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Back to fundamentals of research: Interdisciplinarity

Roundtable 2: The researchers' perspective

Francisco Xavier de la Cruz Montserrat; Ana Clara Mourão Moura; Evert van Emde Boas; Giorgio Franceschelli; Adriana Latorre; Yasaman Yousefi

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09/10/2024

Aula Giorgio Prodi - Piazza San Giovanni in Monte 2 , Bologna

Roundtable 2: The researchers' perspective

ISA Visiting Fellows

- Francisco Xavier de la Cruz Montserrat (*Vall d'Hebron Hospital Institute of Research)*
- Ana Clara Mourão Moura *(Federal University of Minas Gerais, Department of Urban Planning)*
- Evert van Emde Boas *(Aarhus University, School of Culture and Society)*

ISA Doctoral Prize Winners – University of Bologna

- Giorgio Franceschelli *(Department of Computer Science and Engineering)*
- Adriana Latorre *(Department of Cultural Heritage)*
- Yasaman Yousefi *(Department of Legal Studies)*

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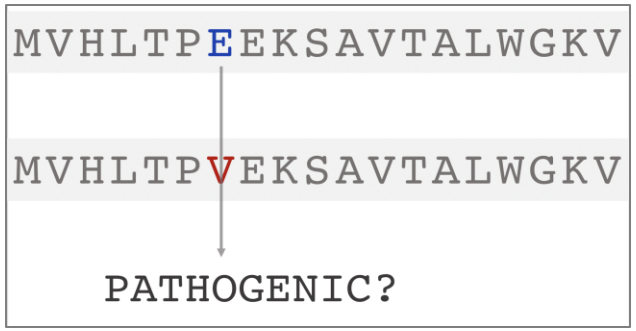
Pathogenicity prediction using Artificial Intelligence (AI) tools

Francisco Xavier de la Cruz Montserrat

Hospital Universitari Vall d'Hebron - Institució Catalana de Recerca i Estudis Avançats – Spain

Interdisciplinarity | Roundtable 2: The researchers' perspective

- **Name and Affiliation:** Francisco Xavier de la Cruz Montserrat; Hospital Universitari Vall d'Hebron - Institució Catalana de Recerca i Estudis Avançats (ICREA)
- **Pathogenicity prediction using Artificial Intelligence (AI) tools**
- **Field: Bioinformatics**
- **Description of the case study: My research is primarily methodological, with a strong focus on healthcare applications**
- **Take home messages** (benefits and challenges of interdisciplinary research related to the case study)
  - Ben.- No field has a complete answer to our problem
  - Ben.- Integration is feasible because of AI
  - Chall.- Identifying all the components of the answer
  - Chall.- Data origin, scarcity, and heterogeneity affect the performance of AI models
  - Chall.- Interpreting the results



