



Proceedings of the International Conference on Advanced Visual Interfaces (AVI 2026)

Venice, Italy
June 8-12, 2026

General Chairs: Antonella De Angeli, Albrecht Schmidt

Program Chairs: Rosella Gennari, Fabio Pittarello

Long Paper Chairs: Paloma Díaz, Alessandra Melonio

Short Paper Chairs: María Menéndez-Blanco, Luigi De Russis

Proceedings Co-Chair: Niccolò Pretto





The Association for Computing Machinery

1601 Broadway, 10th Floor

New York, New York 10019, USA

ACM COPYRIGHT NOTICE. Copyright © 2026 by the Association for Computing Machinery, Inc. Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, to republish, to post on servers, or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from Publications Dept., ACM, Inc., fax +1 (212) 869-0481, or permissions@acm.org.

For other copying of articles that carry a code at the bottom of the first or last page, copying is permitted provided that the per-copy fee indicated in the code is paid through the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, +1-978-750-8400, +1-978-750-4470 (fax).

ACM ISBN: 979-8-4007-2342-1

WELCOME

It is our great pleasure to introduce the 18th edition of the International Conference on Advanced Visual Interfaces organised by the Ca' Foscari University of Venice and the Free University of Bozen-Bolzano, in cooperation with the Association for Computing Machinery (ACM) and the ACM Special Interest Group on Computer-Human Interaction (ACM SIGCHI), and Hypertext and the Web (ACM SIGWEB). With the theme "Interactive Creativity: Agencies, Interfaces, and Ethics", AVI 2026 invited reflection on how interfaces shape creative practices, distribute tasks and agency between humans and computational systems and to bring ethical responsibilities to the foreground of HCI.

Generative AI presents new challenges and opportunities in how we interact with technology. The pragmatic and hedonic needs of diverse user groups, as well as their expectations of interactive systems, are changing with AI. At the same time, creativity and agency remain central to realise the full potential of individuals and societies. At AVI 2026, we encouraged the community to discuss these fundamental issues and to explore how we can create meaningful agency, design truly collaborative interfaces, and embed the values we believe in.

AVI 2026 took place in San Servolo, a small island of Venice. For centuries Venice has been a centre for the exchange of goods and ideas, and a place where engineering and the arts have shaped the fabric of the community. It is also a delicate and fragile ecosystem that is constantly changing. We believe this provides the ideal venue to reflect, reframe, and speculate about creative solutions to more sustainable and rewarding technological futures.

We thank the Program Chairs Rosella Gennari and Fabio Pittarello, the Steering Committee, the Organising Committee, all the authors and participants, and we wish all of you an exciting conference in Venice!

Antonella De Angeli and Albrecht Schmidt

AVI 2026 General Chairs

FOREWORD

The 2026 edition of the International Conference on Advanced Visual Interfaces (AVI 2026), held in Venice, Italy, from 8 to 12 June 2026, continues the conference tradition of bringing together researchers and practitioners working at the intersection of Human-Computer Interaction (HCI) and advanced visual interfaces, while expanding on different forms of interaction and experience. The first two days of the conference hosted workshops and tutorials, followed by the main conference programme. The scientific contributions addressed both consolidated AVI themes related to information visualisation, as well as novel interaction styles—e.g., augmented and virtual reality, intelligent interfaces, social interaction, interaction in natural and urban spaces, multimodal and multisensory interaction, tangible and embodied interaction—and emerging challenges related to artificial creativity and responsible design across various applications, including art and creativity, cultural heritage, security, health and well-being.

AVI 2026 received 107 submissions to the long papers track and 35 submissions to the short papers track. Following a rigorous double-blind peer-review process, 33 long papers and 18 short papers were accepted for presentation and publication in the conference proceedings, corresponding to acceptance rates of 30% for long papers and 51% for short papers. The review process involved an international Program Committee composed of 37 Associate Chairs and a broad panel of expert reviewers from the international HCI research community. Each paper received at least three reviews, including one by an Associate Chair, who coordinated the discussion process, synthesised the reviews, and prepared the meta-review supporting the final decision process. Final decisions were taken jointly by the Program Chairs together with the Long and Short Paper Chairs, based on reviewer evaluations, discussions, and Associate Chair recommendations.

The accepted papers were organised into thematic sessions that reflected both the breadth of contemporary HCI research and the distinctive focus of AVI 2026 on creativity, ethics, and emerging forms of interaction. The programme explored topics including diverse users in context, dynamic urban spaces, interacting with visual information, diverse artefacts in context, trust, awareness and decision-making, interfaces supporting different points of view, interaction methods and patterns, and the crafting of written narratives. Collectively, these sessions highlighted current research directions in tangible, embodied and situated interaction, as well as multimodal and multisensory experiences, intelligent and trustworthy systems, domain-oriented applications, and interfaces designed to support interpretation, collaboration, and creativity beyond exclusively visual paradigms.

The entire conference programme is particularly rich in both scientific content and presentation formats, reflecting the diversity of forms and modalities that interaction and interfaces take today. AVI 2026 features 23 posters, 17 demos and interactive experiences, 13 workshops, and 4 keynote presentations. This edition also introduced the Interactive Experiences (IE) track alongside the traditional demo track. The IE track was conceived to provide space for experiential, performative, and embodied experiences that cannot be adequately communicated through conventional paper presentations alone. This innovation further broadens the scope of AVI and reinforces its role as a venue attentive to emerging forms of interaction research and practice.

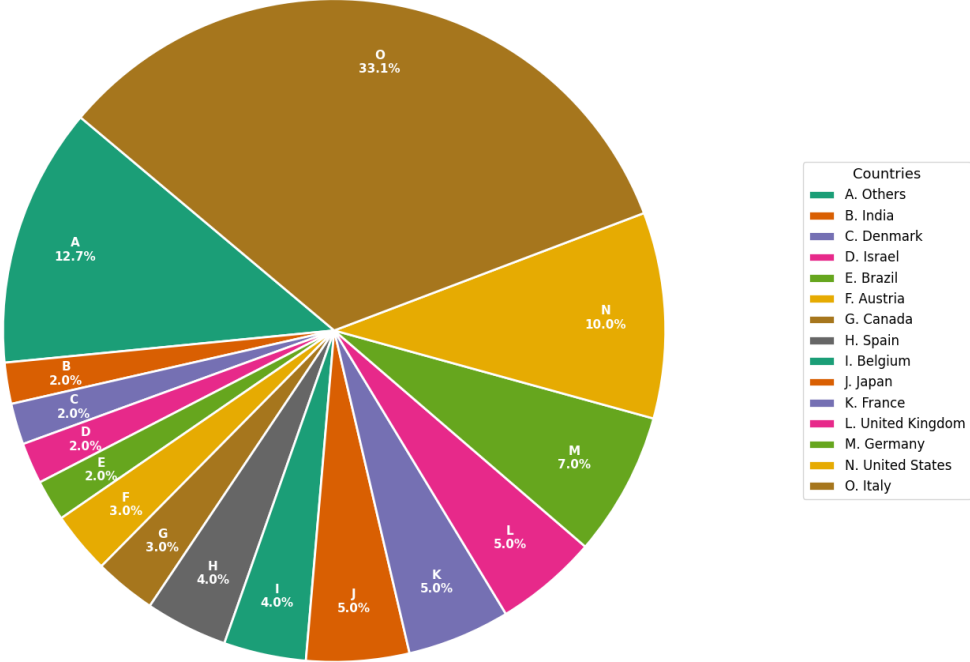
The keynote programme of AVI 2026 reflects the conference theme and its emphasis on creativity, multimodal interaction, ethics, and future human-centred technologies from complementary perspectives. Hiroshi Ishii reflected on embodied and tangible interaction through his pioneering research on Tangible Bits and Radical Atoms, and presented his more recent vision of “TeleAbsence”, inspired by both artistic practices and human-centred design. Stefania Serafin explored multisensory experiences grounded in sound, movement, and bodily perception, exemplifying AVI’s growing interest in interaction beyond purely visual interfaces. Francesco Ricci discussed trustworthy recommender systems and the broader implications of AI-supported decision making, contributing to discussions on responsible AI and human-centred intelligent systems. Felienne Hermans addressed the societal implications of AI and automation, connecting directly with AVI themes concerning artificial creativity, ethics, and human agency.

