



Universiteit Utrecht

[Faculty of Science
Information and Computing Sciences]

Sound and Music Technology

Introduction

Anja Volk
14 Nov 2019

Outline

- Introduction
- Domain knowledge
- Organisation and activities
- Practical matters



The importance of sound and music for games

Do you remember the first video game you were really into? I mean *really* into. You couldn't put the controls down, your eyes were bloodshot from staring for hours at the screen, and all you could feel was the game. **What was so hypnotic about it that kept you glued to the screen?** What was it that made your heart race with anticipation and your body tingle with expectation?

... the importance of music in such a media is often overlooked. Critics and players alike typically comment on what they consciously understand about a game: the story, the controls, the graphics. Nonetheless, at the very least, **music subconsciously** takes hold of the player and pulls him or her into the actual world of the game.

Douglas, Aaron (2002): Sound of Music: The Form, Function, and History in Video Games.
<http://www.stanford.edu/group/htgg/cgi-bin/drupal/?q=node/493>



Game Studies

Faculty of Sciences
Informatics and Computing Sciences
University of Cologne

The importance of sound and music for games

The good thing about audio is that it tends not to be noticed that much.
This means we can affect the player in a powerful **subconscious** level.
The bad thing about audio is, well, that it tends not to be noticed much.
You will have to constantly convince people of the importance of investing in sound and music.

Stevens & Reybold (2013) *The Game Audio Tutorial: A Practical Guide to Sound and Music for Interactive Games*.



Sound and music in other contexts

- Shopping
- Exercising
- Waiting
- Driving
- ... everyday life!
- in all human cultures



Role of computation

- digitization over past decades
- enables computation on digitized musical content
- new research area “Music Information Retrieval”
 - Actually, we just had our 20th anniversary!
- music is rich in structures
 - build computational models and extract these structures
 - employ them within different contexts and for different purposes



Introducing Sound and Music Technology

■ From the course description

- Sound and music provide powerful ways for impacting the *human experience* involved in the engagement with games and media.
- In this course, you will learn how to apply and develop *computational methods* to extract, process and utilize music information from digital sound and music in the context of newly emerging research areas within games and media.

■ Main modules

- A. Sound and music for games
- B. Analysis, classification, and retrieval of sound and music for media
- C. Generation and manipulation of sound and music for games and media



Week	Date	Time and location	Topic (L)	Lecturer	BP
46(1)	Tue 12-11		no lecture		
	Thu 14-11	11.00-12.45 8803-214	A: Introduction to the course	Arja Volk	
47(2)	Tue 19-11	13.15 - 15.00 80L-3.100	A: Introduction sound and music for games	Arja Volk	
	Thu 21-11	11.00-12.45 8803-214	A: Interactivity and immersion in games	Arja Volk	1. Zheng & Fu (2018) 2. Alami et al. (2018)
48(3)	Tue 26-11	13.15 - 15.00 80L-3.100	A: Serious games for music	Arja Volk	1. Bittel et al. (2018) 2. Mendonca et al. (2018)
	Thu 28-11	11.00-12.45 8803-214	B: Symbolic music features: Rhythm and meter	Arja Volk	1. Foubert et al. (2017) 2. Housheer (2014)
49(4)	Tue 03-12	13.15 - 15.00 80L-3.100	B: Symbolic music features: Melody and harmony	Arja Volk	1. Tanschev & De Clercq (2013) 2. van Kesteren et al. (2013)
	Thu 05-12	11.00 - 12.45 8803-214	B: Symbolic music features: Musical patterns	Hs Yaping Ran	1. Pessak et al. (2017) 2. Collins & Lerner (2017)
50(5)	Tue 10-12	13.15 - 15.00 80L-3.100	Individual discussion of student proposals	Arja Volk	
	Thu 12-12	11.00-12.45 8803-214	B: Introduction basic audio feature extraction	Arja Volk	1. Ellis (2007) 2. Karas (2013)
51(6)	Tue 17-12	13.15 - 15.00 80L-3.100	B: Audio feature extraction for corpus analysis	Arja Volk	1. Mauch et al. (2018) 2. Weiss et al. (2018)
	Thu 19-12	11.00-12.45 8803-214	B: Audio Transcription	Arja Volk	1. Ni et al. (2012) 2. Jansen-Mas et al. (2018)
2(7)	Tue 07-01	13.15 - 15.00 80L-3.100	B: Segmentation	Arja Volk	1. Meinard Mueller et al. (2013) 2. Kroher et al. (2018)
	Thu 09-01	11.00-12.45 8803-214	B: Classification of similar musical objects	Arja Volk	1. Escucha et al. (2010) 2. Tzanetakis & Cook (2002)
3(8)	Tue 14-01	13.15 - 15.00 80L-3.100	C: Generation and manipulation of sound and music	Arja Volk	1. Ross et al. (2014) 2. Shum & Ben-Tal (2017)



