Interactive Musicology

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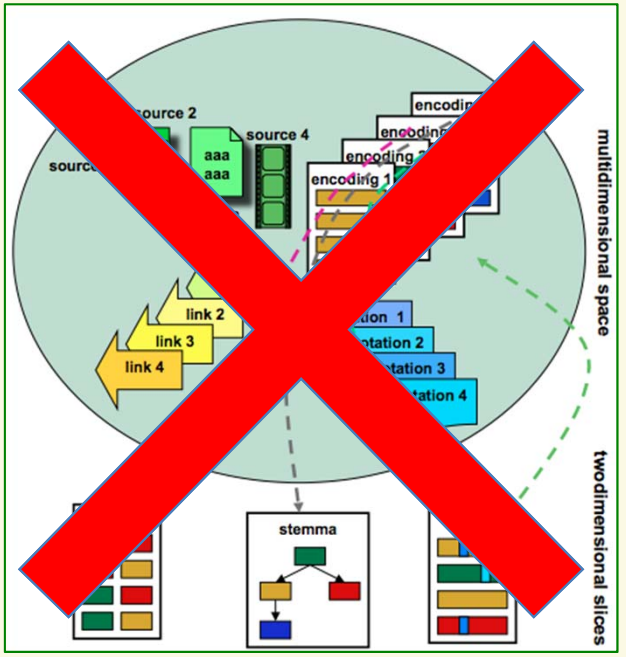
Abstract

Towards the end of 2011, I was given the task to teach a first-year course in Design of Interactive Systems. What I regarded at first as yet another academic chore turned out to be a thought-provoking confrontation with the principles of 'human-centred design'. I started to see interactive systems everywhere; moreover it was easy to observe that they more often than not violated the principles I just had begun to understand. Inevitably, I started to scrutinize computational musicology from the perspective of my newly found belief system. For years I had been worried the lack of impact of computational musicology on the musicological community at large. Could the reason be that it is too much about fully automatic processing of musical information and too little about helping musicologists in their daily work? Weren't computational musicologists making all kinds of unwarranted assumptions about the intended users, just like the developers of public transport cards, social security websites or submission systems for grant applications? If so, isn't it time to rethink computational musicology from a Design of Interactive Systems perspective?

Expectation management

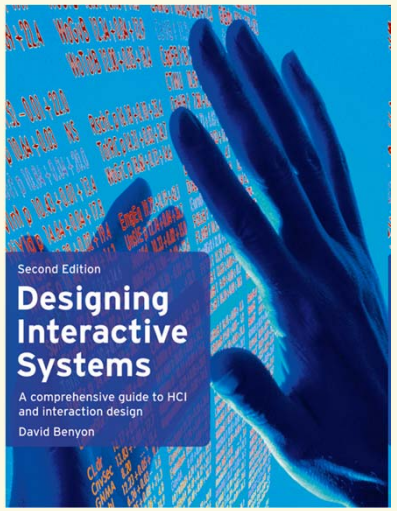
- tentative content: stuff I have been exploring for a while but not at all finished
- no new model for Digital Critical Editions of Music



Designing Interactive Systems

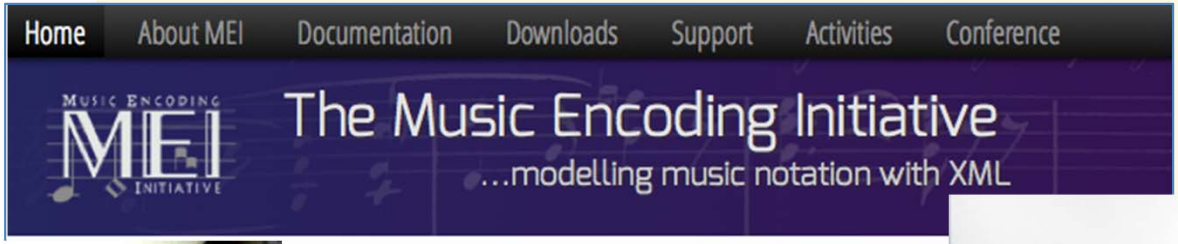
- … is concerned with developing high quality interactive systems, products and services that fit with people and their ways of living (David Benyon 2010, p. 6)

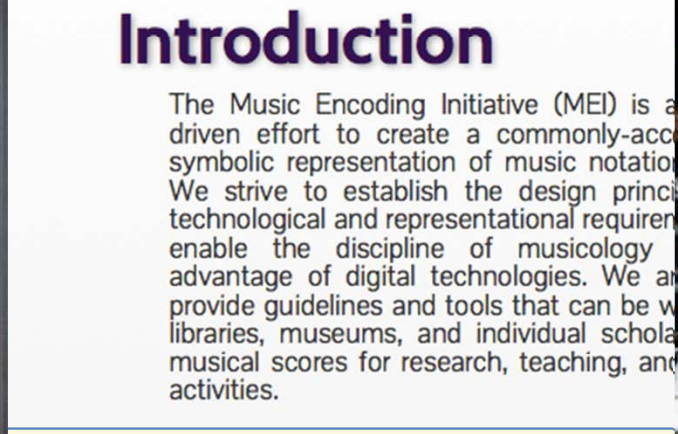
- human-centred design
  - not just 'user-centred'
- people-technology system
  - seamless integration of human and tool



Interactive Systems

- perform certain tasks in collaboration with humans
- process information
- respond dynamically to human actions





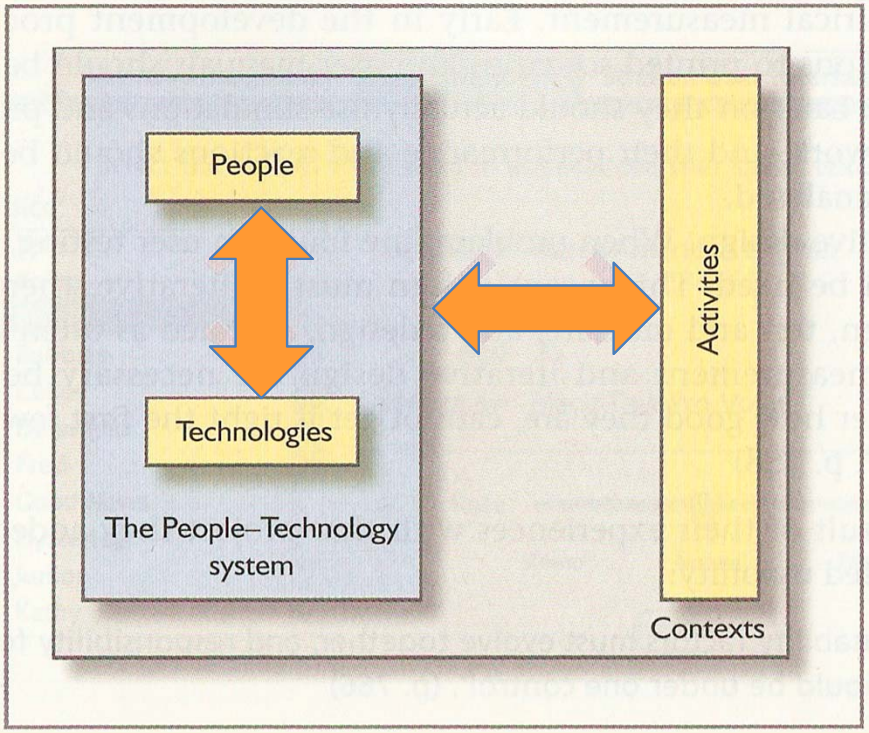
How to…

- The interactive systems designer aims…
  - to produce systems that are accessible, usable, socially and economically acceptable
  - to produce systems that are learnable, effective and accommodating
  - to balance the **PACT** elements with respect to a domain