AVI 2026 also continues the innovation introduced in recent editions concerning further space for students. This year, dedicated events coordinated provide doctoral candidates with opportunities for networking, mentoring, and visibility within the broader conference community. The programme includes a dedicated Doctoral Consortium (DC) session, followed by DC madness presentations and poster sessions integrated into the main conference, fostering direct interaction with senior and peer researchers. In addition, AVI 2026 strengthens student participation through a Student Volunteer programme chaired and coordinated by students themselves. Together, these initiatives reinforce AVI’s commitment to supporting new generations of researchers.

Workshops remain a central component of the AVI experience, with 13 workshops exploring emerging topics and interdisciplinary perspectives across HCI, multimodal AI, creativity, accessibility, immersive environments, and human-centred technologies. Together with posters, demos, and IE’s, these activities contribute to an articulated and dynamic conference programme that encourages discussion, experimentation, and collaboration.

The distribution of submissions and committee memberships suggests that AVI is progressively strengthening its international profile. The plot below shows the distribution of submissions by country; countries with fewer than 10 submissions were grouped into the “Others” category. While Italy still represents the largest share of submissions (33%) and committee members, both scientific contributions and organisational responsibilities are distributed across a broad range of countries spanning Europe, America, Asia, and the Middle East. This diversity highlights the growing international reach of AVI and its ability to attract participation and collaboration from multiple research communities and geographical areas.

Percentage of Submissions per Country



AVI 2026 is the result of the commitment and dedication of many people.

We sincerely thank all members of the Organising Committee for their work for the conference organisation. We are grateful to the DC Chairs for creating novel interaction spaces for students, and to the Student Volunteers Chairs, who coordinated the call for student volunteers; the Web Chair, Publicity and Social Network Chairs, who brought the

conference communication to a new artistic level; the Industry Chairs for their support; and the Accessibility and Inclusion Chairs, who considered diverse perspectives for the conference, drawing on their expertise in accessibility.

We also warmly thank the Poster Chairs and the IE and Demo Chairs for bringing fresh ideas and energy to the conference, as well as the Workshop Chairs, who managed a record number of submissions and coordinated the entire process, from selection to organisation. Finally, we thank the Paper Chairs and Proceedings Chairs for their fundamental contribution to the scientific programme and proceedings.

In recognition of the collective effort invested in shaping AVI 2026, we decided to include as many members of the Organising Committee as possible among the editors. Although it was not feasible to include everyone this year, we hope it is clear that each member of the committee made a meaningful contribution to the conference. AVI would not be possible without the commitment and dedication of its Organising Committee.

We are particularly grateful to the General Chairs, Antonella De Angeli and Albrecht Schmidt, for their guidance and support. We also thank the Associate Chairs, Program Committee members, and external reviewers for ensuring the scientific quality of the conference and for their careful and timely evaluation work.

Last but not least, our appreciation also goes to the initiators of AVI, started in 1992, as well as the AVI Steering Committee for their trust and support throughout the organisation of this edition. We thank all Keynote Speakers, Workshop Organisers, and Student Volunteers for their valuable contributions to the conference. Finally, we express our deepest gratitude to all authors and participants whose enthusiasm, creativity, and research contributions continue to shape AVI as a vibrant and internationally recognised forum for advanced interfaces and interactions, with a distinctive attention to human factors.

Rosella Gennari and Fabio Pittarello
AVI 2026 Program Chairs

COMMITTEES

Organising Committee

General Chairs

Antonella De Angeli, Free University of Bozen-Bolzan, Italy

Albrecht Schmidt, Ludwig-Maximilians Munich University, Germany

Programme Chairs

Rosella Gennari, Free University of Bozen-Bolzan, Italy

Fabio Pittarello, Ca' Foscari University of Venice, Italy

Long Papers Chairs

Paloma Díaz, Carlos III University, Madrid, Spain

Alessandra Melonio, Ca' Foscari University of Venice, Italy

Short Papers Chairs

Luigi De Russis, Polytechnic of Turin, Italy

María Menéndez-Blanco, Free University of Bozen-Bolzano, Italy

Proceedings Chairs

Niccolò Pretto, Free University of Bozen-Bolzano, Italy

Nadine Wagener, OFFIS, Oldenburg, Germany

Workshop Chairs

Daniela Fogli, University of Brescia, Italy

Kyle Montague, Northumbria University, United Kingdom

Interactive Experiences and Demo Chairs

Stefania De Vincentis, Ca' Foscari University of Venice, Italy

Florian Michahelles, TU Wien, Austria

Sebastiano Vascon, Ca' Foscari University of Venice, Italy

Poster Chairs

Alba Bisante, Sapienza University of Rome, Italy

Tanja Doering, TU Berlin, Germany

Doctoral Consortium Chairs

Monica Divitini, Norwegian University of Science and Technology, Norway

Rosa Lanzilotti, University of Bari Aldo Moro, Italy

Industry Chairs

Fabio Morreale, Sony, Spain

Emanuele Pucci, Politecnico di Milano, Italy

Accessibility and Inclusion Chairs

Marco Mores, Free University of Bozen-Bolzano, Italy

Teresa Scantamburlo, University of Trieste, Italy

Web Chair

Tommaso Pellegrini, Ca' Foscari University of Venice, Italy

Publicity Chair and Social Network Chairs

Andrea Rezzani, Free University of Bozen-Bolzano, Italy

Mehdi Rizvi, Heriot Watt University, United Kingdom

Student Volunteers Chairs

Daniel Bermudez, Free University of Bozen-Bolzano, Italy

Bilal Khan, Free University of Bozen-Bolzano, Italy

Steering Committee

Paolo Bottoni, Sapienza University of Rome, Italy

Cristina Conati, University of British Columbia, Vancouver, Canada

Emanuele Panizzi, Sapienza University of Rome, Italy

Ilaria Torre, University of Genoa, Italy

Genny Tortora, University of Salerno, Italy

Giuliana Vitiello, University of Salerno, Italy

Gualtiero Volpe, University of Genoa, Italy

Marco Winckler, Université Côte d'Azur, France

Associate Chairs

Ignacio Aedo, Universidad Carlos III de Madrid, Spain
Carmelo Ardito, Politecnico di Bari, Italy
Russel Beale, University of Birmingham, United Kingdom
Paolo Buono, University of Bari Aldo Moro, Italy
Fabio Buttussi, University of Udine, Italy
Tommaso Calò, Polytechnic of Turin, Italy
Federica Caruso, University of L'Aquila, Italy
Maria De Marsico, Sapienza University of Rome, Italy
Giuseppe Desolda, University of Bari, Italy
Cristina Gena, University of Turin, Italy
Monica Landoni, University of Italian Switzerland, Switzerland
Maria Luce Lupetti, Polytechnic of Turin, Italy
Elisa Marengo, University of Turin, Italy
Andrea Marrella, Sapienza University of Rome, Italy
Massimo Mecella, Sapienza University of Rome, Italy
Aliaksei Miniukovich, Norwegian University of Science and Technology, Norway
Alberto Monge Roffarello, Polytechnic of Turin, Italy
Teresa Onorati, Universidad Carlos III de Madrid, Spain
Nuno Otero, Greenwich University, United Kingdom
Fabio Paternò, CNR, Italy
Antonio Piccinno, University of Bari Aldo Moro, Italy
Albert Ali-Salah, Utrecht University, Netherlands
Paula Alexandra Silva, Universidad Carlos III de Madrid, Spain
Carlos Santos, University of Aveiro, Portugal
Anna Spagnolli, University of Padua, Italy
Giovanna Varni, University of Trento, Italy
Nervo Verdezoto Dias, Cardiff University, United Kingdom
Fabiana Venero, University of Turin, Italy
Luca Viganò, King's College London, United Kingdom
Massimo Zancanaro, University of Trento, Italy

Program Committee Members

Alessandro Aiuti Sapienza, University of Rome, Italy
Dmitry Alexandrovsky, Karlsruhe Institute of Technology, Germany
Abrar Almjaly, Imam Mohammad Ibn Saud Islamic University, Saudi Arabia
Tomás Alves, Instituto Universitário de Lisboa, Portugal
Margherita Andrao, Fondazione Bruno Kessler, Italy
Marco Angelini, Sapienza University of Rome, Italy
Alessio Arleo, Eindhoven University of Technology, the Netherlands
Olivier Augereau, Ecole Centrale de Nantes and LS2N laboratory, France
Danilo Avola, Sapienza University of Rome, Italy
Barbara Rita Barricelli, University of Brescia, Italy
Vita Santa Barletta, University of Bari Aldo Moro, Italy
Paolo Berti, Ca' Foscari University of Venice, Italy
Andrea Bianchi, Korea Advanced Institute of Science and Technology, South Korea

