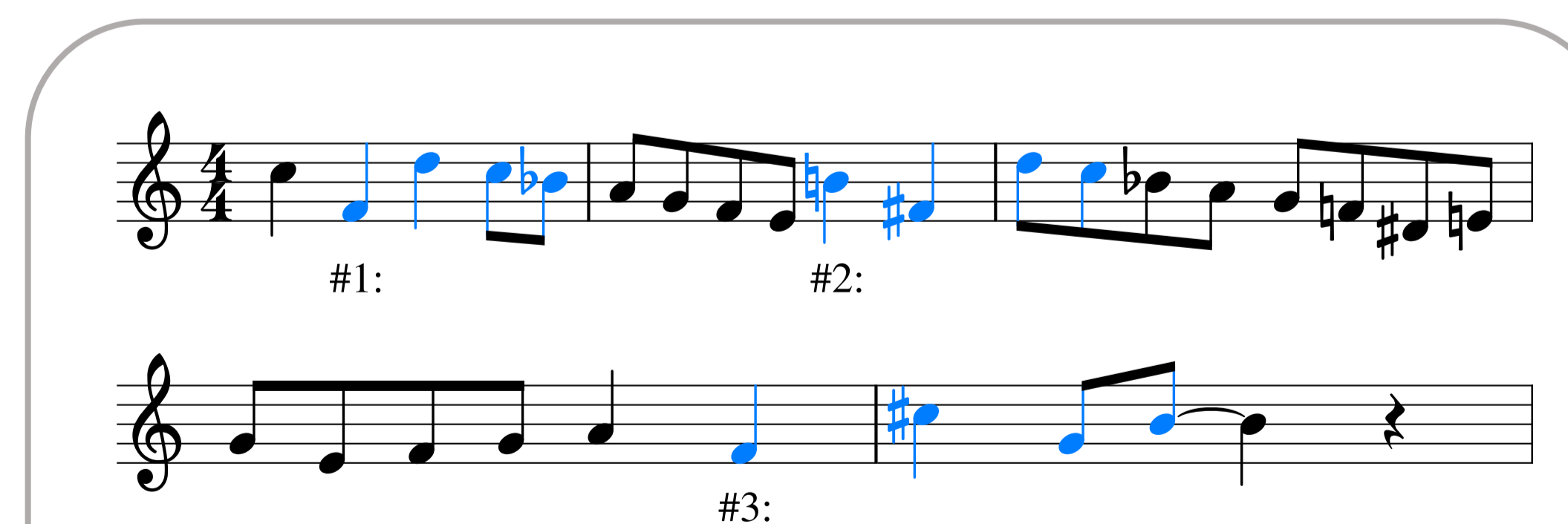


Figure 3: The first two lines of Konitz's solo on "Sax of a Kind," with a motif *not* found by our algorithm highlighted. Each of the occurrences has a different pitch contour; purely rhythmic motifs are difficult for our algorithm to latch onto unless they involve rare and distinctive sequences of note durations (e.g., triplets).

		Duration, Dur. Contour, Mel. Contour	Duration, Mel. Peaks, Mel. Skips	Duration, Int. Size, Diatonic Int. Size
Konitz	Num. Motifs	24	25	3
	Avg. Motif Size	6.5	8.88	5
Parker	Num. Motifs	32	39	25
	Avg. Motif Size	12.1	11.8	6.8

Table 2: We used our motif-finding algorithm to find motifs that occur between multiple solos of Konitz and Parker. This table shows the number of motifs retrieved and the average number of occurrences of each motif for three different sets of viewpoints on an equal number of Parker and Konitz's solos.

Our method finds more motifs from Parker than from Konitz, but motifs found in Parker's solos are much "noisier" and less valid analytically.

DISCUSSION

- After months of tweaking / rounds of feedback, algorithm still **too noisy**
- "Best" motifs found when using *Duration* and *Pitch Contour*
- Finds interesting **stylistic tendencies** that might have gone unnoticed
- Can confirm some **large-scale statistical facts** about style
- (e.g., Parker more repetitious than Konitz, especially when looking for repetitions between solos)
- Biggest issue: finding reasonable **start and end-points**
- Konitz's vocabulary of licks is less specific, less identifiable; bad segmentation is more tolerable

Code available at:

github.com/timothydereuse/jazz-viewpoint-patterns