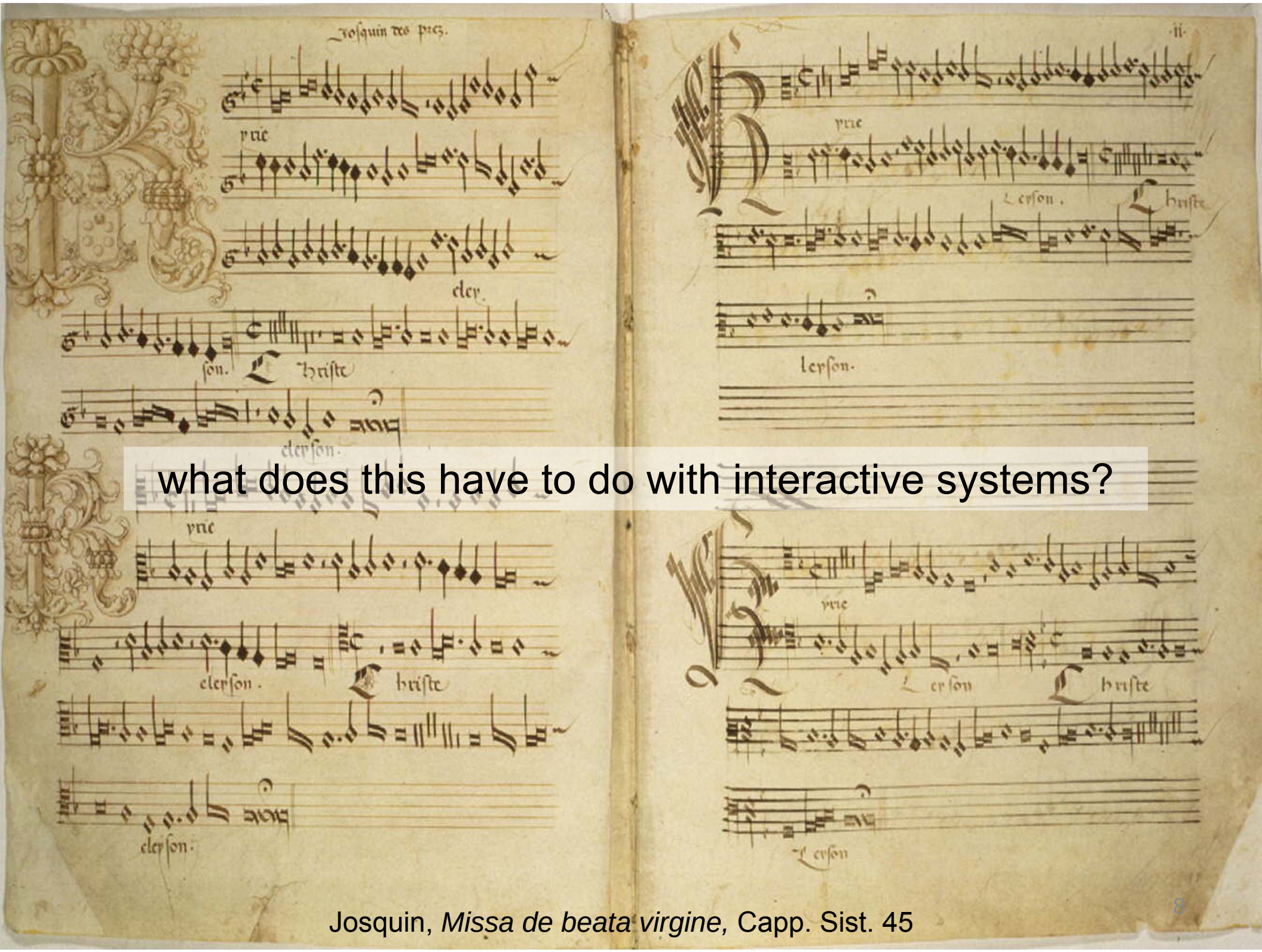
(Benyon 2010 p. 80)

PACT

- people
- activities
- contexts
- technologies



tempting to regard *anything* as an interactive system



Josquin, *Missa de beata virgine,* Capp. Sist. 45

PACT for Renaissance polyphony

- non-digital interactive technology
- domain: liturgical performance
  - **P**eople: everyone involved in preparation and performance
  - **A**ctivity: e.g. singing music to liturgical text
  - **C**ontext: mass, feast, location
  - **T**echnology: manuscript with mensural notation
- *manuscript is surviving half of a people-technology system*
- interactive systems design
  - usable: *optimised* for work practice
  - users develop strong *mental models* of activities
  - relies on *routine* and *expertise*
  - displays common design principles such as:
    - *minimalist design, flexibility*

PACT analysis of Computational Musicology?

Computing in music goes way back

- oldest known study: Bronson 1949 (folk song classification)

- stages
  - prehistory (before 1960)
  - heroic (1960-1980)
  - crisis and recovery (1980-2000)
  - Internet and MIR (1995-present)
  - towards digital musicology (2005-present)

The heroic phase

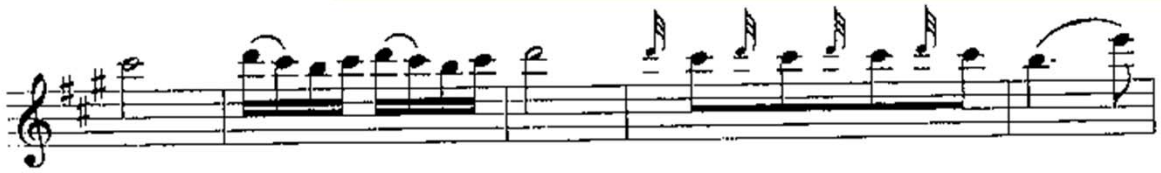
- great ambitions
- everything seemed to fit
  - 'positivist' approach to musicology
  - classical music, notation
  - source studies
  - formalisation, automatic processing

- central role of encoding

- Arthur Mendel, *Evidence and Explanation* (1962)
  - the positivist programme for musicology

Plaine and Easie Code

- incipit encoding for music cataloguing
  - Brook & Gould, 1964
- http://www.iaml.info/en/activities/projects/plain_and_easy_code
- still used in RISM A/II
  - search interface at http://opac.rism.info/



