

# Lectorate Lifelong Learning in Music & the Arts

A Measure of Non Score-dependency: the  
Groningen Test Battery of Audiation in  
Instrumental Performance

GTBAIP

# definitions

Non score-dependency can be defined as the mastery of all stages of *audiation* at the instrument of choice while listening to, recalling from memory and performing familiar or unfamiliar music as well as creating and improvising (Gordon 1989a).

# audiation

Audiation is the process of mentally hearing and comprehending music.

Audiation includes the necessary understanding of music to enable the conscious prediction of patterns in unfamiliar music (Gordon 1989b).

# stages of audiation

- Stage 1 Momentary retention
- Stage 2 Initiating and audiating tonal patterns and rhythm patterns AND recognizing and identifying a tonal center and macrobeats
- Stage 3 Establishing objective or subjective tonality and meter
- Stage 4 Consciously retaining in audiation tonal and rhythmic patterns
- Stage 5 Consciously recalling patterns organized and audiated in other pieces of music
- Stage 6 Conscious prediction of patterns

Are audiation and non score-dependency unique to the musical domain or is there an equivalent in the language domain?

# music-language tradition

- long tradition of thinkers contemplating language-music relation: Plato (Neubauer 1986), Descartes (1618/1987), Rousseau (1781/1993), Wittgenstein (1953), Spencer (1857) Bernstein (1973)
- rhetorical view of music in the eighteenth century (van Dijk, van der Leeuw 1981)
- Darwinian view on the evolution of language (1871)

# auditory domain

- language and music both unique to the species (McDermott & Hauser 2005)
- both ubiquitous elements of all cultures (Molino 2000)
- both develop spontaneously in childhood

# temporal domain

- both language and music are rule-based systems composed of sequential events that unfold in time (Lerdahl & Jackendoff 1983)
- both exhibit specific rhythm and specific segmental and suprasegmental information organized into (recursive) higher-order structures (Besson & Schön 2001; Raffman 1993)

# syntax

Syntactic knowledge allows the mind to accomplish a remarkable transformation of the input: a linear sequence of elements is perceived in terms of hierarchical relations that convey organized patterns of meaning. (Patel 2003)

Listeners demonstrate *implicit knowledge of syntactic patterns* and principles in a number of ways, including judgments of correctness, memory advantages for rule-governed sequences, and production of plausible substitutions when linguistic or musical sequences are recalled less than perfectly (Blacking, 1973; Sloboda, 1985).

# Shared Syntactic Integration Resources Hypothesis

(Patel 2003)

Overlap in syntactic processing of language and music: overlap in the neural areas and operations which provide the resources for syntactic integration.

Proficiency in a foreign language  
is characterized by:

- adequate vocabulary
- correct syntax
- shared prosodic features

..which can be demonstrated in the context  
of speech production by competence in  
three specific areas:

1. replication
2. manipulation
3. generation

# 1. replication

## Verbatim repetition:

- Statement: I got up at 5 and then I practiced for five hours.
- Repetition: I got up at 5 and then I practiced for five hours.

## Synonymous repetition

- I rose at dawn and then I practiced till ten.

## 2. manipulation

Reconjugation:

- He got up at 5 and then practiced for five hours.

Recursivity:

- The student **who got up at five**, practiced for five hours.

Ornamentation:

- The industrious conservatory student who got up around five in the morning was able to practice five hours before going to school.

# 4. generation

## Response:

- Question: What time did the industrious student get up?
- Answer: He got up at five and practiced until ten.

## Free improvisation:

- I go to bed at 5 and do my best work after midnight.

- How can the measure of *non score-dependency* among instrumental performers be determined?

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- How is the measure of oral proficiency among speakers of a foreign language determined?

Non score-dependency is characterized by:

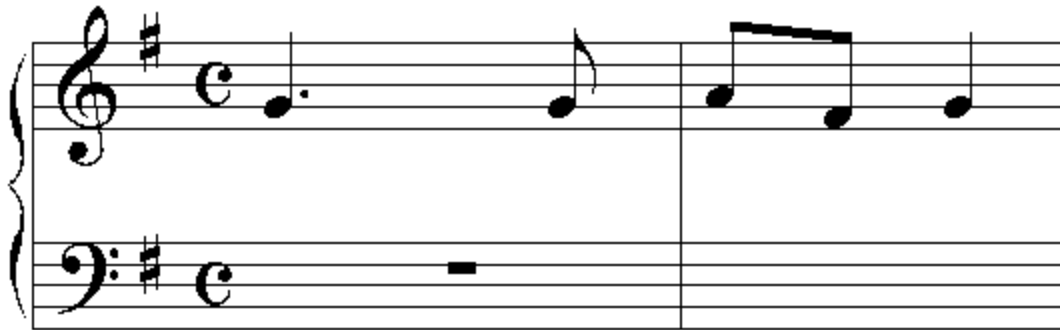
- richness of musical structure
- correct syntax
- agreement between musical structure and expressive performance

