

# SYNERGY<sup>★</sup>

## Designing and Building Hybrid Human–AI Systems

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### Abstract

The SYNERGY 2025 workshop was held at the Fourth International Conference on Hybrid Human-Artificial Intelligence (HHAI) in Pisa, Italy. The workshop explored the intersection of advanced visual interfaces and AI, investigating models for collaboration, ethics, and practical AI applications in augmenting human cognition. Through keynote presentations, interactive exercises, and collaborative discussions, the workshop fostered interdisciplinary dialogue aligned with HHAI's focus on innovative HCI research.

### Keywords

Human-Centered AI, Interaction Design, Visual Interfaces, Augmented Cognition, Human-AI Collaboration, AI Ethics, Interactive Systems, Cognitive Augmentation

## 1. Introduction

The SYNERGY workshop continued the exploration of Joseph Licklider's 1960 vision of "Man-Computer Symbiosis", examining how AI systems can work alongside people in complex tasks to augment human intellect. Building on the success of the first SYNERGY workshop at AVI 2024 [1], this second iteration focused on the design, implementation, and evaluation of systems enabling meaningful human-AI collaboration.

The workshop addressed a critical challenge in contemporary AI development: moving beyond human-in-the-loop systems where humans function as mere cogs in the machine, toward true synergy where AI algorithms adapt to work meaningfully with human intervention and user interactions make human intentions more available to AI systems.

## 2. Workshop Format

The half-day workshop employed an innovative format designed to promote active participation and collaborative knowledge construction. The session began with a keynote presentation sharing our ideas about what elements are important when designing Human-AI systems in decision-making contexts, establishing foundations for subsequent discussions.

Following the keynote, participants engaged in a "flash talk madness" session where each of the 13 accepted papers was presented in exactly 2 minutes using a single slide, creating an energetic overview of the submitted work.

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HHAI-WS 2025: Workshops at the Fourth International Conference on Hybrid Human-Artificial Intelligence (HHAI), June 9–13, 2025, Pisa, Italy

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The workshop then proceeded through three structured exercises:

**Exercise 1: Discussion** Participants worked in small groups to critically examine and refine the keynote, discussing categories, definitions, and theoretical foundations through targeted provocations about collaboration, trust, reliance, and ecological validity.

**Exercise 2: Paper Classification** Groups collaboratively positioned submitted papers, identifying where contributions fit, areas of density and sparsity, and works that challenged existing categorizations.

**Exercise 3: Synthesis and Mapping** An ambulatory plenary session where participants physically arranged poster materials to create thematic connections and visualize relationships between different approaches and findings.

### 3. Accepted Papers

The workshop received 15 paper submissions addressing various aspects of human-AI collaboration. Following peer review, 13 papers were accepted, representing diverse perspectives on interactive decision-making systems, adaptive collaboration frameworks, evaluation methods, and implementation architectures. From these accepted contributions, 10 papers were selected for publication in these proceedings.

The accepted papers were:

- Methods to Effectively Communicate Verbal Probability Expressions in Human-AI Teams. *Christian Fleiner, Joost Vennekens*
- Designing AI Systems that Preserve and Promote Human Creative Agency. *Eran Barak Medina*
- Everyday-Life Information-Seeking With AI: How Insights From ELIS Can Help Design Trustworthy AI Systems. *Rebecca Guerrini, Andrea Beretta*
- A Hybrid Human-Centric approach to combining Rule-based and Attribute based Explanations. *Bahavathy Kathirgamanathan, Gennady Andrienko, Natalia Andrienko*
- Maintaining Coherence in Explainable AI: Strategies for Consistency Across Time and Interaction. *Alan Dix, Tommaso Turchi, Ben Wilson, Alessio Malizia, Anna Monreale, Matt Roach*
- An AI Act-Driven Design for Detecting Brain Tumors through Reconfiguration. *Antonio Curci, Andrea Esposito*
- Melete: Validating the Creativity Support Index as a Metric for Evaluating the Integration of AI In Software Pipelines. *Sokol Murturi, Matthew Yee-King, Joseph Walton-Rivers, Michael Scott, Marco Gillies*
- Melete: Exploring the Components of Mixed-Initiative Artificial Intelligence Pipelines for Level Design. *Sokol Murturi, Tony Pellicone, Matthew Yee-King, Marco Gillies*
- Melete: Play testing and 3D environments for Mixed Initiative Artificial Intelligence as a method for prototyping video game levels. *Sokol Murturi, Joseph Walton-Rivers, Michael Scott*
- Birds of a Different Feather Flock Together: Exploring Opportunities and Challenges in Animal-Human-Machine Teaming. *Myke Cohen, Xiaoyun Yin, David Grimm, Reuth Mirsky*
- Who is an Expert? The Role of Human Expertise in Human-AI Synergy Studies. *Michelle Mancenido, Erin Chiou*
- Bayesian reasoning for overcoming over-reliance in AI-assisted decision making. *Daria Mikhaylova, Tommaso Turchi, Gustavo Cevolani, Alessio Malizia*
- “It’s Not About Doing Less Thinking, It’s About Thinking Differently”: Cognitive Redistribution in Human-AI Co-Creative Systems. *Chaeyeon Lim*

Selected authors will be invited to submit extended versions of their work to a future special issue, providing an opportunity for deeper exploration of their research contributions.