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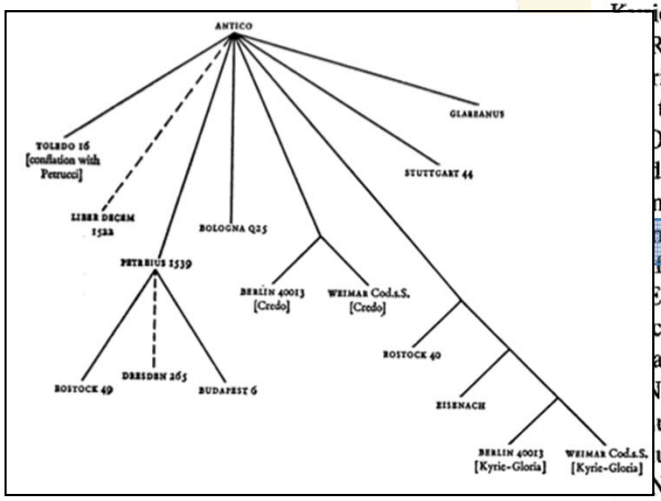
112B      pf.
112C      G-2
112D      xFCG
112E      2/4
112F      '''2C/!{y6DCz''B'''C}!f/2D/q3D{8Cq3D8Cq3D8Cq3D8C}/y'
          '4.B'''8Ez/
```

Princeton Josquin Project

- all (?) Josquin's works encoded in 1960s-70s
  - Arthur Mendel, Lewis Lockwood, Michael Kassler
- ambitions
  - computational analysis of counterpoint
  - composer attribution
  - stemmatics



MOVEMENT	A:3&6 &4&5	B:TRIADS & INVERSIONS	A/B
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[illegible]RIE	15	67	0.22
[illegible]ria	24	56	0.43
[illegible]tollis	14	61	0.23
[illegible]ORIA	19	56	0.34
[illegible]lo	16	59	0.27
[illegible]ncarnatus	14	79	0.18
[illegible]n spiritum	8	75	0.11
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[illegible]EDO	15	66	0.23
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[illegible]NCTUS	24	54	0.44
[illegible]us Dei 1	21	60	0.35
[illegible]us Dei 3	10	60	0.17
[illegible]NUS DEI	11	60	0.18
MISSA L'H. A.	15	62	0.24

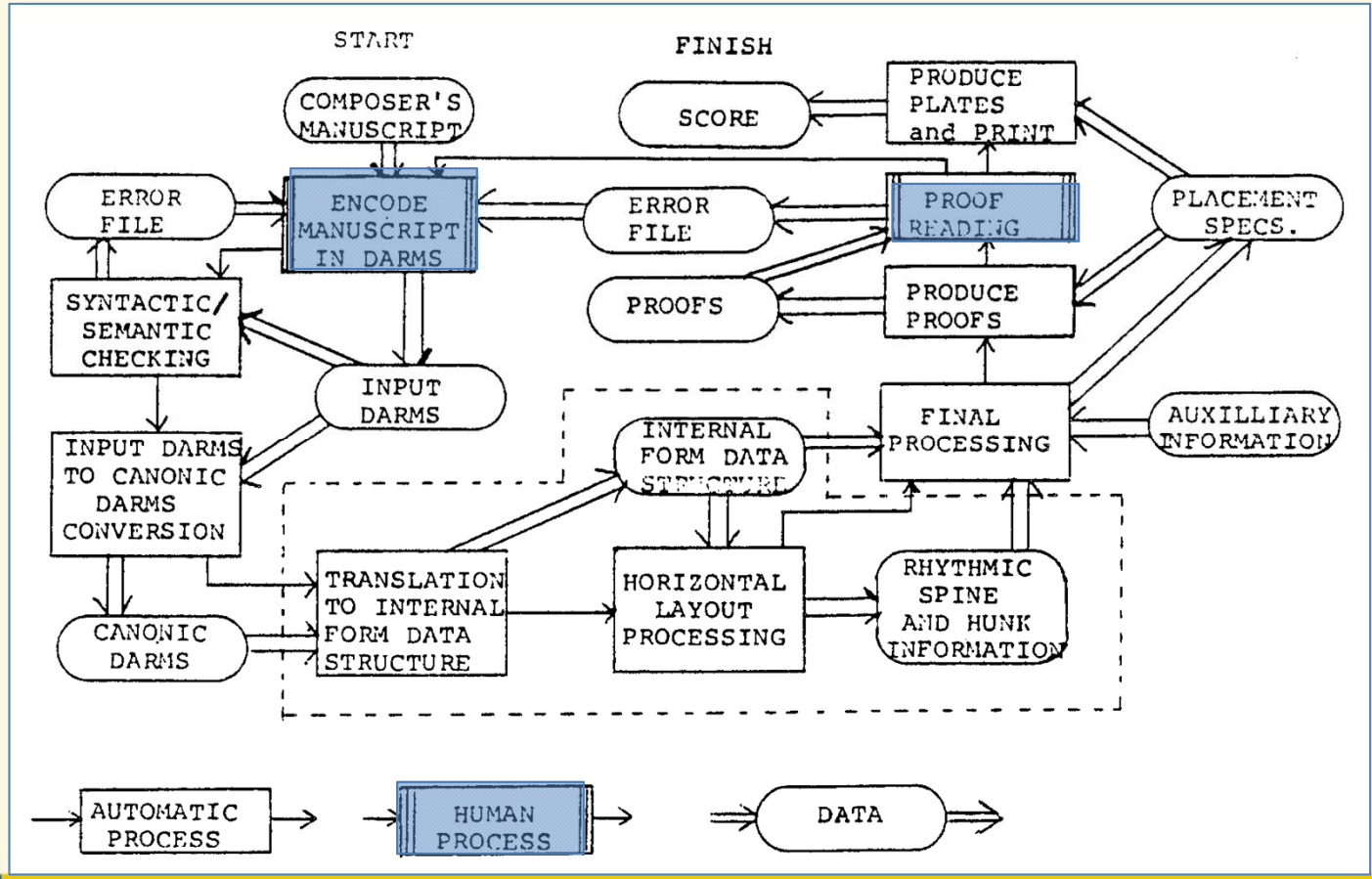
Fig. 4 Four-Voiced Simultaneities (Percentages of Total Duration)

DARMS project

- Digital Alternate Representation of Musical Scores
  - Stefan Bauer-Mengelberg, Melvin Ferentz, Raymond Erickson

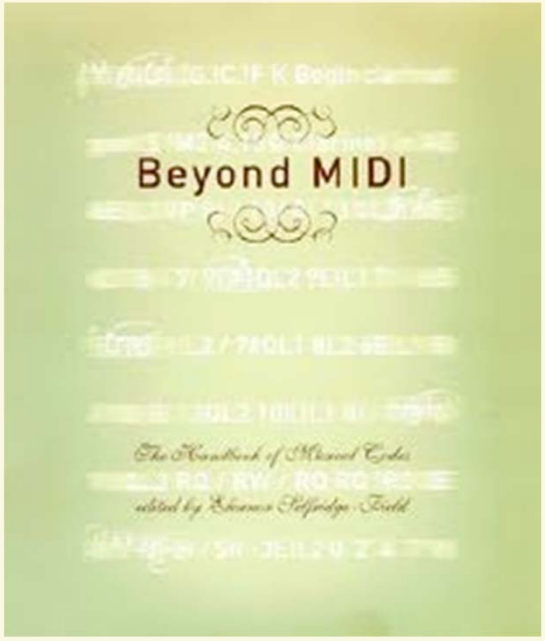
- aims:
  - high-quality printing
  - automatic analysis

- ambitions:
  - completeness
  - formalisation
  - universality



DARMS printing system

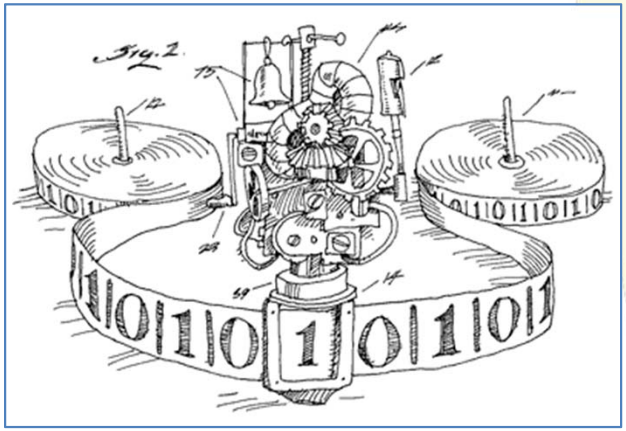
Summing up…

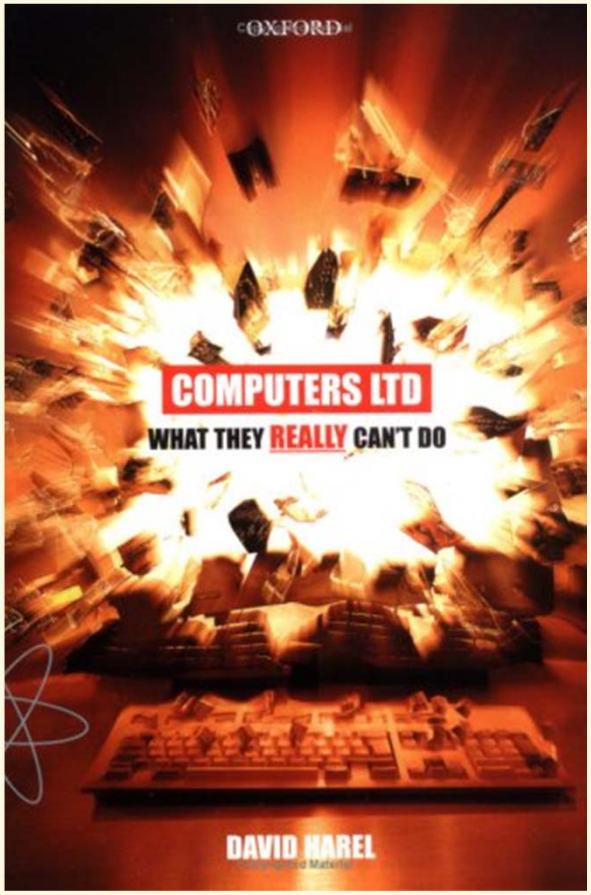


- lots of activity
  - Brook's bibliography (1970): 617 publications
- obsession with encoding
  - extreme reinvention of the wheel
  - interesting ideas about usability of encoding systems
- mega ambitions
  - unrealistic?
  - driven by small teams of researchers, no consolidation (except RISM/PAEC)
- algorithmic paradigm of computer science

Intermezzo: paradigms in CS

- algorithmic paradigm
  - emphasis on computability, mathematical proof (Turing machine)
  - solve problem by
    - formal representation of information
    - algorithmic processing
  - 'autistic' behaviour in closed world

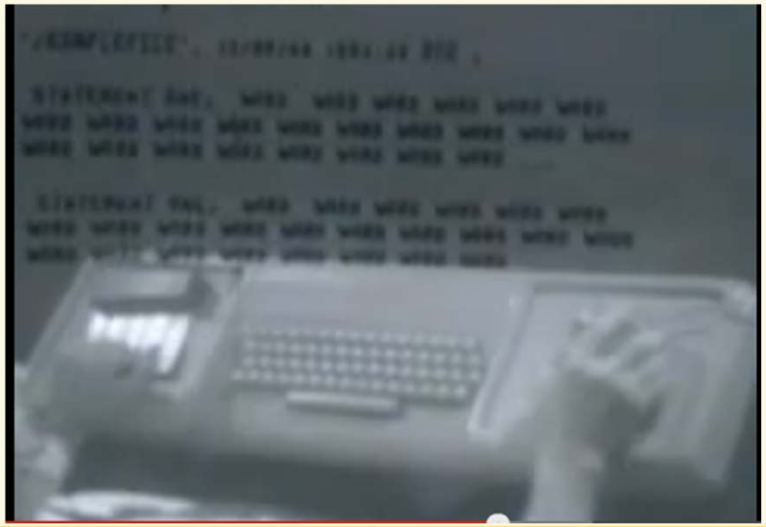




Intermezzo: paradigms in CS

- interactive paradigm