..which can be demonstrated in the context of performance by competence in three specific areas:

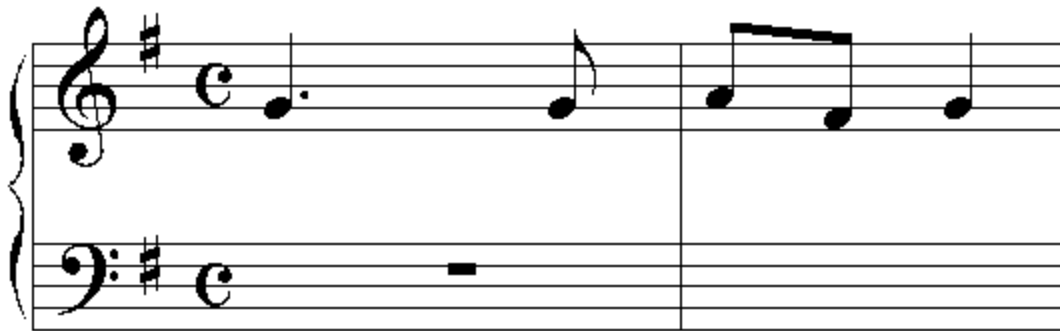
1. replication
2. manipulation
3. generation

# 1. replication

a. exact repetition:



Musical notation for the first instance of exact repetition. It consists of two staves: a treble clef staff and a bass clef staff. The key signature is one sharp (F#) and the time signature is common time (C). The treble staff contains a sequence of notes: a quarter note G4, a quarter note A4, a quarter note B4, a quarter note C5, a quarter note B4, a quarter note A4, and a quarter note G4. The bass staff contains a whole rest.



Musical notation for the second instance of exact repetition. It consists of two staves: a treble clef staff and a bass clef staff. The key signature is one sharp (F#) and the time signature is common time (C). The treble staff contains a sequence of notes: a quarter note G4, a quarter note A4, a quarter note B4, a quarter note C5, a quarter note B4, a quarter note A4, and a quarter note G4. The bass staff contains a whole rest.



# 1. replication

b. transposition:

The image shows a musical score for a piano piece in A major (two sharps: F# and C#) and 2/4 time. The score is written on two staves: a treble clef staff and a bass clef staff. The treble clef staff contains the melody, which starts with a quarter note on G4, followed by a dotted quarter note on A4, an eighth note on B4, and a quarter note on C5. The bass clef staff contains a whole rest in the first measure, indicating that the bass part is silent during this transposition exercise.



# 1. replication

c. modal shift:



The image shows a musical score for a piano, consisting of two staves: a treble clef staff and a bass clef staff. Both staves are in the key of D major (one sharp, F#) and common time (C). The score is divided into two measures by a vertical bar line. In the first measure, the treble staff contains a dotted quarter note on D4, followed by an eighth note on E4, and another dotted quarter note on F#4. The bass staff contains a whole rest. In the second measure, the treble staff contains a quarter note on G4, followed by a quarter note on A4, a quarter note on B4 with a sharp sign, and a quarter note on C5. The bass staff contains a whole rest.



# 1. replication

d. interval shift

The image shows a musical score for a piano piece in G major (one sharp) and C major (no sharps or flats). The score is written in common time (C) and consists of two measures. The right hand (treble clef) plays a melody that starts on G4, moves to A4, then B4, and then descends to A4, G4, and F#4. The left hand (bass clef) plays a simple accompaniment consisting of a single note on G2 in the first measure and a single note on G2 in the second measure. The interval shift is demonstrated by the change in the right hand's starting note from G4 to A4 in the second measure.



# 2. manipulation

a. secondary voices: descant

The image shows a musical score for piano in G major (one sharp) and 3/4 time. The score is divided into three measures. The right hand (treble clef) features a descant, which is a melodic variation of the main theme. The left hand (bass clef) provides a simple accompaniment with a steady bass line. The descant begins in the second measure and continues through the third measure, characterized by a series of eighth and sixteenth notes.