Graziano Blasilli, Sapienza University of Rome, Italy
Stefano Burigat, University of Udine, Italy
Diogo Cabral, Polytechnic University of Lisbon, Portugal
Sara Capecchi, University of Turin, Italy
Emmanuela Carbé, Ca' Foscari University of Venice, Italy
Eleonora Ceccaldi, University of Genoa, Italy
Elisa Corrà, Ca' Foscari University of Venice, Italy
Marta Curreri, University of Milano-Bicocca, Italy
Venkata Srikanth Varma Datla, Sapienza University of Rome, Italy
Boris de Ruyter, Philips Research, Belgium
Gireg Desmeulles, ENIB, France
Tania Di Mascio, University of L'Aquila, Italy
Juan Manuel Doderó, Universidad de Cádiz, Spain
Gabriella Doderó, ASLERD, Italy
Emmanuel Dubois, IRIT- Elipse - University of Toulouse, France
Andrea Esposito, University of Bari Aldo Moro, Italy
Federico Fontana, University of Udine, Italy
Alessandro Forgiarini, University of Udine, Italy
Rita Francese, University of Salerno, Italy
Carla M.D.S. Freitas, Federal University of Rio Grande do Sul, Brazil
Ombretta Gaggi, University of Padua, Italy
Franca Garzotto, University of Milano-Bicocca, Politecnico di Milano, Italy
Theodoros Georgiou, Heriot-Watt University, United Kingdom
Mathyas Giudici, Politecnico di Milano, Italy
Daniel Gonçalves, INESC-ID and Instituto Superior Técnico, University of Lisbon, Portugal
Francesco Greco, University of Bari Aldo Moro, Italy
Shah Rukh Humayoun, San Francisco State University, United States
Saverio Iacono, University of Genoa, Italy
Dietrich Kammer, University of Applied Sciences Dresden, Germany
Simone Lenti, Sapienza University of Rome, Italy
Chiara Leonardi, Fondazione Bruno Kessler, Italy
Francesco Leotta, Sapienza University of Rome, Italy
Yifei Li, Sapienza University of Rome, Italy
Angela Locoro, University of Brescia, Italy
Marco Manca, ISTI CNR, Italy
Maurizio Mancini, Sapienza University of Rome, Italy
Marco Raoul Marini, Sapienza University of Rome, Italy
Masood Masoodian, Aalto University, Finland
Ambuj Mehrish, Ca' Foscari University of Venice, Italy
Eleonora Mencarini, Fondazione Bruno Kessler, Italy
Aline Menin, Univ. Côte d'Azur, CNRS, Inria, France
Thomas Mildner, University of Bremen, Germany
Frida Milella, University of Milano-Bicocca, Italy
Marcelo Milrad, Linnaeus University, Sweden
Mark Minas, Universität der Bundeswehr München, Germany
Andrea Minuto, Hogeschool Rotterdam, the Netherlands
Silvia Mirri, University of Bologna, Italy

Diego Morra, Politecnico di Milano, Italy
Martin Murer, University of Salzburg, Austria
Michele Nappi, University of Salerno, Italy
Radoslaw Niewiadomski, University of Genoa, Italy
Claudio Enrico Palazzi, University of Padua, Italy
Angelika Peer, Free University of Bozen-Bolzano, Italy
Maria Angela Pellegrino, University of Salerno, Italy
Francesca Perillo, University of Salerno, Italy
Evgheni Polisciuc, Center for Informatics and Systems of the University of Coimbra, Portugal
Catia Prandi, University of Bologna, Italy
Roberta Presta, University of Suor Orsola Benincasa, Italy
Francesco Ricci, Free University of Bozen-Bolzano, Italy
Luigia Rizzo, University of Salerno, Italy
Florent Robert, Inria, France
Veronica Rossano, University of Bari Aldo Moro, Italy
Carmen Santoro, ISTI-CNR, Italy
Gianluca Schiavo, University of Trento, Italy
Katta Spiel, TU Wien, Austria
Manuel Striani, University of Piemonte Orientale, Italy
Antonella Toffetti, Centro Ricerche Fiat, Italy
Gabriella Trasciatti, Sapienza University of Rome, Italy
Riccardo Treglia, University of Bologna, Italy
Cesare Tucci, University of Bari Aldo Moro, Italy
Stefano Valtolina, University of Milan, Italy
Zeynep Yucel, Ca' Foscari University of Venice, Italy
Nima Zargham, University of Bremen, Germany
Telmo Zarraonandia, Universidad Carlos III de Madrid, Spain
Stefano Zeppieri, Sapienza University of Rome, Italy
Daniele Zolezzi, University of Genoa, Italy

Additional Reviewers

Qi Ai, Politecnico di Milano, Italy
Christian Brinkhaus, Osaka Metropolitan University, Japan
Simone Ciciliano, Free University of Bozen-Bolzano, Italy
Tommaso Colafoglio, Politecnico di Bari, Italy
Luca Cordioli, Politecnico di Milano, Italy
Umberto Domanti, Free University of Bozen-Bolzano, Italy
Henry Kam, New York University, United States
Meagan Loerakker, TU Wien, Austria
Leticia Machado, UFRGS, Brasil
Kim Mönch, Universität der Bundeswehr München, Germany
José Miguel Mota Macias, UCA, Spain
Toanquoc Nguyen, TU Dortmund, Germany
Rafael Oleques Nunes, UFRGS, Brasil
Jorge Enrique Olivares Peña, Universität der Bundeswehr München, Germany
Ludovica Piro, Politecnico di Milano, Italy
Muhammad Rahman, Sapienza University of Rome, Italy

Jannis Schopp, University of the Bundeswehr Munich, Germany
Fe Simeoni, Free University of Bozen-Bolzano, Italy
Isabel Cristina Siqueira Da Silva, UFRGS/UniRitter, Brasil
Giulia Valcamonica, Politecnico di Milano, Italy
Peter Weinert, Universität der Bundeswehr München, Germany
Michael Yin, University of British Columbia, United States
Marco Matarese, Free University of Bozen-Bolzano, Italy

TABLE OF CONTENTS

KEYNOTE TALKS

Trustworthy Recommender Systems for Multiple Stakeholders	Article 1
<i>Francesco Ricci</i>	
Vision-Driven Design	Article 2
<i>Hiroshi Ishii</i>	
Beyond Visual Interfaces: Designing Multisensory Experiences	Article 3
<i>Stefania Serafin</i>	
AI and the Future of Work	Article 4
<i>Felienne Hermans</i>	

SESSIONS

Interfacing Points of Views

Long Papers

Enhancing Pointing Gestures of Non-HMD Users in Asymmetric Collocated Mixed Reality Collaboration.....	Article 5
<i>Nam-Dang Vo, Van-Vinh Thai, Anthony Tang, Khanh-Duy Le</i>	
Directional Illusion: Displaying Different Images Based on Gaze Movement Directions using a High-Speed Projector.....	Article 6
<i>Ryusuke Miyazaki, Shio Miyafuji, Hideki Koike</i>	
InsightAR: A Tool for Multi-modal Summarization and Interactive Analysis of AR-based Egocentric Task Videos.....	Article 7
<i>Guande Wu, Dishita Turakhia, Eden Wu, Sonia Castelo Quispe, João Rulff, Erin McGowan, Jianben He, Yawei Wang, Jing Qian, Claudio Silva</i>	
LentiMorpho: A Lens Array Based Display with Switchable View-Dependent and View-Independent Modes by Varying Liquid Volume	Article 8
<i>Rintaro Akiyama, Kouyou Otsu, Mai Kamihori, Yuichi Itoh, Takafumi Koike</i>	

Crafting Written Narratives

Long Papers

EmoArc: Interactive Emotion Graph for Human-AI Collaborative Writing	Article 9
<i>Rifat Mehreen Amin, Seyit Baran Özdemir, Sven Mayer, Andreas Butz</i>	
TombWriter: Scaffolding Story Archeology through Beat-Level Interaction in Human-AI Co-Writing	Article 10
<i>Hugo Andersson, Niklas Elmqvist</i>	
Semantic Prompting: Agentic Incremental Narrative Refinement through Spatial Semantic Interaction	Article 11
<i>Xuxin Tang, Ibrahim Tahmid, Eric Krokos, Kirsten Whitley, Xuan Wang, Chris North</i>	
The Effect of Idea Elaboration on the Automatic Assessment of Idea Originality	Article 12
<i>Umberto Domanti, Moritz Mock, Sergio Agnoli, Antonella De Angeli</i>	

Short Papers

An AI Tool for Gender Bias Analysis in News PublicationsArticle 13
*Jorge Garcelán, Teresa Onorati, Carmen Peláez-Moreno, Clara Sainz de Baranda Andújar,
Paloma Díaz, Ignacio Aedo*

