

# Cross-Cultural Music Perception and Retrieval

**Alexander Schindler**

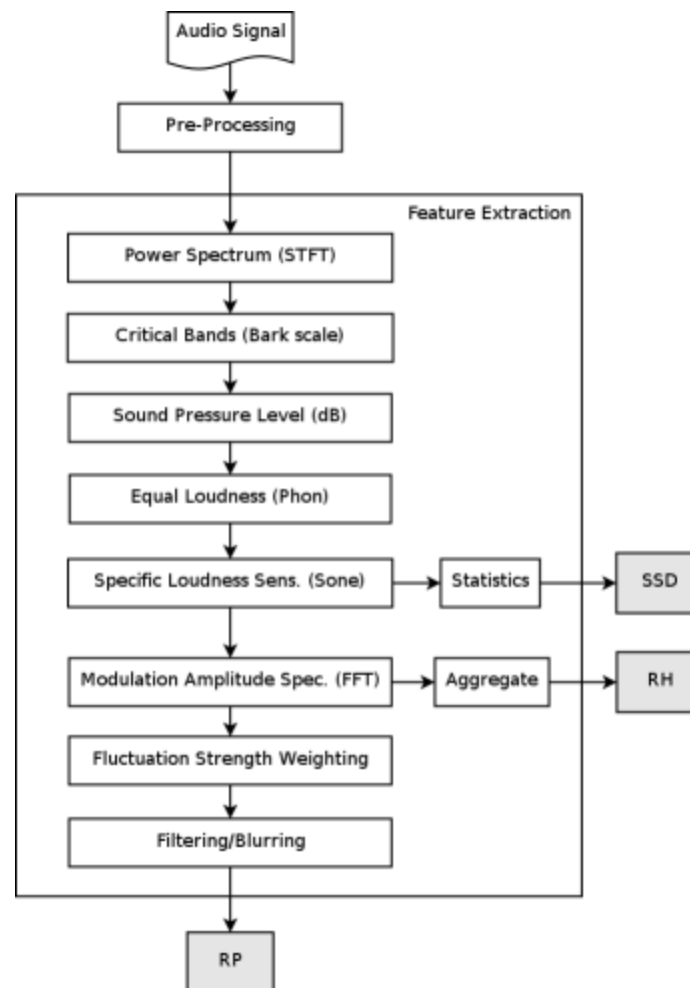
**Department of Softwaretechnology and  
Interactive Systems**

**Vienna University of Technology**

<http://www.ifs.tuwien.ac.at/~schindler>

# Music Annotation

- Common Approach
  - Content-Based
    - Extract features
    - Train Classifier
    - Assign Label
- Problems
  - Developed on western music datasets
  - General approach questioned





# Music Genre Classification

MVD-VIS			MVD-MM		
Genre	Videos	Artists	Genre	Videos	Artists
Bollywood	100	32	80s	100	72
Country	100	70	Dubstep	100	78
Dance	100	84	Folk	100	66
Latin	100	72	Hard Rock	100	69
Metal	100	76	Indie	100	64
Opera	100	NA	Pop Rock	100	65
Rap	100	81	Reggaeton	100	69
Reggae	100	75	RnB	100	67
MVD-MIX			MVD-Themes		
MVD-VIS + MVD-MM	1600	1040	Christmas	56	42
16 Genres			K-Pop	50	39
			Broken Heart	56	48
			Protest Songs	50	42
MVD-Artists					
Artist Name	Videos	Artist Name	Videos	Artist Name	Videos
Aerosmith	23	Jennifer Lopez	23	Nickelback	18
Avril Lavigne	20	Justin Timberlake	12	P!nk	23
Beyonce	26	Katy Perry	12	Rihanna	25
Bon Jovi	27	Madonna	30	Shakira	24
Britney Spears	25	Maroon 5	14	Taylor Swift	20
Christina Aguilera	15	Matchbox Twenty	13	Train	11
Foo Fighters	23	Nelly Furtado	16		
MVD-Complete					
MVD-VIS + MVD-MM + MVD-THEMES + MVD-ARTISTS					2212

## • Non-Audible Themes

- Cross-genre problem
- Aligned to MusiClef music tagging task

## • Improvements

- Christmas => 45.5%
- **K-Pop** => **14.1%**
- Protest Song => 22.6%
- Broken Heart => No improvement

- Video features outperform audio-content descriptors

	Audio-Only				Visual-Only				Audio-Visual			
Theme	VIS	MM	MIX	TH	VIS	MM	MIX	TH	VIS	MM	MIX	TH
Christmas	67.6	36.7	29.5	52.9	71.7	65.5	64.0	88.9	87.5	70.8	75.0	90.4
K-Pop	86.0	65.4	68.6	86.0	88.4	81.6	80.4	91.7	95.5	88.2	82.7	90.0
Protest Song	50.0	21.7	7.7	47.5	23.7	33.3	16.7	75.5	44.4	57.1	30.3	77.5
Broken Heart	75.0	28.6	28.6	54.9	51.2	21.9	16.7	70.2	61.0	31.9	25.5	68.6



# Music Tagging / MVD-Themes

## Classification

- **Christmas**
  - Tracks that can be related to Christmas.
  - Genres covered: Alternative-, Indie- and Hard-Rock, 60s-, 80s- and 90s-Pop, Dance, Rock 'n Roll, RnB, Soul, Big Band, Country, A capella.
  - Languages: English, Thai.
- **K-Pop**
  - Korean-Pop is strongly influenced by western music and characterized through visual content (synchronized dance formations, colourful outfits).
  - Genres covered: Pop, Dance, RnB, Rap
  - Languages: **Korean, English** (chorus).
- **Broken Heart**
  - Songs about losing someone beloved either through death or breakup of a relationship.
  - Genres covered: Rock, Hard Rock, Metal, Pop, RnB, Country, Folk, 80s.
  - Languages: **English, Taiwanese**.
- **Protest Songs**
  - Songs protesting against war, racism, police power and social injustice.
  - Genres covered: Pop, Folk, Rap, Reggae, Rock, Punk Rock, Metal, Punjabi, Indie, 80s.
  - Languages: **English, French, German, Egyptian Arabic, Hindi**.



# Music Video Dataset Results

## ■ Bollywood - Audio Results

=== Confusion Matrix ===																			
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	<-- classified as	
78	0	3	0	0	0	0	1	2	3	0	2	0	2	1	1	4	3		a = Bollywood
3	72	1	0	0	0	0	0	0	2	0	5	1	3	9	1	1	2		b = Country
3	0	93	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0		c = Dance
1	0	1	96	0	0	0	0	0	0	1	0	0	0	0	0	0	1		d = Latin
0	0	0	0	82	0	0	0	0	0	1	0	14	0	3	0	0	0		e = Metal
1	0	0	0	0	99	0	0	0	0	0	0	0	0	0	0	0	0		f = Opera
3	0	0	0	0	0	88	1	0	0	0	0	0	0	1	7	0	0		g = Rap
4	0	1	1	0	0	3	86	0	0	0	0	0	0	2	1	2	0		h = Reggae
7	4	2	2	0	0	1	1	65	0	5	2	5	0	0	0	2	4		i = 80ies
1	2	6	1	1	0	2	1	4	77	0	1	0	1	1	0	2	0		j = Dubstep
4	9	0	1	0	1	0	2	4	0	63	0	10	4	0	0	2	0		k = Folk
0	4	1	0	12	0	0	0	2	0	2	60	8	10	0	0	1	0		l = Hard_Rock
1	6	0	1	4	0	0	0	4	3	9	13	44	9	0	1	5	0		m = Indie
1	10	1	0	5	0	0	0	3	1	3	12	13	45	1	0	5	0		n = Pop_Rock
2	1	1	0	0	0	3	4	0	0	0	0	0	0	81	7	1	0		o = Reggaeton
8	3	2	0	0	0	6	5	1	2	1	0	0	2	3	64	3	0		p = RnB
5	5	1	1	0	1	2	2	5	1	12	0	3	0	0	5	13	0		q = Christmas

# Music Tagging

- K-Pop
  - Audio Results
    - Album Effect?

