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From Local Kernels to Global Form

Modeling the Emergence of Musical Content

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What changes across a piece?

First-order memory and time homogeneity are different assumptions

A global kernel pools different temporal contexts

Local kernels turn transition structure into a trajectory along the score.

Estimate locally, move through time

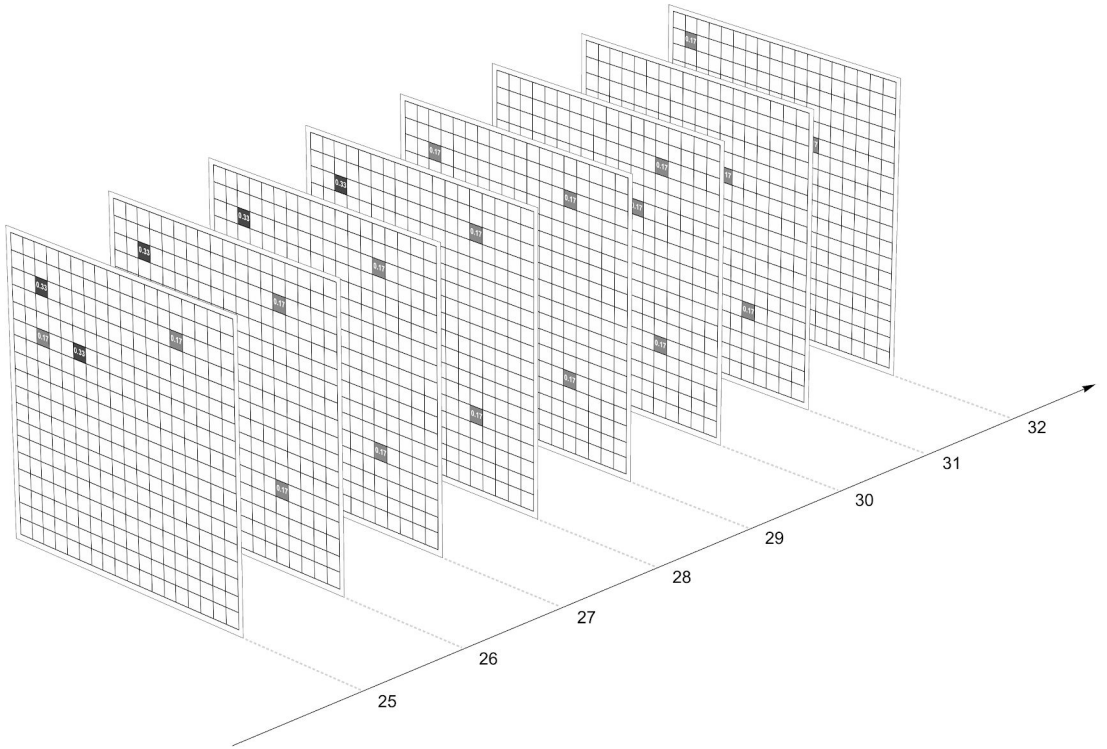
Separate pitch and duration models · one shared window schedule

A moving first-order model

Count local transitions.
Normalize each nonempty row.

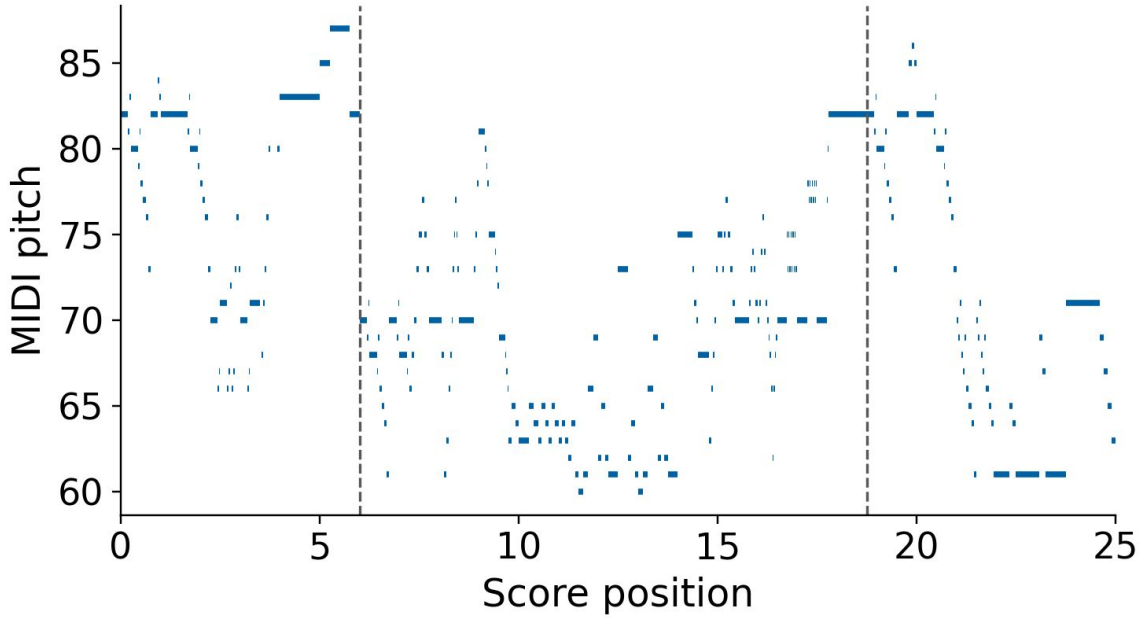
For generation, empty rows
use the corresponding global row.