Visual Interface Design for Informal Language Acquisition with Machine Translation and LLMs.....Article 14
Giada Pantana, Ilaria Torre, Myriam Garcia, Marta Castello

Interaction Methods and Patterns

Long Papers

Investigating the Design and Performance of Letter Chords.....Article 15
Cameron Dale Beattie, Yen-Ting Yeh, Andy Cockburn, Carl Gutwin

Leveraging Large Language Models for Alt-Text Evaluation in E-Commerce:
A Data-Driven Study.....Article 16
Nicola Leonardi, Marco Manca, Fabio Paternò

Navigating the Pattern Maze: A Human-Centered Investigation into Structuring
Web Design PatternsArticle 17
Nadzeya Nabok, Kathrin Probst, Mandy Keck

Reflection-in-the-Loop: An AI-Augmented Visual Environment for Early-Stage Interface Design.....Article 18
*Francisco Ivanilso Soares Araujo, Simone de Oliveira Santos, Cristina Albuquerque Douberin,
Francisco Carlos de Mattos Brito Oliveira*

Does Removing Pen Pressure in Cost-Cutting Pen Designs Matter for Handwritten Learning in
Education? A Case Study of Geometry Problem Solving.....Article 19
Yuki Miyazaki, Sari Kobayashi, Satoshi Nakamura, Akiyuki Kake

Short Papers

Time WizARd: Exploring the Use of Augmented Reality for Supporting Multitask
Timekeeping in Kitchen CookingArticle 20
Joseph O'Hagan, Xinuo Zhou, Katharina Margareta Theresa Pöhlmann, Mark McGill

Diverse Artefacts in Context

Long Papers

Evaluating AI Assistance in Human-in-the-Loop Scenographic Prop AuthoringArticle 21
*Giacomo Vallasciani, Pasquale Cascarano, Jacopo Meglioraldi, Daniele Giunchi,
Riccardo Bovo, Gustavo Marfia*

Using Open-Ended Elicitation to Explore Adults' Virtual-Object Interaction Preferences in
AR Headsets.....Article 22
*Alejandro Delgado, Md Mehedi Hasan Jibon, Hetvi Shah, Fareeza Rahman, Anzhelika Kurnikova,
Julia Woodward*

Short Papers

Understanding the Potential of Artificial Intelligence to Semi-automatically Generate Realistic
3D Interactive Models of Composite Objects.....Article 23
Roberto Cuervo-Rosillo, Telmo Zarronandía, Paloma Díaz

EmoRainbow: How Can Phygital Artefacts Support Emotional Regulation in Disaster Preparedness?.....Article 24
Alessandra Melonio, Elena Cicuto, Muhammad Bilal Khan, Maria Vittoria Bellini, Roberto Burro, Daniela Raccanello, Giada Vicentini

Representing Intangible Cultural Heritage as Living Artifacts: A First Digital Twin of a Culinary RecipeArticle 25
Gianni Tumedei, Catia Prandi, Augusto Esteves

Immersive Reachability Planning for the Excavation of Cultural Heritage ObjectsArticle 26
Alexander Gall, Anja Heim, Laura Longo, Christoph Heinzl

Interacting with Visual Information

Long Papers

DataForager: Integrating and Visualizing Datasets From the Web Using Large Language ModelsArticle 27
Alexander Bendeck, Harry Li, Steven Gomez, Ashley Suh

VISPEK: A Visual Interactive System for Progressive Ensemble K-Means ClusteringArticle 28
Marco Angelini, Graziano Blasilli, Giorgio Cazzetta, Simone Lenti, Alessia Palleschi, Giuseppe Santucci

Transforming Natural Language into Knowledge Graph Queries with LinkQ: An Agentic Visual InterfaceArticle 29
Harry Li, Gabriel Appleby, Kenneth Alperin, Steven Gomez, Ashley Suh

LLM-Augmented Semantic Steering of Text Embedding Projection Spaces.....Article 30
Wei Liu, Eric Krokos, Kirsten Whitley, Rebecca Faust, Chris North

Short Papers

User-friendly Design of Distributed Systems: A Visual Interface for Composing Networks of Personal DevicesArticle 31
Andrea Pietro Arena, Sofia Marilina Glorioso, Salvatore Sorce

Dynamic Urban Spaces

Long Papers

Temporal Augmentation for Remote AV Takeover: A Dual-Phase Evaluation of Replay-Buffered Interfaces.....Article 32
Gerhard Graf

Geometries of Navigation: A Comparative Study of Transit Map Layouts.....Article 33
Jenny Portwich, Elena Stoll, Dietrich Kammer

Augmenting Information Access in Cultural Virtual Tours through Automatic Artifact Segmentation.....Article 34
Gonçalo Cerveira, Rui Rodrigues, Nuno Correia

Short Papers

Beyond Analog Mimicry: Reframing Digital Automotive Dashboards for Awareness-Driven Driving ExperienceArticle 35
Marco Ajovalasit, Matteo Valoriani, Alessandro Chiarion, Viola Falchi, Dogan Mert Güven, Sabrina Maida, Giovanni Sartorio, Gustav Moorhouse, Marco Trizio

Challenges in Reviewing Research Utilising Maps Visualizations: A Case Study of Cholera.....Article 36
Saturnino Luz, Shane Sheehan, Masood Masoodian

The BrutARlist: Exploring How and Why Individuals Alter a Known Brutalist Building with
Augmented RealityArticle 37
Joseph O'Hagan, Graham Wilson, Thomas Goodge, Diego Drago, Mark McGill

Domain Experts and Practitioners

Long Papers

From 'Nice Try' to 'Nice Throw': Exploring Counterfactual Explanations as Corrective Feedback
for Javelin Throwing.....Article 38
Lennart Eing, Annika Stippler, Cristina Conati, Stefan Künzell, Elisabeth André, Silvan Mertes

Can Sonification Aid the Perception of Complex Visual Networked Data? A Tool for
the Interactive Exploration of Bibliometric Data.....Article 39
Maurizio Berta, Roberto Bresin, Gaël Dubus

Beyond Distance Metrics: A Nested Model of Similarity in Visual Art SearchArticle 40
Houda Lamqaddam, Quinten Mortier, Ivania Donoso-Guzmán, Koenraad Brosens, Katrien Verbert

Designing Adaptive AI Assistance for Block-Based Modelling: A Wizard of Oz Study with
Domain ExpertsArticle 41
Chiara Mannari, Tommaso Turchi, Manlio Bacco, Alessio Ferrari, Cristina Conati, Alessio Malizia

Short Papers

Virtual Augmentation of a Simulated Scenario for First Aid Operators TrainingArticle 42
Giacomo Colussi, Giovanni Serena, Federico Fontana, Fabio Buttussi

Trust, Awareness, and Decision

Long Papers

Memorability of Greenhouse Gas Emissions in Virtual Reality: An Evaluation of Enactment
and Quiz-Based GamificationArticle 43
*Aymeric Ferron, Elpida Bampouni, Yvonne Jansen, Arka Majhi, Juho Hamari,
Daniel Fernández Galeote*

Trust Me, I'm Probably Right: Investigating AI Explanations for Establishing Appropriate TrustArticle 44
Freja Dahl Hartvig, Asta Lundbek Egelund, Niklas Elmqvist

A Design Space and Exploration Tool for Visual Interfaces in Recommender Systems.....Article 45
Mandy Keck, Lisa-Maria Freller, Thomas Neumayr, Mirjam Augstein

V-RECS: A NL2Vis Recommender for Chart Generation with Explanations, Captioning, and
SuggestionsArticle 46
Luca Podo, Paola Velardi, Marco Angelini

Short Papers

Can Human Gaze Supervision Improve VLM Robustness to Misleading Data Visualizations?Article 47
Mir Rayat Imtiaz Hossain, Enamul Hoque, Giuseppe Carenini

When AI Lies with Charts: Misleading Infographics in Text-to-Image Generation.....Article 48
Mandy Keck, Andreas Stöckl

Brainy: A Virtual Pet Encouraging Digital WellbeingArticle 49
Luca Scibetta, Alberto Monge Roffarello

Diverse Users in Context

Long Papers

Navigating Uncertainty in a Virtual Supermarket: Designing a VR Tool to Promote Autonomy
in Autistic Youth.....Article 50
*Daniel Bermúdez-Chinea, Gianpaolo Alvari, Tommaso Coianiz, María Menéndez-Blanco,
Stefano Burigat, Fabio Buttussi, Luca Chittaro, Paola Venuti, Antonella De Angeli*

