


Technological challenges and possibilities in the ENOMA project

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Outline


- **Music research at DEI**
- **Collaborations**
- **Challenges and possibilities**


 **DEI**

DEPARTMENT OF
INFORMATION
ENGINEERING
UNIVERSITY OF PADOVA

- **DEI: Dept. of Information Engineering
University of Padova**
- **Research on music**
 - Sound and music computing
 - Information management systems
 - Audio restoration and music digitalization
 - Open music


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 **Sound and Music Computin**



- **Sound synthesis/processing**
- **Audio in multimodal rendering**
- **Expressiveness in music and audio**
- **Music performance modeling**
- **Interactive performance and music production**
- **Audio restoration**


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Main research projects

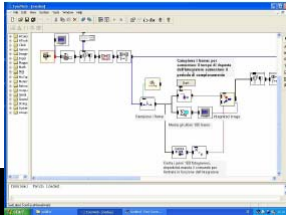

- **Enactive Interfaces: EU NoE (Network of Excellence)**
- **S2S2 – Sound-to-Sense, Sense-to-Sound: EU Coord. Action**
- **MEGA – Multisensory Expressive Gesture Applications: EU IST**
- **MOSART – Music Orchestration Systems in Algorithmic Research and Technology: IHP network**
- **CONGAS – Control Gestures in Audio Systems: EU COST**
- **DAFx – Digital Audio Effects: EU COST**
- **Audio heritage preservation: CNR national project**
- **Sound Control Co-Design: National project**
- **Sound models in human-computer interaction: National project**
- **Preservative rerecording and restoration of audio documents: La Biennale di Venezia**

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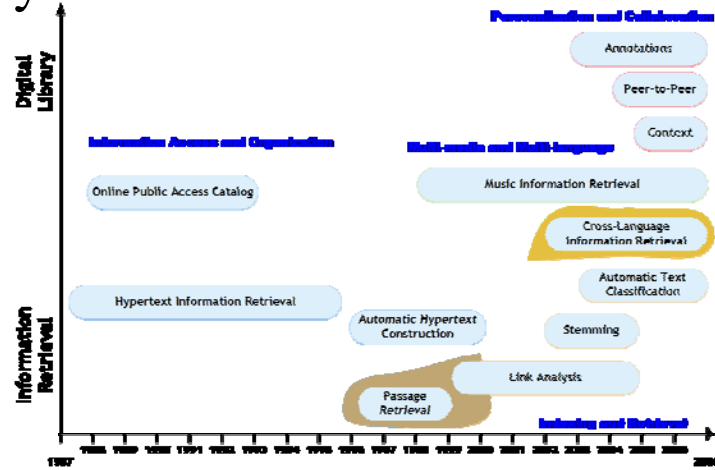
Musical production

- **Computer and Electronic Music**
- **Music for live electronics**
- **Technologies for music production**
- **Recent productions and installations**
 - “Medea” by Guarnieri
 - “The embalmer” by Battistelli
 - “Il sogno” by Sciarrino

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Information Management Systems




▪ Reference: Maristella Agosti


Research threads



- Highly dynamic/multi platform heterogeneous environments and rich media formats: P2P
- Models to support contextual navigation
- Annotations on heterogeneous environments
- Music search also for possible future business opportunities
- Cultural diversity spectrum: Cross-Language search engines evaluation infrastructures



Main research projects



- **DELOS: EU Network of Excellence on Digital Libraries**
- **CLEF: Cross-Language Evaluation Forum: UE project**
- **ECD: Enhanced Content Delivery: CNR project**
- **IPSA: Imaginum Patavinae Scientiae Archivum: national project**
- **SIAR for local government archives: regional project**
- **ALFA: Mobility Network EU-Latin America**

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Cooperations: Mirage




- **Musical Informatics Research and Applications Lab. University of Udine at Gorizia**
- **Research topics**
 - Cataloguing of audio documents
 - Preservation (recording systems and audio documents)
 - Carrier and audio restoration
- **Reference: Sergio Canazza**

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Research Projects




- **EU Culture 2000: Preservation and On-line Fruition of the Audio Documents from the European Archives of Ethnic Music.**
- **PRIN national project : Contemporary music Italian archives.**
- **PRIN national project: Conservation and philological restoration of Bruno Maderna's audio documents.**
- **La Biennale di Venezia: Preservative rerecording and restoration of audio documents (with DEI)**
- **Armida. Multimedia system for recognition, indexing and retrieval of musical data. Regional grant**
- **Socrates-Grundtvig project "Connecting memories". EU grant.**
- **Preservation and restoration of Luigi Nono's electronic music on tape.**

