

# Still haven't found what I'm looking for?

A technologist's and musician's perspective on the digital information age

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The Netherlands

# We've come a long way...



© Haaglander,  
<https://www.flickr.com/photos/haaglander/2714411536/>

© Haagse Beeldbank

# We've come a long way...



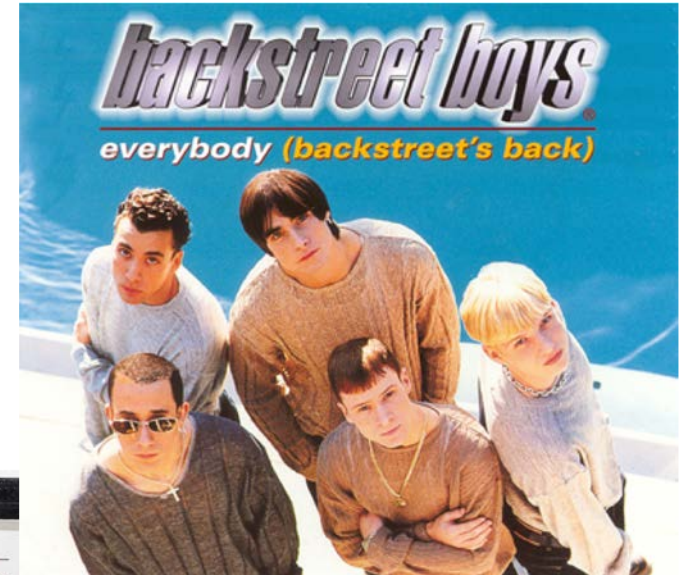
from Archives Beeld & Geluid  
[CC-BY-SA-3.0]



# We've come a long way...

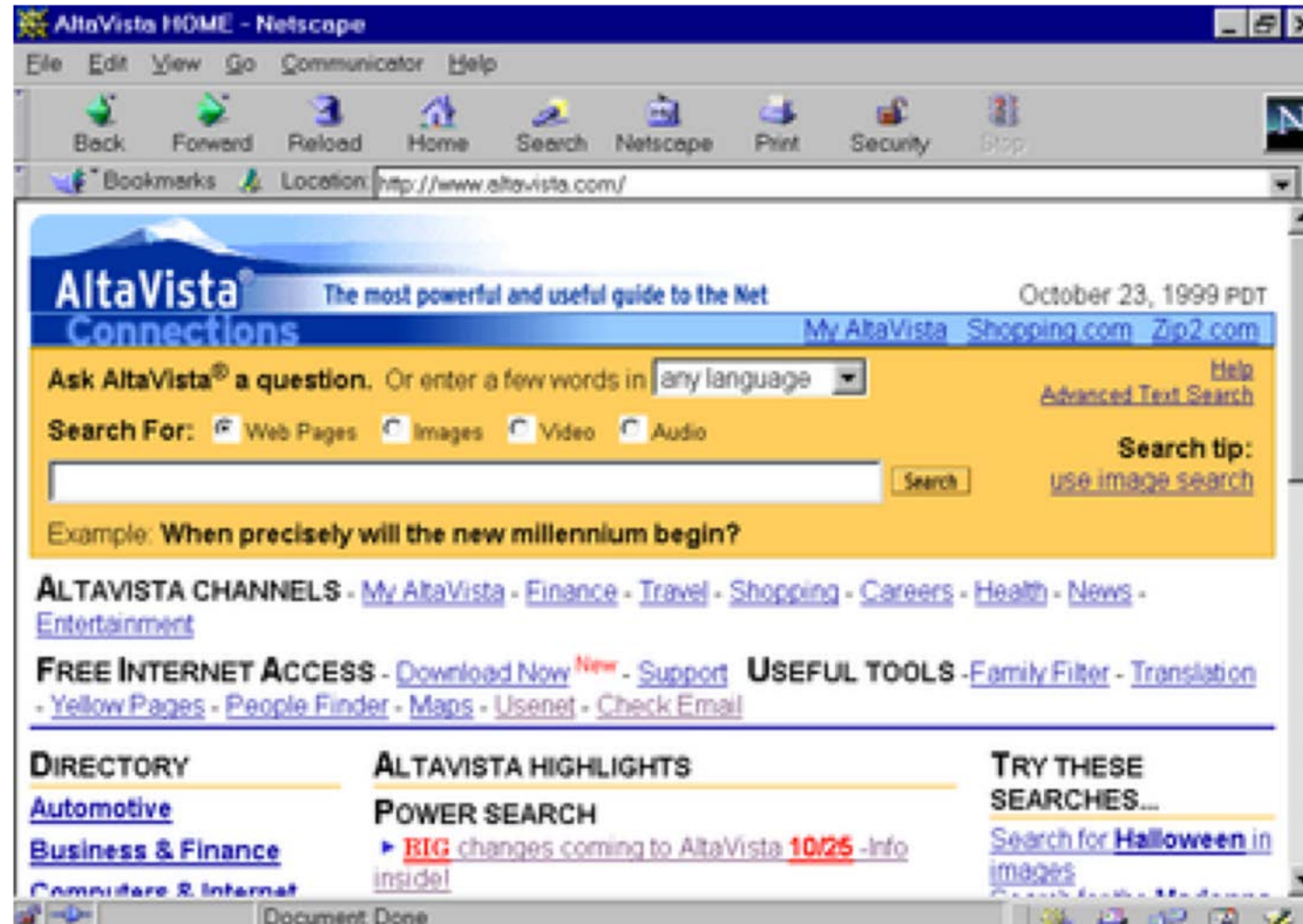


by Niton1  
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(<http://creativecommons.org/licenses/by-sa/3.0/>)]



by Thegreenj  
[CC-BY-SA-3.0]

# We've come a long way...



...to a situation like this

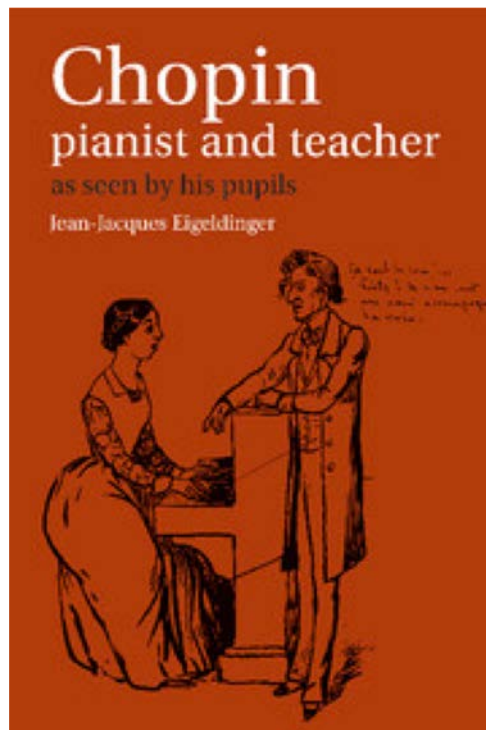


# By then, I looked like this



# How did music sound in Chopin's time?

Eigeldinger, 1987



Revue Musicale, 1832

## CONCERT DE M. CHOPIN, de Varsovie.

Dire maintenant d'un pianiste qu'il a beaucoup de talent, ou même si l'on veut *un grand talent*, c'est indiquer qu'il est l'émule ou le rival de quelques artistes du premier ordre dont le nom se présente aussitôt à la mémoire : ajouter que sa musique est très bonne, c'est faire supposer que son mérite est analogue à celui des œuvres de Hummel et d'un petit nombre de compositeurs renommés ; mais par ces éloges il est difficile de donner l'idée de la nouveauté, de l'originalité, car, sauf quelques nuances de style et de mérite de facture, la musique des pianistes est en général écrite dans de certaines formes de convention qu'on peut considérer comme radicales, et qui se reproduisent sans cesse depuis plus de trente ans. C'est le défaut du genre, et nos



# How did music sound in Chopin's time?

(14) *Andante sostenuto*.

EXEMPLE:

Exécution:

*Sol Do Sol*

Lablache, 1840

# At the dawn of recording technology

- Bellini: La Sonnambula, Ah Non Credea Mirarti
- Adelina Patti (1906)

<https://www.youtube.com/watch?v=IfQYMLTvSnY>

Andante cantabile.

*fz.*  
*pp*  
*legato*

Amina.

Ah! non cre-dea mi - rar - - ti si pre - sto e-stin - to, o  
Ah, must ye fade, sweet flow - - ers, For - sa - ken by sun - light and

# Many of these resources are digitally available in the public domain!

CONCERT DE M. CHOPIN,  
de Varsovie.

Dire maintenant d'un pianiste qu'il a beaucoup de talent, ou même si l'on veut *un grand talent*, c'est indiquer qu'il est l'émule ou le rival de quelques artistes du premier ordre dont le nom se présente aussitôt à la mémoire : ajouter que sa musique est très bonne, c'est faire supposer que son mérite est analogue à celui des œuvres de Hummel et d'un petit nombre de compositeurs renommés ; mais par ces éloges il est difficile de donner l'idée de la nouveauté, de l'originalité, car, sauf quelques nuances de style et de mérite de facture, la musique des pianistes est en général écrite dans de certaines formes de convention qu'on peut considérer comme radicales, et qui se reproduisent sans cesse depuis plus de trente ans. C'est le défaut du genre, et nos

EXEMPLE :

Exécution :

(14) Andante sostenuto .