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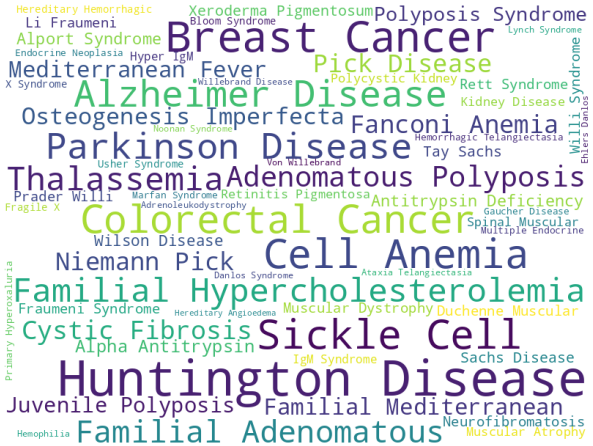
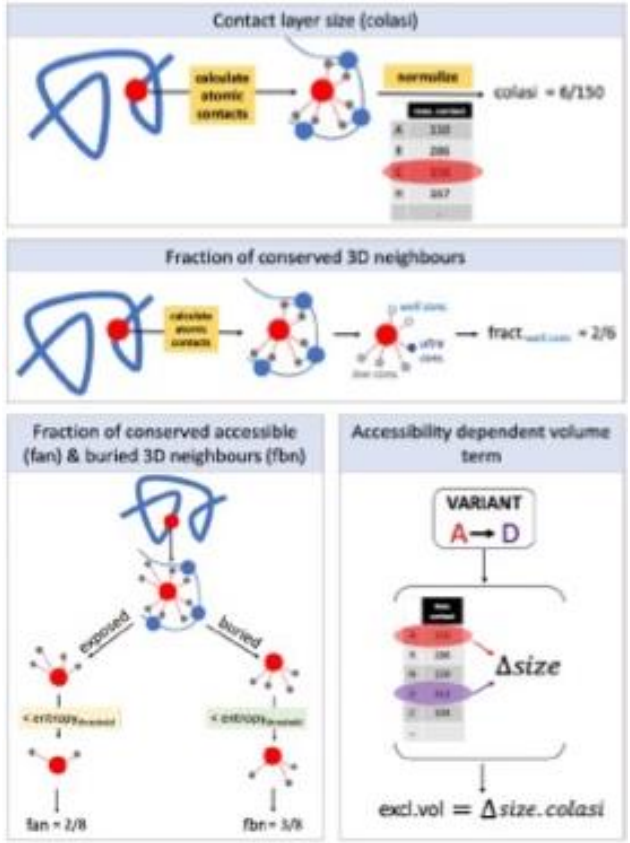
DATA ON HEREDITARY DISEASE

- biomedical res.
- computational sci.
- etc.



WHAT MAKES A VARIANT PATHOGENIC

- biophysics
- biochemistry
- mol. biol.



ARTIFICIAL INTELLIGENCE TOOLS

- computational sci.
- statistics
- maths?

- **Neural Networks**
- **Random Forests**
- **…**

VALIDATION CLARIFIED

- statistics
- application field

- **Cross-Validation:**
  - **N-FOLD**
  - **LOOCV**
  - **LGOCV**
- **Independent Valid.**

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Geodesign and Geoprocessing: facing the challenges of global climate changes

Ana Clara Mourão Moura

Federal University of Minas Gerais – Brazil

Interdisciplinarity | Roundtable 2: The researchers' perspective

- **Name and Affiliation:** Ana Clara Mourão Moura; Federal University of Minas Gerais, Brazil (UFMG)
- **Project title:** Geodesign and Geoprocessing: facing the challenges of global climate changes
- **Description of the case study:** Geospatial technologies as resources to characterize the territory, presenting characteristics, vulnerabilities and potentialities of the place, to support decision making to deal with the challenges of climate changes. Geodesign as a method of co-creation and to face the values of interoperability, between different actors in society and different values to be considered. The use of geovisualization resources, to make data available to citizens and technicians; the use of interoperability between digital systems, so that we can share data and information; the commitment to use defensible and reproducible criteria, so that people can understand our planning and project; the respect to the sense of scalability, because we must face many case studies; and of adaptability, because each case study has its own local characteristics.