## === Confusion Matrix ===

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	<-- classified as
82	0	2	1	0	0	1	1	3	1	2	1	1	0	2	2	1	1	a = Bollywood
2	80	0	0	0	0	0	0	0	1	0	4	1	2	8	1	0	1	b = Country
3	0	94	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	c = Dance
1	1	1	95	0	0	0	0	0	0	1	0	0	1	0	0	0	0	d = Latin
0	1	0	0	83	0	0	0	0	0	0	12	1	3	0	0	0	0	e = Metal
1	0	0	0	0	99	0	0	0	0	0	0	0	0	0	0	0	0	f = Opera
4	0	0	0	0	0	89	1	1	0	0	0	0	0	1	4	0	0	g = Rap
6	0	1	0	0	0	4	76	0	0	4	0	0	1	3	2	3	0	h = Reggae
9	4	2	2	0	0	0	0	67	1	3	2	4	2	0	3	1	0	i = 80ies
1	2	5	0	1	0	1	2	3	75	0	1	2	1	1	2	3	0	j = Dubstep
3	9	1	1	0	0	0	2	3	0	69	0	8	4	0	0	0	0	k = Folk
0	2	1	0	16	0	0	0	2	0	1	59	11	8	0	0	0	0	l = Hard_Rock
2	7	0	0	6	0	0	0	8	3	9	12	45	7	0	0	1	0	m = Indie
2	14	1	0	7	0	0	0	2	1	2	10	13	47	1	0	0	0	n = Pop_Rock
5	1	2	0	0	0	3	4	1	0	0	0	0	0	79	4	1	0	o = Reggaeton
6	3	2	0	0	0	8	6	3	0	0	0	0	3	5	60	4	0	p = RnB
<b>1</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>35</b>	<b>1</b>	<b>q = K Pop</b>

# Music Tagging

- K-Pop
- Visual Concept Detection Results

## === Confusion Matrix ===

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	<-- classified as
75	0	4	4	0	2	1	3	0	0	1	0	1	1	3	5	0	a = Bollywood
4	56	0	4	3	0	1	3	3	0	4	1	6	11	0	4	0	b = Country
2	0	50	5	0	0	0	1	1	11	3	1	3	3	8	11	1	c = Dance
5	5	4	41	2	2	0	10	4	2	4	1	3	4	10	3	0	d = Latin
0	3	1	1	58	0	3	2	0	2	4	17	4	5	0	0	0	e = Metal
1	0	0	1	0	97	0	0	0	0	0	0	1	0	0	0	0	f = Opera
1	2	1	1	2	0	67	6	7	1	1	3	3	0	2	3	0	g = Rap
2	4	1	9	2	0	8	49	1	2	2	3	4	1	10	2	0	h = Reggae
1	3	0	4	0	2	6	1	64	2	5	3	5	3	0	0	1	i = 80ies
0	1	8	2	5	1	0	6	0	54	7	1	8	1	4	2	0	j = Dubstep
1	5	3	8	6	5	2	3	4	12	30	1	12	6	1	1	0	k = Folk
0	4	0	0	15	0	0	1	5	1	2	60	3	9	0	0	0	l = Hard_Rock
2	2	3	5	12	3	3	5	4	13	15	3	20	7	1	1	1	m = Indie
1	10	4	10	10	1	3	1	2	5	3	7	7	25	2	5	4	n = Pop_Rock
2	2	8	16	0	0	1	5	0	7	2	0	2	3	39	12	1	o = Reggaeton
3	5	10	3	4	0	4	2	1	2	1	1	4	9	11	39	1	p = RnB
<b>0</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>37</b>	<b>q = K Pop</b>



# Music Tagging

- Protest Songs
  - Genres covered: Pop, Folk, **Rap, Reggae**, Rock, Punk Rock, **Metal**, Punjabi, Indie, 80s.
  - Languages: English, French, German, Egyptian Arabic, Hindi.
- => Culturally Independent „Visual Language“?
  - Learned from Mass-Media?

=== Audio

4 3 0 0 4 0 8 **6** 1 3 3 6 6 2 0 2 **2** | q = Protest Songs

=== Visual

1 1 0 5 6 1 5 **8** 3 5 2 4 1 0 2 1 **5** | q = Protest Songs

=== Audio-Visual

0 3 0 0 **5** 0 **7 11** 2 2 **4** 2 1 2 0 1 **10** | q = Protest Songs

# Music Videos?

- Music Videos to bridge cultural differences?
- Viral Music Videos
- K-Pop Example



Words cannot even describe how amazing this video is... [youtube.com/watch?v=9bZkp7...](https://www.youtube.com/watch?v=9bZkp7...)

Reply Retweet Favorite



YouTube

Flag this media



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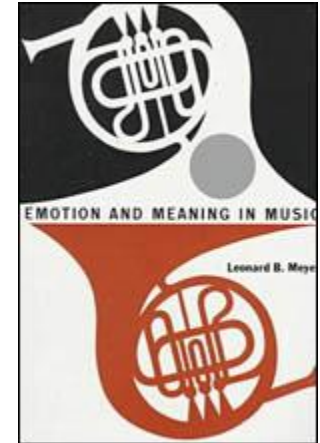