Sol Do Sol

Andante cantabile.



Andante cantabile.

Andante.

Ah, must ye fade, sweet flow - ers, for - ev - er by sun - light and

**Many of these resources are digitally available in the public domain!**  
**But...good luck finding them**

- Do we represent the right information?
- Do people actually know of their existence?

# When online audiences are small

[Schedl & Tkalcic, 2014]

Genre	PC				LC				APCL		
	Sum ( $\times 10^3$ )	Max ( $\times 10^3$ )	Mean ( $\times 10^3$ )	Std ( $\times 10^3$ )	Sum ( $\times 10^3$ )	Max ( $\times 10^3$ )	Mean ( $\times 10^3$ )	Std ( $\times 10^3$ )	Max	Mean	Std
Classical	1991879	168703	1992	8990	95720	3337	96	241	140.67	12.02	11.87
Blues	5031033	438219	5031	21809	207036	3441	207	466	136.73	11.33	10.85
Country	3907296	216282	3907	16488	175459	4025	175	419	154.48	10.00	10.39
Easy Listening	6774381	438219	6774	23228	294616	4787	295	521	647.55	12.57	23.56
Electronic	11638651	397692	11639	28059	417558	4787	418	554	168.30	20.45	14.80
Folk	5747398	126142	5747	13461	228865	2559	229	356	100.48	18.59	14.11
HipHop	5840235	239943	5840	14873	320283	3982	320	514	196.89	21.06	25.05
Jazz	3085327	397692	3085	15123	167026	4252	167	309	93.53	11.29	9.61
Metal	10183140	239943	10183	21530	257709	3535	258	429	152.61	34.35	19.76
Pop	12894615	438219	12895	28176	568479	4787	568	653	225.51	17.14	16.67
Rap	4941372	239943	4941	14110	272730	3982	273	487	205.11	25.79	31.20
RnB	4692720	216282	4693	15084	289493	3982	289	517	173.28	11.54	14.67
Rock	25071659	438219	25072	40781	800762	4787	801	745	186.90	26.98	20.58
Vocal	5316390	438219	5316	21307	208841	3832	209	436	161.06	14.93	16.60
World	1255660	74054	1256	5377	68110	1956	68	156	83.46	9.99	8.68
Classical vs. Others	0.276/0.018	0.544	0.262	0.450	0.329/0.022	0.854	0.313	0.514	0.73	0.68	0.70



Table 1: Descriptive statistics of PC, LC, and APCL for each genre, computed on the Last.fm dataset.

Genre	PC				LC				APCL		
	Sum	Max	Mean	Std	Sum	Max	Mean	Std	Max	Mean	Std
Classical	4970	886	5	47	3292	562	3	29	9.67	0.21	0.63
Blues	47613	12640	48	452	24286	7304	24	257	54.00	0.93	2.98
Country	60055	6892	60	413	35329	4692	35	251	561.50	1.79	18.27
Easy Listening	128408	18007	128	901	65843	9159	66	496	107.25	1.60	5.22
Electronic	136577	18007	137	848	70283	9159	70	437	76.00	1.60	4.52
Folk	31867	2712	32	164	15165	1579	15	83	41.00	1.43	3.06
HipHop	197935	18007	198	1051	126057	10537	126	627	180.33	1.26	7.09
Jazz	22284	2369	22	144	10552	1451	11	75	294.50	1.27	9.62
Metal	64071	7323	64	360	36068	3177	36	169	7.00	0.99	0.86
Pop	340766	18007	341	1265	179663	10537	180	724	536.60	5.02	31.64
Rap	178815	18007	179	1039	115235	10537	115	619	21.00	0.76	1.19
RnB	211899	18007	212	1027	135066	10537	135	612	243.60	1.28	7.90
Rock	234747	12842	235	728	126455	7331	126	405	390.38	2.88	17.30
Vocal	33030	3262	33	190	17972	1869	18	113	54.75	0.83	2.71
World	3514	293	4	17	2192	196	2	10	30.00	0.41	1.34
Classical vs. Others	0.041/0.003	0.079	0.041	0.077	0.048/0.003	0.089	0.048	0.084	0.05	0.14	0.08



Table 2: Descriptive statistics of PC, LC, and APCL for each genre, computed on the MMTD.

# Describing a musical object

## Showing Songs for chopin op 9 no 2

	TITLE	ARTIST	ALBUM	🕒	👍
+	Nocturnes, Op. 9: No. 2 in E-Flat Major. And...	Frédéric Chopin, Bri...	Chopin: The Essentials	4:34	■■■■■■■■
+	Nocturnes, Op. 9: No. 2 in E-Flat Major. And...	Frédéric Chopin, Bri...	Chopin: Complete N...	4:34	■■■■■■■■
+	Nocturnes, Op. 9: No. 2 in E-Flat Major	Frédéric Chopin, Fra...	Chopin: 21 Nocturnes	4:23	■■■■■■■■
+	Nocturne Op. 9 No. 2	Frédéric Chopin, Olg...	JUST THE BEST MU...	5:02	■■■■■■■■
+	Nocturnes, Op. 9: No. 2 in E-Flat Major	Frédéric Chopin, Art...	Chopin Nocturnes	4:31	■■■■■■■■
+	Nocturnes, Op. 9: No. 2 in E-Flat Major	Frédéric Chopin, Art...	Chopin: Nocturnes - ...	4:26	■■■■■■■■
+	Nocturnes, Op. 9: No. 2 in E-Flat Major	Frédéric Chopin, Art...	50 Masterworks - Ar...	4:28	■■■■■■■■
+	Nocturnes, Op. 9: No. 2 in E-Flat Major	Frédéric Chopin, Art...	The Original Jacket ...	4:21	■■■■■■■■
+	Nocturnes, Op. 9: No. 2 in E-Flat Major	Frédéric Chopin, Ad...	Classical Study Music	4:50	■■■■■■■■
+	Nocturnes. Op. 9: No. 2 in E-Flat Maior	Frédéric Chopin. Elia...	Chopin: Notturmo	4:30	■■■■■■■■

# Describing a musical object

## Google Student Blog

Google news and updates especially for students

### Getting to Know a PhD

March 17, 2014

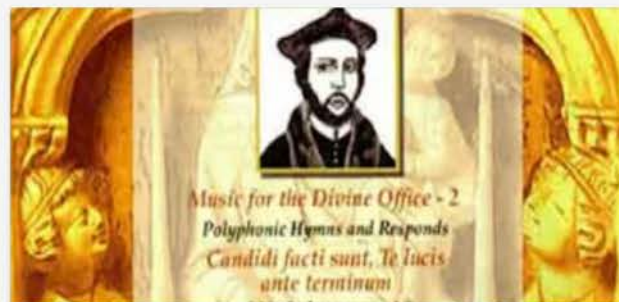
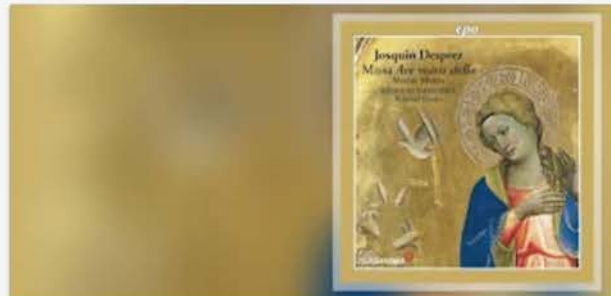
*Google offers a variety of opportunities for PhD students who wish to gain industry experience. Through our Getting to Know a PhD series, we'll provide a glimpse into some of these opportunities as well as the impactful projects PhD students at Google work on. Today we're featuring [Cynthia Liem](#), a PhD student, [Google European Doctoral Fellowship Recipient](#) and former [Google Anita Borg Scholarship](#) recipient who interned as a Software Engineer on the research team in Mountain View, CA last summer.*



# Describing a musical object



## Similar Artists



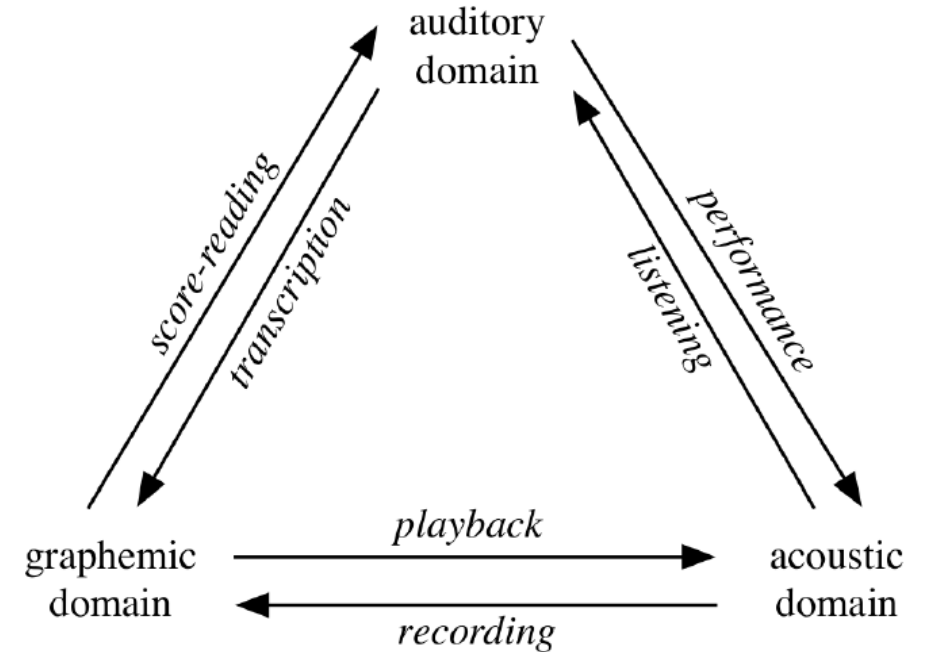


# Describing a musical object

- Is the information in the score?