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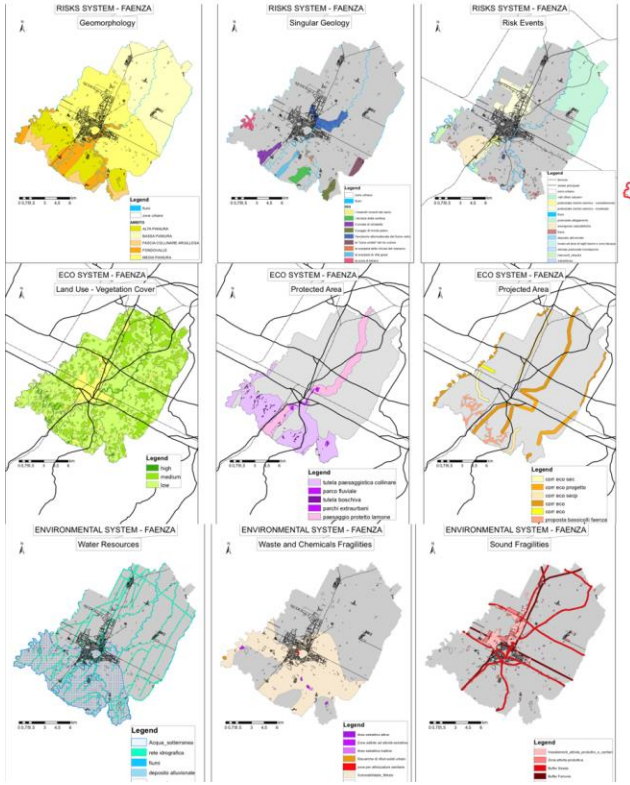
Geospatial technologies

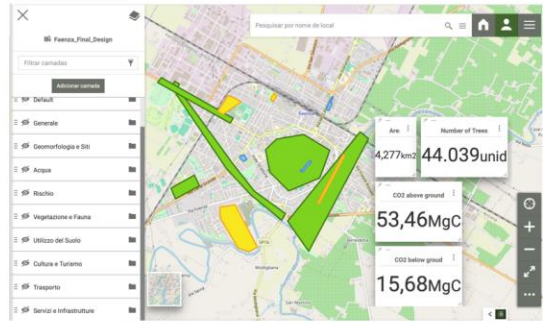
GEODESIGN

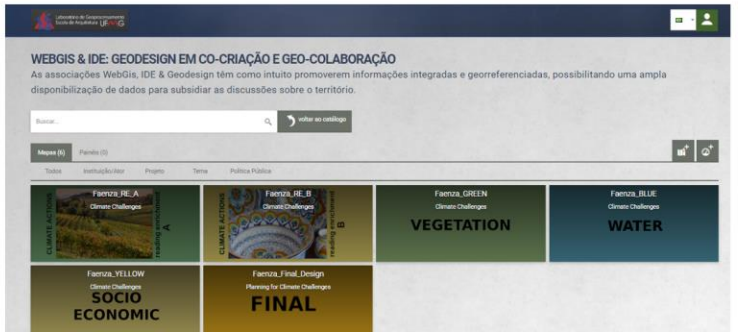
Data production and distribution	Spatial Analysis Models	Predictive Models	Propositional Models
Data	Analysis	If-Then	Propositional
SDI data sources	Diagnosis and Prognosis	Future Scenarios	Creation and Co-Creation



FAENZA– PLANNING FOR CLIMATE CHANGES

accumulation





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Adults at Play(s)

Evert van Emde Boas

Aarhus University – Denmark

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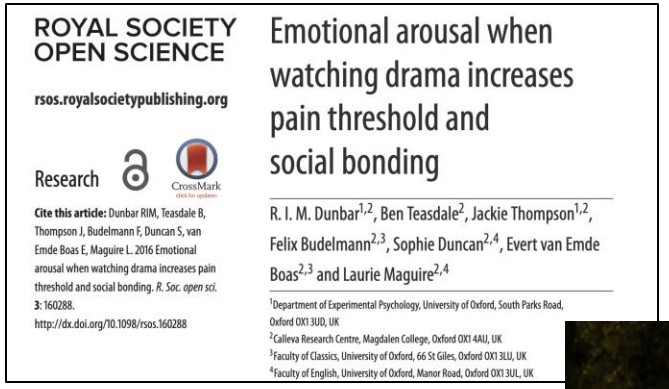
- **Name and Affiliation:** Evert van Emde Boas; Aarhus University (School of Culture and Society, Department of History and Classical Studies)
- **Project name:** Adults at Play(s)
- **Field:** classical studies (specialization in Ancient Greek language and literature), but interest in cognitive approaches to (ancient) literature, and in interdisciplinary work traversing literary studies/drama studies and (cognitive, social) psychology
- **Description of case study:** research collaboration between classicists, English literature scholars, and psychologists, investigating the psychology of drama audiences.
- **Example 1: Endorphins (?)**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Research