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Cooperation: Conservatory of Padova


- **Research topics**
 - Free software and Creative Commons licensing for music
 - Musical gesture data analysis
 - Electronic music archives
 - eLearning for higher music education
- **Research projects**
 - S2S2 – Sound-to-Sense, Sense-to-Sound: EU Coord. Action
 - CONGAS – Control Gestures in Audio Systems: EU COST
 - DAFx – Digital Audio Effects: EU COST
 - AGNULA - A GNU/Linux Audio distribution: EU IST
- **Reference: Nicola Bernardini**



Sound to Sense, Sense to Sound




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Challenges

- Peculiarities of music language
- Forms of music documents
- Content in music
- Music search
- Music digitalization
- Non-commercial music distribution

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Peculiarities of Music Language

- A music work can be represented in two different ways:
 - the notated form → score
 - the acoustic form → performance
- **Challenges:**
 - from performance to score, to expression, . . .
 - from score to performance
- Each music work may have different instantiations
 - more performances correspond to an individual score
 - the same music work may be transcribed into different scores
- The choice of a representation format has a direct impact on access and retrieval

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Forms of Music Documents

- **Symbolic/structured music documents**
 - represent the information on the music score
 - → only musically trained users can read them
 - indicate how the piece is to be played by the performer
 - contain information on melody, harmony, structure, key and time signatures, ...
- **Audio/unstructured music documents**
 - are related to the perception of music by listeners
 - → all users can listen to them
 - are audio recordings of real performances
 - contain information on timbre, expressive gestures, ...
- **Challenge:**
 - not all the needed information can be extracted directly from the document

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Content in music

- **It is still unclear what type of content, if any, music works do convey**
- **Study how music is perceived and processed by listeners**
 - to highlight which kind of content is carried by this medium.
- **Listeners perceive music as structured and consisting of different basic elements**
- **Different dimensions characterize the information conveyed by music**
- **It is likely that all the dimensions of music language**
 - can be segmented in their basic elements
 - be used to extract a content from a music document

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Music Search

- **The access and search of musical documents is an emerging research area that focuses on**
 - the content-based access
 - retrieval of musical documents against musical queries.
- **Approaches and paradigms:**
 - content-based approach to indexing
 - query-by-example or query-by-humming paradigm
 - user-friendly interfaces for evaluation.


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Data vs. content based MIR

- **Data-based MIR approach:**
 - searching databases by specifying exact values for predefined fields
- **Limitations:**
 - bibliographic values are not always able to describe exhaustively and precisely the content of music works
 - the user must have a good knowledge of the domain
- **Content-based MIR approach:**
 - takes into account the music document content
 - automatically extracts some features to be used as content descriptors


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Evaluation of Retrieved Pieces

- **Ranking Relevant Documents**
- **Problems**
 - It takes time to download a complete audio performance
 - It takes time to evaluate whether an unstructured document is relevant or not
 - Copyright management
 - The user should be presented with a preview of the piece

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Digitalization

- **Tendency: automatic digitalization processes**
- **Problems:**
 - not adequate for electronic music and its derivatives
 - how to derive suitable information from audio and tape?
 - e.g. tracks numbers, junctions, recording artifacts, etc.
- **Unsolved problems of copyright management for research institutions for testing the methodologies**

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Digitalization approaches

- **Conservative Approach:**
 - focus on the physical nature of the original audio artifact
 - *How is the document?*
- **Documentary Approach:**
 - focus on the network of relationships that interweaves the copies
 - *Where is the sound fabric of the document?*
- **Sociological Approach:**
 - focus on the reception of the audio artifact as it was originally heard
 - *How was the document perceived?*
- **Authorial Approach:**
 - focus on the original intentions of the author
 - *How should the document have been?*
- **Aesthetic Approach:**
 - focus on publishing and potential commercial value
 - *Can the document be transformed?*

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Music distribution

- **Public access**
 - which rights deliver to archive users?
- **Reputation systems (e.g. e-bay, amazon.com)**
 - A reputation system collects, distributes, and aggregates feedback about participants' past behavior.
- **Reuse of music**
 - digital identity: who is the author of networked music
- **Entertainment model: not adequate for non-commercial music**
- **Non commercial music vs. scientific literature**
 - wide accessibility
 - peer reviewing
 - impact factors

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