6  
M. M. ♩ = 132.  
2<sup>da</sup>  
NOCTURNE.  
ANDANTE.  
espress. dolce  
Ped. Ped. Ped. Ped. Ped. Ped. Ped. Ped. Ped. Ped. Ped.  
f p cresc. p pp  
Ped. Ped. Ped. Ped. Ped. Ped. Ped. Ped. Ped. Ped. Ped.  
Ped. Ped. Ped. Ped. Ped. Ped. Ped. Ped. Ped. Ped. Ped.




[Wiggins, 2009]

# Is the information in the score?

Filters ▾ About 7,200,000 results

 **Chopin - Nocturne op.9 No.2**  
andrea romano  
3 years ago • 32,146,965 views  
Nocturne in E-flat major, Op. 9, No. 2 Played by Vadim Chaimovich  
(<https://www.youtube.com/vadimchaimovich>) FB-Vadim: ...

 **Chopin - Nocturne Op. 9 No. 2 (60 MINUTES) - Classical Music Piano Studying Concentration...**  
Just Instrumental Music  
2 years ago • 5,475,685 views  
1 Hour of Classical Music for studying and concentration. The best Chopin study music and relaxing instrumental piano song with ...

.....



## Raoul Koczalski plays Chopin: Nocturne in E flat major

Xqwrtz  
9 years ago • 21,436 views  
Raoul Koczalski is one of those last performers who use the romantic freedom in their performance.

# Is the information in the score?



Allegretto F. CHOPIN, Op.30, No.2.

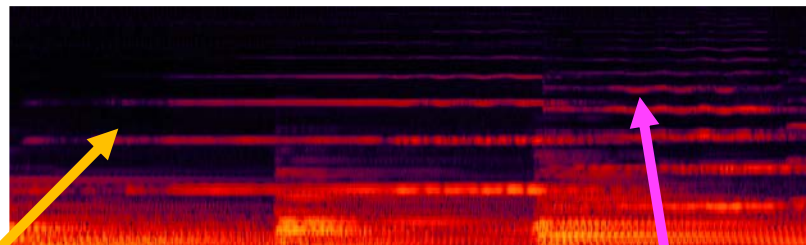
19.

1885

- Arthur Rubinstein - Chopin Mazurka, Op. 30 No. 2 - YouT...  
www.youtube.com/watch?v=PjV7L4zvc  
13 jul. 2009 - Geüpload door ArthurRubin  
HQ - http://www.youtube.com/watch?  
feature=player\_detailpage&vinnqM15MliqWw2335t Arthur
- Jan Lisiecki - F. Chopin Mazurka Op. 30 No. 2 - YouTube  
www.youtube.com/watch?v=K0qDQyJd  
20 jun. 2011 - Geüpload door Jan Lisiecki  
I know why you disable the ratings, Jan. If you didn't, there  
would be so many likes, it would malfunction ...
- Horowitz plays Chopin Mazurka Op.30 No.2 - YouTube  
www.youtube.com/watch?v=9AQO4wE  
26 nov. 2009 - Geüpload door spee2per  
Carnegie Hall, 28 March 1945 ~~~ Between 1945 and 1950,  
Horowitz played 13 Carnegie Hall recitals that ...
- Chopin Mazurka in B Minor Op. 30 No. 2 - YouTube  
www.youtube.com/watch?v=BT\_s\_Uj8tU  
17 mvt. 2011 - Geüpload door victor ZEE  
One of my favorite Chopin Mazurkas. Not too hard for me to  
play, but sounds really good.
- Chopin Mazurka Op. 30 No. 2 - YouTube  
www.youtube.com/watch?v=PMWz2BTople  
8 jan. 2010 - Geüpload door GregKnightPiano  
Chopin Mazurka Op. 30, No. 2 GregKnightPiano  
Subscribe/Subscribe/Subscribe 87 ... This ...
- chopin mazurka op.30 no.2 in b minor - YouTube  
www.youtube.com/watch?v=KulgnqkYVA  
17 sep. 2010 - Geüpload door Decora Chu  
的確，覺得這首特別容易聽的這首音樂，這好像太強硬了難以  
字著聲的作詞者除了給予的讚賞。 Read more>Show less. Show  
more>Loading.
- Frédéric Chopin - Mazurka - Op. 30 Nr. 2 - h-moll (b mino...  
www.youtube.com/watch?v=2h0GJpVtV8I  
10 jul. 2011 - Geüpload door Johannes Rummel  
Frédéric Chopin - Mazurka - Op. 30 Nr. 2 - h-moll (b minor)  
Johannes ... Chopin / V. Horowitz, 1949 ...
- Mazurka op. 30 n. 2 - Chopin - Alessandro Vena - YouTube  
www.youtube.com/watch?v=K2QJ-VWbW  
18 mei 2010 - Geüpload door alessandrovena  
Mazurka op. 30 n. 2 - Chopin - Alessandro Vena. Alessandro  
Vena ... Henryk Sztompka: Mazurka in B ...
- Frederyk Chopin Mazurka Op. 30 No. 2 - YouTube  
www.youtube.com/watch?v=FP-gyAkvVA  
8 apr. 2014 - Geüpload door Pablo Clinton  
Pianist Pablo Clinton performs Chopin's Mazurka Op. 30 No.  
2 Thank you for visiting my channel!
- Michelangelo Chopin Mazurka Op 30 No. 2 - YouTube  
www.youtube.com/watch?v=qmaz1OEGTU  
9 jul. 2009 - Geüpload door Carlos Alberto Navarro  
Comprendere certe cose... con la tua intelligenza, non con  
quella della massa che non è in grado di ...

# Is the information in the score?

SPECTROGRAM OF RECORDED AUDIO SIGNAL

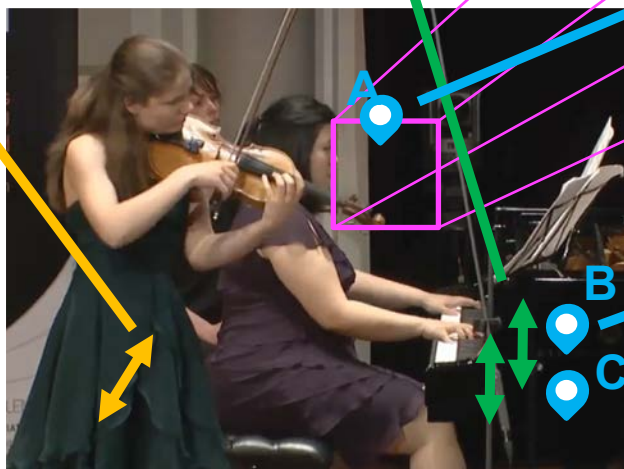


Bowing movement affects violinist's sound-forming, e.g. causing subtle onset entrances and subsequent tone development.

Piano sounds have strong onsets with subsequent sound decays. The pianist's way of making impacts on the piano keys affect loudness and timbre of the sound.

Violinist's hand movement produces vibrato frequency fluctuations. String choices affect timbre.

VIDEO RECORDING OF PERFORMING MUSICIANS



SCORE OF PERFORMED MUSIC



Player's hand positions correspond to played pitches.

[Duan et al., 2019]

