

# Pianists' Focus of Attention Modulates Expressive Performance: Differential Effects on Timing, Loudness, and Variability of Keystrokes

Tracy Lipke-Perry, Crane School of Music, SUNY Potsdam; lipkeptd@potsdam.edu  
Morris Levy, University of Minnesota Duluth; Darren Dutto, Eastern Oregon University



## Background

Widely studied in athletic pursuits, **attentional focus** has been comparatively neglected in the performing arts. Research has consistently demonstrated that **external focus** (focus on the implication of a movement) enhances both motor performance & learning relative to internal focus (focus on the movement itself). A particularly intriguing aspect at the piano is the extent to which a performer's attentional focus might influence the **quality of movement**. Results lay the foundation for development of means to objectively assess and quantify movement in music and highlight the need to better understand parameters (experience with focus conditions; skill level; age) underlying the FOA phenomenon in music.

## Research Question

What is the effect of focus condition on the timing, loudness, duration, and variability of keystrokes?

## Methods

**Participants:** (9) pianists: (5 females, 4 males; age=33.7 ± 10.5)

- (5) Piano students: (3) undergraduate, (1) graduate, (1) graduate music minor
- (4) Faculty: (2) university keyboard faculty; (1) staff pianist; (1) university conductor

**Piece:** Bartók's *Romanian Folk Dances*, Sz. 56., No. 2 (Fig. 1).



Fig. 1. Bartók *Romanian Folk Dance*, Sz. 56., No. 2, Phrase 1.

**Instrument:** Kawai MP11: 88 fully-weighted, touch-sensitive, wooden keys. MIDI capable.

**Procedures:** Performers were asked to initially play the piece without any instruction followed by a 1-minute typing task to "washout" previous instructions. Performers subsequently performed the piece 3 additional times with randomized focus conditions.

**Focus Conditions:** Participants were asked to perform the piece under (4) separate focus conditions: Baseline (B): without instruction; External (E): creating the idea of a dance; Internal (I): focusing on the fingertips to create a staccato touch; Metronome (M): focusing on, and synchronizing playing with a metronome's beat (144 BPM), the suggested tempo in the Universal Edition presumed to be the composer's indication.

**Pedal:** No explicit pedal instructions were given.

## Analysis

**MIDI keystroke data:** Loudness: MIDI note-on velocity (0-127 scale). Timing: Note-on and note-off time. Duration (articulation): Note-off time minus note-on time for each keystroke.

**ANALYSIS:** Group mean: Assessing performance trends across the group of participants. Coefficient of variability: Ratio of standard deviation to the mean. Assessment of relative variability in performance across focus conditions. Matrices of stability: Calculated to examine the relative stability of note-on velocity and timing of keystrokes over time period of interest (Demos, 2016). Hierarchical cluster analysis: Clusters of performance were identified by calculating the within cluster sum of squares and confirmed by calculating respective means, standard deviations, and coefficients of variability.

## Results

Significant differences across conditions were observed in excerpt duration (see Fig. 2); LH velocity onset & duration; and RH micro-expression--inter-note onset interval and velocity. Internal and metronome conditions appeared to constrain performance while the external condition seemed to facilitate expressive variation (see Fig. 3). Clusters of performance were identified (see Figs. 4-5), demonstrating within-participant performance consistency across conditions for several pianists.

