Designing and Building Hybrid Human-AI Systems

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ABSTRACT

This workshop explores the evolving landscape of Human-AI collaboration, focusing on Advanced Visual Interfaces and Artificial Intelligence to enhance human cognition. We explore synergistic models of collaboration that merge human insights with AI capabilities, addressing ethical dimensions and practical AI applications. Our goal is to foster rich interdisciplinary dialogue and challenge existing paradigms of human-machine interaction. We aim to redefine interaction paradigms and establish new benchmarks for intelligent systems, ensuring AI not only supports but significantly augments human decision-making processes.

CCS CONCEPTS

• **Human-centered computing** → *Human computer interaction (HCI)*; **Interactive systems and tools**; • **Computing methodologies** → *Artificial intelligence*.

KEYWORDS

Artificial Intelligence, Human-Centered AI

1 OBJECTIVES AND MOTIVATION

In 1960 the visionary Joseph Licklider wrote "Man-Computer Symbiosis" [3], looking forward to a day when computation could "augment the human intellect" in a similar way that mechanical tools augmented humans' physical abilities. Sixty years on, this vision seems about to become reality. AI systems are working alongside people in many areas including complex visual analytics, coding using tools such as co-pilot and music composition with generative AI. We have long experience in expert systems elicitation techniques that attempt to capture and often substitute human expertise in AI systems and also in systems where AI performs some sub-task such as speech recognition. However, we are still in the infancy of understanding how to design and build truly synergistic systems where humans and AI work flexibly alongside one another complimenting the different abilities of each. Some human-in-the-loop systems, effectively mean the human is a cog in the machine, however true synergy means adapting AI algorithms to work more meaningfully with human intervention and adapting user interactions to make human intentions more available to the AI.

In this workshop we aim to bring together researchers working or intending to work in this new and rich area. Some will bring experience in designing intelligent systems; others may have worked on synergistic systems using non-AI technology; some may bring understandings of human–human collaboration; and others still simply interested and excited by the potential opportunities on radically new interactions.

The workshop will include consortium partners from the new 10 million Euro project TANGO[1] "It takes two to tango: a synergistic approach to human-machine decision making".

2 ORGANISERS

- **Alan Dix**, Director of the Computational Foundry, is renowned for his HCI research, including a core textbook and pioneering work in mobile interfaces and machine learning bias. Elected to the ACM SIGCHI Academy, his work spans practical applications in diverse fields. Known for his eclectic methods, Alan combines technical, philosophical, and artistic insights, emphasizing the importance of technical creativity.
- **Matt Roach** is an Associate Professor of Computer Science at Swansea University and an established leader in research and innovation. His multidisciplinary interests focus on the intersection of people, algorithms and data, themes

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[1]https://tango-horizon.eu/

include: Machine Learning; Algorithmic Bias, Fairness; Human Computer/Data Interaction; Participatory Design; Socio-Technical Decision-Making Systems. He plays a key role in several large-scale collaborative projects and doctoral training initiatives. Prior to academia, Matt contributed significantly to computing skills development in industry and business sectors.

- **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.
- **Alessio Malizia** is an Associate Professor at the University of Pisa (Italy). His research explores the convergence of physical and digital realms, aiming to enhance interactive system design.
- **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.

2.1 Program Committee

- **Alan Chamberlain**, University of Nottingham (United Kingdom)
- **Silvio Carta**, University of Greenwich (United Kingdom)
- **Marlene Weber**, Harness Inc. (United States)
- **Glenn McGarry**, University of Nottingham (United Kingdom)
- **Daria Mikhaylova**, University of Pisa (Italy)
- **Roberto Figliè**, University of Pisa (Italy)
- **Serena Versino**, University of Pisa (Italy)

3 TOPICS

The workshop is particularly timely and relevant to AVI's focus, as it addresses the intersection of advanced visual interfaces and the fast-growing capabilities of AI, a combination that is redefining the field of HCI.

