



Introduction to **Audio Content Analysis**

Module 15: Music Performance Analysis

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introduction

overview

corresponding textbook section

chapter 15

■ lecture content

- musical communication
- music performance
- music performance analysis

■ learning objectives

- give examples for score-inherent and performance-inherent musical characteristics
- describe typical challenges in music performance analysis



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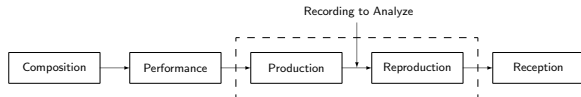
- give examples for score-inherent and performance-inherent musical characteristics
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music performance

introduction

- music exists only with performance
- performance realizes acoustic rendition of musical ideas
- each rendition is unique
- score information is interpreted, modified, added to, or dismissed
- adds “expressivity”



music performance parameters

category

tempo/timing

dynamics

pitch

timbre

score representation/idea

explicitly defined rhythmic content

basic dynamics instructions

explicitely defined pitches

implicit definitions (instruments, ..)

performance

tempo, micro-timing

accents,...

vibrato, intonation,...

playing techniques

music performance analysis

goals

by analyzing the music performance, we learn about

■ the **performance**:

- general performance characteristics
- notable stylistic differences (over time, between artists, ...)

■ the **performer**:

- mapping of intent and projected emotion to measurable parameters

■ the **listener**:

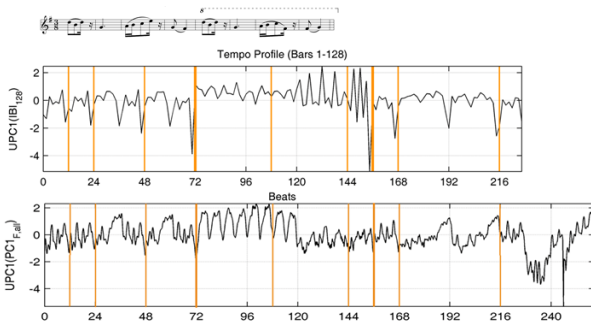
- what is perceived as (appropriate level of) expressiveness
- how can different performance parameters impact the listener
- how is aesthetic perception shaped by performance parameters



performance analysis

insights 1/3

- close relation between **tempo/dynamics and structure**:
 - ritardandi at phrase boundaries
 - tempo changes at structural boundaries
 - repetitions very similar
- performance sounds unnatural without these general trends
- no clear relation to timbre



performance analysis

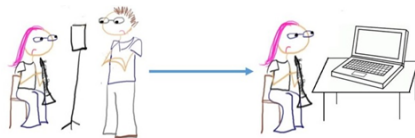
insights 2/3

- perceptual relevance of “expressive” performance characteristics:
 - dynamics highest impact on ratings of emotional expression
 - expressive timing best predicts ratings of musical tension
 - sharpened intonation at phrase climax contributes to perceived excitement
- measured \neq perceived
 - e.g., measurable difference between “normative” and “expressive” performance does not necessarily lead to perception of expressivity
 - e.g., no correlation between measured and perceived vibrato onsets

performance analysis

insights 3/3

- Humans rate performances regularly (schools, auditions, competitions) but specific criteria are often badly defined
- use cases
 - music education
 - computer-assisted practice
 - pre-screening of candidates for music programs
 - provide insights into **technical and aesthetic descriptors** of human judgments
- most models still lack generalizability and reliability beyond simple note matching



music performance analysis

challenges

■ observations

- style dependent, lacking research beyond western classical music
 - data is manually annotated in most cases
 - most research
 - ▶ focused on piano and voice
 - ▶ descriptive and explorative
-
- 1 datasets small, not general
 - ▶ automatic tools not reliable enough?
 - ▶ generality: instrument specific, performers, listeners
 - 2 unknown mapping of performance parameters to perception
 - ▶ isolation of parameter meaning tricky
 - ▶ hard to define expressivity, hard to control variables

music performance analysis

opportunities

- understanding why current MIR systems are of limited use to music psychologists and performance researchers
 - wrong measures of success?
 - miscommunication of system capabilities?
- score-based and performance-based information should be disentangled
 - lack of separation of core musical ideas and performance characteristics impedes differentiation of relevant and irrelevant information (example: music emotion recognition)
- cross-disciplinary approaches and methodologies can help
 - enabling larger scale perceptual studies with music data
 - interpretability of data
 - ▶ better understanding of music and its perception
 - ▶ better systems for music analysis and music generation

summary

lecture content

■ performance

- all music needs to be performed
- while the general performance characteristics are clear, their analysis is less clear

■ performance analysis

- 1 describes and formalizes commonalities and differences of performances

■ challenges

- 1 tricky to disentangle variables
- 2 unclear impact on listeners
- 3 hard to find reliable ground truth data