Detecting Intent in XR for Nonspeaking Autistic TypersArticle 51
*Pratishtha, Ahmadreza Nazari, Kenzy Hamed, Lorans Alabood, Vikram Jaswal,
Diwakar Krishnamurthy*

LLM-empowered Shared Cross-Reality to Enhance Communication Skills in Individuals
with Neurodevelopmental DisordersArticle 52
*Francesco Vona, Giulia Valcamonica, Marco Mores, Giuseppe Anzillotti, Luca Proserpio,
Nicolò Gandini, Giuseppe D'Amico, Franca Garzotto*

Short Papers

Conceptual Alignment through Large Language Models: A Case Study in an Educational
Context.....Article 53
Simone Ciciliano, Rosella Gennari

Reconnecting Seniors with Blue Spaces: A Technology-Mediated Immersive ApproachArticle 54
Tommaso Pellegrini, Fabio Pittarello, Fabio Pranovi

From Trust to Agency: Designing Child-Centred AI Interaction.....Article 55
Grazia Ragone, Paolo Buono, Judith Good, Rosa Lanzilotti

POSTERS

BonGO: Reimagining the In-Car Experience through Phygital Interaction and AI-Driven
Narrative Co-Creation.....Article 56
*Marco Ajovalasit, Matteo Valoriani, Kexin Ma, Betül Özlem Yilmaz, Mehmet Aflazi,
Aranza Villarreal Alcalá, Beatriz Lara Espinosa, Daniela Pérez Ardila, Marco Trizio,
Gustav Moorhouse*

Visual Diffs: Towards Versioning of Tactons.....Article 57
Christopher Chlebowski, Dennis Wittchen, Georg Freitag, Dietrich Kammer

Effects of Progress Bar Thickness on Users' Perception of Waiting TimeArticle 58
Narumi Sugawara, Takanori Komatsu, Shota Yamanaka

On Promoting Agency in People with Intellectual Disabilities in Co-Design.....Article 59
Marco Mores, Alessandra Melonio, Rosella Gennari

A Conceptual Framework to Foster Sustainability with Gamified Digital TwinsArticle 60
Maryam Samiepour, Davide Guizzardi, Barbara Rita Barricelli, Daniela Fogli

Success Criteria for Evaluating Symbiotic AI Systems.....Article 61
Miriana Calvano, Antonio Curci, Paloma Díaz, Rosa Lanzilotti, Antonio Piccinno

Act on the Present and Peek into the Past: A System for Asynchronous Immersive Analytics Collaboration.....	Article 62
<i>Alejandro Rey López, Diego Navas Sánchez</i>	
Visualizing Parametric Density through Three-dimensional Amplitude Spectrum Slopes in Urban Canyons.....	Article 63
<i>Mirna Zordan, Jiakun Pei, Zixian Lei, Chan Qiu</i>	
Recognition-based Image Authentication Using Masked Images as a Robust Alternative to PINs.....	Article 64
<i>Tetsuji Takada</i>	
Visual Transformation for Reflective Ambient Displays: Comparing Mirror and Frame Representations	Article 65
<i>Naho Yokoyama, Rena Matsuura, Bruce Ferwerda, Risa Kimura, Tatsuo Nakajima</i>	
From Motion Data to Meaning: Towards Human-Centered and Interpretable Movement Analysis Interfaces.....	Article 66
<i>Eleonora Cabai, Maristella Matera, Jonathan Adam Gustafson</i>	
Telling Where You Are Without Saying Too Much	Article 67
<i>Gabriella Trasciatti, Alba Bisante, Venkata Srikanth Varma Datla, Nane Harutyunyan, Stefano Zeppieri, Emanuele Panizzi</i>	
MoCoRo: Towards A Modular Robotics Platform for Automated Cocktail Creation.....	Article 68
<i>Pascal Nowarra, Lukas Mensing, Barbara Huemer, Jonas Rathberger, Samuel Zühlke, Andreas Riegler, Kathrin Probst</i>	
GeoMINDS: A Web-Based Framework to Flexibly Instantiate Multi-Surface Interfaces for Spatial Decision-Making	Article 69
<i>Christian Moll, Johannes Hermen, Valerie Maquil</i>	
Cloud-9: A Multimodal Interaction Paradigm for Assisted and Automated Parking Adoption.....	Article 70
<i>Matteo Valoriani, Marco Ajovalasit, Chiara Aliverti, Adele Calvi, Andrea Febbraro, Emma Forlani, Sara Tibaldo, Marco Trizio, Gustav Moorhouse</i>	
Towards Design Guidelines to Support Young Adults' Digital Wellbeing with Large Language Models.....	Article 71
<i>Giuseppe Arbore, Luigi De Russis</i>	
FantasIA: Immersive, Child-driven Social Stories in Interactive Smart Spaces	Article 72
<i>Irene Lo Presti, Matteo Lussana, Simona Mastroberardino, Lara Tongiorgi, Matteo Secco, Franca Garzotto</i>	
Voices from the Lagoon: An Interactive Experience for Climate Awareness.....	Article 73
<i>Zofia Milczarek, Joy Ciliani</i>	
LLMs to Support Speech Therapists in Creating Exercises: A Preliminary Study.....	Article 74
<i>Miriana Calvano, Antonio Curci, Rosa Lanzilotti, Antonio Piccinno, Alfonso Pio Pretorino</i>	
InvestChat: Exploring Multimodal Interaction via Natural Language, Touch, and Pen in an Investment Dashboard	Article 75
<i>Sarah Lykke Tost, Adson Lucas de Paiva Sales, Henrik Østergaard, Vaishali Dhanoa, Gabriela Molina León</i>	
The Venice Lagoon Climate Change Dashboard as a Tool for Capacity Building for Local Populations.....	Article 76
<i>Vito Garramone, Francesco Musco</i>	

Exploring AI-Supported Artistic Practices through Human-Centred AIArticle 77
Carmelo Ardito, Tommaso Colafoglio, Claudio Pomo, Tommaso Di Noia

The Rice-Paper Layer (RPL): Intention Segmentation for Human-AI Co-Creation in
Generative AIArticle 78
Helena G. Theodoropoulou, Dimitris Kalles

DEMOS AND INTERACTIVE EXPERIENCES

poli:bit: A No-Code Toolkit for Creating Phygital Artefacts for PreschoolsArticle 79
Muhammad Bilal Khan, Alessandra Melonio, Rosella Gennari

Remote Grandparents: A Tangible Interactive Experience for Intergenerational Connection
at a DistanceArticle 80
Kristi Kuusk, Paula Veske-Lepp, Azeem Hamid, Zaur Babayev

Wearable Rhythm: An Ambient Wearable for Promoting Awareness of Internal RhythmsArticle 81
Rena Matsuura, Naho Yokoyama, Risa Kimura, Tatsuo Nakajima, Bruce Ferwerda

From Answer to Audio: Visual Traceability for AI-Assisted Meeting RetrievalArticle 82
Takuya Nakata, Masahide Nakamura

AR Data Ribbon: Break the Frame and Unroll Data in the AirArticle 83
Aymeric Ferron, Leni Yang, Adrien Corn, Yvonne Jansen, Pierre Dragicevic, Martin Hachet

Revealing Nature's Heartbeats: A Playful Experience for TeensArticle 84
Ioanna Terzi, Niccolò Pretto, Rosella Gennari

Building Explainable User InterfacesArticle 85
Tommaso Turchi, Alan Dix, Ben Wilson, Matt Roach, Alessio Malizia

A Multi-Agent AI System for Human-in-the-Loop Cognitive WalkthroughArticle 86
Alba Bisante, Federica Caruso, Valentino Giona, Stefano Zeppieri, Tania Di Mascio, Emanuele Panizzi

NeuroHarmonium: An Interactive Neuroadaptive Musical Instrument Using Brain-Computer
Interface and Neural Network LearningArticle 87
Tommaso Colafoglio, Mariagrazia De Leo, Claudio Pomo, Tommaso Di Noia, Carmelo Ardito

Training Station: A Learning Ecosystem for an Inclusive AI WorkforceArticle 88
*Bernhard Schenkenfelder, Ulrich Brandstätter, Catalina Jesús Toro Plaza,
Gastón Patricio Márquez Ortega, Lukas Fischer, Martin Hartl, Markus Wurm, Rita Außerlechner,
Dominik Laister*

A Visualization and Control Interface for Rhythmic RelationsArticle 89
Cagri Erdem, Davide Rocchesso