Literature study and student presentations

- student presentation in the second half of (nearly) every lecture
- usually, 1 paper will be presented per session by a group of two students
- papers are mandatory reading for everyone
- register for paper via Google drive: document "Schedule for student presentations"
 - In groups of two students per paper
- Choose paper no later than Monday 18 Nov, 23:59
 - Otherwise I'll assign paper(s) to you



What I expect presenters to do

- 10- 15 minutes presentation followed by 5 minutes of discussion
 - your responsibility to keep discussion going
- in your presentation
 - summarize paper; discuss main contribution(s)
 - put in context of other research (before and after)
 - what domain knowledge is needed to understand the paper and how to acquire it
 - critical evaluation
 - what research questions / opportunities follow from it?
- Load your slides into Google drive folder under folder "Slides student presentations"



What SMT is and what it isn't

- SMT is closely tied to ongoing research in (computational) Music Information Research at ICS
 - much attention to music
 - less to other (often very interesting) types of sound
 - no treatment of speech
- research scope is being extended to music in games as well
 - increasing interest in music's contribution to experience and emotion
- mostly dealing with existing music / sound
 - we do look into some aspects of music generation
 - not about sound synthesis / studio electronics



Research in our group

- Department of Information and Computing Sciences
 - division of Interaction Technology
 - Media technology
 - **Music Information Research**