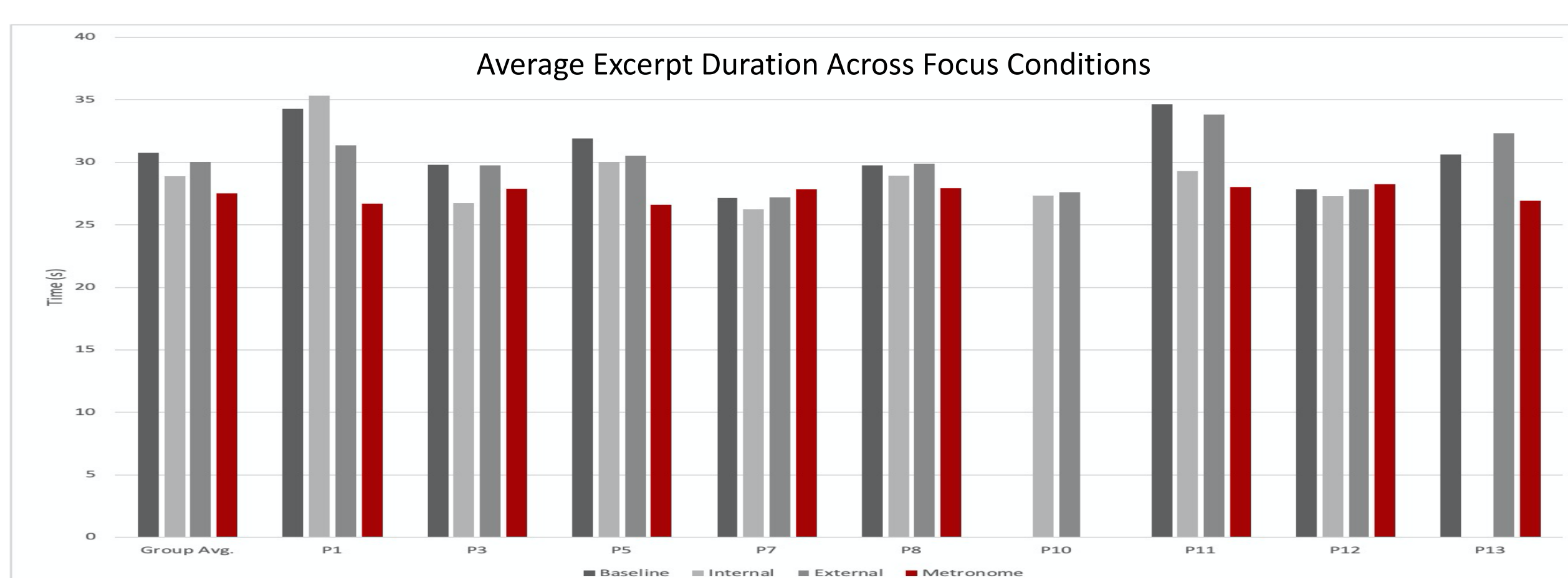


Fig. 2. Excerpt duration (group average) and by pianist (P#). Significant difference in M condition compared to each of the other focus conditions,  $p \leq .05$ . \*Impossible to calculate for P10 and P13 due to repetition of material.

