

# TIMING VARIATIONS IN MUSIC PERFORMANCE: MUSICAL COMMUNICATION, PERCEPTUAL COMPENSATION, AND/OR MOTOR CONTROL ? PENEL & DRAKE

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## OUTLINE

MOTIVATION  
METHOD  
RESULTS  
DISCUSSION  
CONCLUSION

## MOTIVATION

Parameters that make a musical performance unconstrained

Perceptual, cognitive and motor abilities

Multidimensional – Timing variation, articulation, chord asynchronies, dynamics

Paradigm that constrains musicians to use one dimension. Used to investigate timing variations.

## Origin of timing variation

Musical communication hypothesis

- Communicate structure and emotion to listener
- Example: Group final lengthening communicates hierarchical grouping structure. Lengthening in first/last beats of a bar communicate metrical structure

## Perceptual compensation hypothesis

- Timing variations compensate for perceptual biases.
- Biases due to psychoacoustic effects. Deviation in frequency or intensity can cause the perception of deviation in time.
- Example: Some IOI's perceives as shorter/ longer than they are. So played longer/ shorted to restore regularity.

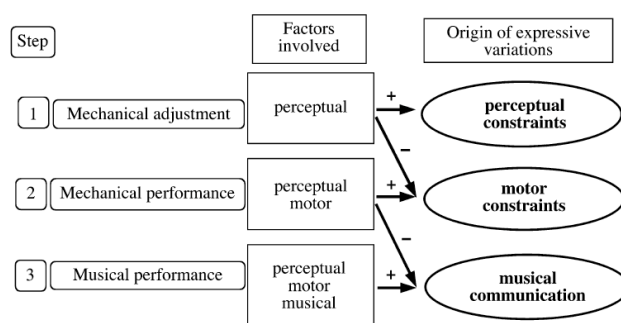
## Motor control Hypothesis

- Biomechanical and instrument related constraints may produce systematic variations.
- Biomechanical Example : tap-accentuate .  
Instrument Example : Piano-distance .

## Perceptual Performance paradigm

- Disentangling timing variations due to musical communication from those due to perceptual and motor constraints.
- Adjustment task added to the mechanical and musical performance.

## The Rationale of the Perceptual performance paradigm



## Procedure for the paradigm

First- Mechanical rendition

Choose one dimension – Timing, articulation, dynamics. Keep others constant

Adjust perceptually performance parameters of each event

Second- Same mechanical rendition as that in the adjustment task

Third- Musical rendition

## Paradigm

Perceptual – First task

Perceptual + motor – second task

Perceptual + motor+ musical communication factors – Third task

No hierarchy in 1 and 2. Should be noticed only in 3. ie. Higher levels of hierarchical grouping structure

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## METHOD

A simple melody, Brahms Intermezzo ( opus 117, No.1) and the latter with an accompaniment

5 professional successively adjusted mechanically, performed mechanically, and performed musically.

All tracks at 100 bpm

## The three excerpts used

Excerpt 1:



Excerpt 2:



Excerpt 3:



Metronome

Play Stop

Excerpt

Play Stop

1 2 3 4  
+ - + - + - + - ●●●

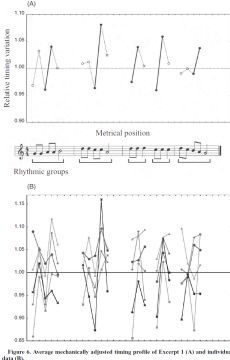


Figure 5. Schema of the computer screen and the score the participants used in the mechanical adjustment task.

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# Mechanical adjustment



Average mechanically adjusted timing profile for excerpt 1

Figure 6. Average mechanically adjusted timing profile of Excerpt 1 (A) and individual data (B).

## Mechanical Adjustment

**Excerpt 1:** Last short IOI of each rhythmic group adjusted to be longer than preceding one

ANOVA for relative timing variation, with rhythmic group and position of IOI in the group as factors, confirmed an effect of position and revealed no effect of group and no interaction.

**Excerpt 2:** Two levels of rhythmic groups: 16th note and 8th note.

For 16th note group-Last short IOI was adjusted to be longer than the preceding. Pattern not seen for 8th.

ANOVA with 16th note rhythmic group and position of the IOI within the group as factors revealed only an effect of position. Not seen in ANOVA with 8th

**Excerpt 3:** Rhythmic groups + intensity difference between successive events.

Thus, perceptual bias + bias from intensity difference. Soft-loud IOI's adjusted to be shorter than loud-soft IOI's

## Mechanical Performance

**Excerpt 1:** Difference from mechanically adjusted will reveal variations due to motor constraints. There was no difference noticed.

Same variation. Last short IOI longer than preceding.

**Excerpt 2:** Same variations observed as mechanically adjusted task.

8th note also followed pattern. Implies motor constraints brought about variations but did not reflect hierarchy.

## Musical performance

Difference from mechanical performance should reveal variations in musical communication.

**Excerpt 1:** variation observed and with greater magnitude. ANOVA showed effects of group and position and interaction between the two.

Greater group final lengthening was observed in the musical performance.