# 2. manipulation

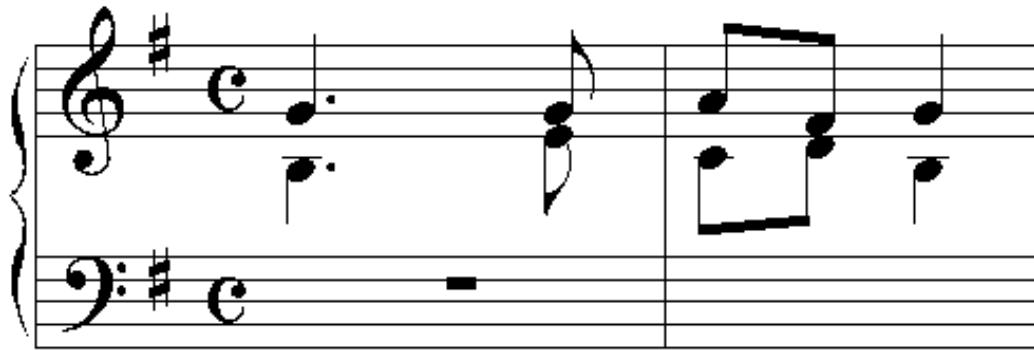
b. bass

A musical score for a bass line in G major, 4/4 time. The score is written on a single bass staff. The key signature has one sharp (F#) and the time signature is common time (C). The piece is divided into two measures by a vertical bar line. In the first measure, the bass line starts with a quarter rest, followed by a dotted quarter note G2, an eighth note A2, and a quarter note B2. In the second measure, there is a quarter note G2, an eighth note A2, a quarter note B2, and a quarter note C3. The notes are connected by a horizontal line, indicating they are part of a single melodic phrase.



# 2. manipulation

c. thirds and sixths





# 2. manipulation

## e. recursive harmony

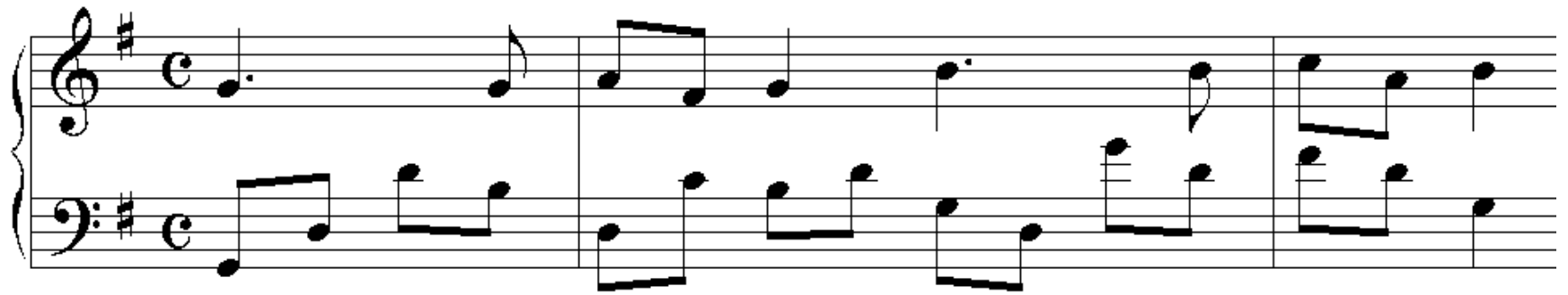
G G7 C Gmin A D7 G Gmin A7 A<sup>b</sup> G

The image shows a musical score for piano in G major, consisting of two systems of three staves each (treble, middle, and bass clefs). The first system covers measures 1-2, and the second system covers measures 3-5. Above the first staff, a sequence of chords is listed: G, G7, C, Gmin, A, D7, G, Gmin, A7, A<sup>b</sup>, G. The notes in the score correspond to these chords. Below the first system, the label 'TD/IV' is placed under the first measure, and below the second system, the label 'TD/V' is placed under the first measure of that system. A small blue speaker icon is located below the 'TD/IV' label.