# Cross-Cultural Music Perception

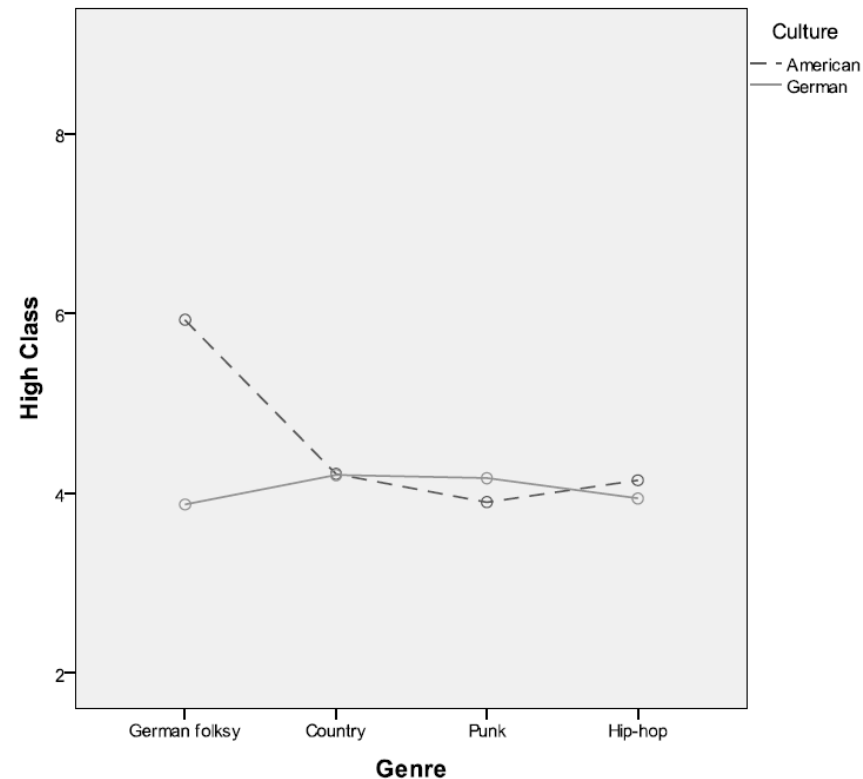
## Extra-Musical Connotations

- Meyer, Leonard B. *Emotion and meaning in music*. University of Chicago Press, 2008.
- User Study
  - Kristen, Susanne, and Mark Shevy. "Consistent and Contrary Constructs: A Comparison of German and American Listeners' Cognitive Associations with Popular Music Genres." (2012).
- German vs. American
- Extra-Musical Connotations
  - Folksy
  - Country
  - Punk
  - Hip-Hop
- Method
  - Listen to Samples
  - Answer Questions



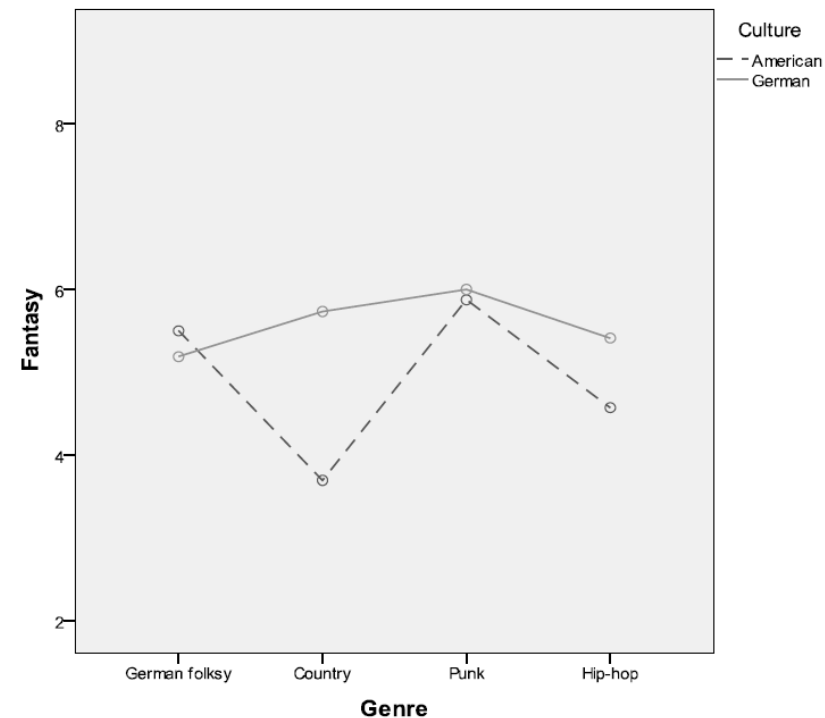


- Mean ratings of ***High class vs. low-class*** for German and American listeners (10-point scale)



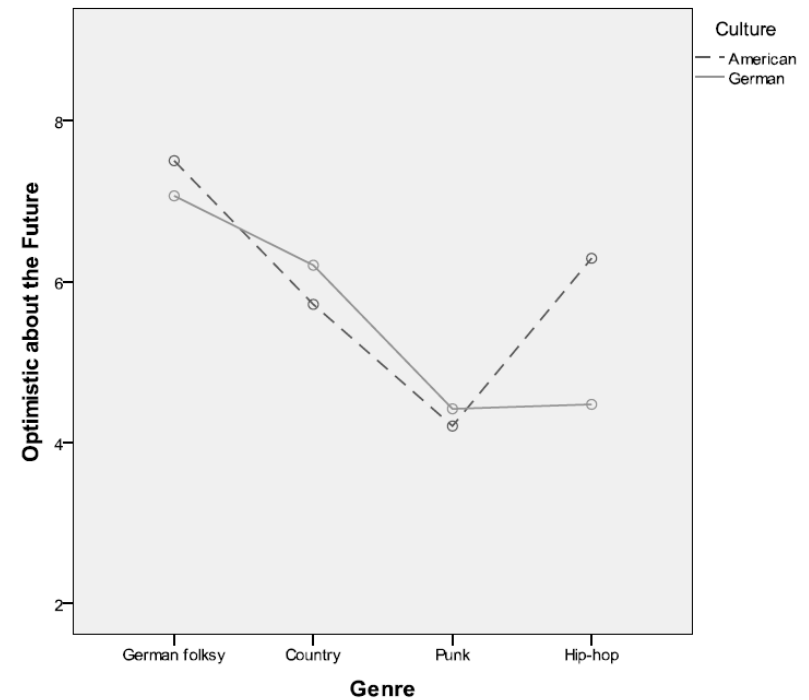


- Mean ratings of ***Fantasy vs. Real life*** for German and American listeners (10-point scale).



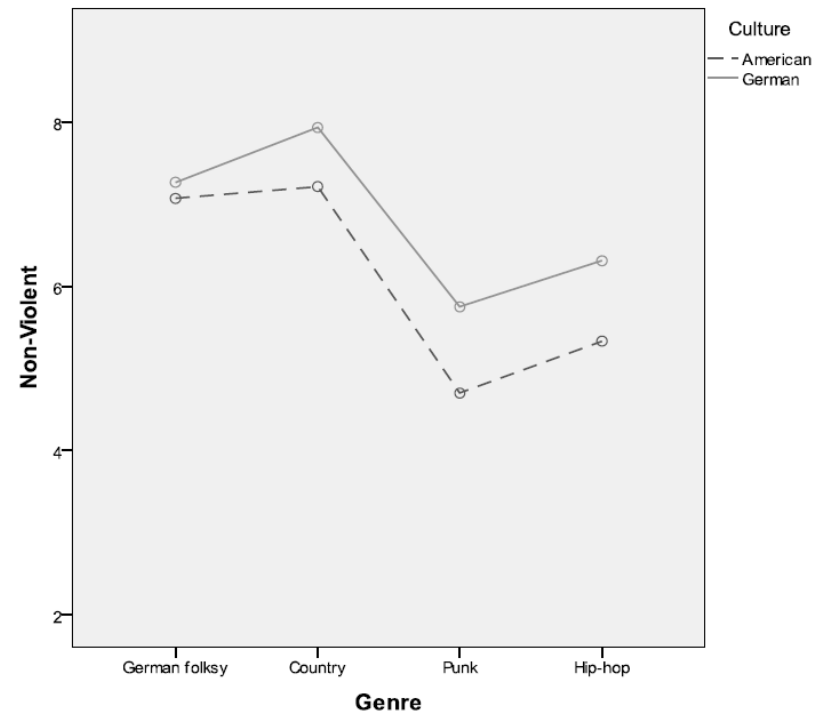


- Mean ratings of ***Future looks good vs. Future looks bad*** for German and American listeners (10-point scale).