**Excerpt 2:** Same variations

For 16th and 8th – greater group final lengthening was not observed in musical performance, but it was dependent on the excerpt's hierarchy.

**Excerpt 3:** Same variations

For 16th and 8th note rhythmic groups, greater group final lengthening was observed.

## OUTLINE

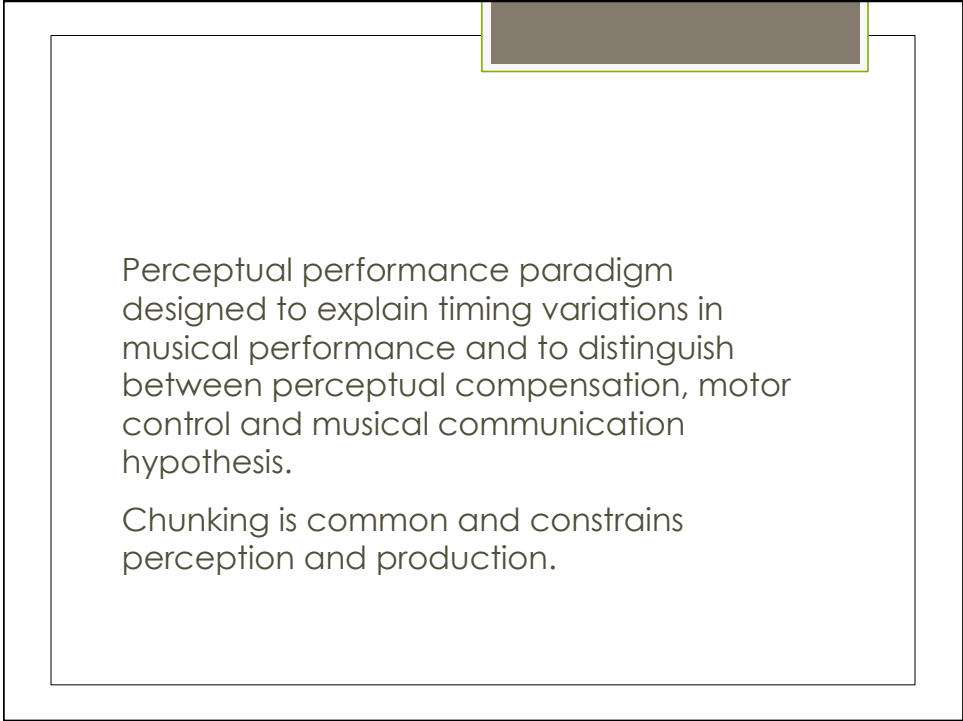
MOTIVATION

METHOD

RESULTS

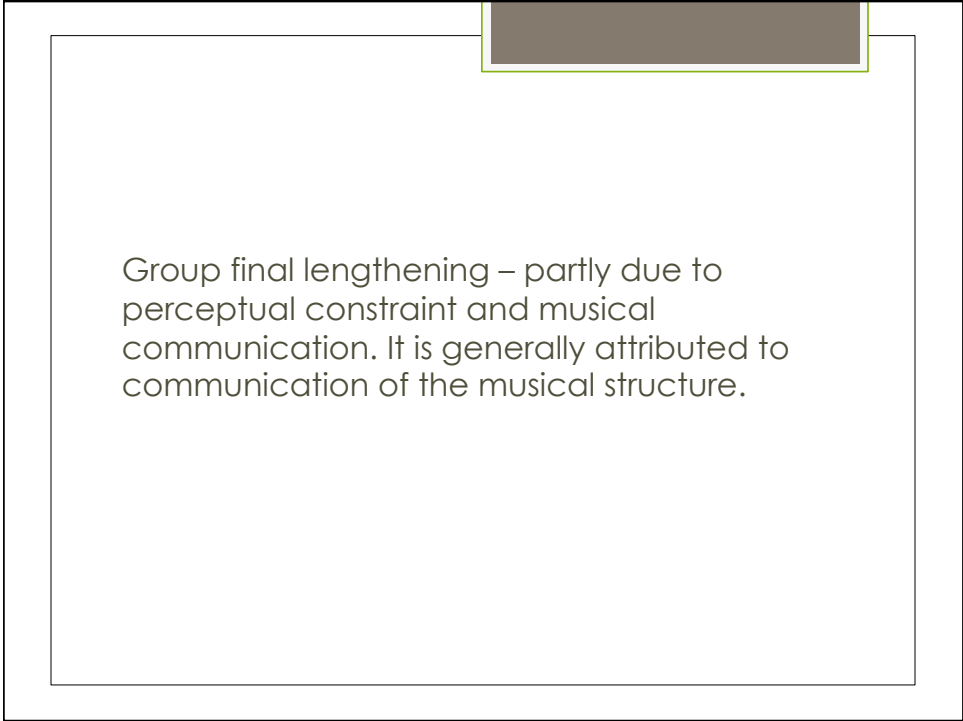
DISCUSSION

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Perceptual performance paradigm designed to explain timing variations in musical performance and to distinguish between perceptual compensation, motor control and musical communication hypothesis.

Chunking is common and constrains perception and production.



Group final lengthening – partly due to perceptual constraint and musical communication. It is generally attributed to communication of the musical structure.