  - interaction with real world
  - sense of time, history
  - only partial, empirical proof of computational properties possible
  - yet more powerful than algorithmic paradigm (Wegner 1997)

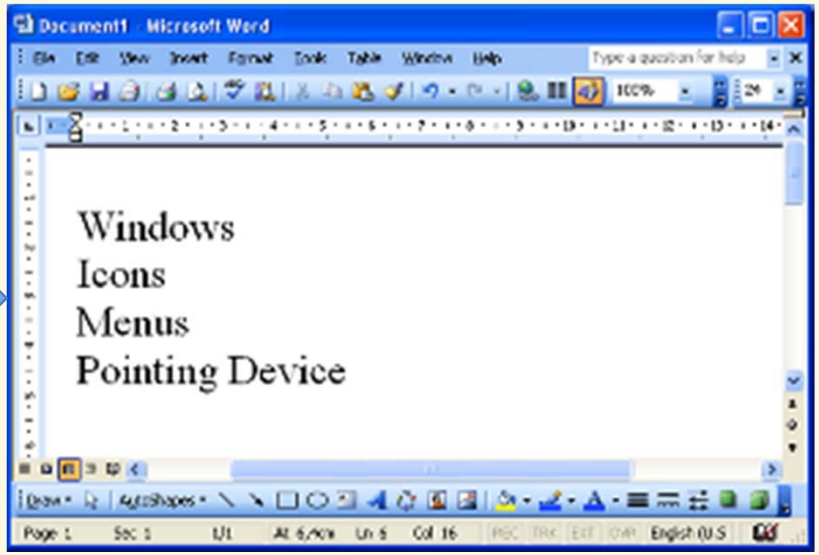
- emerged in the 1960s
  - Douglas Engelbart (9-12-1968)
  - The Mother of All Demos



http://www.youtube.com/watch?v=JfIgzSoTMOs

Changes in computing, 1980-2000

- just a few of them…
  - prominence of interactive paradigm
  - command line interfaces replaced by interactive WIMP interfaces
  - introduction of the Personal Computer
  - digital data storage
  - Internet

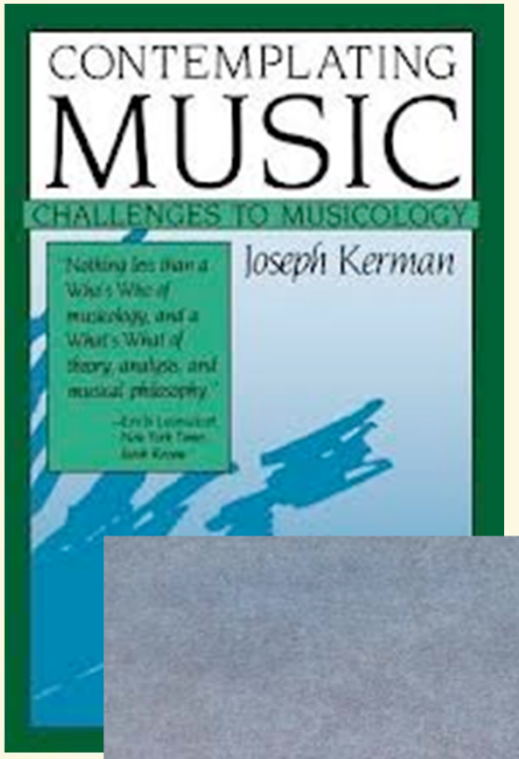


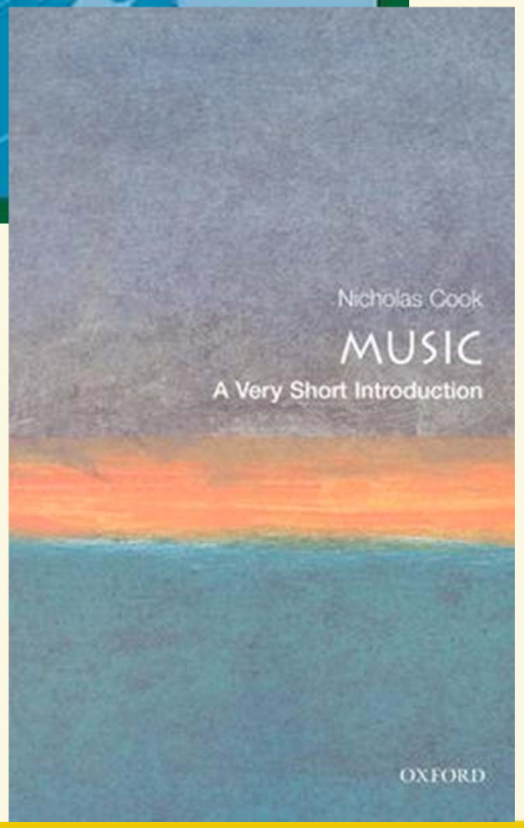
Changes in musicology

- Joseph Kerman, *Contemplating music: Challenges to musicology* (1985)
  - catalyst for *new musicology*

- just a few aspects
  - ideological criticism of positivism
  - musical work loses central position
  - contextualisation

- admirably explained by Nicholas Cook in *Music: a very short introduction* (2000)





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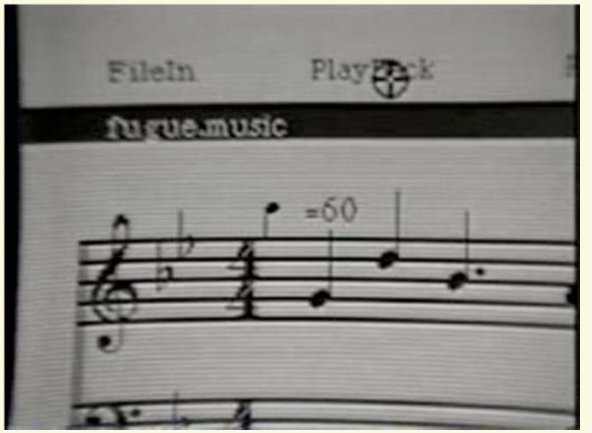
Crisis and recovery (1980-2000)

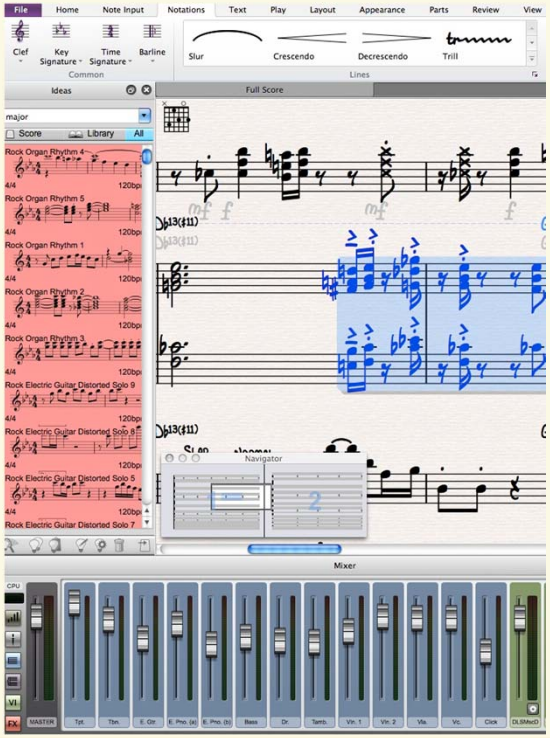
- many researchers no longer active
- everything attained so far in Computational Musicology had become obsolete
  - lots of work had to be redone (or not)
  - answers to most technical challenges were somehow produced
- generally, CM remained true to the algorithmic paradigm
  - no consistent answers to challenges of new musicology

Consumer music software

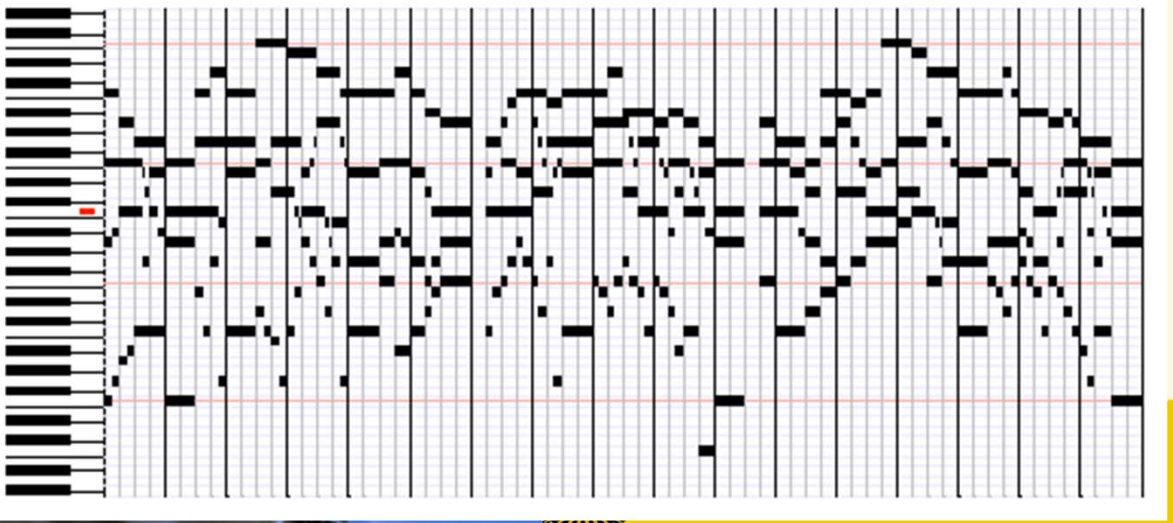
- first interactive music printing prototype: Mockingbird by Severo Ornstein and John T. Maxwell (Xerox)
  - https://www.youtube.com/watch?v=_Xu3r5lZds0
- many music printing programs emerged
  - proprietary storage formats
- MIDI format and sequencers
  - primitive interoperability



Mockingbird

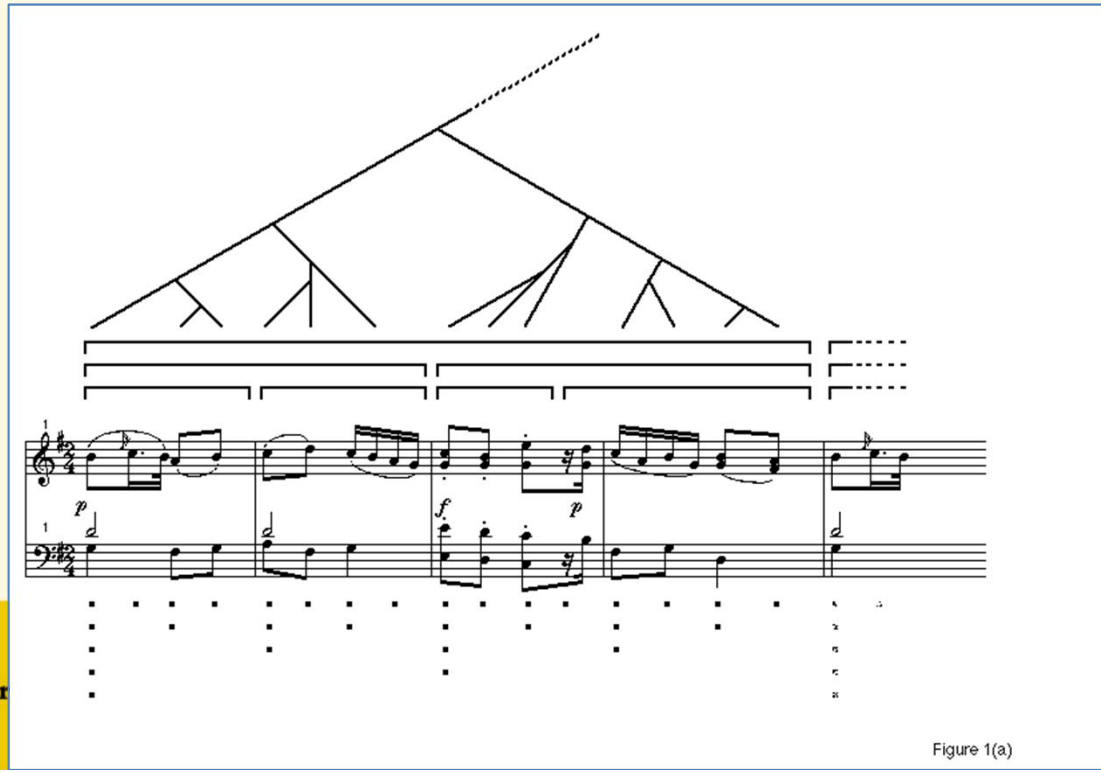


Sibelius



Analytical innovations

- Humdrum toolkit (David Huron)
  - first music-analytical toolkit for end-users
  - UNIX platform, central role for *grep*
  - large set of tools doing basic operations
  - tools can be pipelined for complex tasks
- Musical grammars
  - Lerdahl and Jackendoff, *Generative Theory of Tonal Music* (1983)