# So much to discover!



# Visual analysis

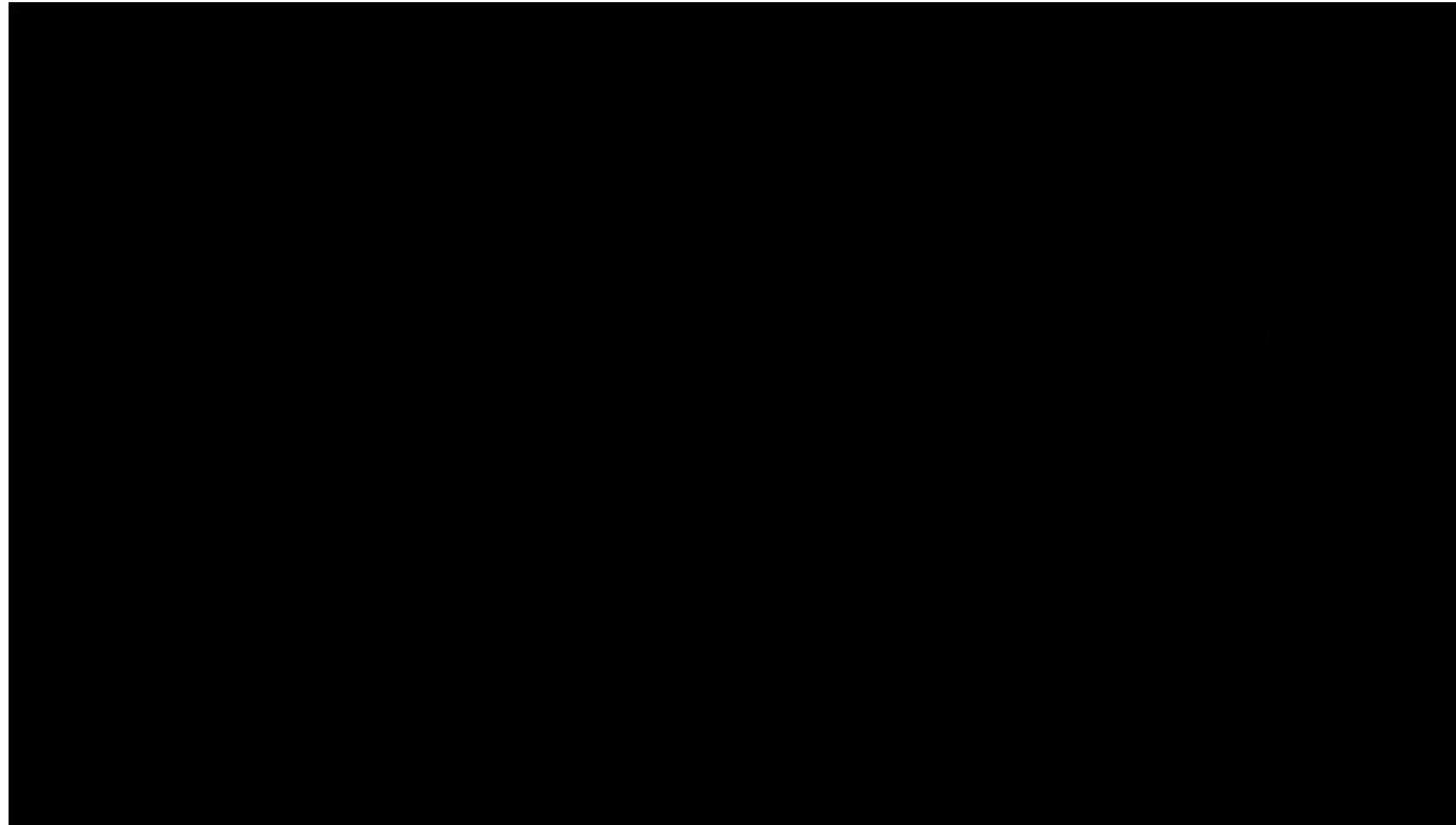


PHENICX

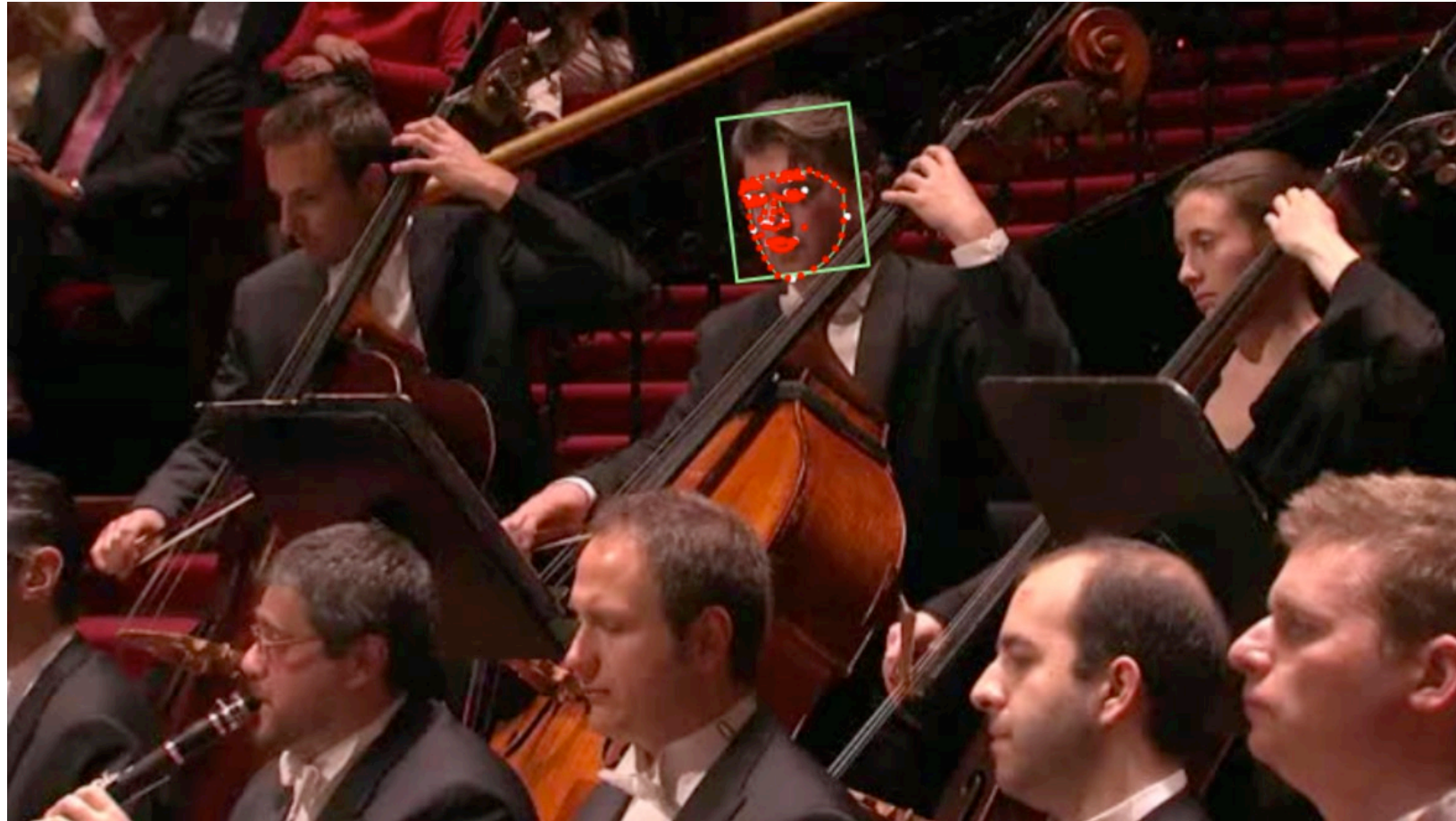
Performances as **H**ighly **E**nriched  
a**N**d Interactive **C**oncert **eX**periences



# Visual source separation?



# Surprisingly non-trivial from a computer vision perspective



PHENICX

Performances as **H**ighly **E**nriched  
a**N**d Interactive **C**oncert **eX**periences



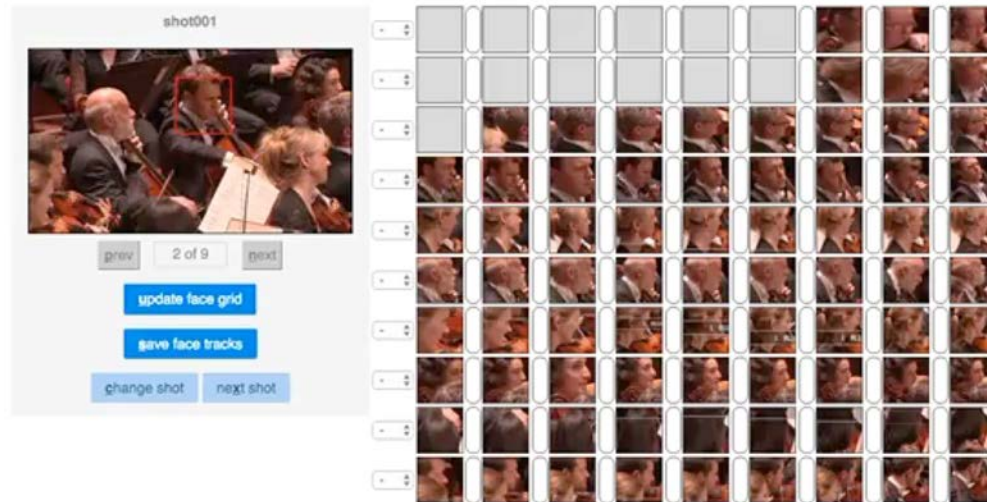
This project is co-funded by  
the European Union



# Solution: human-in-the-loop and smart propagation

## Face Tracks

With this tool, the automatically computed face tracks can be quickly fixed. Select a shot and follow all the steps.



[Bazzica, Liem & Hanjalic, ISMIR, 2014]  
[Bazzica, Liem & Hanjalic, CVIU, 2016]  
[Bazzica, Liem & Hanjalic, IMAVIS, 2017]



**“If there aren’t enough listeners, it is not worth it”?**

# A musician's struggle



# A musician's struggle



Magma Duo spielt Werke für Violine und Klavier von Poulenc, Copland u. a.