# 2. manipulation

f. accompaniment



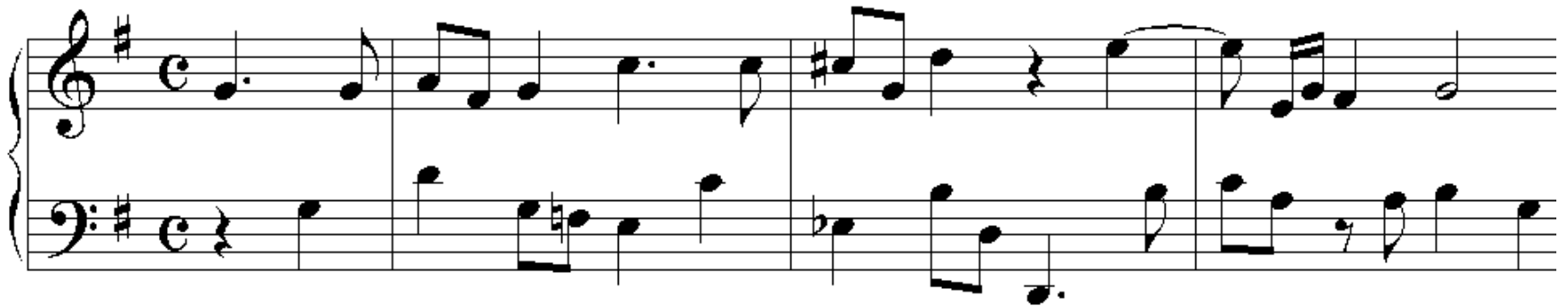
# 2. manipulation

## g. Theme and variations



# 3. generation

a. antecedent: model – consequent: improvisation

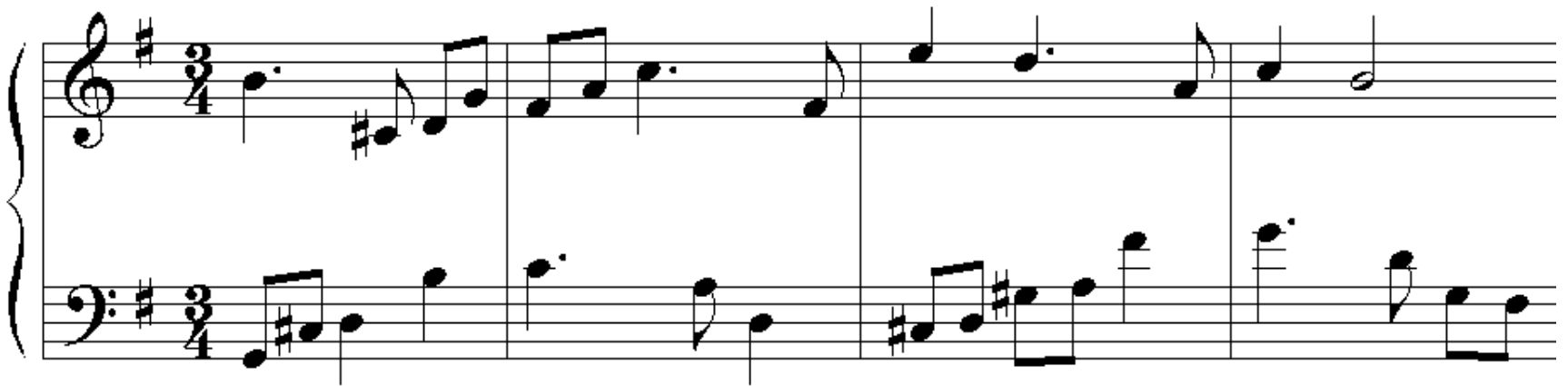


antecedent..... consequent.....



# 3. generation

b. free improvisation (no aural model)



Subjects will listen to short aural models characterized by:

- tonal harmony
- homophony
- lack of performance expression  
(WAV files generated digitally)

Subjects will perform on a MIDI piano which generates a MIDI file of the performance for analysis using the MIDI toolbox.

Een audio recording (WAV file) will be made of condition four (oral improvisation).

# conditions

## 1. Replicate

- a. play as heard
- b. transpose to .... (specified key)
- c. transpose to the relative minor
- d. play the melody with a tonal shift starting on...

# conditions

## 2. Manipulate

- a. harmonize the melody with a descant voice
- b. harmonize the melody with a bass voice
- c. harmonize the melody in thirds and sixths
- d. harmonize the melody with full chords
- e. harmonize the melody with the indicated bass
- f. play a broken chord accompaniment in the left hand
- g. play a variation on this theme

## 4. Generate

- a. finish the phrase
- b. whistle a happy tune (oral improvisation: audio recording)
- C. improvise a happy tune at the keyboard (MIDI recording).

# Analysis

The results will be analyzed according to

- melodic similarity between model and performance (method Peter van Kranenburg, Meertens Institute)
- correct syntax (theoretical analysis)

Using the MIDI toolbox, analysis of

- force of keystroke (MIDI toolbox)
- timing (MIDI toolbox)

will be employed to discover discrepancies between musical structures and expressive performance.

Results of the two conditions free improvisation 'whistle a happy tune' and 'play a happy tune' at the keyboard will be analyzed to discover discrepancies between oral and manual domains.

## Possible tools for analysis are:

- tonal and harmonic analysis to uncover discrepancies in structural richness and regularity.
- MIDI toolbox to uncover discrepancies between timing and dynamics between both domains.
- statistical analysis to uncover variation in the frequency of appearance of the seven tones of the scale.

# correlation

The results of the various tests will be correlated with one another to validate their use in a battery of tests designed to measure non score-dependency among instrumentalists.