Cite this article: Dunbar RIM, Teasdale B, Thompson J, Budelmann F, Duncan S, van Emde Boas E, Maguire L. 2016 Emotional arousal when watching drama increases pain threshold and social bonding. *R. Soc. open sci.* **3**: 160288. http://dx.doi.org/10.1098/rsos.160288

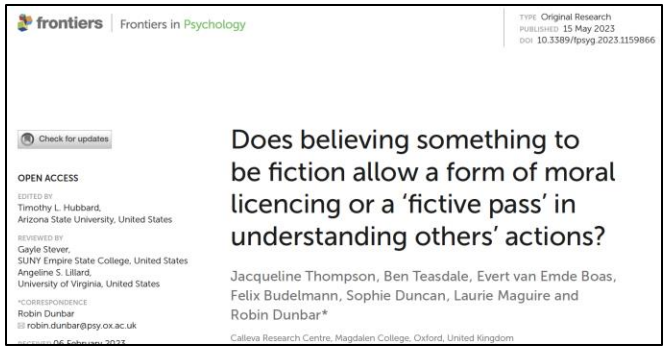
Emotional arousal when watching drama increases pain threshold and social bonding

R. I. M. Dunbar[1,2], Ben Teasdale[2], Jackie Thompson[1,2], Felix Budelmann[2,3], Sophie Duncan[2,4], Evert van Emde Boas[2,3] and Laurie Maguire[2,4]

[1]Department of Experimental Psychology, University of Oxford, South Parks Road, Oxford OX1 3UD, UK
[2]Calleva Research Centre, Magdalen College, Oxford OX1 4AU, UK
[3]Faculty of Classics, University of Oxford, 66 St Giles, Oxford OX1 3LU, UK
[4]Faculty of English, University of Oxford, Manor Road, Oxford OX1 3UL, UK

Stuart: A Life Backwards

Example 2: Real vs. fiction


frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 15 May 2023
DOI 10.3389/fpsyg.2023.1159866

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EDITED BY
Timothy L. Hubbard,
Arizona State University, United States

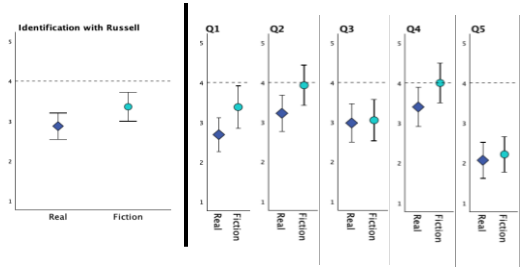
REVIEWED BY
Gayle Stever,
SUNY Empire State College, United States
Angeline S. Lillard,
University of Virginia, United States

*CORRESPONDENCE
Robin Dunbar
robin.dunbar@psy.ox.ac.uk

Does believing something to be fiction allow a form of moral licencing or a 'fictive pass' in understanding others' actions?

Jacqueline Thompson, Ben Teasdale, Evert van Emde Boas, Felix Budelmann, Sophie Duncan, Laurie Maguire and Robin Dunbar*