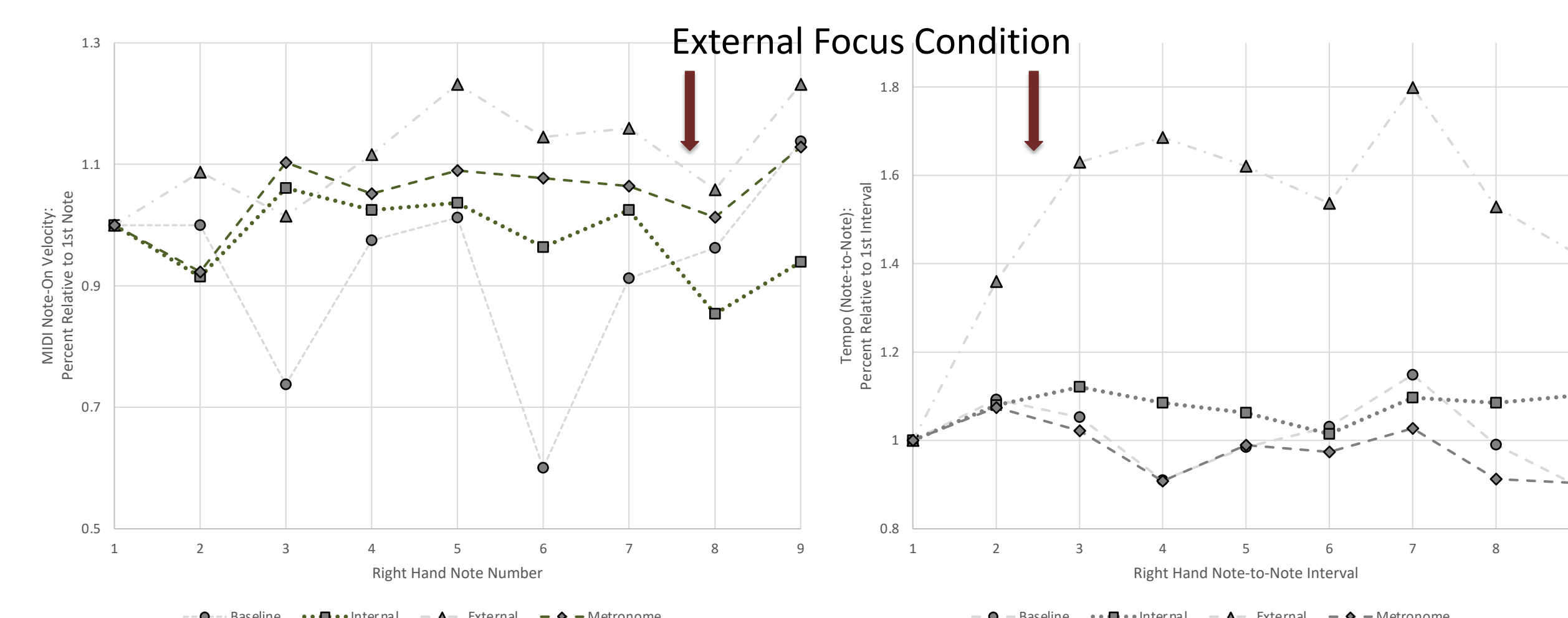


Fig. 3. Pianist 12. 3A (Above left). Relative MIDI note-on velocity of RH keystrokes 1-9 by focus condition. 3B (Above right). Relative tempo across RH keystrokes 1-10 by focus condition.

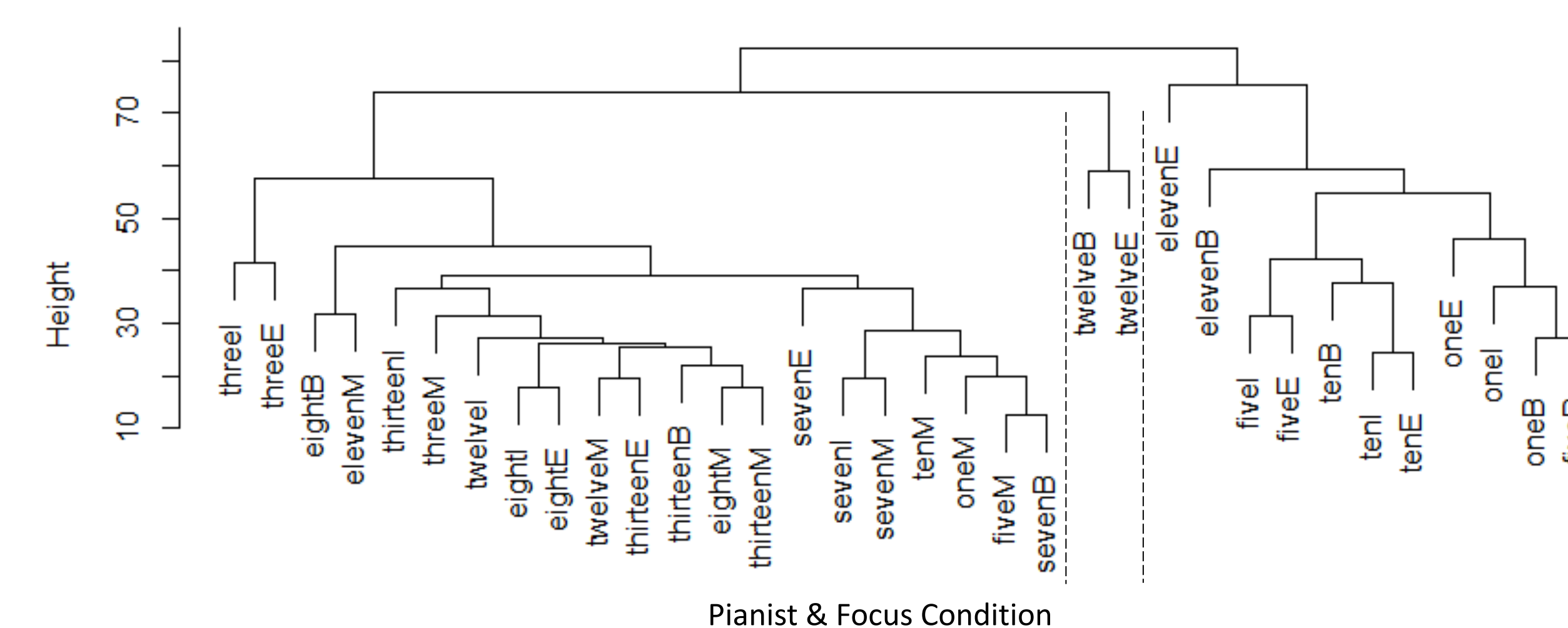


Figure 4. Tempo clustering: First 9 notes. Note. Performances cluster in 3 trees (delineated by dashed lines) representing similarity in note-to-note tempo across the first 9 keystrokes. Greater similarity is indicated by lower y-axis linkage. \*Performances are labeled by number of pianist participant and focus condition. \*\*3B and 11I were excluded due to missing data.