  - influenced by Chomsky
  - influential outside CM



Corpus creation

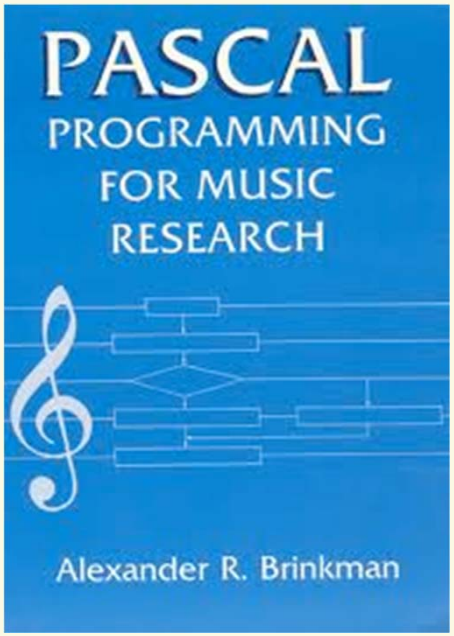
- nearly everything from before 1980 was lost
- closed storage representations of commercial products

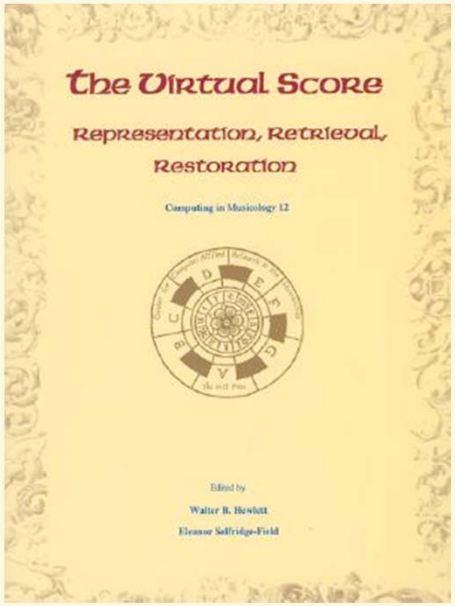
- creation of open research corpora
  - classical
    - MuseData (CCARH) c. 1000 works, high quality
    - KernScores, 10.000 works
  - folk song
    - ESAC data (Steinbeck, Schaffrath, Dahlig) c. 20.000 songs
    - WITCHCRAFT corpus (Kranenburg et al.) c. 7.000 songs
  - non-standard notation types
    - ECOLM: lute tablatures (www.ecolm.org)
- often created together with dedicated software for editing, searching and/or analyis

Conclusion: late 1990s

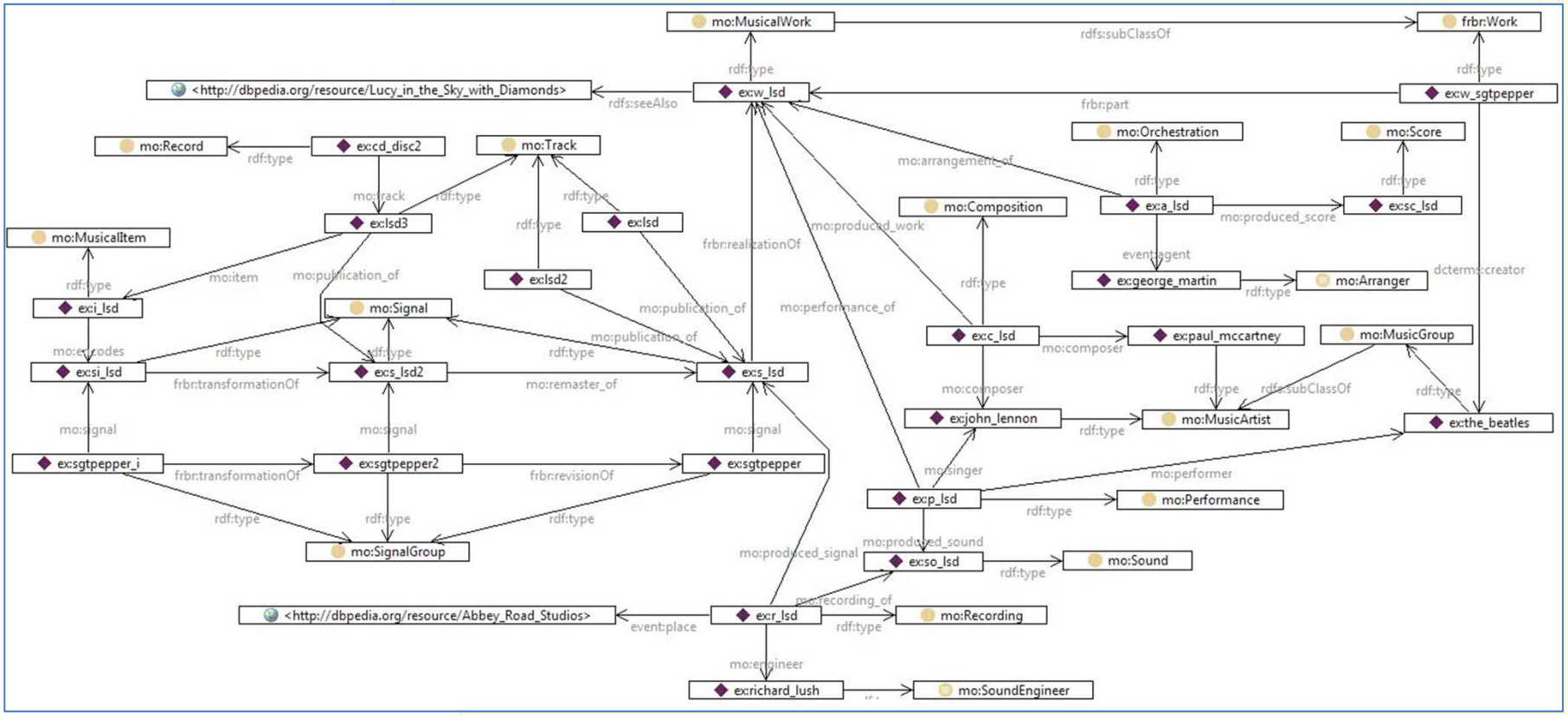
- partly recovered from crisis
  - contours of infrastructure emerging
  - tiny amounts of data and software
- adherence to computability paradigm
  - except maybe music printing

- increasing separation from mainstream musicology
- emerging community (important role CCARH)
- anchoring the discipline elsewhere
  - music psychology: cognition and perception (e.g. Huron)
  - Internet, Music Information Retrieval





Internet and MIR (1995-present)



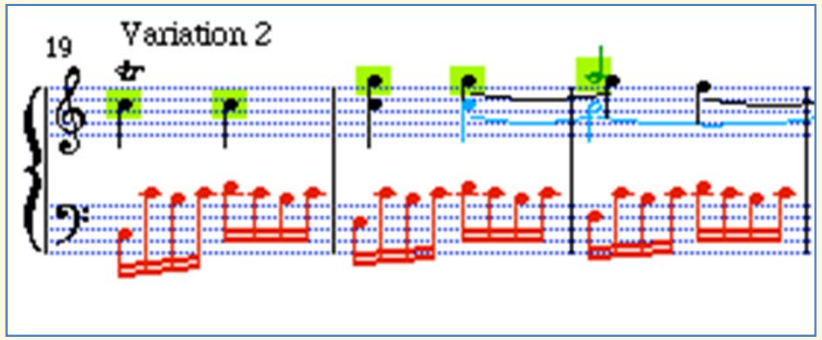
visualisation from the Music Ontology, http://musicontology.com/

Three WWW landmarks

Rome Reborn
Library of Congress, 1993

Music Information Retrieval

- technologies for exploring musical data on the Internet
  - unprecedented quantities
  - serious quality issues



- MIR definition (Downie 2004)
  - a multidisciplinary research endeavor that strives to develop innovative content-based searching schemes, novel interfaces, and evolving networked delivery mechanisms in an effort to make the world's vast store of music accessible to all

- International Society for Music Information Retrieval (www.ismir.net)

What has MIR delivered?

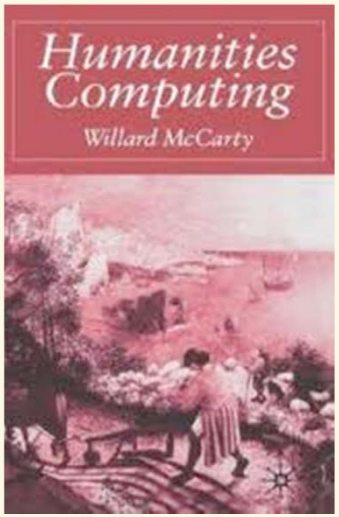
- bad news
  - engineering approach (whatever it takes to get the best results)
    - lowers explanatory value
  - not many successful applications
    - often solution in search of problem
  - little attention for user-centred design
    - usability = beauty contest

- good news