Anja Volk



Remco Veltkamp



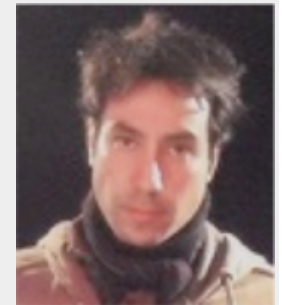
Frans Wiering



Peter van Kranenburg



Bas de Haas



Marcelo
Rodriguez Lopez



Dimitrios Bountouridis



Vincent Koops



Geert-Jan Giezeman



Iris Ren

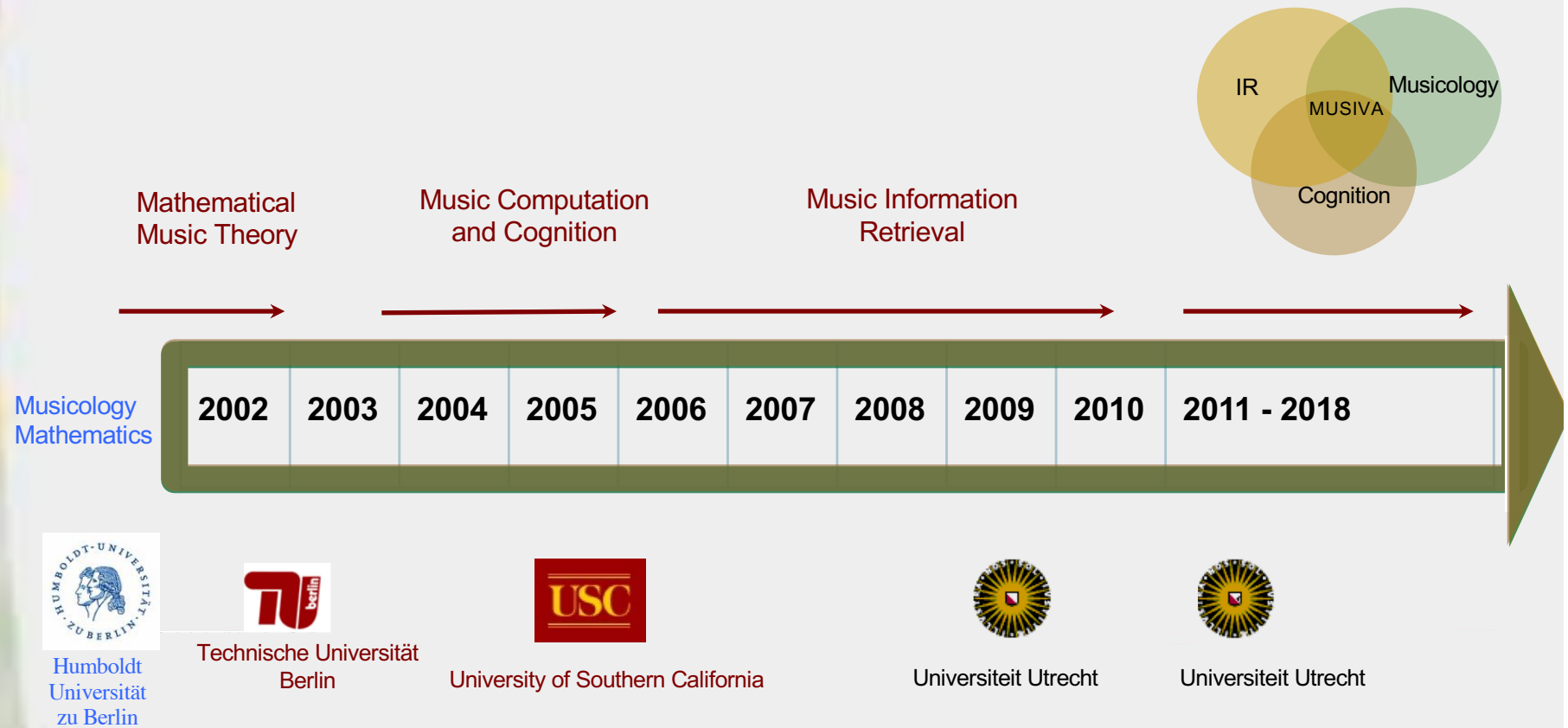


Anna Aljanaki



Jan Van Balen

Introduction: Anja Volk



What we do

- research at the intersection of computer science and music, connecting computer science methodology to state-of-the-art domain knowledge of music
- three areas
 - Music Information Retrieval
 - Computational / Digital Musicology
 - Music Technology for Games and Virtual Worlds
- here follow some examples of research we've done
 - part of the context of the SMT course





From the past: WITCHCRAFT

- *What Is Topical in Cultural Heritage: Content-based Retrieval Among Folksong Tunes*
 - NWO-CATCH project, 2006-2010
- Aims included designing a melody search engine
 - sequence alignment



Universiteit van Amsterdam

[Faculty of Sciences
Informatics and Computing Sciences]

Sample WITCHCRAFT search output

[En wat] baart de liefde veel smarten / En al van [...]

OPN OCL 407: opname Houtigehage 1930

In Frankrijk buiten de poorten (2)



mp3

transact.

Daar reed er een heer

OPN OCL 30306: opname Enschede 1968

Daar reed een jonkheer (2)



mp3

transact.

In Veendam daar staat er een herberg / Een [...]

OPN OCL 18304: opname Hoogkerk 1961

In Frankrijk buiten de poorten (2)



mp3

transact.

In Veendam en daar staat er een herberg

OPN OCL 20515: opname Hoogkerk 1961

In Frankrijk buiten de poorten (2)



mp3

transact.

In Frankrijk buiten de poorten

OPN OCL 26321: opname Blijham 1966

In Frankrijk buiten de poorten (2)



mp3

transact.