## Natürliche, wilde Musikalität

CD-Tipp vom 1.7.2016



CD

Titel:

Poulenc, Namavar, Vermeulen,  
Copland, Igudesman | Works for  
Violin and Piano

Interpret:

MAGMA DUO

Label:

GLOBE RECORDS GLO 5263

# The problem at scale: forgotten resources

- 400 years of digitized newspapers (delpher.nl):  
> 12 million pages
- All music released in The Netherlands:  
> 500,000 CDs



[delpher.nl/nl/kranten](https://delpher.nl/nl/kranten)

# “New releases”

[Liem, 2018]

NIEUWE MUZYK bij de GEBROEDERS ABRAHAMS,  
(Boekwinkel Langendelft.)  
L'intonant, Principes de Lyre & de Guitare à six cordes, 12 St.  
Glachant, Trois Duos agréables pour deux Flutes, f 2.  
Gamme pour la Flute ordinaire, 8 St.  
Paer, Ouverture d'Agnèse pour le Piano-Forte, 16 St.  
Beethoven, Variations pour le Piano-Forte, 14 St.  
Dussek, Sonate posthumé à 4 mains pour le Piano-Forte, f 1.

Amsterdamse courant, March 11, 1815

# Concert practice

[Liem, 2018]

Java-bode, August 18, 1866

PROGRAMMA der Muziekuitvoeringen, van de  
Stafmuziek, van 18 tot 22 Augustus.

1)	„Marche Triomphale . . . . .	T. F. MARKUS.
2)	Ouverture van de opera „ <i>Wilhelm Tell</i> ”	} G. ROSSINI.
3)	Aria „ <i>cujus animam</i> ” uit de „ <i>Stabat mater</i> ”	
4)	Scene en Koor (2 acte) uit de Opera „ <i>Der Tannhäuser</i> ” . . . . .	RICHARD WAGNER.
5)	„ <i>Souvenir van den Megamendoeng</i> ”, Pol- ka-Mazurka . . . . .	T. F. MARKUS.
6)	Ouverture van de Opera „ <i>La Reine de Chypre</i> ” . . . . .	HALEVY.
7)	Scene en Aria (Leonore, 4 acte) uit de Opera „ <i>Il Trovatore</i> ” . . . . .	G. VERDI.
8)	„ <i>Marien Walzer</i> ” . . . . .	JOS. GUNG’L.

# Le Tribut de Zamora

[Liem, 2018]



Haagsche Courant, September 25, 1883



# Trends over time

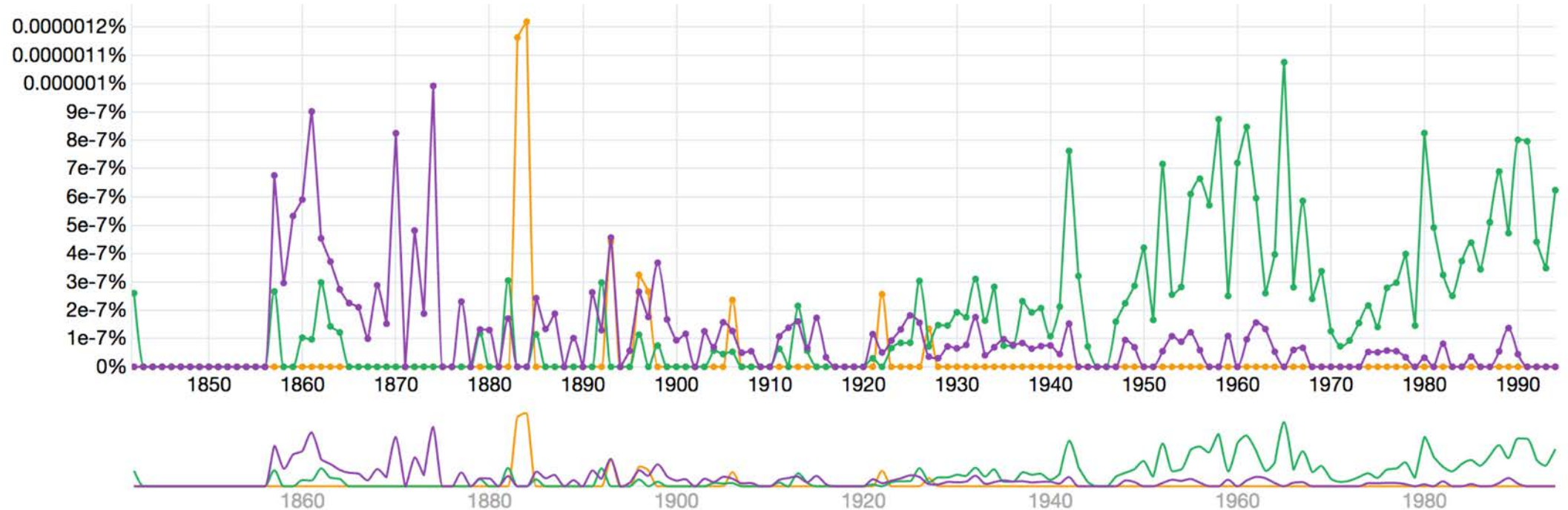
[Liem, 2018]

- KB Labs n-gram viewer

✕ le tribut de zamora

✕ don giovanni

✕ il trovatore



# Trends over time

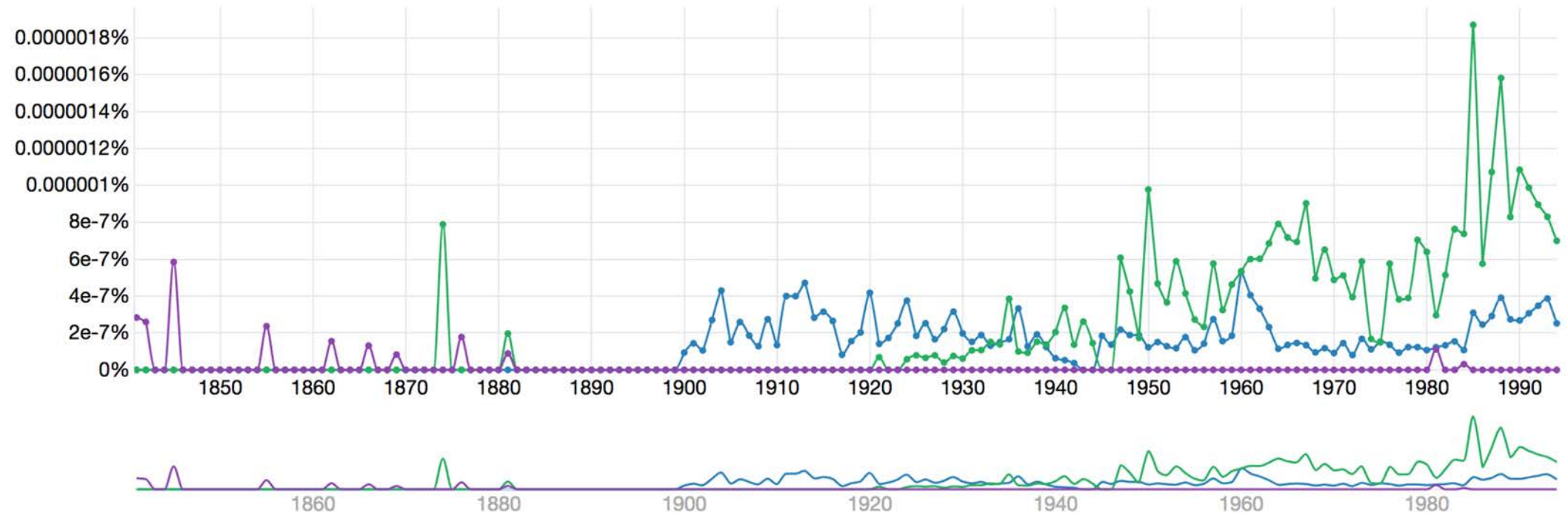
[Liem, 2018]

- KB Labs n-gram viewer

✕ gustav mahler

✕ johann sebastian bach

✕ henri vieuxtemps

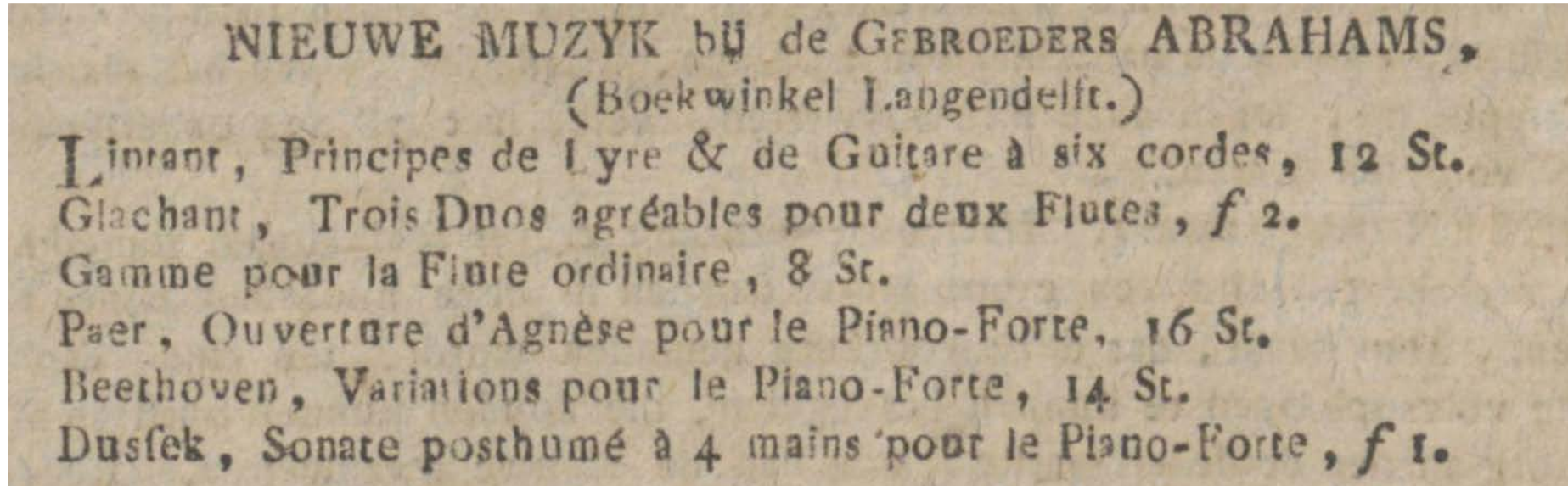


**So, can we find these?**

# Syntactic challenges: OCR, spelling...

Amsterdamse courant, March 11, 1815

[Liem, 2018]



NIEUWE MUZYK bij de GEBROEDERS ABRAHAMS.