  - lots of computational methods waiting to be exploited
  - audio-based research now serious possibility
  - ready to deal with data-rich potential of the Internet

Elsewhere in the humanities

- mass digitisation of cultural heritage
- Internet as a scholarly resource

- Digital Humanities
  - interoperability
  - digital media studies
  - builds on 'normal' digital literacy
  - end users become end makers (Willard McCarty 2005)



- much more serious about interactive paradigm

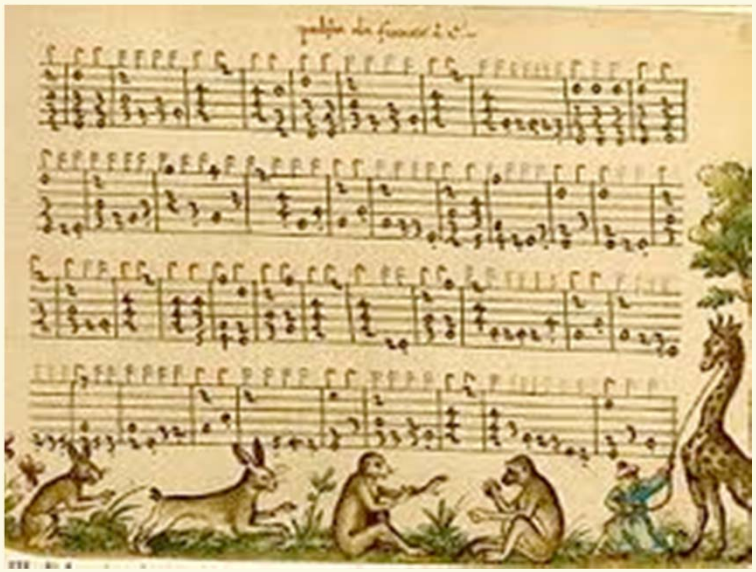
Digital Musicology (since 2005?)

- similar re-orientation possible for Musicology?
  - exploit the Internet
  - creative use of existing technologies
  - not primarily about notation data processing
  - support musicological work processes
  - interactive paradigm

- digital musicology = computational musicology in reverse
  - from people to technology, not other way around

Where is it happening?

- some areas
  - folk music research
  - performance research
  - lute music
  - digital editions
- each characterised by
  - sizeable community
  - fairly high level of computer literacy



MUSIC ENCODING MEI INITIATIVE

THE .C.M.M.E. PROJECT computerized mensural music editing

EsAC Essen Associative Code and Folksong Database

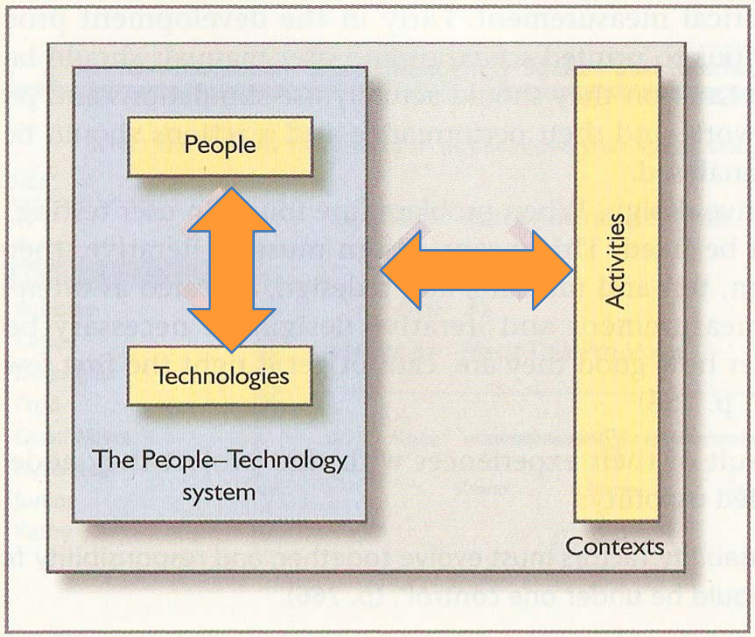
Commercial break

- Amsterdam, Netherlands, June 6 and 7, 2013
- http://www.elab-oralculture.nl/fma2013/

PACT conclusion: 2 weaknesses

- computational musicology is isolated
  - focus on musical work
  - 'positivist' approach
  - weakly connected to mainstream musicology

- most computational musicology (and a great deal of MIR) falls within algorithmic paradigm
  - closed computational world difficult to create and interpret
  - are results meaningful from musical viewpoint?



no convincing people-technology systems

Human-centred design for musicology

- core issue: acceptability
  - what makes people want to use technology?
  - what prevents people from using it?

- first step is understanding
  - what do they value?
  - what do musicologists do?

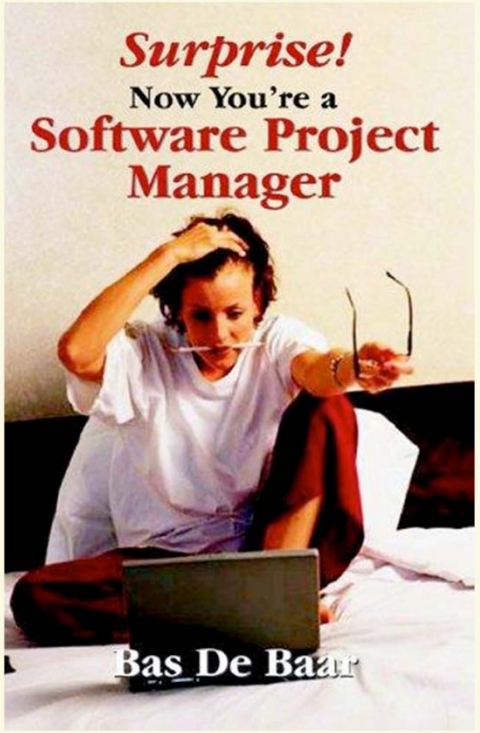
- meet them in their own world
  - flow of stakes
  - contextual design

Flow of stakes

- software design begins with stakeholders
  - produce requirements