3.1 Key Topics

- Human-AI Collaboration Models: Investigating new models for collaboration that leverage AI's computational power to enhance human decision-making and creativity, crucial for the development of next-generation visual interfaces.
- Augmenting Human Cognition with AI: Focusing on how AI can be integrated into visual interfaces to augment human cognitive processes, a topic that resonates with AVI's interest in expanding the boundaries of user interaction.
- Design Principles for Synergistic Systems: Discussing design strategies for systems where AI and humans collaborate,

ensuring these systems are intuitive, efficient, and aligned with human-centric design principles.
- Ethics and Trust in Human-AI Interaction: Addressing the ethical implications and trust dynamics in AI-integrated systems, a topic of growing importance as these systems become more pervasive.
- Philosophical and Theoretical Approaches: Uncovering fundamental issues surrounding and underpinning human–AI collaborations.
- Adaptive Interfaces for Human-AI Synergy: Exploring how visual interfaces can adapt to both AI capabilities and human needs, a key area for advancing HCI research.
- Software Architectures and Tools: Frameworks, infrastructure and toolkits to enable the prototyping and development of systems for synergistic interaction.
- Case Studies of Human-AI Synergy: Showcasing real-world applications where AI and humans work in tandem, offering insights into practical implementations and evaluations.

3.2 Relevance to AVI

The themes of this workshop align seamlessly with AVI's tradition of exploring innovative visual interfaces and novel paradigms in HCI. By focusing on the integration of AI within the realm of human-computer interaction, the workshop directly contributes to the research on visual interface design and evaluation. It also addresses the conference's expanded interest in new technologies and user interaction possibilities, bringing forth a discussion that is at once cutting-edge and grounded in practical, user-centered design considerations.

3.3 Background Knowledge Required

Participants will benefit from having a foundational understanding of HCI principles and some familiarity with AI concepts. However, the workshop is designed to be inclusive, catering to both experts in the field and those who are newer to the domain of human-AI interaction. By bringing together diverse perspectives, the workshop aims to foster a rich, interdisciplinary dialogue that will push the field forward.

4 FORMAT

We plan a full-day workshop, starting with short presentations by participants followed by small group and open discussions to establish a baseline state of the art, key open questions, and future research roadmap. The workshop will start with a keynote address by Dr. Yang Li, a leading expert in Human-Computer Interaction and Artificial Intelligence. This will provide a foundation for the topics and collaborative efforts that will be explored throughout the workshop.

4.1 Similar Initiatives

Some similar workshops offered at recent HCI venues include:

(1) The First Workshop on Hybrid Human-Machine Learning and Decision Making (HLDM) [2] @ ECMLPKD 2023
(2) International Workshop on Multidisciplinary Perspectives on Human-AI Team Trust (MULTITTRUST) [1] @ HHAI 2023

(3) Diversity-aware Hybrid Human-Artificial Intelligence (DHHAI) [4] @ HHAI 2023
(4) Workshop on Human-Centered Design of Symbiotic Hybrid Intelligence [5] @ HHAI 2022

We expect to gather participants across different areas and ranges of expertise, promising insights for:

- HCI Practitioners and Researchers: As they aim at making AI systems more intuitive and dynamic, a challenge recognized in many HCI research studies.
- AI Scholars: Tasked with making complex algorithms transparent, a challenge highlighted in recent literature.
- Technology Enthusiasts: Keen to discover future trajectories of human-AI collaborations, an area of huge interest.

5 PROCEEDINGS

We collected all peer-reviewed accepted papers in a dedicated proceedings volume.

Our primary objective is to not only stimulate cutting-edge discussions but also to cultivate tangible outcomes that push the research field forward. To this end, we are already in advanced discussions to establish a Special Issue in a journal, which will feature the best-selected papers from those accepted for the workshop. The curated collection of papers will showcase the rigorous research and innovative ideas presented during our sessions.

5.1 Accepted Papers

Here's the list of accepted papers, along with the abstract and a brief summary.

(1) Serena Versino, Tommaso Turchi, and Alessio Malizia. *Fostering Inexperienced User Participation in ML-based Systems Design: A Literature Review of Visual Language Tools.* This review explores how Visual Programming Languages (VPLs) can enhance accessibility and understanding of ML-based system design for non-technical users, despite limitations in customizability.

(2) Tommaso Turchi. *Human & AI: Fool Us – Crafting Synergistic Interactions with Insights from Magic.* The paper argues that integrating stage magic techniques into AI design can enhance transparency and user engagement, fostering a more synergistic relationship between humans and AI.