Calleva Research Centre, Magdalen College, Oxford, United Kingdom



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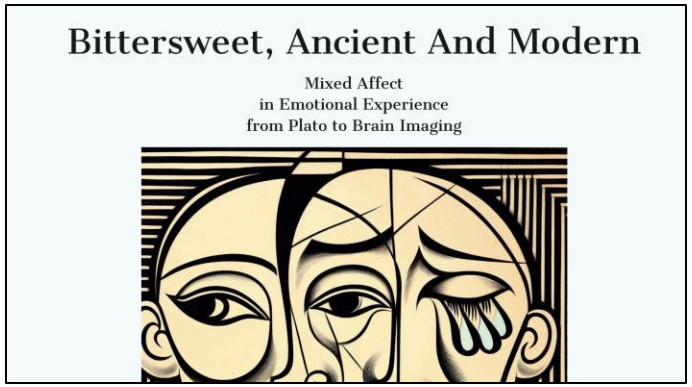
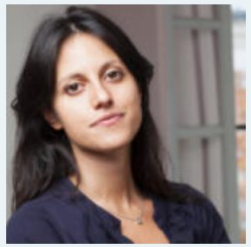
- 



Pia Campeggiani, PI

- **Take-home messages:**
  - **Research design**
  - **Publication strategy**

frontiers | Frontiers in Psychology ⟷ The Cambridge Quarterly ⟷ Scientific Study of Literature

  - **Interdisciplinary 'daily life'**

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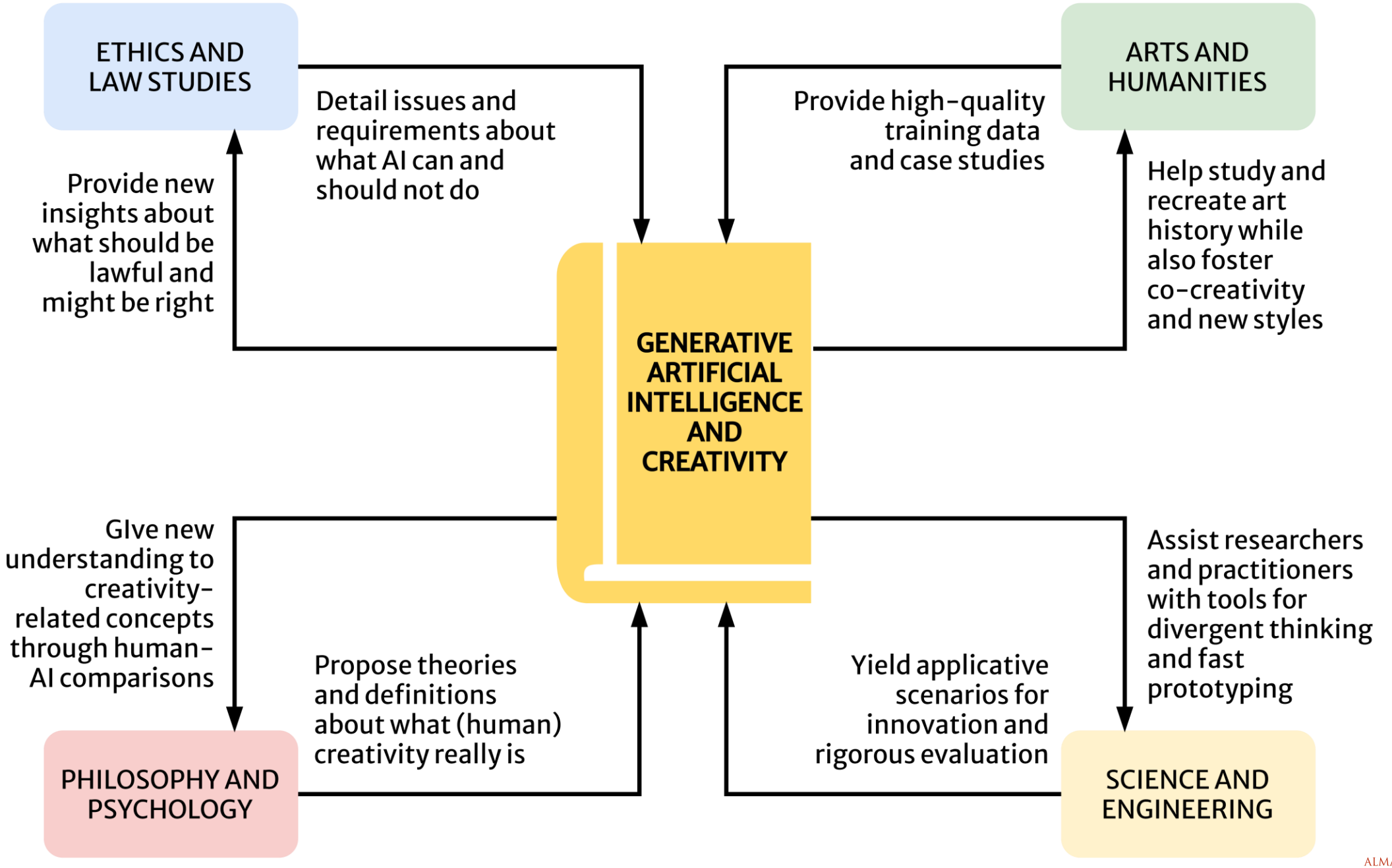
Generative Artificial Intelligence and Creativity