  - requirements ≠ stakes
- nearly always, stakes remain implicit
  - expectations, hopes, fears, values

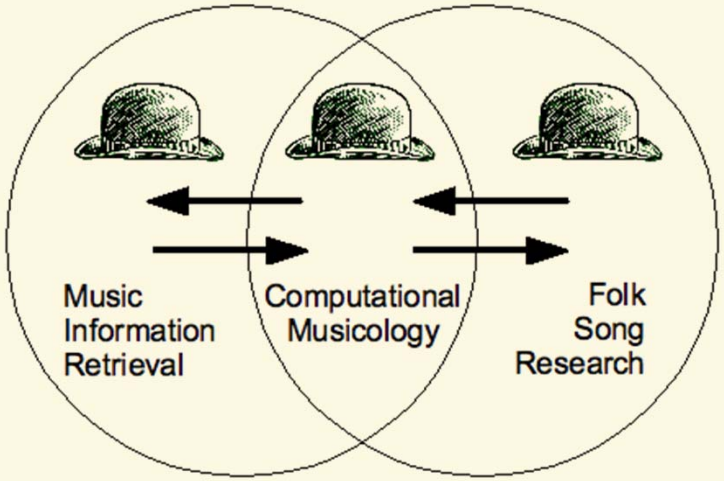
- requirements can be negotiated, stakes cannot

Bas de Baar



WITCHCRAFT project (2006-2010)

- aim: to create melody search engine for Dutch folk songs
  - seemed easy enough
- domain experts had bizarre terminology
  - identity of a melody
  - tune family
- focus on eliciting expert knowledge
  - observation, participation, modelling, evaluation
- collaboration model with 3 roles
- interactive paradigm
  - experts use search engine improve classification



A bone one can chew on both sides

- quote: Leen Breure
- hypothetical example
  - computer science: multimedia analysis
  - humanities: contextualise
  - possible solution: linked data research

- stakes are fixed, requirements can be negotiated

Hans Holbein, *The Ambassadors* (1533)

Playing the interdiciplinarity game

- good rules respect everyone's stakes
  - if 'subjectivity' is someone's core value, it makes no sense to claim that one needs to be objective
  - observe your own standards in your part of the project, but do not violate those of others
- remember, you don't bring the truth, you just belong to a tribe with a different perspective on things

Contextual Design

- Contextual Design is a structured, well-defined user-centered design process that provides methods to collect data about users in the field, interpret and consolidate that data in a structured way, use the data to create and prototype product and service concepts, and iteratively test and refine those concepts with users

- redesigning work processes
- user is expert

Holtzblatt, Karen and Beyer, Hugh R. (2011). Contextual Design. In: Soegaard, Mads and Dam, Rikke Friis (eds.), *Encyclopedia of Human-Computer Interaction*. Aarhus, Denmark: The Interaction-Design.org Foundation. Available online at http://www.interaction-design.org/encyclopedia/contextual_design.html.

Role models for the analyst

archeologist

detective

psychologist

antropologist

disciple

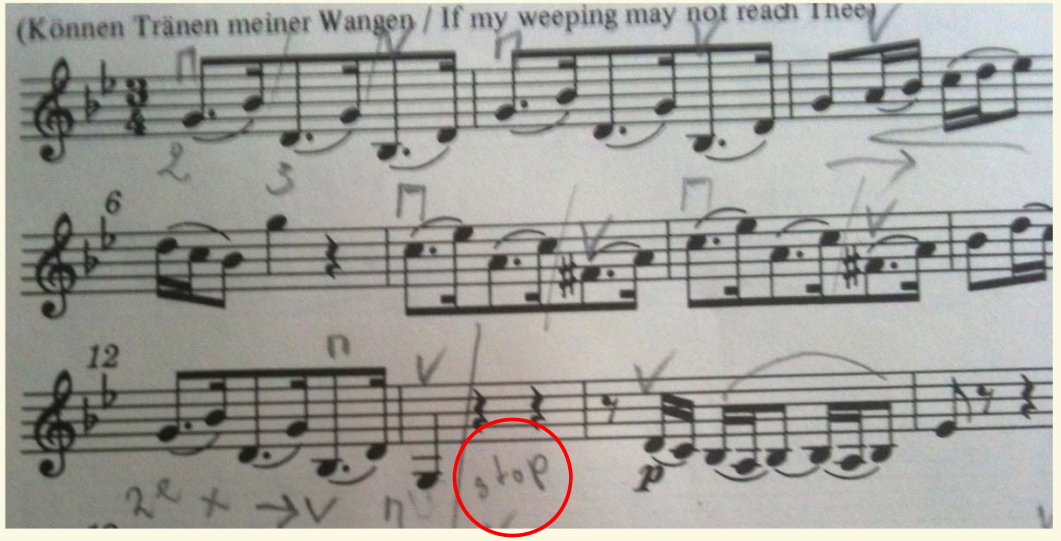
Work modelling

- annotated graphical models
  - flow (communication)
  - sequence (actions)
  - artefact (objects)
  - cultural (values)