Glyphspace: An Integrated Browser-Based Workflow for Glyph-Enriched Dimensionality
ReductionArticle 90
Dietrich Kammer, Mandy Keck, Lilia Schneider, Thomas Gründer

Always Controlled by What We Control: Rewiring Algorithmic Perception in an Interactive
InstallationArticle 91
Jeremiah Teipen

Evaluating the Feasibility of Superposed QR Code Attacks Using High Refresh Rate DisplaysArticle 92
Keita Suzuki, Kentaro Fukuchi

Demonstrating Infrastructure-Free Indoor Occupancy Visualization using Passive BLE SensingArticle 93
Venkata Srikanth Varma Datla, Alba Bisante, Gabriella Trasciatti, Stefano Zeppieri, Emanuele Panizzi

SCAPED: Spoken Conversational AI Platform for Experiments on DialogueArticle 94
Vladislav Maraev, Christine Howes, Catherine Pelachaud

An Immersive Virtual Reality Interface for Archaeological Reconstruction.....Article 95
Luca Palmieri, Omidreza Safaei, Marco Ronchese, Marina Khoroshiltseva, Sebastiano Vascon, Marcello Pelillo

WORKSHOPS

Digital Tools for Connecting with Blue Spaces.....Article 96
Fabio Pittarello, Università Ca' Foscari Venezia, Italy
Fabio Pranovi, Università Ca' Foscari Venezia, Italy
Tommaso Pellegrini, Università Ca' Foscari Venezia, Italy

CoPDA2026: Exploring the Relationship between EUD, AI-Assisted Development, and Meta-Design.....Article 97
Barbara Rita Barricelli, Università degli Studi di Brescia, Italy
Gerhard Fischer, University of Colorado, United States
Daniela Fogli, Università degli Studi di Brescia, Italy
Anders Mørch, University of Oslo, Norway
Antonio Piccinno, University of Bari Aldo Moro, Italy
Stefano Valtolina, University of Milan, Italy

Evaluation of Advanced Multimodal Interfaces: Towards New Methodologies.....Article 98
Niklas Rönnerberg, Linköping University, Sweden
Camilla Forsell, Linköping University, Sweden

Advanced Visual Interfaces for Cultural Heritage (AVI-CH) 2026.....Article 99
Antonio Origlia, University of Naples Federico II, Italy
Julia Sheidin, Braude Academic College of Engineering, Israel
Tsvi Kuflik, University of Haifa, Israel
Niccolò Pretto, Free University of Bozen-Bolzano, Italy

Advances in Map-based Interfaces and Interactions – MAPII.....Article 100
Masood Masoodian, Aalto University, Finland
Saturnino Luz, University of Edinburgh, United Kingdom

Distributed Agency and Multimodal AI Interfaces: Meaning, Human-Centered Implications, and Pathways to Design and Implementation.....Article 101
Umberto Domanti, Free University of Bozen-Bolzano, Italy
Angela Faiella, University of Bologna, Italy
Caterina Moruzzi, University of Edinburgh, United Kingdom
Chiara Natali, Vrije Universiteit Amsterdam, Netherlands
Anna Marie Rezk, University of Glasgow, United Kingdom
Mario Mirabile, University of Santiago de Compostela, Spain

Designing and Building Hybrid Human-AI Systems (SYNERGY 2026).....Article 102
Tommaso Turchi, University of Pisa, Italy
Alan Dix, Swansea University, United Kingdom; Cardiff Metropolitan University, United Kingdom
Ben Wilson, Swansea University, United Kingdom
Matt Roach, Swansea University, United Kingdom
Alessio Malizia, University of Pisa, Italy; Molde University College, Norway

Designing Advanced Interfaces for Learning and Teaching	Article 103
<i>Audrey Serna</i> , INSA Lyon, France	
<i>Antonio Bucchiarone</i> , University of L'Aquila, Italy	
<i>Iza Marfisi-Schottman</i> , Université du Maine, France	
<i>Sebastian Simon</i> , Université du Maine, France	
<i>Arnaud Prouzeau</i> , Inria, Université Paris-Saclay, CNRS, France	
<i>David Bertolo</i> , Université de Lorraine, France	
<i>Elise Lavoué</i> , Université Jean Moulin Lyon 3, France	
<i>Alina Glushkova</i> , Mines Paris PSL University, France	
INI-DH 2026: 2nd Workshop on Innovative Interfaces in Digital Healthcare	Article 104
<i>Paola Barra</i> , University of Naples Parthenope, Italy	
<i>Andrea Antonio Cantone</i> , University of Salerno, Italy	
<i>Teresa Onorati</i> , Universidad Carlos III de Madrid, Spain	
CIVICS - Citizen Science Advanced Interfaces: From Sensing to Sensemaking	Article 105
<i>Catia Prandi</i> , University of Bologna, Italy	
<i>Diego Morra</i> , MIT Senseable City Lab, USA	
<i>Simone Mora</i> , MIT Senseable City Lab, USA	
<i>Alberto Martinetti</i> , University of Twente, Netherlands	
Trustable, Reproducible, and Intelligent Information Visualization Systems (TRI-IVIS)	Article 106
<i>Paolo Buono</i> , University of Bari Aldo Moro, Italy	
<i>Philippe Tamla</i> , Fernuniversität Hagen, Germany	
<i>Thomas Krause</i> , Fernuniversität Hagen, Germany	
<i>Haithem Afli</i> , Munster Technological University, Ireland	
<i>Matthias Hemmje</i> , Fernuniversität Hagen, Germany	
Future Horizons in Human-AI Interaction: Joint Perspectives from HCI and AI	Article 107
<i>Elisabeth André</i> , University of Augsburg, Germany	
<i>Cristina Conati</i> , University of British Columbia, Canada	
<i>Shelly Levy Tzedek</i> , Ben Gurion University, Israel	
<i>Maristella Matera</i> , Politecnico di Milano, Italy	
<i>Micol Spitale</i> , Politecnico di Milano, Italy	
Rethinking Artistic Research in the Age of AI: New Frameworks, HCAI Practices, and Challenges	Article 108
<i>Claudio Pomo</i> , Politecnico di Bari, Italy	
<i>Carmelo Ardito</i> , Politecnico di Bari, Italy	
<i>Alessandra Micalizzi</i> , SAE Institute, Italy	
<i>Elisa Poli</i> , Nuova Accademia di Belle Arti, Italy	
<i>Emanuele Lomello</i> , Nuova Accademia di Belle Arti, Italy	

In cooperation with



With the support of



Ca' Foscari
University
of Venice



Freie Universität Bozen
Libera Università di Bolzano
Università Lieldia de Bulsan

The Venice Lagoon Climate Change Dashboard as a tool for capacity building for local populations

Vito Garramone*
IUAV University of Venice
Venice, Italy
vgarramone@iuav.it

Francesco Musco
IUAV University of Venice
Venice, Italy
francesco.musco@iuav.it

Abstract

Among the many visualisation technologies, dashboards enable extensive exploration of data and its relationships. They enable the reporting and display of static data, historical series, and dynamic (continuously updated) data with a wide range of visualisation options. Therefore, in today's knowledge-based society, dashboards are extremely useful tools for both raising public awareness and activating accountability and/or decision support systems (or planning decision support systems). It is therefore essential to cultivate a data culture and provide useful insights for approaching these tools and interpreting the data they produce. The paper proposes a novel and imaginative method for engaging with data and its visualisations by incorporating analogue techniques. This approach encourages users to interact with data in tangible ways, fostering deeper understanding and new perspectives even when specific technical skills and expertise are lacking.

CCS Concepts

• **Information systems** → Information systems applications; • **Human-centered computing** → Visualization; • **Applied computing** → Education.

Keywords

Spatial-temporal analysis, Visualization Technologies, Open data, Climate change

ACM Reference Format:

Vito Garramone and Francesco Musco. 2026. The Venice Lagoon Climate Change Dashboard as a tool for capacity building for local populations. In *Proceedings of the 2026 International Conference on Advanced Visual Interfaces (AVI '26)*, June 08–12, 2026, Venice, Italy. ACM, New York, NY, USA, 4 pages. <https://doi.org/10.1145/3811427.3811530>

1 Introduction

Visualisation technologies have become prevalent across numerous fields, including planning [1, 2, 3, 4]. However, as [5] observe, "despite the wide use of visualisation to support decision-making in urban management, the understanding of urban data visualisation remains limited in the literature." Currently, neither plans nor public administrations systematically employ dashboards, with or without

maps, nor do they often integrate them into GIS environments. The use of open data to engage citizens or to demonstrate the progress of short- and medium-term policy objectives or plan actions is even less common.