(Boekwinkel I.a0gendelft.)

T inrant, Principes de I yre & de Guitare 4 s 'x cordes, 12 St.

Ghcham , Trois Doos agrÃlable pour deux Flute.i, f 2.

Gamme pour la Finte ordinaire, 8 St.

Paer, Ouverrore d'AgnÃlse pour Ie Piano-Forte, 16 St.

Beethoven, Variations pour Ie Piano-Forte, 14 St.

Dusfek, Sonate posthumÃl' 4 4 mains'poor Ie Pismo-Forte , f I.

# Semantic challenges: underspecification, ambiguity, incomplete entities...

[Liem, 2018]

Beethoven, Variations pour le Piano-Forte, 14. St.

Amsterdamse courant, March 11, 1815

## LAATSTE BERICHTEN

### MENGELBERG EN HET CONCERTGEDOUW- ORKEST TE BRUSSEL.

Onze correspondent te Brussel meldt ons dat prof. dr Willem Mengelberg en het Concertgebouworkest Maandag 17 December in de groote zaal van het Palais des Beaux-Arts zullen optreden met het volgend programma: Symfonie in bes van J. Ch. Bach, Cantate 51 van J. S. Bach en Vierde Symfonie van G. Mahler. Mevrouw Jo Vincent zingt de solistenpartij.

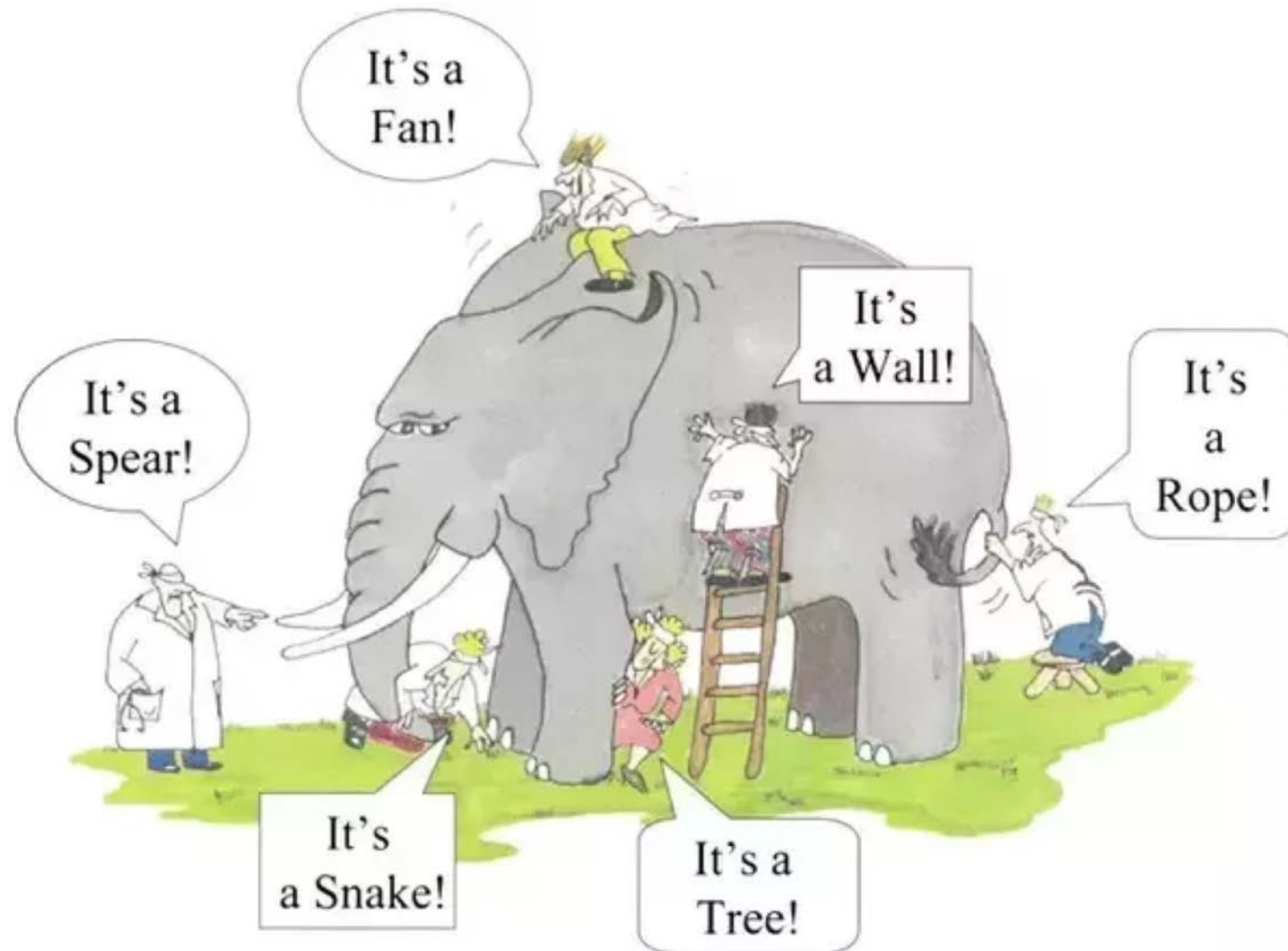
Het Vaderland, December 8, 1934

# Music as human-interpreted data

# Music as human-interpreted data

- A musical message is encoded symbolically
- Its manifestation: audio (plus production-related modalities)
- We can validly (re)describe the same input in many different ways, at many different conceptual levels

# Blind men and an elephant

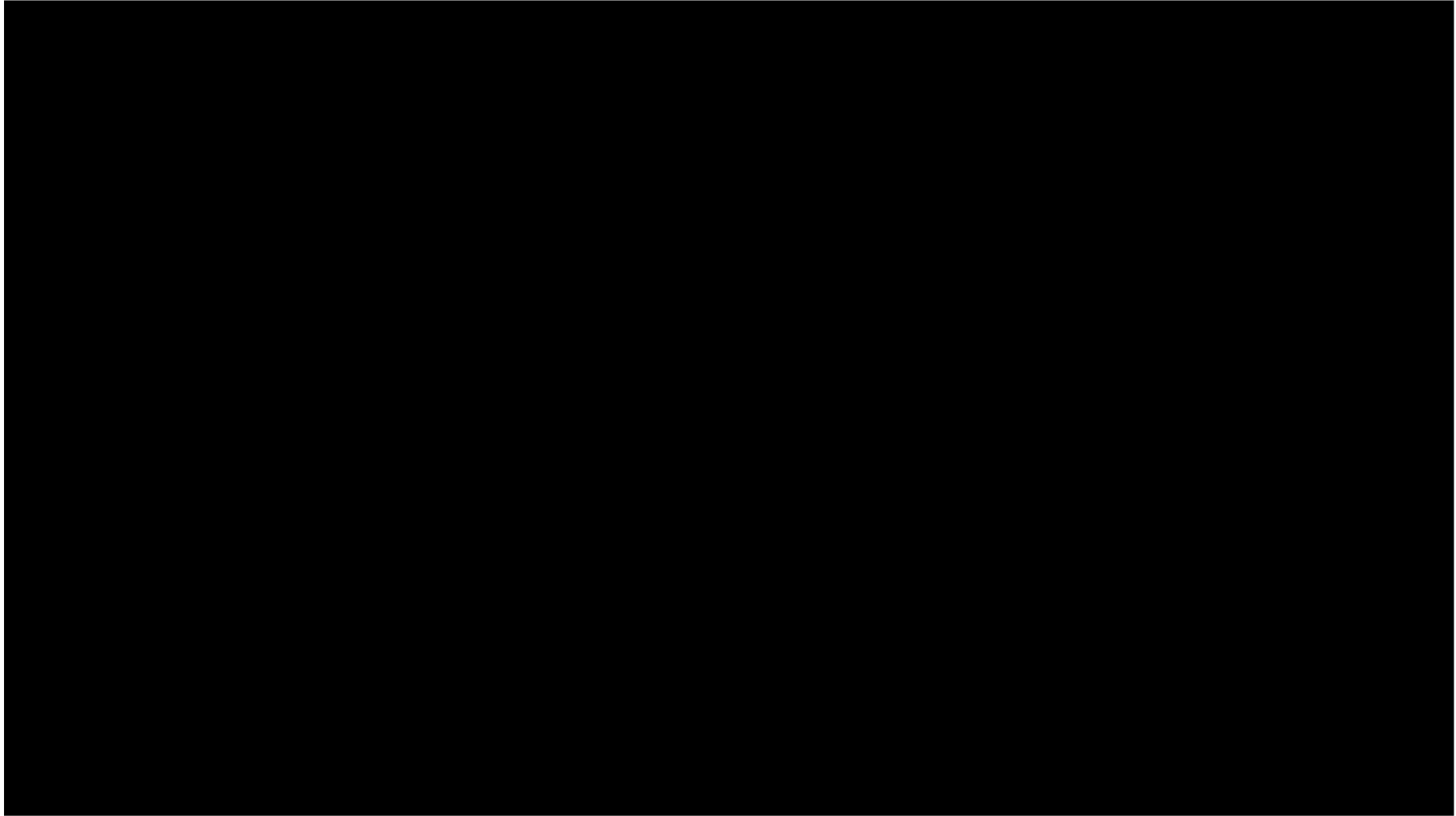




# Music as human-interpreted data

- Hard to pinpoint where 'the informative aspect' exactly is
- Still, humans seem to have some intuitive common understanding