(3) Eric Tron Gianet, Luigi Di Caro, and Amon Rapp. *Music Composition as a Lens for Understanding Human-AI Collaboration.* The authors propose using music composition as a context to explore human-AI collaboration, suggesting an ethnographic study to deeply understand this creative interaction.

(4) Alan Dix, Ben Wilson, Matt Roach, Tommaso Turchi, and Alessio Malizia. *Epistemic Interaction – tuning interfaces to provide information for AI support.* This paper introduces the concept of epistemic interaction, which aims to refine human-AI interaction by leveraging subtle user behaviors to improve AI system learning and adaptability.

(5) Roberto Figliè, Tommaso Turchi, Giacomo Baldi, Daniele Mazzei. *Towards an LLM-based Intelligent Assistant for Industry 5.0.* The authors discuss the development of an LLM-based Intelligent Cognitive Assistant for Industry 5.0, aiming to

integrate industrial data into a natural language interface to facilitate decision-making.

(6) Peter Daish, Nicholas Micallef, Nuria Lorenzo-Dus, Adeline Paiement, and Deepak Sahoo. *Towards Co-Designing a Continuous-Learning Human-AI Interface: A Case Study in Online Grooming Detection.* This paper presents a framework for incorporating diverse stakeholder perspectives into the design of Human-AI interfaces, with a focus on a continuous-learning system for online grooming detection.

(7) Piero Marra, Lorenzo Pulito, Antonio Carnevale, Antonio Lombardi, Abeer Dyoub, and Francesca Lisi. *A Procedural Idea of Decision-making in the Context of Symbiotic AI.* The study explores a procedural approach to AI decision-making that aligns with European legal standards, aiming for a symbiotic relationship that ensures ethical and effective AI outputs.

(8) Mario Alessandro Bochicchio, and Simona Corciulo. *Symbiosys and Synesthesia in Proactive Conversational Agents for Healthy Ageing.* The paper introduces a Conversational Companion for elderly people, developed under the Age-It Project, employing symbiotic AI to support healthy aging.

(9) Ben Wilson, Darren Scott, Matt Roach, Emily Nielsen, and Berndt Muller. *Designing for situated AI-human decision making: Lessons learned from a primary care deployment.* This case study evaluates the challenges and lessons from deploying AI systems in UK primary care, emphasizing the importance of participatory design and continuous improvement.

(10) Bo Fu, Peter Gatsby, Angelo Ryan Soriano, Kayla Chu, and Nicolas Guardado Guardado. *Towards Intelligent Flight Deck – A Case Study of Applied Eye Tracking in The Predictions of Pilot Success and Failure During Simulated Flight Takeoff.* This research uses eye-tracking to predict pilot performance in simulated takeoffs, demonstrating the potential for AI to enhance safety and performance in aviation.

(11) Miriana Calvano, Antonio Curci, Rosa Lanzilotti, and Antonio Piccinno. *The Human-Centered Approach to Design and Evaluate Symbiotic AI Systems.* The authors propose a framework for designing symbiotic AI systems that prioritize user needs and transparency to facilitate informed decisions and enhance human-AI interaction.

(12) Magdalena Igras-Cybulska, Barbara Kolber-Bugajska, Rafał Salamon, Paweł Babiuch, Hubert Jegierski, Maciej Jegierski, Adrian Łapczyński, Alicja Marmon, Kamil Kwiatkowski, Artur Cybulski, Mirosław Płaza, Grzegorz Łukawski, Stanisław Deniziak, Paweł Pięta, Artur Jasiński, Jacek Opałka, and Paweł Węgrzyn. *Supporting Unity Developers with an AI-Powered Asset: Insights from an Exploratory User Study on Multiplayer Game Development.* This paper outlines an exploratory study focused on developing AI-enhanced tools for multiplayer game development, emphasizing user-centered design and iterative testing.

(13) Paolo Grigis, and Antonella De Angeli. *Roleplay with Large Language Model-Based Characters: A Creative Writers Perspective.* The authors discuss a case study where creative writers engage in roleplay with LLM-based characters, aiming to explore and support creative writing through innovative human-computer interaction practices.

ACKNOWLEDGMENTS

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