Today, many open data sources provide both historical series and real-time data dynamics, which are highly valuable for monitoring, informing, raising awareness, and supporting accountability. Moreover, many dashboards now offer extensive customisation, enabling users to explore data and investigate diverse combinations. Taken together, these features position dashboards as effective tools for building citizens' capacity on local issues, such as climate change and pollution, and as valuable components within Planning Decision Support Systems.

This paper introduces a simplified, educational dashboard designed for workshops that utilise demographic, climate, and pollution data from the Venice Lagoon. The initiative aims to foster a "data culture" and foundational analysis skills through creative visualisation techniques that blend digital and analogical approaches to data and their interrelationships.

2 Dashboards and awareness

"A dashboard is a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance." [6]

While this is the current use of this visualisation technology, it has acquired many potentialities over time (the term appeared in 1847 according to the Oxford English Dictionary, or 1846, according to [7]). The tool essentially allows you to 1) focus on certain aspects; 2) extract and display the data from these aspects in a synoptic manner; 3) interact with the data or with data visualisation methods. Often, however, this experience of browsing and exploring data requires specific skills to understand the results and trends displayed. Very often, this deficiency also inhibits data navigation or limits the acquisition of data, information, and knowledge. For these reasons, dashboards can also be classified by their intended audience: a technical user, i.e., with appropriate training and expertise, who must perform certain functions or provide an action support system (piloting, rating, etc.); an integrated pool of users, some with technical training and some decision-makers, to guide or support decision support systems (such as for control rooms or operational rooms); many end users, with varying degrees of knowledge of the topic, the technologies used, and with different interests or needs (interactive information available on websites, newspapers, etc.).

According to the literature, urban geospatial dashboards are distinguished based on their purposes and interface styles. Regarding

*Corresponding author.



This work is licensed under a Creative Commons Attribution 4.0 International License. *AVI '26, Venice, Italy*

© 2026 Copyright held by the owner/author(s).
ACM ISBN 979-8-4007-2342-1/2026/06
<https://doi.org/10.1145/3811427.3811530>

purposes [6, 8, 9, 10, 11], we have operational dashboards, which describe spaces, phenomena, and their states through measurements; analytical dashboards, which go beyond descriptive statistics to perform data tests and diagnoses, or to demonstrate relationships between variables and, in some cases, even construct statistical-interpretative models or their relationships, models, etc.; strategic dashboards, which build future forecasts based on specific models. Regarding the graphical user interface styles used, however, there are two distinct trends: one that employs single-page styles and one that utilises drill-down [11]. For operational purposes, the single-page dashboard design is the most commonly used, allowing users a synoptic view of the information. Typically, the drill-down style is used for analytical and strategic purposes, and therefore requires customisation, in-depth analysis, and often the use of drop-down menus. Often, however, the boundary between the single-page and drill-down styles is blurred. However, considering this bipartite nature and the ability to visualise or manipulate data. It collects as much data as possible, often from the platform, traffic cameras, various monitoring stations, smart grids, newspapers, ex-Twitter messages, and so on. It allows the recipient to explore the data and its interactions, as well as choose the topics and levels of detail to explore. It's also possible to compare data at different spatial (districts, neighborhoods, and communities) or temporal (daily, monthly, or yearly) scales and by topic (childcare services, correctional facilities, education, environmental protection, health, homelessness, sanitation, police and firefighters, and more), export it, and explore the indices, comparisons, and correlations (textual explanations and specific attachments are also available). Finally, achieving strategic objectives necessitates interactive engagement, often facilitated through participatory processes. Each of these forms of data experience contributes to social learning and enhances citizens' awareness of their city's performance, thereby fostering greater engagement. Public bodies can leverage these tools in diverse ways to address a range of needs and objectives.

3 A prototype of an educational program though a dashboard

To address operational-descriptive needs, we developed a user-friendly, single-page dashboard utilising open data from IS-TAT, ISPRA, and ARPAV. This dashboard highlights key climatic, demographic, and pollution indicators for the Venice Lagoon. Named DASHBOARD_LaVECC1, it was created using the Shiny R package (<https://shiny.posit.co/>), a free and open-source framework supported by Posit and integrated within RStudio (Version 2025.09.1+401) [12]. The dashboard comprises 10 thematic panels—8 of which are dynamic—that explore the impacts of climate change in the area over periods ranging from 2000 to 2025, depending on data availability.

Three dynamic visualisations from the dashboard were selected as an analytical framework for engaging non-expert citizens in the interpretation of urban environmental data. The dataset encompasses three dimensions particularly relevant to urban resilience: temperature (to examine heat trends and thermal extremes in the built environment), wind (a critical variable governing tidal dynamics and urban microclimate), and pollution (to assess urban waste patterns and their spatial distribution). Each visualisation

corresponds to distinct data characteristics and affords different modes of inquiry into urban environmental change.

In the case of temperature, two data types are considered: aggregated temperature data — comprising the mean of average, minimum, and maximum values — and absolute temperature data (see Figure 1). The line graph reveals a recurring pattern in the urban heat time series: a consistent $\sim 3^{\circ}\text{C}$ differential between mean annual temperature and the annual absolute extremes. Critically, when maximum temperatures are examined in isolation, an exclusive reliance on average values proves to substantially underrepresent the intensity of urban heat stress — and, by extension, its impact on the liveability and thermal comfort of urban spaces. The average is a central value, and we might be interested in knowing the extreme values (indicated by the asterisk or red sun). Furthermore, averages can yield a frequency not found in extreme values, as in the case of the maximum average value in 2000 or the homogenization and flattening of various oscillations. So if we're interested in heat waves, perhaps actual values could be more useful than average values. The same is true if we want to study microtrends within our time series. And precisely on the maximums, we've built an analysis exercise using the similarity with the spheres of an abacus. Using three axes aligned at the highest temperatures and returning a value of 2 (black) for centring on the temperature, a value of 1 for semi-centring (grey), and a value of 0 (no centring), it is possible to study the historical series as a plot, a symphony, a texture. This allows us to verify the frequency in an analogical and artistic way, that is, without any technical expertise. It is easier to notice a micro-trend of two high peaks in close proximity in 2022 and 2024 (both above 25°C), unlike what happened in the past, which in the period 2000-2021 presented only 4 peaks (2003, 2006, 2015, 2018), with 2024 recording the highest absolute value of the series (31.3°C).

In the case of the Wind Direction data, the choice of the spider chart is again inspired by a representation of analogical similarity with the compass rose (see Figure 2). With this data, the user can choose between annual data, which shows a trend analysis, and monthly data that allows them to verify which months were characterized by "acqua alta" (significant tide values), with problems related to damage and traffic disruptions, especially in the historic centre of Venice. The directions to be monitored, as they favour high tide in Venice, are all those related to the Sirocco, namely East-Southeast (ESE, in light blue and enclosed within a red oval), Southeast (SE, in grey), and partly also South-Southeast (SSE, not in our representation). In this case, it is necessary to monitor only the occupation of the lower left quarter to understand the periods in which high tide occurred.

Finally, the waste data allow the end user to experience a crosstable, that is, the value of the resultant resulting from the intersection of two variables, in our case the household user thresholds (represented as a logarithmic value, to abstract and compare the different trends despite differences in scale) and the total kilograms of waste produced in the various municipalities and in various years. Each municipality was represented by an identifying colour and the size of the circle, which represented the population's size in logarithmic proportion (smaller and similar circles belonged to municipalities with fewer inhabitants and with the same scale of values; larger circles represented municipalities with a larger population,