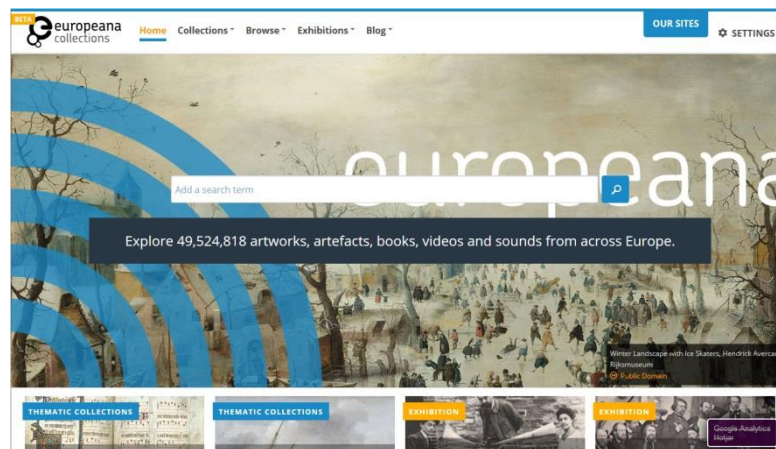




- Mean ratings of ***Anti-violence vs. Pro-violence*** for German and American listeners (10-point scale).

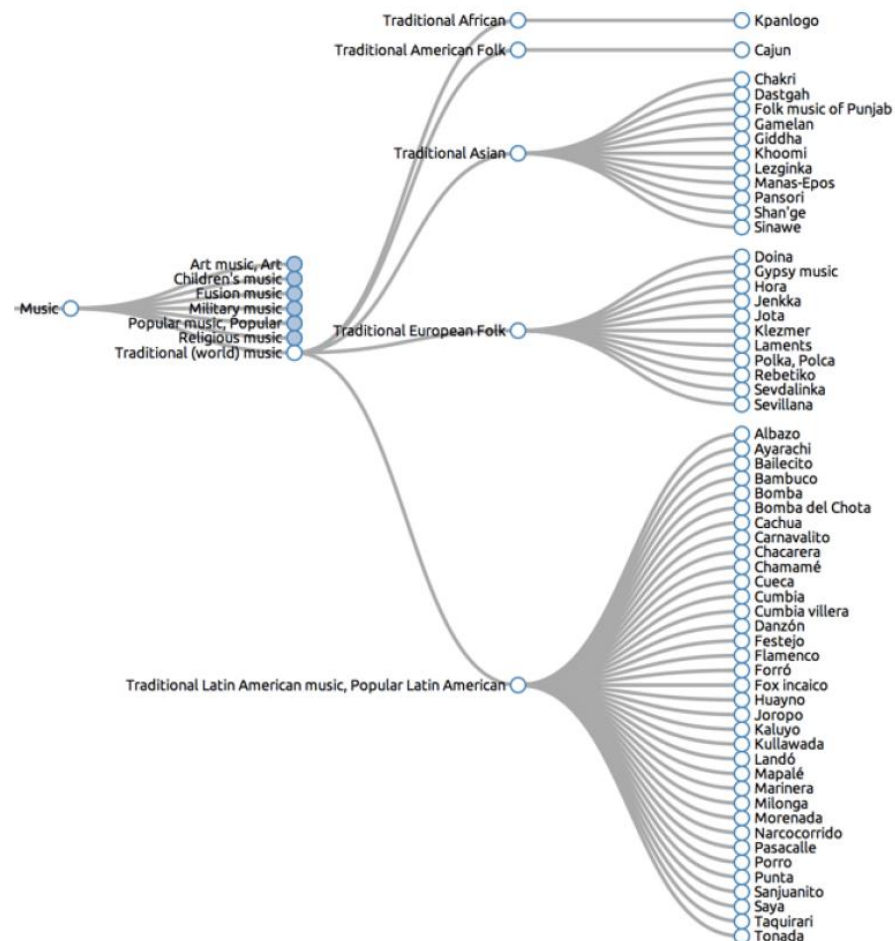


- Europeana
  - Europe's „Virtual“ „National“ Library
- Europeana Sounds
  - 24 Partners
    - 20 Content Providers
    - 4 Technical Partners
  - ~ 500.000 Sound Items
  - Europe's Sound Heritage





- Music Genre Taxonomy
  - Task in first year
  - Identify relevant genre hierarchies
- Difficulties!



## Cross-Cultural / Cross- Lingual Differences

Austria/Germany

Romania

Volksmusik



Traditional Folk

Muzică ușoară

Volkstümliche Musik



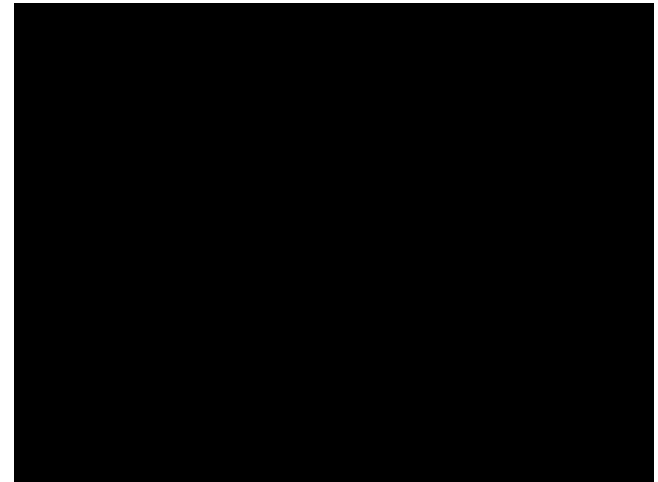
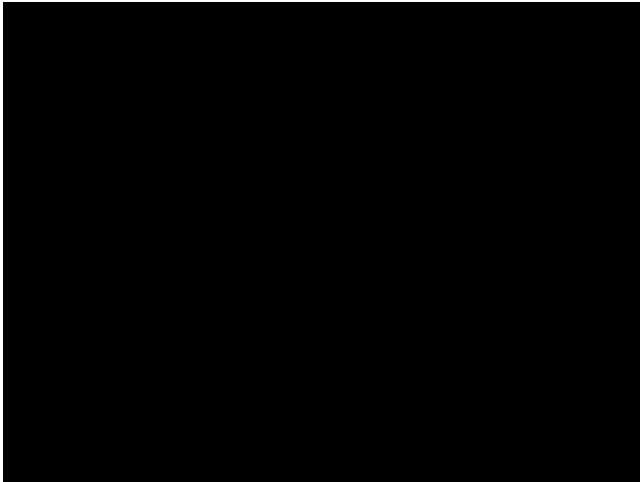
Modern Popular Folk

Muzică populară





# Volksmusik vs. Folksy



# Music Genres in Korea

Korea

- Little knowledge of specific genres
- Main Categories of major Korean music Websites

Pop

Overseas

K-Pop

Korean popular Music

- K-Pop
- Pop (*overseas*)
- J-Pop
- OST (*movies*)
- Classical
- Music Video

Lee, Jin Ha, J. Stephen Downie, and Sally Jo Cunningham. "Challenges in Cross-Cultural/Multilingual Music Information Seeking." *ISMIR*. 2005.