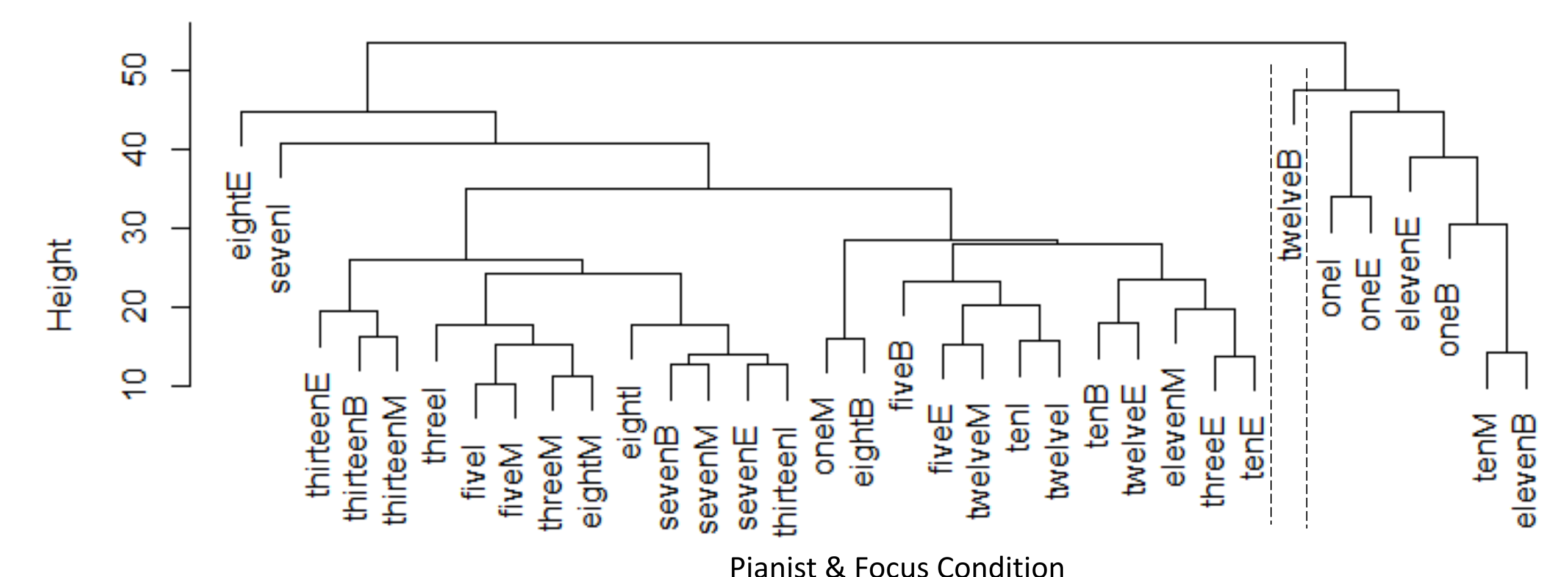


Figure 5. Velocity onset clustering: First 9 notes. Note. Performances cluster in 3 trees (delineated by dashed lines) representing similarity in MIDI note-onset velocity across notes 1-9. Greater similarity is indicated by lower y-axis linkage. \*Performances are labeled by number of pianist participant and focus condition. \*\*3B and 11I were excluded due to missing data.

## Conclusions

- Directing a pianist's focus internally vs. externally may influence variability of keystroke timing, duration, and loudness, aspects of performance directly related to expressive performance (Figs. 1 and 2).
- Level of experience may be reflected in the clustering of performances by timing and loudness (Figs. 4 and 5).
- Results highlight potential influence of instruction on performance & the importance of aligning focus with stages of learning & performance goals (i.e. technical practice & development) as means to cohesive performance.
- Future studies will be valuable in parsing differences attributable to the FOA phenomenon vs. contributing factors such as prior training experience; familiarity with the conditions; and level of expertise.

## Acknowledgments

Thank you to the Terascale All-sensing Research Studio (TARS) at Clarkson University and Damon Gwinn for MIDI-parsing programming.