# Being wrong with high confidence



<https://www.youtube.com/watch?v=Sbv4CYq3dPs>

# AI, media and creative industries

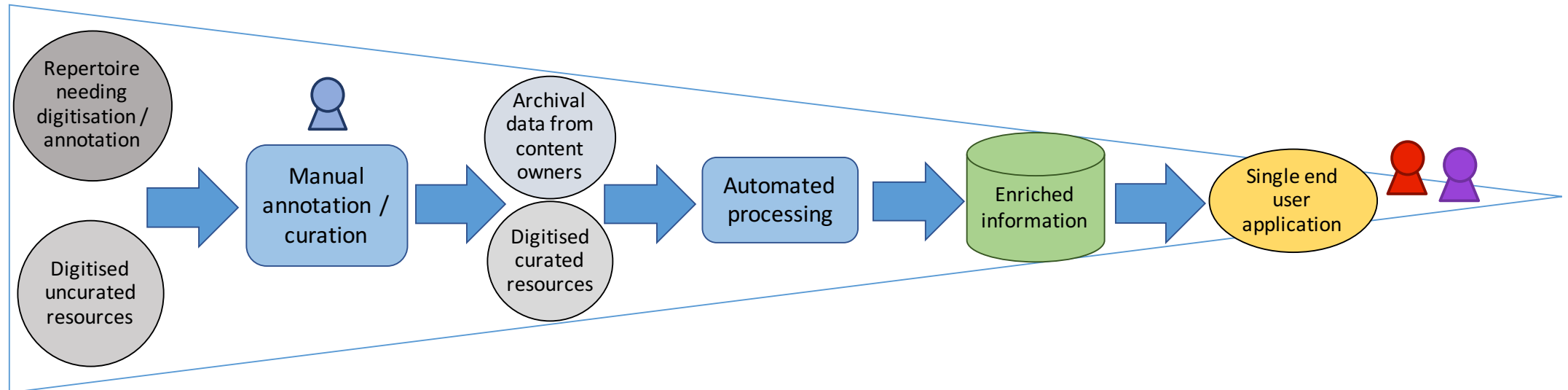
# Creative media is human-interpreted data. It is more than a physical phenomenon.

Frequently, some groups are over-represented and others are under-represented. More than 45% of ImageNet data, which fuels research in computer vision, comes from the United States<sup>2</sup>, home to only 4% of the world's population. By contrast, China and India together contribute just 3% of ImageNet data, even though these countries represent 36% of the world's population. This lack of geodiversity partly explains why computer vision algorithms label a photograph of a traditional US bride dressed in white as 'bride', 'dress', 'woman', 'wedding', but a photograph of a North Indian bride as 'performance art' and 'costume'<sup>2</sup>.

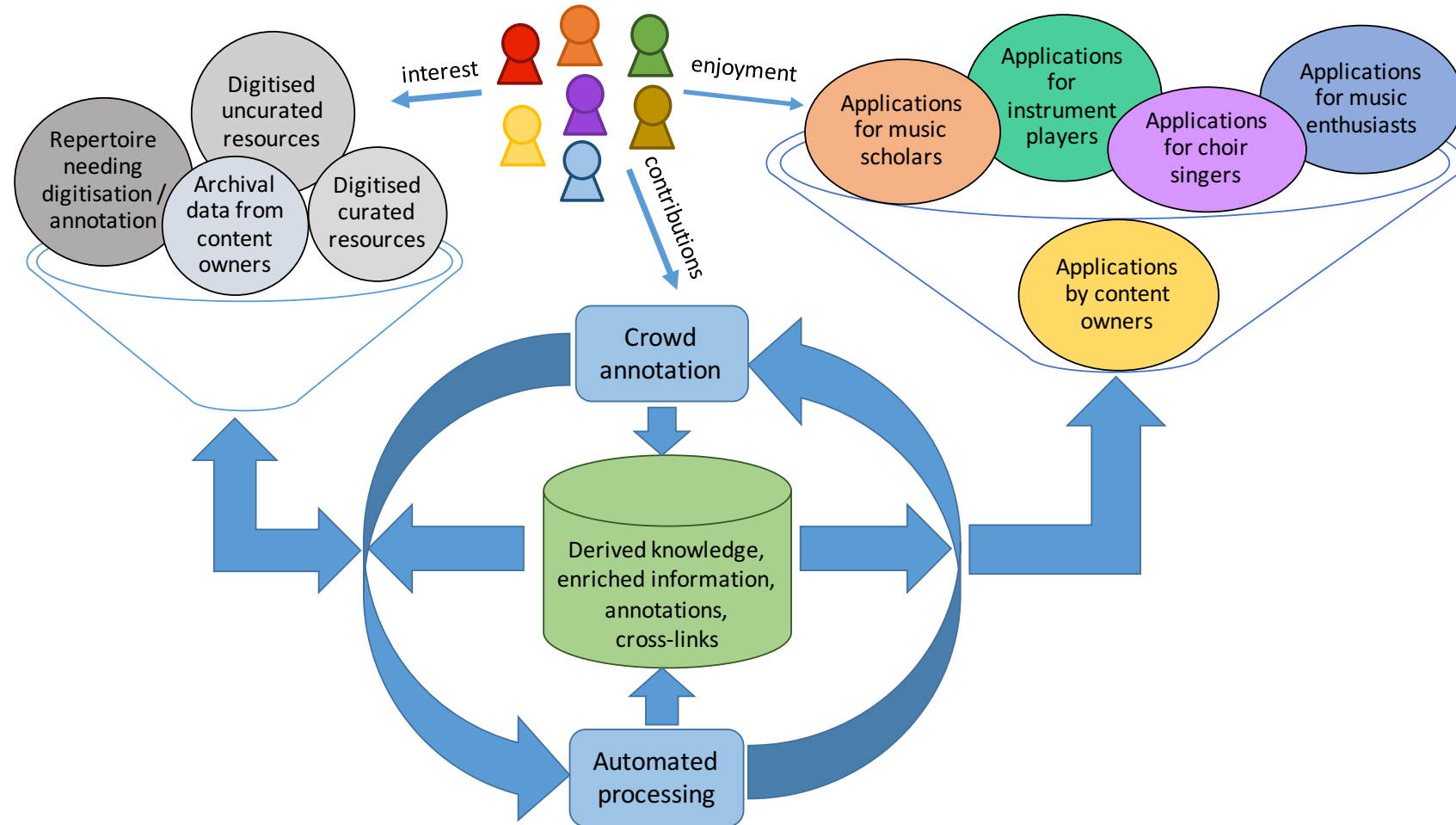
<https://www.nature.com/articles/d41586-018-05707-8>