Each plane corresponds
to a successive window.



One score, two symbolic streams

Debussy's Syrinx · monodic solo flute · score time, not performance time



Dashed lines: reference starts of mm. 9 and 26

From notation to events

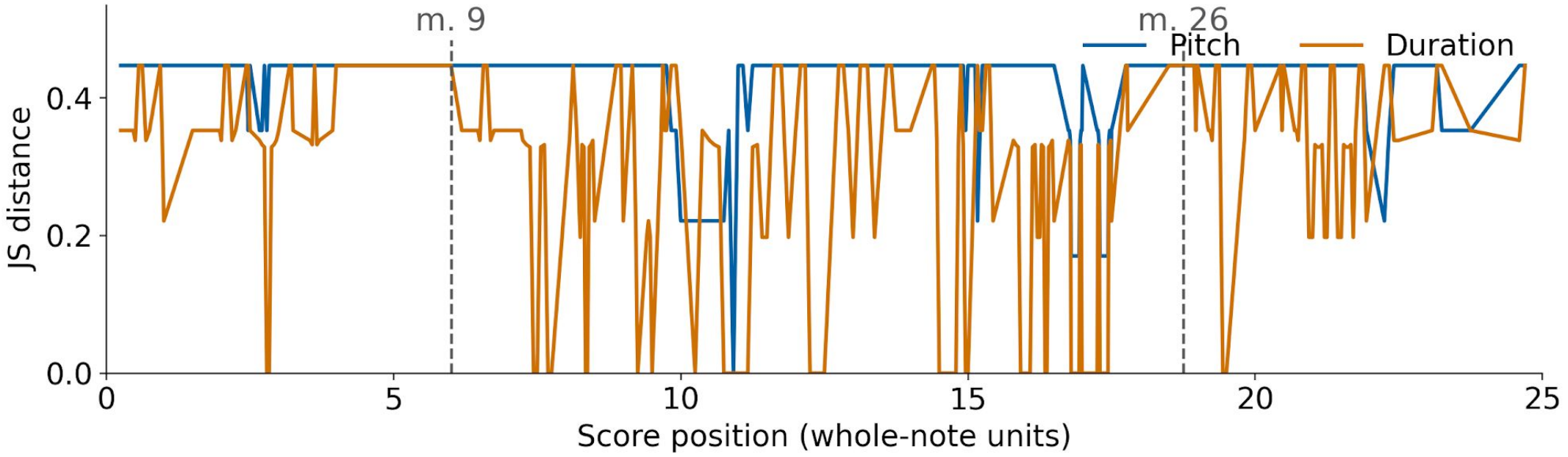
273 logical events

28 absolute-pitch states
23 exact-duration states

Grace notes excluded; ties merged.

Boundary alignment, with limited selectivity

L = 6 · Jensen–Shannon distance between successive transition distributions



Both reference boundaries reach 0.447 in both streams; maxima also occur elsewhere.

Why are the maxima so frequent?

Adjacent windows share all but one transition

Maximal turnover ceiling
$1 / \sqrt{(L - 1)} = 0.447$ at $L = 6$

Maxima: pitch 210 / 267 (78.7%) · duration 64 / 267 (24.0%)
Duration is more selective; neither curve uniquely segments form.

Resynthesis: window size controls departure

Mean aligned-state mismatch with the source · 500 draws per condition

Window L	Pitch mismatch	Duration mismatch
2	0.0%	0.0%
6	67.8%	34.4%
20	83.9%	58.8%

L = 2 copies the source exactly. Mismatch measures departure, not perceptual quality.

What this case supports

A bounded analytical result, followed by testable next steps

Syrinx shows local change without unique segmentation

Next: less-overlapping boundary comparisons, corpus tests, and joint musical evaluation.

Local kernels make change inspectable

A trajectory of transitions in Syrinx
with distinct limits for analysis and generation.

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