In Frankrijk staat een herberg

OPN OCL 33312: opname Muntendam 1969

In Frankrijk buiten de poorten (2)



mp3

transact.

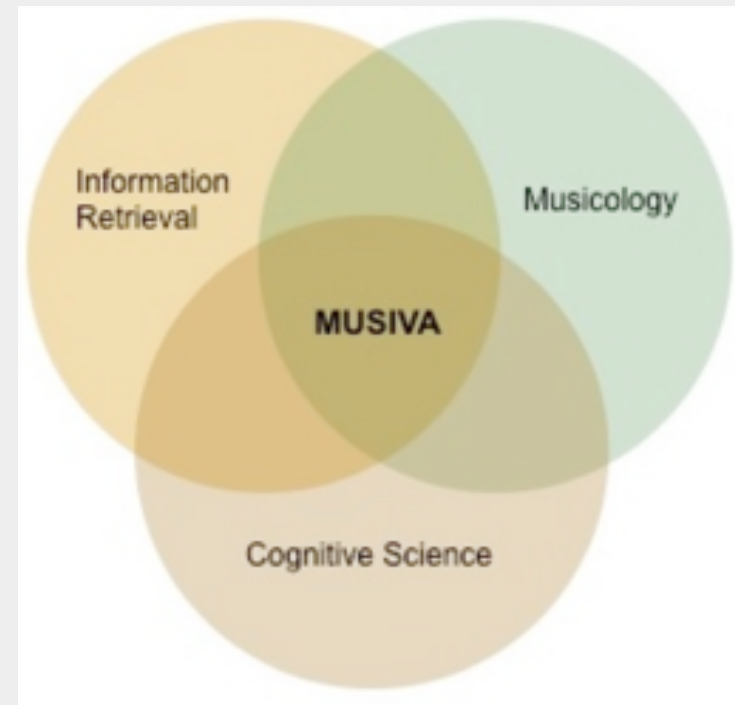
COGITCH (2011-2015)

- COgnition Guided Interoperability beTween Collections of musical Heritage
- The name also refers to the 'cognitive itch' that is caused by 'earworms': fragments of music that you cannot get out of your head, no matter how hard you try
- <http://www.youtube.com/watch?v=gLXdhouWQF8>



MUSIVA (2011-2016)

- Modelling musical similarity over time through the variation principle
- VIDI project led by Anja Volk
- just a few topics
 - corpus study of ragtime music
 - melody segmentation
 - repeated pattern finding
 - automatic chord labeling



Sensing Emotion in Music

- part of huge research programme COMMIT
 - Virtual Worlds for Wellbeing
 - PhD thesis Anna Aljanaki
- focus on induced emotion
 - no big-enough dataset available
 - created new dataset through Game with a Purpose called Emotify

COMMIT/



Collaboration with Chordify

- <https://chordify.net/chords/kensington-home-again-official-video-kensingtonband>
- Music e-learning service, Online automatic chord extraction

Chordify is using cookies to offer you the best possible experience. Learn more

Kensington - Home Again (Official video) [View all chords](#)

Search any song

Log in

Create Account

Library

Go Premium

Blog

Help

Feedback

Similar to Kensington - Home Again (Official video)

Chords Kensington - Home Again (Official video)

Chords Kensington - Home Again (Official video)

Chords Kensington - Home Again (Official video)

Chords Kensington - Home Again (Official video)

New emerging field: Health applications

The poster features a dark blue background with a grid of EEG waveforms on the left and a musical staff with notes on the right. A yellow banner at the top contains the event title and dates. The NIAS and Lorentz center logos are in the top left corner.