# Humans care about creative media. They may be willing to actively get involved.



# Humans care about creative media. They may be willing to actively get involved.



TROMPA



This project is co-funded by the European Union

# Disruptive works of art did not just imitate, but made us reflect.

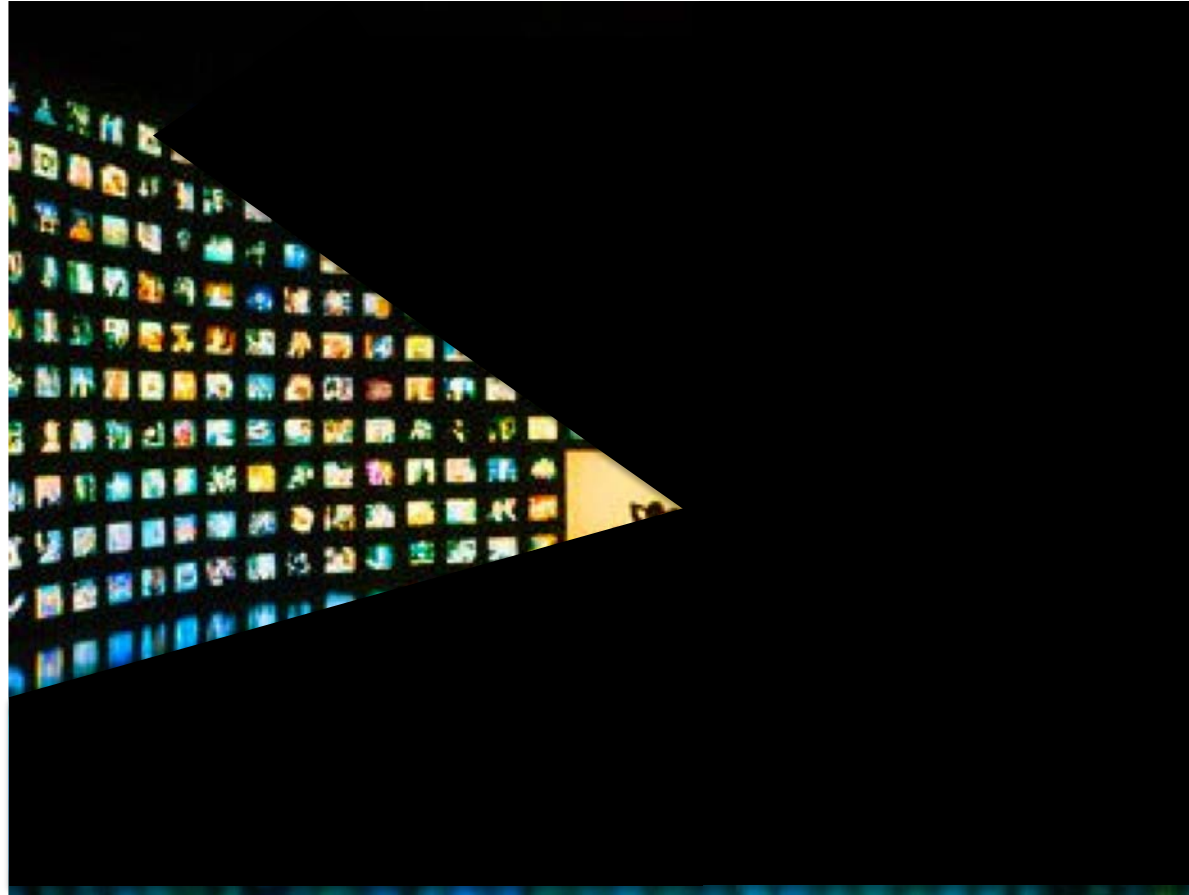


# Do we really want this?



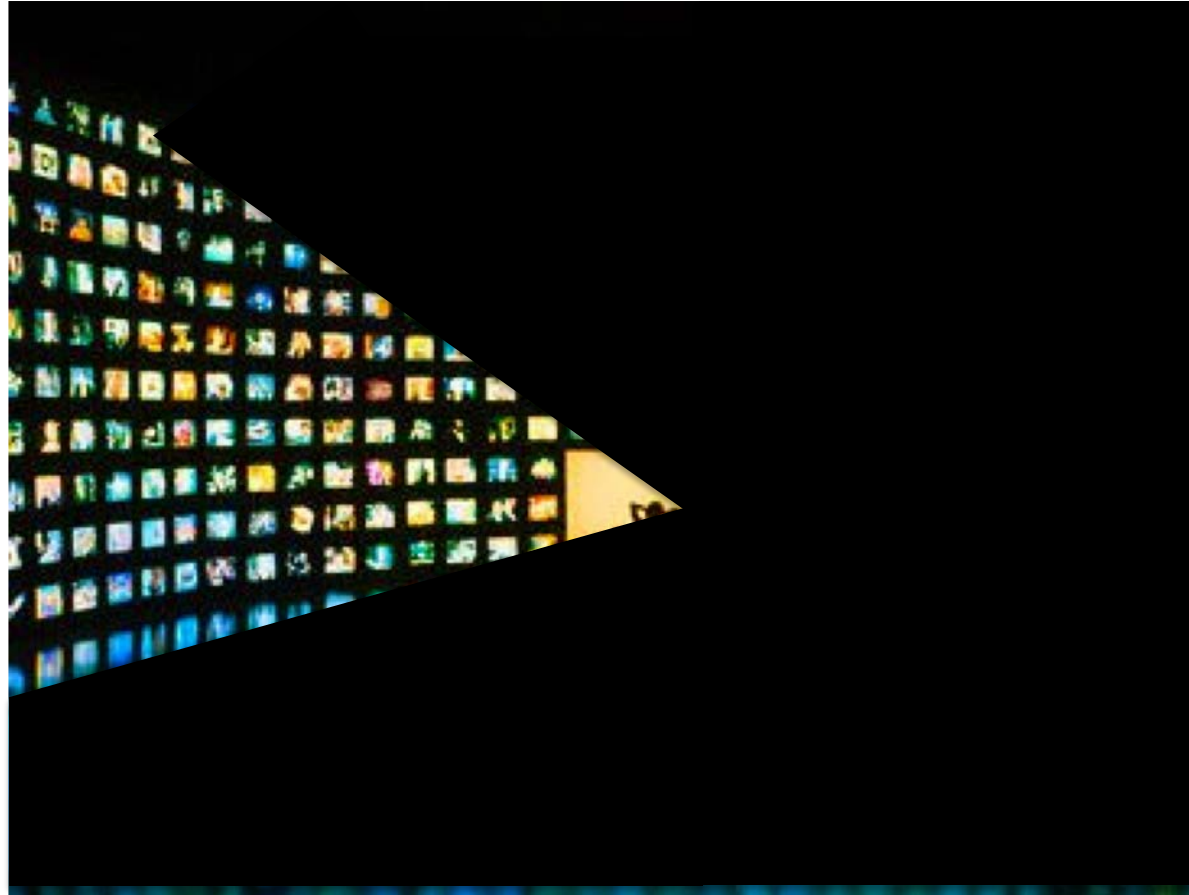


# Do we really want this?



# Do we really want this?

relevant



# Do we really want this?



# Do we really want this?



irrelevant

# Do we really want this?

**prediction error**



**irrelevant**

# Do we really want this?

**prediction error**



**irrelevant**

**uninteresting**

# Do we really want this?

**prediction error**

**not worth our  
time**



**irrelevant**

**uninteresting**

# Do we really want this?

**prediction error**

**not worth our  
time**



**irrelevant**

**uninteresting**

**non-existent**



# Do we really want this?

**prediction error**

**not worth our  
time**



**irrelevant**

**uninteresting**

**non-existent**

**unreachable**

# Do we really want digital twins?

			
User 1	★	★★	★
User 2	★★★★	★★★★	★★★★★
Alice	★★★★	★★★★	???

# What about developmental curators?



Gosford Library circulation desk, December 1951  
CC BY-NC 2.0,

<https://www.flickr.com/photos/gostalgia/6514399173/in/photostream/>

# Do we really want to minimize friction?





zagreb


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### Top things to do in Zagreb

 <p><b>Museum of Broken Relationships</b> Exhibits devoted to failed love affairs</p>	 <p><b>St. Mark's Church</b> Imposing medieval-style church</p>	 <p><b>Cathedral of Zagreb</b> Early 12th-century Neo Gothic cathedral</p>	 <p><b>Upper Town</b> Zagreb Funicular &amp; Lotrščak Tower views</p>
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 [Zagreb travel guide](#)

### Zagreb - Wikipedia

<https://en.wikipedia.org/wiki/Zagreb>

Zagreb is the capital and the largest city of Croatia. It is located in the northwest of the country, along the Sava river, at the southern slopes of the Medvednica ...



[Zagreb Airport](#) · [Mayor of Zagreb](#) · [Zagreb Cathedral](#) · [History of Zagreb](#)

### Grad Zagreb službene stranice

<https://www.zagreb.hr/> Translate this page

Besplatne radionice, manifestacije, prevencija, #ZAGREB · Moj Zagreb. Možete preuzeti aplikaciju Moj Zagreb na svom mobilnom uređaju ili online pregledati.

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## Zagreb

Capital of Croatia


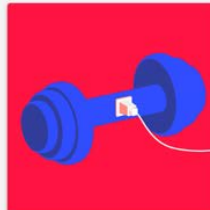


Zagreb, Croatia's northwestern capital, is distinguished by its 18th- and 19th-century Austro-Hungarian architecture. At its center, Upper Town is the site of the Gothic, twin-spired Zagreb Cathedral and 13th-century St. Mark's Church, with a colorfully tiled roof. Nearby is pedestrian-friendly Tkalčićeva Street, lined with outdoor cafes. Lower Town has the main square, Ban Jelačić, plus shops, museums and parks.

**Area:** 641 km<sup>2</sup>  
**Elevation:** 158 m  
**Weather:** 16°C, Wind N at 5 km/h, 76% Humidity  
**Local time:** Wednesday 22:28  
**Population:** 792,875 (2011)

[Plan a trip](#)

# (Can you) tell me what you want, what you really, really want?

It's Sunday afternoon  
Play something for...

			
Hanging Out	Working Out	Relaxing at Home	Barbecuing

Actie rond Pokémon-liedje houdt Top 2000 levend

CULTUUR  
Hanne Obbink – 17.55, 16 december 2015



# Getting lost without having a clue



# Mind the new generation



**Creative media as the natural environment where humans want to engage, and where human interpretation needs to be handled seriously**



**AI as a tool  
that increases our  
understanding of the world**

# Still haven't found what I'm looking for?

A technologist's and musician's perspective on the digital information age

**Dr Cynthia C. S. Liem MMus**

[c.c.s.liem@tudelft.nl](mailto:c.c.s.liem@tudelft.nl)

 @informusiccs