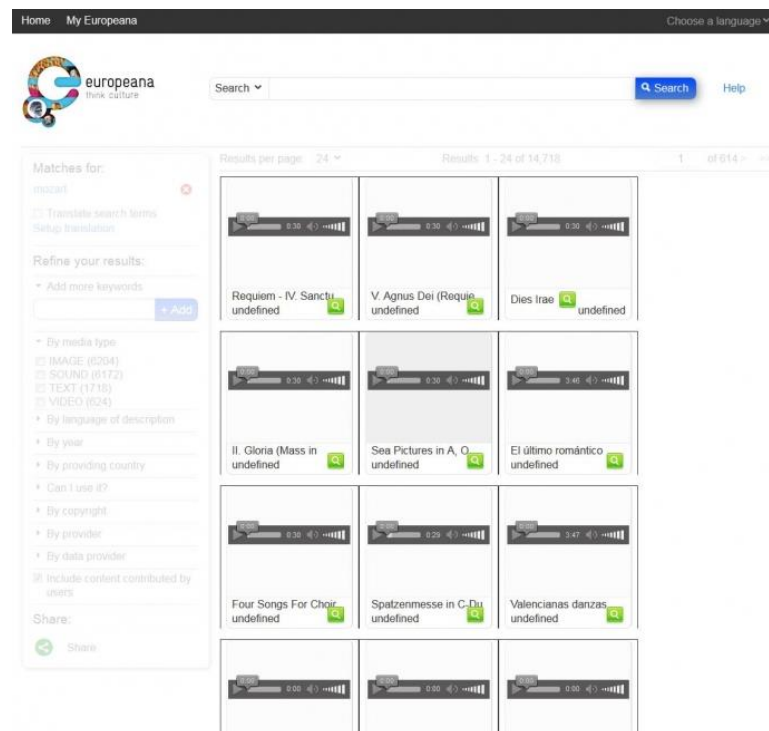
## ■ Query-By-Example

- Bainbridge, David, Sally Jo Cunningham, and J. Stephen Downie. **"How people describe their music information needs: A grounded theory analysis of music queries."** *Proceedings of the International Symposium on Music Information Retrieval*. 2003.

## ■ Ignore Context

- => Focus on audio only

## ■ Europeana Sounds MIR Pilot



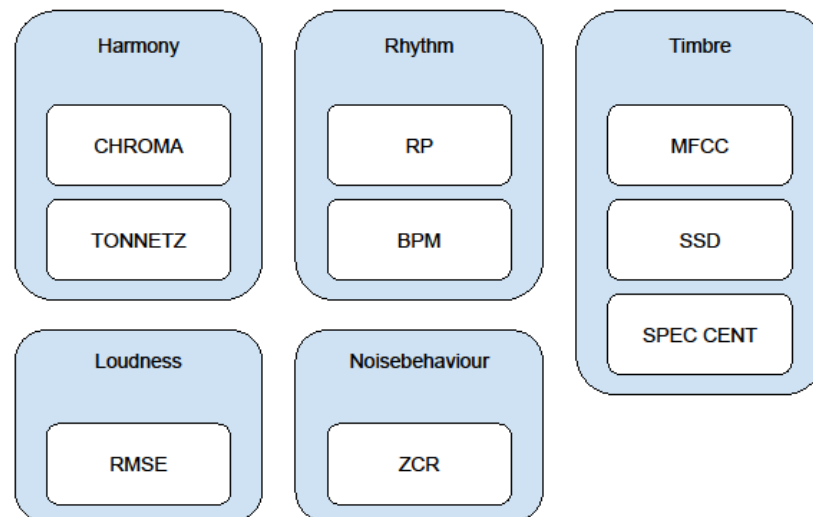
## Data providers:

- Number of Data Providers: 1,002
- Top-10 Data Provides:
  - Preiser Records; Austria (30,738)
  - National Library of Spain (10,462)
  - The Orchard (8,860)
  - JSP Records (7,686)
  - Hacienda Records (6,537)
  - Carinco AG (6,534)
  - Ovação; Portugal (6,032)
  - Gesellschaft für Historische Tonträger; Austria (5,985)
  - Duck Records; Italy (5,691)
  - Arts Productions Ltd (5,644)

## Data aggregators:

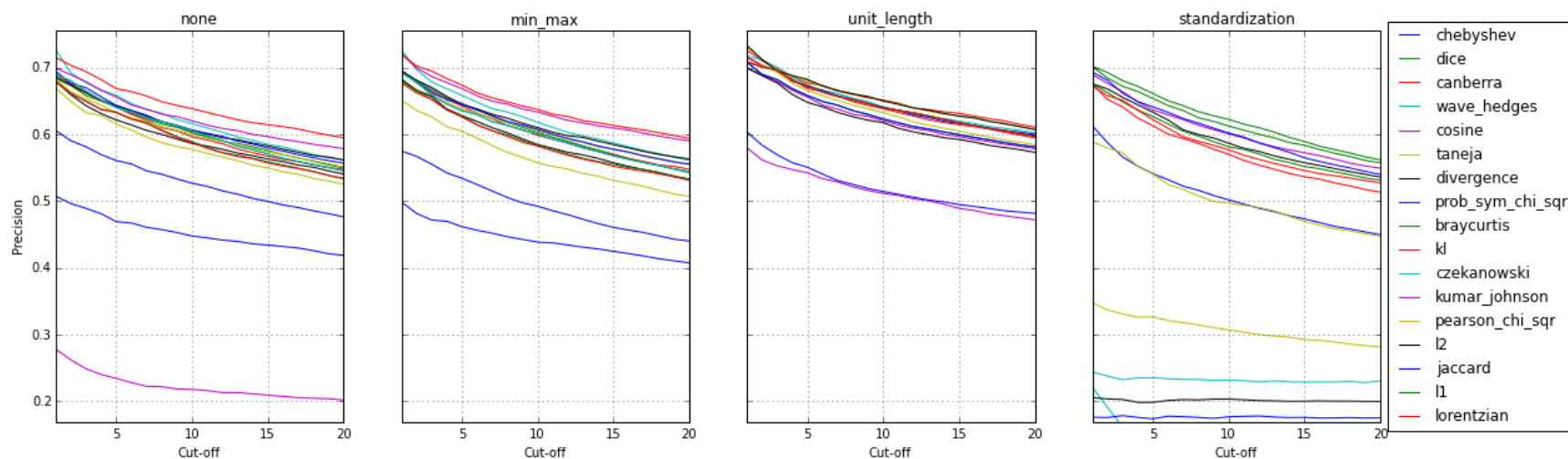
- Number of Data Aggregators: 20
- Top-10 Data Aggregators:
  - DISMARC (286,189)
  - Judaica Europeana (8,033)
  - Hispana (2,373)
  - Deutsche Digitale Bibliothek (1,661)
  - OpenUp! (1,097)
  - National Library of Finland (183)
  - EuropeanaLocal Romania (136)
  - HOPE - Heritage of the People's Europe (123)
  - The Natural Europe Project (104)
  - Europeana 1914-1918 (47)
- Median number of sound files per aggregator: 39

- Combined Feature Set
  - Different audio-content descriptors
  - Empirically estimated weighting
  - Late Fusion



Category	Feature	Description	Weight	Category Weight
Timbre	MFCC	Timbre description	23%	39%
	SSD	General spectral description	8%	
	SPEC CENT	Pitch description	8%	
Rhythm	RP	Rhythmic patterns	18%	25%
	BPM	Tempo	7%	
Harmony	CHROMA	Harmonic Scale	12%	24%
	TONNETZ	Traditional harmonic description	12%	
Loudness	RMSE	Loudness description	9%	9%
Noise Behaviour	ZCR	Noisiness description	3%	3%