NIAS
Lorentz center

Music, Computing, and Health

Workshop @Cort. 4 - 8 March 2023, Leiden, the Netherlands

Scientific Organizers

- Kai Aiguo, SHPC A*STAR / National University of Singapore
- Sutan van Hoozen, Research centre Keesik / Open University
- Rebecca Schaefer, Leiden University
- Anja Volk, Utrecht University

Aim

- Towards music technology for health: drawing from music cognition, computer science, music therapy and music education

- Serious games involving music
- MIR methods to support diagnosis and intervention

Outline

- Introduction
- **Domain knowledge**
- Organisation and activities
- Practical matters



Domain knowledge

- music is not just another kind of data
 - human processing is important
 - huge amounts of knowledge available from music theory, musicology, music psychology
 - level of formalization varies
- you're not expected to be an expert at this
- but people generally have a lot of musical knowledge from 'mere exposure'
- how to acquire even more such knowledge
 - Wikipedia (lots of good stuff there...)
 - <http://www.oxfordmusiconline.com/>: the ultimate professional resource (via UU library)
 - **ask questions during lectures**
 - listen to, make music



Student introduction

- Please introduce yourself by answering the following questions
- Name (obviously...)
- What do you hope to gain from this course?
- Level of musical skill / knowledge (formal *and* informal)
- What music interests you most?



Musical knowledge through exposure

■ Classroom experiment

- try to describe what you hear
- experts: let the others talk first

1. John Lee Hooker

This land is nobody's land



2. Prince

Question of U



Wissenschaftszentrum für Kognitionswissenschaften

[Faculty of Sciences
Psychology and Computing Sciences]

Perceived musical features (1)

- Sound events
 - pitched, unpitched
- Basic parameters of a pitched sound event
 - pitch: how high or low the sound is: perceptual analog of frequency
 - duration: how long the note lasts
 - loudness: perceptual analog of amplitude
 - timbre or tone quality
- Above is decreasing order of importance for most Western music
- (after Don Byrd)



Perceived musical features (2)

■ Relations between sound events

- interval: distance between two pitches
- melody: sequence of pitches
- chord: several pitches sounding at the same time
- tonality: the 'key' of a piece or fragment
- harmony: sequence of chords
- rhythm: pattern of durations
- metre: pattern of stressed and unstressed beats
- form: large-scale organisation of music
- etc.



Perceived musical features (3)

■ Global

- genre: class to which a piece of music belongs
- expression: emotion(s) it communicates
- ensemble composition: voices, instruments and their relationships
- etc.



Contribution of music to multimedia/games

- related to musical meaning
 - often equated with mood or emotion
 - but there is clearly more to it
- subjective aspects of meaning
 - doesn't mean 'arbitrary'
 - subjectivity can be studied successfully
 - role of context (situation, personal history)
- music may enhance meaning expressed in other media
 - song
 - advertising
 - film, documentary



Desperate housewives, season 7 trailer

<http://www.youtube.com/watch?v=nxvMgCpgiYM>

- play without / with sound
- what is it the music adds?



Wissenschaftszentrum für Sozialforschung

Wissenschaftszentrum für Sozialforschung
[Faculty of Sciences
Informatics and Computing Sciences]
Wissenschaftszentrum für Sozialforschung

Desperate housewives

- what is it the music adds?
- story line depends on music
- meaning through allusion
 - there's a new girl in town, and she's dangerous
- question remains: what makes this an effective piece in the first place?



Assignment

- find another example yourself, where music *contributes* to the meaning of the movie or game or even *alters* it.
- example should be short (1-2 minutes max), so we can discuss a number of examples in class
- Go to Google drive of the course: go to document "Film/Game music examples"
- Deadline: **Sunday, 17 Nov**, 23:59 p.m.



Assignment

Film and game music examples

Sound and Music Technology, 2019-2020

Deadline submission: Sunday, Nov 17, 2019, 23.59 p.m.

Name student	Name film/game	Link	Description: What is the music adding to the meaning, or even altering?
David			
Jasper van			
Manon			
Martijn			
Bart			
Ernis			



Wiskunde en Informatica

Faculty of Sciences
[Physics and Computing Sciences]
www.fsw.uva.nl

Organisation: contacting Anja Volk

- Anja Volk: a.volk@uu.nl
- Email: not answered on Fridays



Homework for next week

- Choose a film/game music example
- Choose a paper you would like to present