The workshop attracted participants from multiple disciplines, including HCI practitioners and researchers, AI scholars, and technology enthusiasts, creating the rich interdisciplinary dialogue that characterizes the SYNERGY community.

## 4. Organisers

**Tommaso Turchi** is an Assistant Professor at the University of Pisa (Italy). His research focuses on Human-Centered AI and End-User Development. He has worked on various research projects related to the interaction with AI systems and is currently investigating the use of Design Fiction for AI-as-a-service applications in the medical field. His most recent work includes the development of a co-design toolkit to identify and address bias in ML-based collaborative decision-making domains.

**Alan Dix** is Professorial Fellow at Cardiff Metropolitan University (United Kingdom) and Emeritus Professor of the Computational Foundry at Swansea University. He is known for his HCI research, including a core textbook and pioneering work in mobile interfaces and machine learning bias. He is a member of the ACM SIGCHI Academy and his work includes both theoretical foundations and practical applications in diverse fields. Alan is known for his eclectic methods which combine technical, philosophical, and artistic insights, emphasizing the importance of technical creativity.

**Matt Roach** is a Senior Lecturer in Computer Science at Swansea University (United Kingdom), specializing in machine learning for smart city traffic management and fraud detection. His research interests include Machine Learning, Algorithmic Bias, and Human-Computer Interaction. He plays a key role in several large-scale collaborative projects and doctoral training initiatives. Prior to academia, Matt significantly contributed to computing skills development in industry and business sectors.

**Alessio Malizia** is an Associate Professor at the University of Pisa (Italy). His research focuses on Human-Centered AI and Design Fictions. He's involved in different National and International projects developing novel approaches for improving scientific methods to study Human-Artificial Intelligence Interaction.

**Ben Wilson** is a PhD candidate at Swansea University having done previous work in the UK National Health Service on health systems development, informatics, clinical outcomes capture and analysis. His current work is on human-machine synergy in relation to decision-making. He is a Research Officer on the Tango-Horizon project.

## 5. Key Themes and Contributions

The papers presented at the workshop address several critical areas in human-AI collaboration:

**Interactive Decision-Making Systems** Mechanisms and interfaces for real-time human-AI collaboration, including protocols for dynamic task allocation, methods for mutual understanding of capabilities, and approaches for handling disagreement and uncertainty.

**Adaptive Collaboration Frameworks** Systems that dynamically adjust based on ongoing interaction, featuring real-time assessment of cognitive load, learning mechanisms from human intervention, and context-aware collaboration strategies.

**Evaluation Methods** Novel approaches to measuring human-AI collaboration effectiveness, including metrics for assessing genuine partnership, methods for evaluating joint decision quality, and frameworks for comparing different collaboration models.

**Implementation Architectures** Practical solutions for building collaborative systems, including software patterns for responsive interaction, methods for maintaining human agency, and real-world case studies with lessons learned.

The workshop particularly welcomed submissions that presented concrete mechanisms for human-AI collaboration, provided empirical evaluation of collaborative systems, demonstrated novel interaction patterns, and addressed practical implementation challenges.

## 6. Looking Forward

The discussions and contributions from the workshop represent important steps toward realizing truly synergistic human-AI systems. The workshop's collaborative format and the diverse perspectives represented in the accepted papers continue to advance our understanding of how to design AI systems that genuinely augment human capabilities rather than replace them.

The SYNERGY workshop series remains committed to fostering this critical research area, bringing together researchers and practitioners to tackle the complex challenges of human-AI collaboration through both theoretical frameworks and practical implementations.

## Acknowledgments

This work was supported by multiple funding sources:

- Next Generation EU, in the context of The National Recovery and Resilience Plan, Investment 1.5 Ecosystems of Innovation, Project Tuscany Health Ecosystem (THE), Spoke 3 “Advanced technologies, methods and materials for human health and well-being”, CUP: B83C22003920001;
- Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Health and Digital Executive Agency (HaDEA). Neither the European Union nor the granting authority can be held responsible for them. Grant Agreement no. 101120763 — TANGO.

## Declaration on Generative AI

The author(s) have not employed any Generative AI tools.

## References

- [1] A. Dix, M. Roach, T. Turchi, A. Malizia, B. Wilson, Designing and building hybrid human-ai systems (synergy 2024), in: Proceedings of the 2024 International Conference on Advanced Visual Interfaces, AVI '24, Association for Computing Machinery, New York, NY, USA, 2024. URL: <https://doi.org/10.1145/3656650.3660537>. doi:10.1145/3656650.3660537.