Evaluating Distance Measures with different Normalizations on RP



## Canberra Distance (L1 Derivate)

$$d(\mathbf{p}, \mathbf{q}) = \sum_{i=1}^n \frac{|p_i - q_i|}{|p_i| + |q_i|}$$



- Based on Metadata
  - Provided by National Libraries, Archives, etc.
  - Enriched through „Editathons“





# MIR Pilot Evaluation



Keywords = ["string", "quartet", "allegro", "C Minor"]

- String Quartet N. 8 In C Minor Op. 110: Allegro Molto;Dmitry Shostakovich (Performer);Classical;00:03:03, 00:00:30 (preview duration)
- "String Quartet In C Minor, D 703, ""Quartettsatz"": Allegro assai";Franz Schubert (Performer), Chamber Orchestra Kremlin (Performer), Misha Rachlevsky (Conductor);Orchestral Music;00:09:34, 00:00:30 (preview duration)
- String Quartet No. 12 in C minor, Op. posth. D. 703 (Quartettsatz) - Allegro assai;Franz Schubert (Performer), Enesco Quartet (Ensemble);Classical;00:09:02, 00:00:30 (preview duration)
- String Quartet No.4 in C minor, Op.18 No.4, I. Allegro;Ludwig Van Beethoven (Performer);Other;00:07:30, 00:00:30 (preview duration)
- String Quartet No.4 in C minor, Op.18 No.4, IV. Allegro;Ludwig Van Beethoven (Performer);Other;00:03:57, 00:00:30 (preview duration)
- String Quartet No.4 in C minor, Op.18 No.4, I. Allegro;Ludwig Van Beethoven (Performer);Orchestral Music;00:07:31, 00:00:30 (preview duration)
- String Quartet No.4 in C minor, Op.18 No.4, I. Allegro;Ludwig Van Beethoven (Performer);Orchestral Music;00:07:30, 00:00:30 (preview duration)
- String Quartet No.4 in C minor, Op.18 No.4, IV. Allegro;Ludwig Van Beethoven (Performer);Orchestral Music;00:03:57, 00:00:30 (preview duration)
- String Quartet No.4 in C minor, Op.18 No.4, I. Allegro;Ludwig Van Beethoven (Performer);Romantic;00:07:30, 00:00:30 (preview duration)
- String Quartet No.4 in C minor, Op.18 No.4, IV. Allegro;Ludwig Van Beethoven (Performer);Romantic;00:03:57, 00:00:30 (preview duration)
- String Quartet No.4 In C Minor, Op.18 No.4, I. Allegro;Ludwig Van Beethoven (Performer);Classical;00:07:31, 00:00:30 (preview duration)
- String Quartet No.4 In C Minor, Op.18 No.4, IV. Allegro;Ludwig Van Beethoven (Performer);Classical;00:03:55, 00:00:30 (preview duration)
- String Quartet in C minor, Op. 51, No. 1: Allegro;Mandelring Quartett Johannes Brahms (Performer);Classical (Core - Classical);
- String Quartet in C minor, Op. 51, No. 1: Allegro;Mandelring Quartett Johannes Brahms (Performer);Classical (Core - Classical);



ID	Query	Num. Tracks	1	2	3	5	10	24
<b>Jazz</b>								
1	"Jazz"	31801	38.0	35.0	31.4	31.7	<b>28.6</b>	26.2
2	"Smooth Jazz"	2419	<b>49.1</b>	45.9	<b>43.8</b>	25.8	20.8	16.0
3	"Jazz" + "Traditional"	577	25.3	21.1	17.1	13.0	9.2	6.3
4	"Ragtime"	57	24.6	15.8	12.3	7.3	3.6	1.6
5	"Shuffle"	112	22.3	14.3	11.0	7.0	4.0	1.7
6	"Jazz" + "Blues"	1398	14.6	10.1	7.5	5.6	4.2	2.9
7	"Jazz" + "Bob Crosby, Andy Kirk, June Richmond"	24	12.5	6.3	<u>4.2</u>	2.5	3.8	1.8

Classical								
9	"Classical"	28569	<b>44.3</b>	42.1	<b>40.5</b>	38.3	<b>35.1</b>	32.3
10	"Piano Concerto"	510	38.6	32.0	28.0	23.9	17.6	10.2
11	"Requiem"	463	32.6	26.9	22.0	16.2	10.7	6.6
12	"operette", "operetta", "opereta", "zarzuela"	1081	27.7	22.9	20.8	17.3	14.6	11.5
13	"Opera"	8278	26.8	24.7	22.7	21.1	18.9	16.1
14	"Classical" + "g major" or "g dur" or "g-dur" or "g majeur"	304	17.1	14.8	14.0	12.6	9.3	5.6
15	"Classical" + "g major" or "g dur" or "g-dur" or "g majeur" + "quartett"	13	15.4	7.7	<u>5.1</u>	3.1	<u>2.3</u>	1.6
16	"Classical" + "major" or "dur" or "majeur" + "quartett" + "allegro"	191	<u>9.4</u>	6.3	7.3	8.1	5.6	3.7



# MIR Pilot Evaluation



## Non-music

17	"Interview"	484	77.5	74.3	72.0	68.6	60.8	51.4
18	"Biodiversity Center" (=Animal Sounds)	1097	<b>89.7</b>	87.0	<b>85.1</b>	82.8	<b>78.7</b>	73.9
19	"Biodiversity Center" + "Chorthippus" (=Crickets)	113	<u>59.3</u>	55.3	<u>56.6</u>	53.0	<u>48.1</u>	43.0

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European popular/traditional music								
20	"Flamenco"	1827	<b>40.7</b>	33.0	<b>29.2</b>	24.3	<b>18.2</b>	12.8
21	"Tarantella"	152	33.6	28.0	22.4	16.1	8.5	4.0
22	"Tango"	3716	30.2	24.9	22.3	19.5	16.0	12.5
23	"Flamenco" + "Guitarra"	287	22.3	17.1	15.3	13.5	10.0	8.3
24	"Jodler"	61	16.4	8.2	5.5	3.6	<u>2.0</u>	1.4
25	"Serenata"	436	9.7	7.5	5.5	4.4	3.0	2.0
26	"Volksmusik"	13	7.7	3.9	<u>2.6</u>	4.6	4.6	2.9
27	"Fados"	107	<u>6.5</u>	10.8	9.7	7.3	4.9	2.7

## Facilitating comprehensive benchmarking experiments on the million song dataset.

*Alexander Schindler, Rudolf Mayer, and Andreas Rauber.*

In *Proceedings of the 13th International Society for Music Information Retrieval Conference (ISMIR 2012)*, pages 469-474, Porto, Portugal, October 8-12 2012.