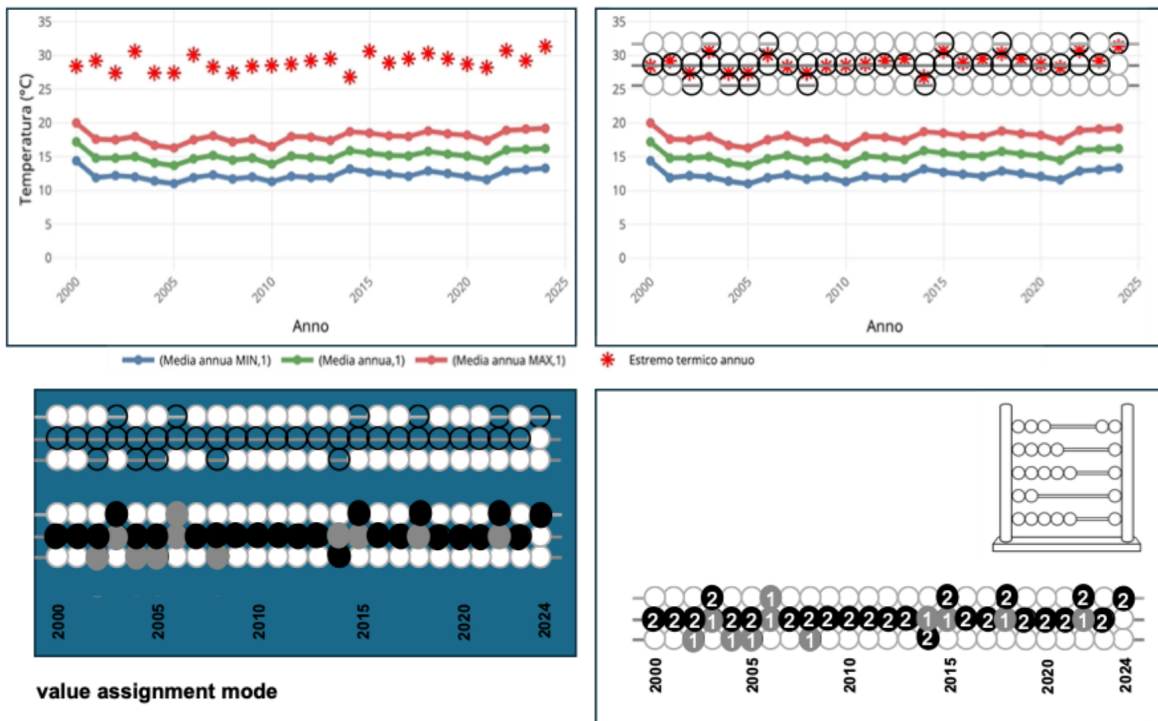


Figure 1: The transition from real data to an analog interpretation of the temporal trends of annual extreme temperatures.



Figure 2: The analogy between a compass rose and a spider chart, as a way to help read the predominant direction of the winds.

etc.). How can we explain the trends over the two decades? Simply through the visual appearance of the shape. Where the shape of the same colour differed from the circle, then an oscillation around the same values had occurred (see Jesolo, Cavallino-Treponi, etc.). Where the shift occurred along an axis, such as the horizontal one (as in the case of Mira), the greatest impact was on waste production per capita, unlike where the quantity of waste had not changed much, unlike the population variation, which had decreased significantly, as in the case of Codevigo. Simply hover your mouse over the circle to see the data change over the years (indicated by the arrows in our representation).

These three exercises constitute distinct pedagogical entry points for fostering data literacy among citizens in relation to climate,

demographic, and pollution dynamics in the urban (spatial) environment. Beyond their analytical function, they are designed as icebreakers to lower the threshold of engagement with open urban (spatial) data — introducing participants to key data consultation practices such as the identification of thresholds, ratios, and temporal patterns as foundational tools for evidence-based urban (spatial) inquiry.

4 Suggestions and proposals for the future

Currently, we have no empirical evidence of the results of such a training program. Target groups are currently being determined; the first phase will likely involve schools (youth target) and associations (adults, not necessarily with technical profiles), followed by

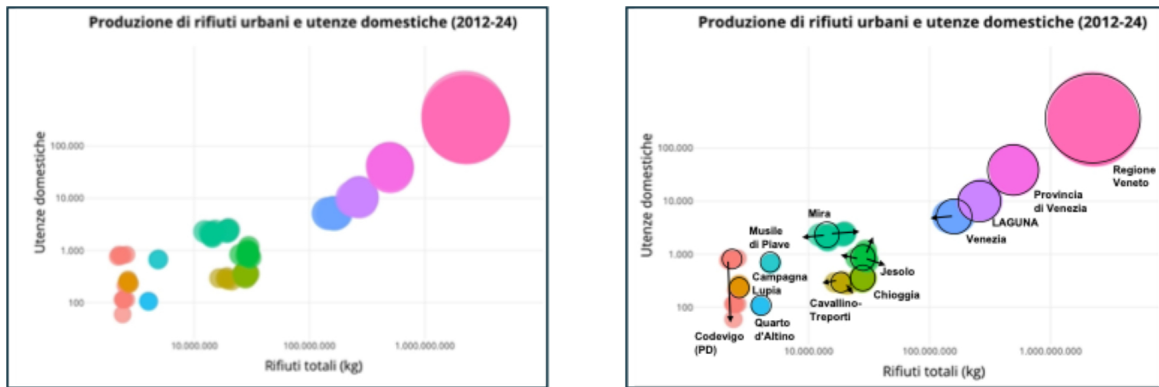


Figure 3: Visualization of the variations in waste production taking into account the ratio between domestic users and kilograms of waste produced per year, through the deburring and moving of the circles.

a second phase involving institutions (officials target) and professionals (professional associations) to test the effectiveness of this program.

Furthermore, the number of monitoring stations in the dashboard will be increased to provide increasingly abundant data and results that better fit the analysed lagoon phenomena, as well as to provide the most realistic possible dimension in the simulations. It will also be verified whether, as exploration options increase, users actually decide to explore the data after an initial familiarity with the dashboard tool.

Further research may also be conducted in the future to verify the possibility of distinguishing learning performance by comparing the differences between dashboards with single-page styles and those using drill-down styles.

References

- [1] Antje Kunze, Remo Burkhard, Serge Gebhardt, and Bige Tunçer. 2012. Visualization and decision support tools in urban planning. In *Communications in Computer and Information Science*. Springer, Berlin, Heidelberg, 279–298. https://doi.org/10.1007/978-3-642-29758-8_15
- [2] Satyendra Singh, Günter Wenzel, and Frank Brettschneider. 2016. Visualization for decision-making in smart cities, in *Smart Economy in Smart Cities: International Collaborative Research: Ottawa, St. Louis, Stuttgart, Bologna, Cape Town, Nairobi, Dakar, Lagos, New Delhi, Varanasi, Vijayawada, Kozhikode, Hong Kong*. Springer, Singapore, 317–322. https://doi.org/10.1007/978-981-10-1610-3_14
- [3] Christopher J. Pettit, Ivo Widjaja, Patrizia Russo, Richard Sinnott, Robert J. Stinson, and Martin Tomko. 2012. Visualisation support for exploring urban space and place. In *Proceedings of the 22nd ISPRS Congress Annals Photogrammetry Remote Sensing and Spatial Information Sciences*, Melbourne, 1, Aug. 25–Sept. 1, 153–158. <https://doi.org/10.5194/isprsannals-1-2-153-2012>
- [4] Michael Batty, Andrew Hudson-Smith, Stephan Hugel, and Flora Roumpani. 2018. Visualising data for smart cities. In *Smart Technologies: Breakthroughs in Research and Practice*, IGI Global Scientific Publishing, 453–475. <https://doi.org/10.4018/978-1-5225-2589-9.ch021>
- [5] Teresa Cepero, Luis G. Montané-Jiménez, and Guadalupe Toledo-Toledo. 2021. Visualization Technologies to Support Decision-Making in City Management. *Program Comput Soft* 47, 803–816. <https://doi.org/10.1134/S0361768821080107>
- [6] Stephen Few. 2007. Dashboard confusion revisited. *Visual Business Intelligence Newsletter*, March, 1–6. Retrieved April 9, 2026 from https://perceptualedge.com/articles/visual_business_intelligence/dboard_confusion_revisited.pdf
- [7] Shannon Mattern. 2015. Mission Control: A History of the Urban Dashboard. *Places Journal*, March. Retrieved April 9, 2026. <https://doi.org/10.22269/150309>
- [8] Stephen Few. 2006. *Information Dashboard Design: The Effective Visual Communication of Data*. O’Reilly Media. Boston, MA, USA.
- [9] Lisa Pappas, and Lisa Whitman. 2011. Riding the technology wave: Effective dashboard data visualization. In *Symposium on Human Interface*. Springer, Berlin, Germany, 249–258. https://doi.org/10.1007/978-3-642-21793-7_29
- [10] Ieva Dobraja, Menno-Jan Kraak, and Yuri Ngelhardt. 2018. Facilitating Insights with a User Adaptable Dashboard, Illustrated by Airport Connectivity data. In *Proceedings of the 2017 International Cartographic Conference*, Washington, DC, USA, 2–7 July 2017, 1–9. <https://doi.org/10.5194/ica-proc-1-30-2018>
- [11] Changfeng Jing, Mingyi Du, Songnian Li, Siyuan Liu. 2019. Geospatial dashboards for monitoring smart city performance, *Sustainability* 11(20), 5648. <https://doi.org/10.3390/su11205648>
- [12] R Core Team. 2019. *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>