  - physical (location)
- indicate *breakdowns*

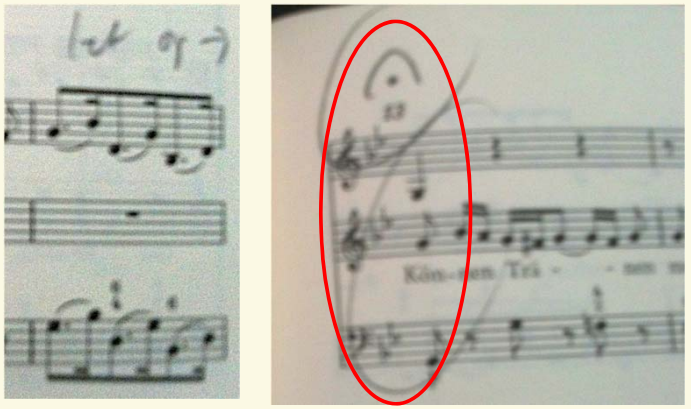
- toy example
  - digital score for performance
  - Westerkerkkoor, Amsterdam (2012)

Artefact modelling

continuous note taking

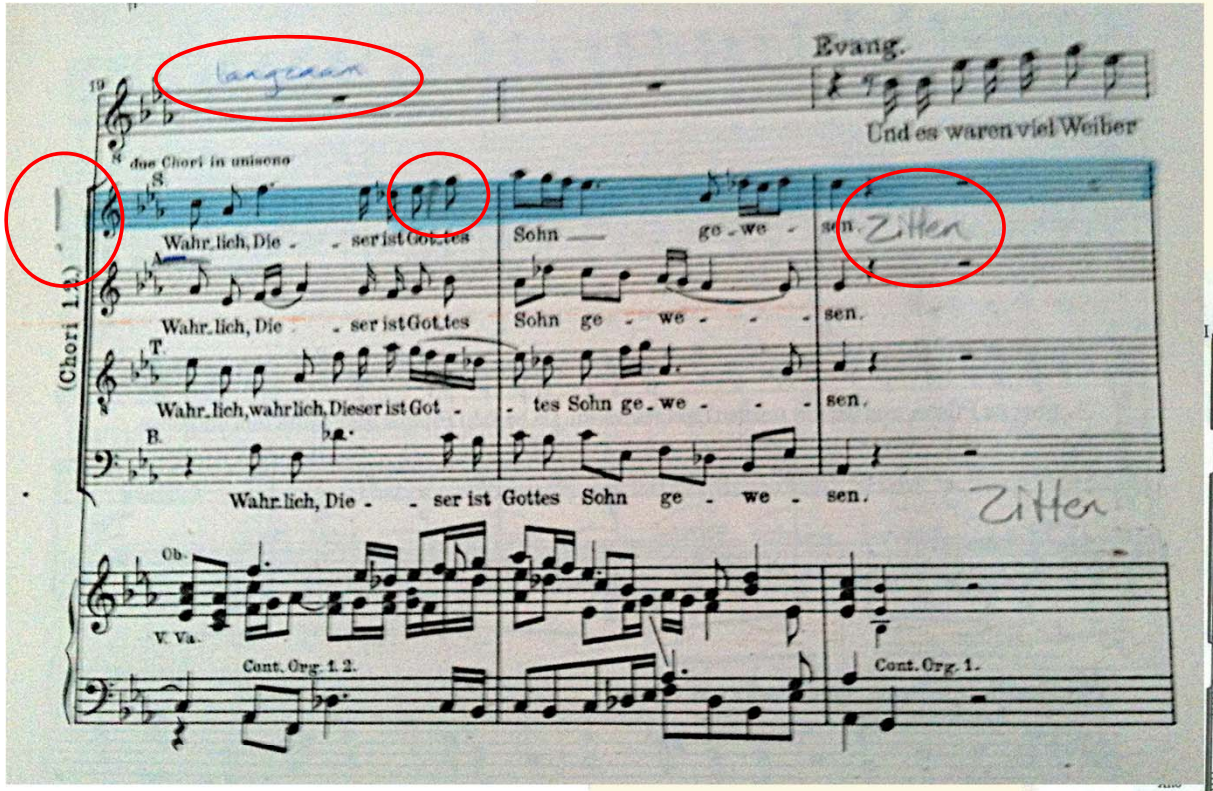


violin part

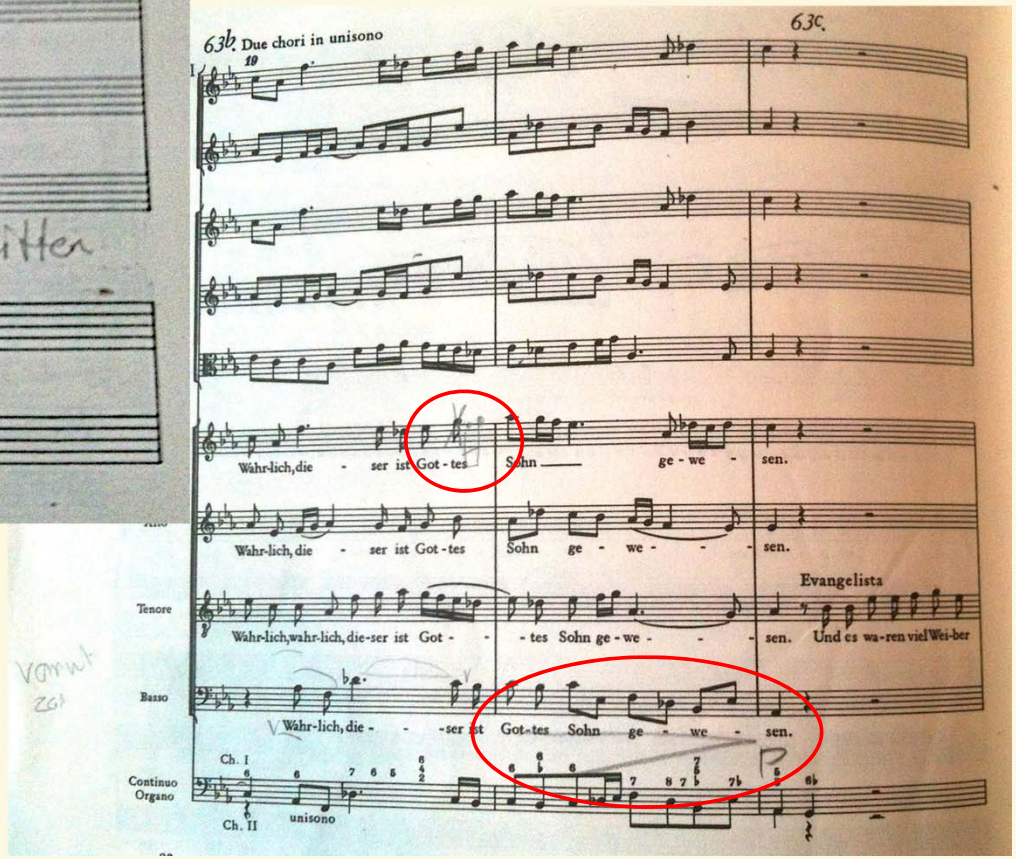


conductor's score

Scores used by singers



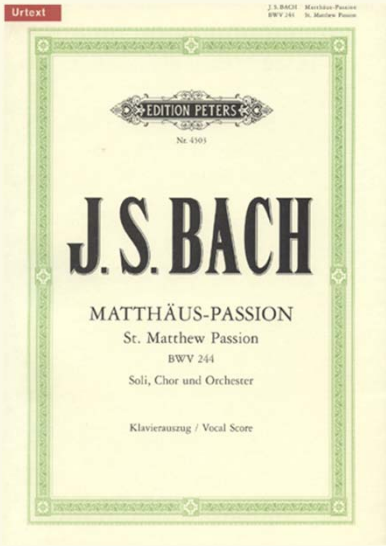
annotations
- changes
- interpretation decisions
- warnings/problems



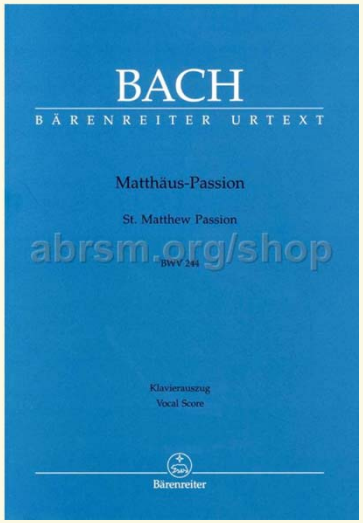
breakdowns:
- inconsistencies between singers
- previous performances
- different editions

Sample breakdown

MATTHÄUSPASSION		Westerkerkkoor		2013	
Nummering					
Bärenreiter	Peters	**SVP in je eigen bladmuziek aantekenen!!**			
		NB Staan / zitten is hier en daar anders dan bij eerdere uitvoeringen. SVP controleren!			
		Koor I	Koor II		
1	1	X *(x=zingt)*	X *(x=zingt)*	Kommt, ihr Töchter…	
2	2			Da Jesus diese…	
3	3	X	X	Herzliebster	
4.a	4			Da versammleten…..	
4.b	5	X	X (hierna zitten)	Ja nicht auf das Fest	
4.c	6			Da nun Jesus	
4.d	7	X		Wozu dienet…	
4.e	8	(hierna zitten)		Da das Jesus merkete..	
5	9			Du lieber Heiland	
6	10			Buß und Reu	
7	11			Da ging hin der Zwölfen einer	
8	12	(hierna staan)		Blute nur…	
9.a	13			Aber am ersten Tage	
9.b	14	X		Wo, wo willst du…	



12.80 €



16,95 €

- directions for renumbering from email attachment
  - identified through participatory observation

Conclusion Contextual Design

- participatory observation is essential for *understanding* and *redesign* of work practices
- very few studies in workplace anthropology among musicologists
  - Mathieu Barthet, Simon Dixon. *Ethnographic Observations of Musicologists at the British Library.* ISMIR 2011
  - Richard Lewis. *Understanding Technology Adoption in Musicology.* IMS 2012
- rich analysis of work practices is hardly ever part of project descriptions
  - future MEI applications?

General conclusion

- stop focusing on technology
  - there's probably more than enough of it
  - and it is seldom the real issue at stake

- practice human-centred design
  - MEI excellent case
  - look for opportunities during this conference

- MEI as the core of a new Interactive Musicology?

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