- **Dataset Size**
  - EU-Sounds: 312,096
  - MASD: 273,936
- **Average Precision**
  - EU-Sounds: 28.7%
  - MASD: 27.1%

Dataset	NB	SVM	k-NN	DT	RF
MFCC (4)	<b>15.04</b>	20.61	24.13	14.21	18.90
Spectral (5)	14.03	17.91	13.84	12.81	17.21
Spectral Derivates (5)	11.69	21.98	16.14	14.09	19.03
MethodOfMoments (6)	13.26	16.42	12.77	11.57	14.80
LPC (8)	13.41	17.92	15.94	11.97	16.19
SSD (10)	13.76	<b>27.41</b>	<b>27.07</b>	<b>15.06</b>	<b>20.06</b>
RH (11)	12.38	17.23	12.46	10.30	13.41



# Audio-to-Score Alignment

## 1. Extract Music Symbols from Image



### Applying Optical Music Recognition

- Coordinates of staves, measures, etc
- Extract Note values

## 2. Feature Extrac-

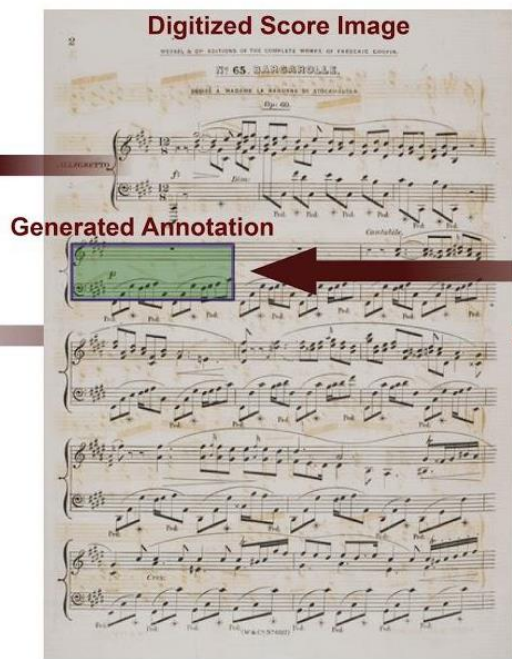
- Make both sides comparable
- Map music energy to the 12 semitones of an Octave
- Can be calculated from symbolic and recorded music

## 2.1 Symbolic Music Feature Extraction

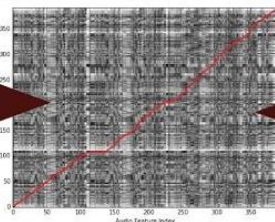


## Synchronization

- Compare symbolic with audio features
- Find matching vectors



## 3. Align Score with Audio Informa-



## Audio Recording

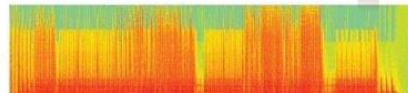
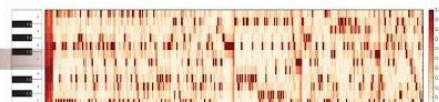


## 4. Map Coordinates from Image to Time-Events of the Audio

Time	X	Y	Width	Height	Page
0:00	20	120	90	21	1
0:05	110	122	92	20	1
0:09	202	121	91	21	1
0:13	21	162	120	22	1
0:16	141	163	122	20	1

- Create a mapping of time-codes to page coordinates
- Describes which region of the image has to be highlighted at which time

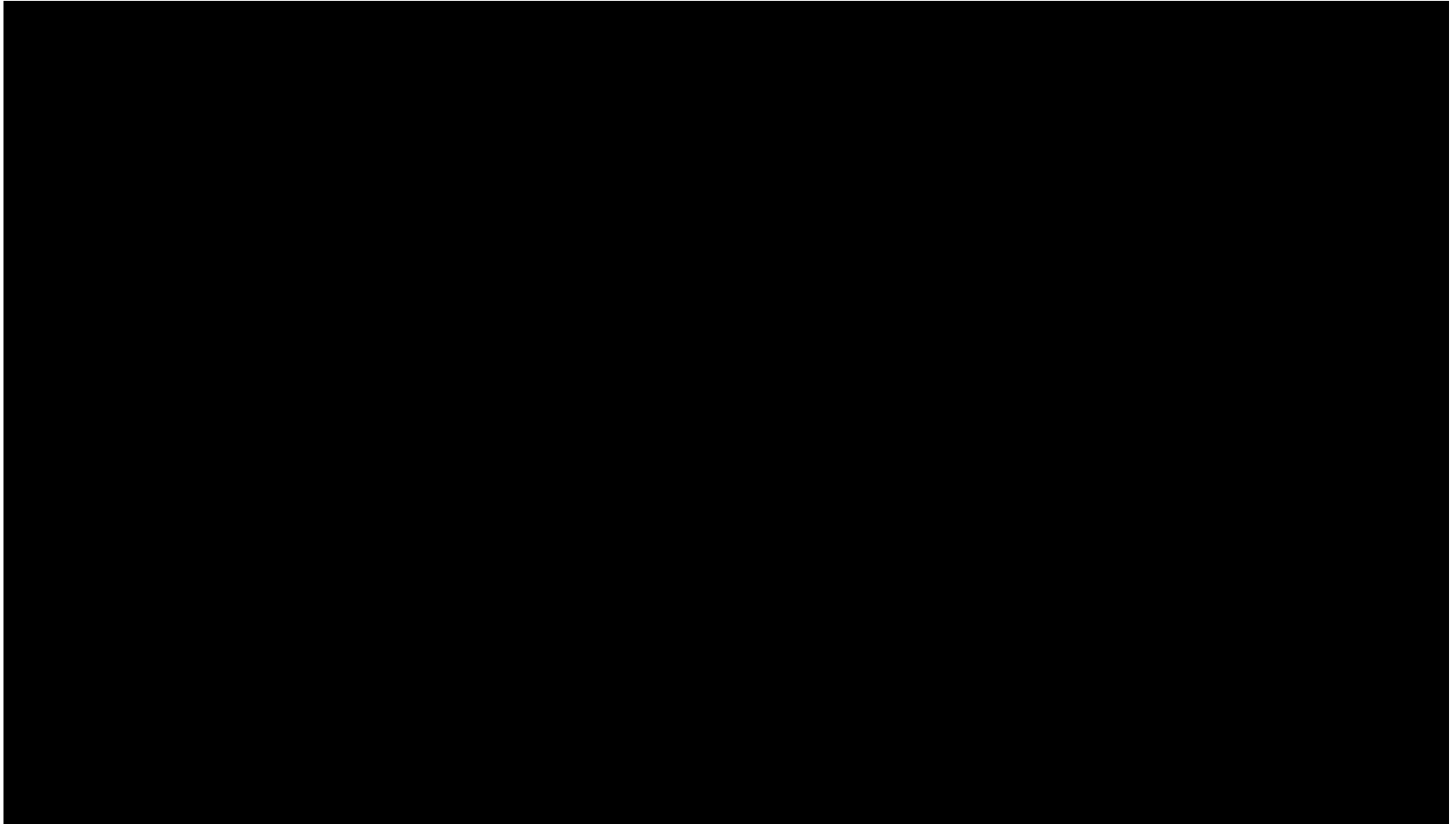
## 2.2 Audio Feature Extraction







# Europeana Sounds Score-Following Pilot



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- „Easy“
  - MIDI  $\Leftrightarrow$  Audio
- **Difficult**
  - Scanned Image  $\Leftrightarrow$  (Bad) Audio
- **Impossible**
  - Handwritten Scores
  - Non-Standard Notations