Giorgio Franceschelli

Department of Computer Science and Engineering

Interdisciplinarity | Roundtable 2: The researchers' perspective

- **Name and Affiliation:** Giorgio Franceschelli – Department of Computer Science and Engineering, University of Bologna
- **Project name:** Generative Artificial Intelligence and Creativity
- **Description of the case study**: Application of reinforcement learning techniques to develop generative AI models that are closer to human theories of creativity and less dependent on training data, addressing ethical and legal issues, and providing tools to foster divergent thinking.



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A multidisciplinary approach to the study of the lagoon population of Venice

Adriana Latorre

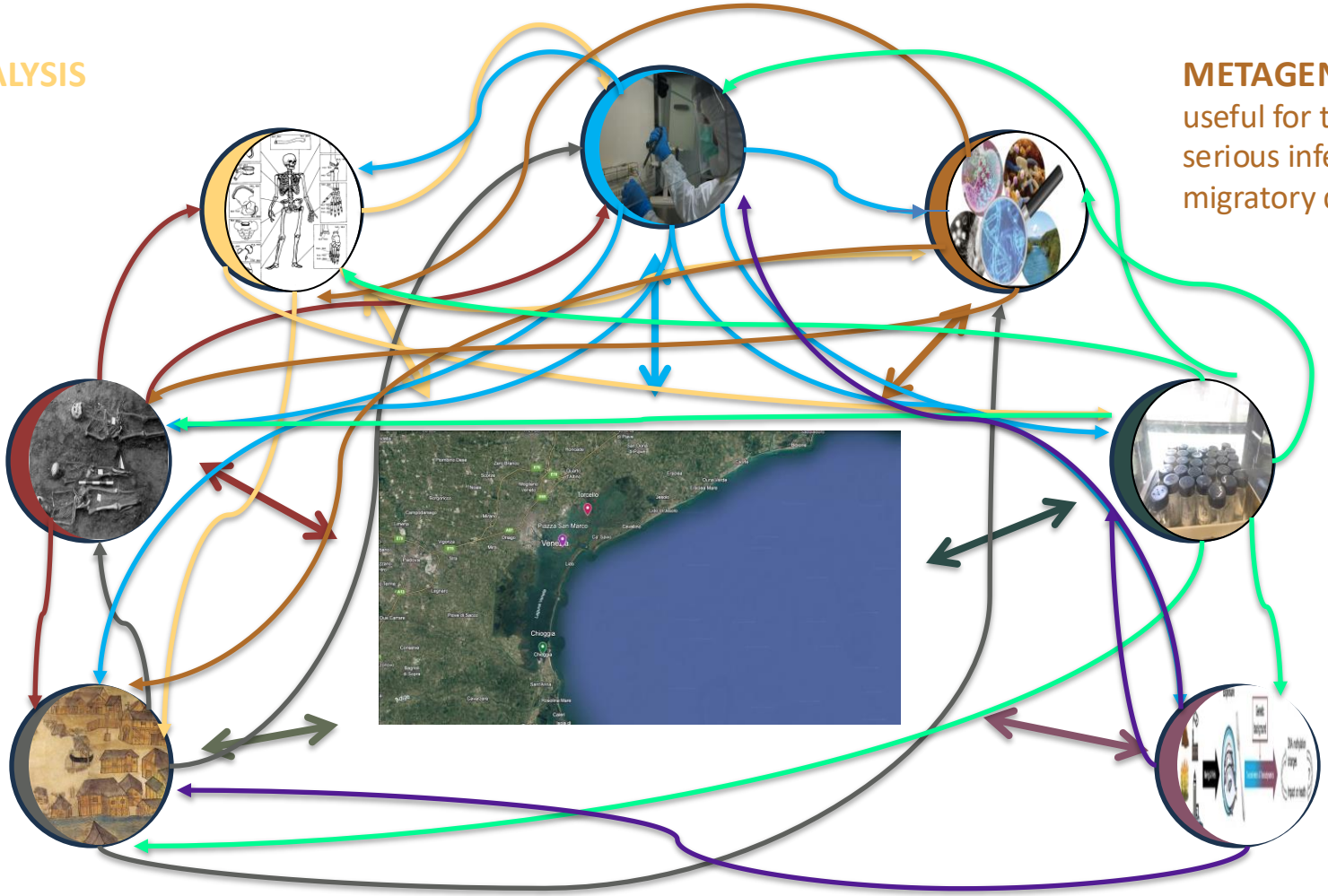
Department of Cultural Heritage

Interdisciplinarity | Roundtable 2: The researchers' perspective

GENETIC ANALYSIS
useful for understanding the changes in genetic composition of the original population due to exchanges between culturally diverse groups.

ANTHROPOLOGICAL ANALYSIS
Useful for understanding adaptive dynamics

METAGENOMIC ANALYSIS
useful for trace pathogens responsible for serious infectious diseases and for tracing the migratory dynamics of these microrganisms



ARCHEOLOGICAL ANALYSIS
Useful for understanding socio-evolutionary dynamics

ISOTOPIC ANALYSIS:
Useful for reconstructing the diet and the movements of individuals

HISTORICAL ANALYSIS
Useful for the understanding of microevolutionary dynamics

HEAVY METAL ANALYSIS
Useful for verifying the presence of pollutants, such as metyl mercury, in human skeletal remains

A multidisciplinary approach to the study of the lagoon population of Venice

Adriana Latorre, Department of Cultural Heritage, University of Bologna

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Challenges and Benefits of Interdisciplinary Research

BENEFITS:

- Exploring other disciplines allows for broader avenues of dialogue regarding the research project
- The combination of data from different disciplines can lead to new discoveries that would not have emerged by considering only data from more narrow research fields
- A better and more reliable understanding is provided by comparing different scientific data
- It fosters teamwork among experts with different skills, promoting the exchange of ideas and diverse approaches

CHALLENGES:

- Different and hard-to-understand research terms
- Different ways of interpreting data
- Different research studies provide results that don’t match
- The combination and integration of data from different disciplines can be complicated