# Music Notations

- Different notations within European Cultural Heritage

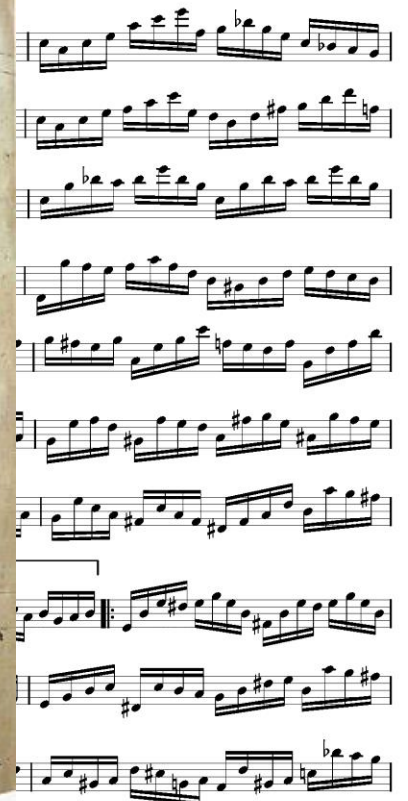
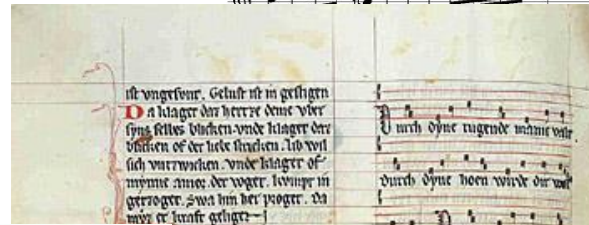
## Partita BWV 1013

flute solo

Johann Sebastian Bach

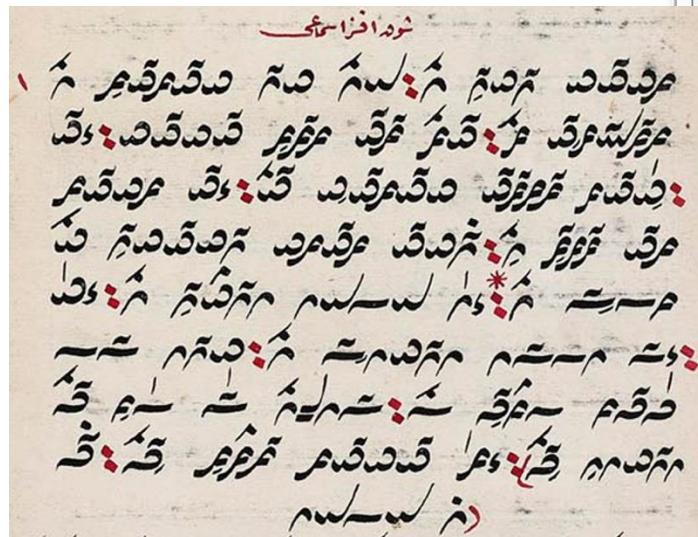
typeset by Michele Giulianini

Allemande



# Music Notations

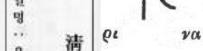

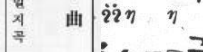
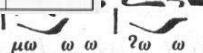
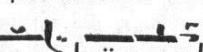
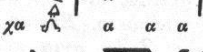
- **Asian and Arabic notations**

[illegible]

—	無	—
—	廣	—
—	清	—
—	聲	—

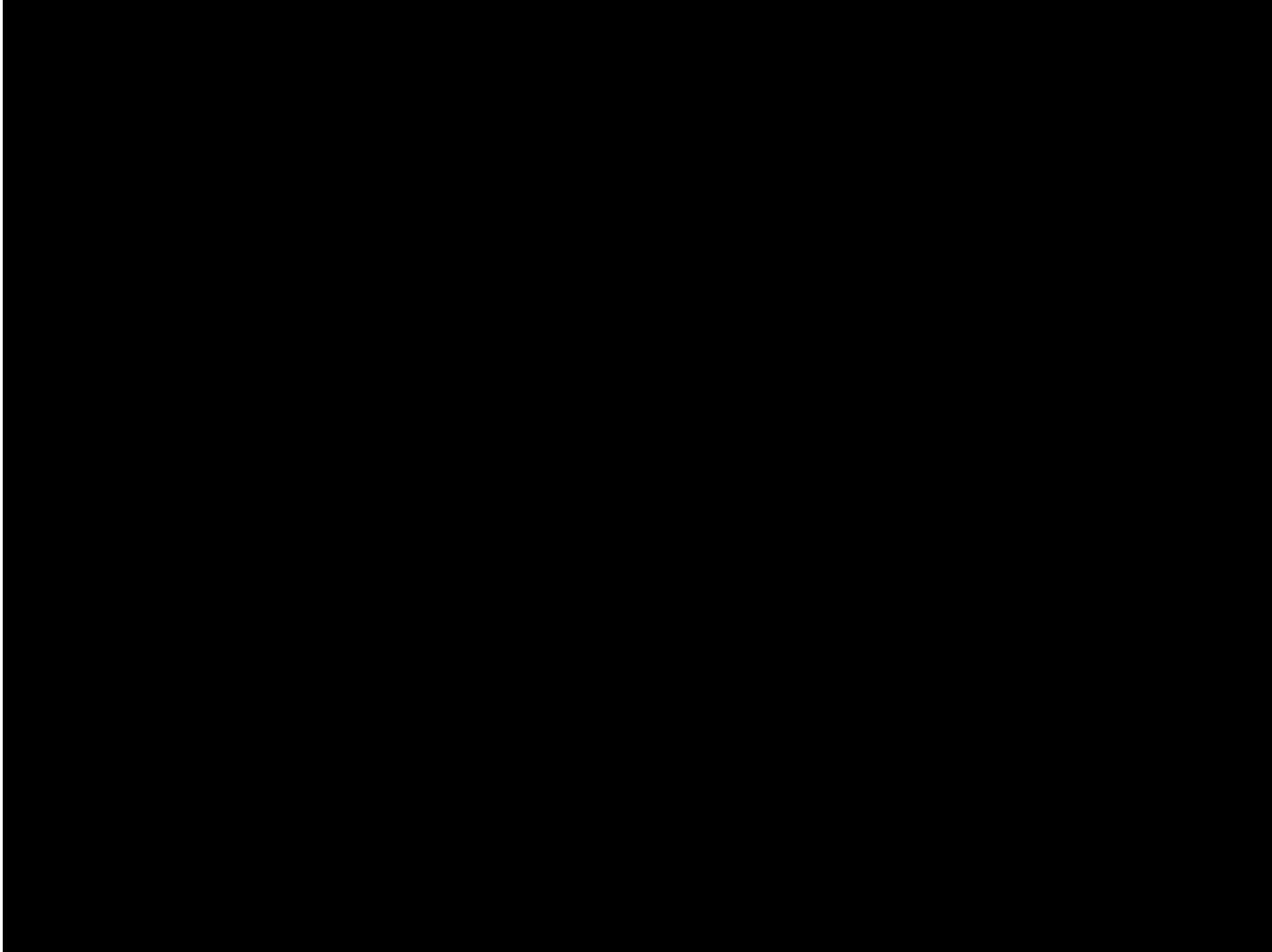
일명 : 요컨대  
요컨대

清聲曲



# Identify Music Documents



# Summary

- **Music Videos as cross-cultural pivotal point?**
- **Many TODOs / Ideas for Proposal**
  - **Music Similarity / Recommendation**
  - **Music Indexing / Digital Libraries**
  - **Music Scores**
  - ...

# Thank You!