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The Quest to Fairness in AI

Yasaman Yousefi

Department of Legal Studies

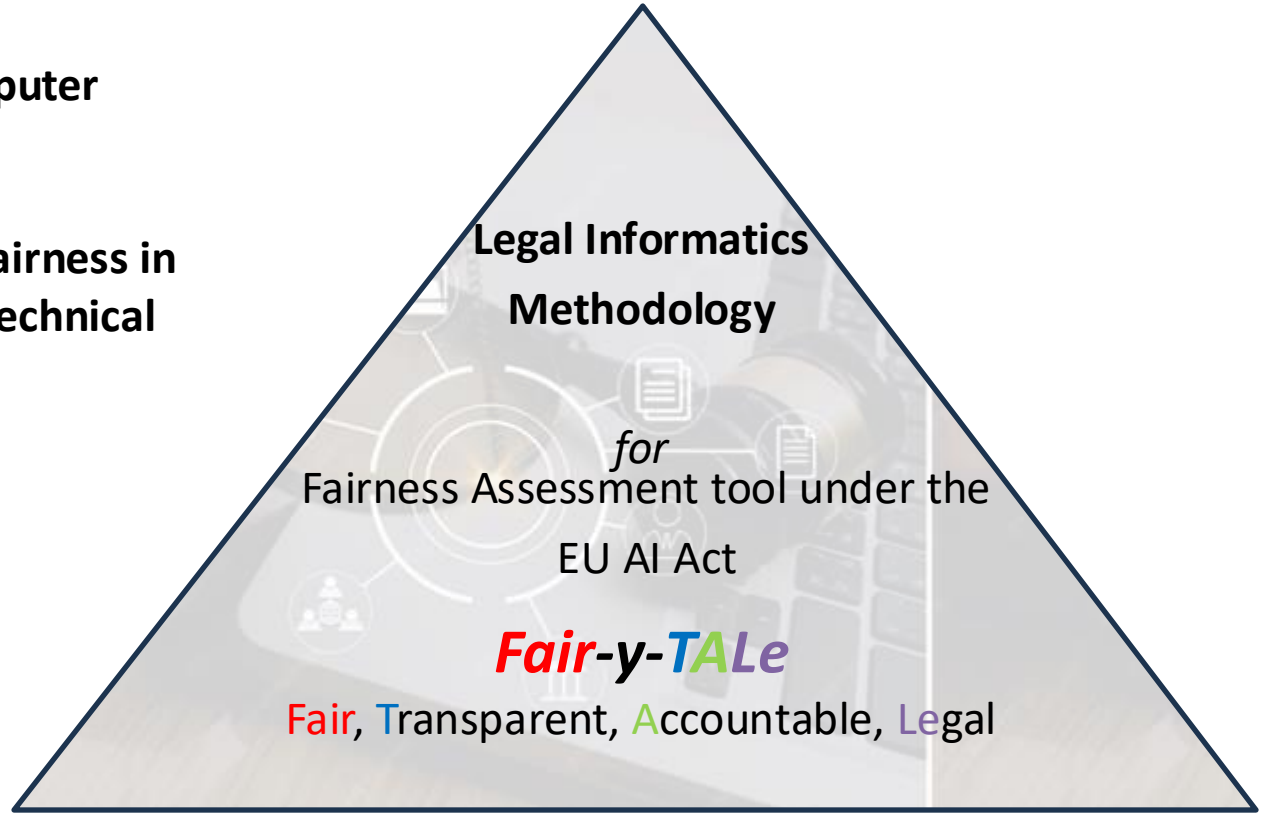
Interdisciplinarity | Roundtable 2: The researchers' perspective

- **Yasaman Yousefi, PhD Candidate in Law, Science and Technology at Unibo,**
- **PhD candidate in Computer Science at Unilu**

- **Thesis: The Quest to Fairness in AI: Ethical, Legal and Technical Solutions**

Ethics and Philosophy of Law

What is fairness?



Legal Research

How is fairness interpreted and guaranteed?

Technical Research

(How) Can fairness be integrated in AI systems?

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Challenges and Benefits of Interdisciplinary Research

Benefits

- Holistic Understanding of the Problem
- Innovative Solutions
- Practical Impact
- Cross-disciplinary Learning
- Future-oriented
- Better job opportunities and a Unique Profile

Challenges

- Integration of Diverse Disciplines
- Conflicts in Terminologies and Notions
- Technical Complexity
- Publication Difficulties- Getting validation and setting common grounds
- Background Insufficiency
- Dynamic Legal and Technological Landscape

Yasaman.yousefi3@unibo.it

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