PERSONAL INFORMATION

Bruno Fanini

CURRENT POSITION

Researcher @ CNR ISPC
(Institute of Heritage Science, National Research Council)

TOPICS

His research and development activities are focused on real-time 3D visualization and interaction with complex and multi-dimensional data, immersive VR and 3D user interfaces, Web3D/WebXR applications and services. He designed and developed several open-source tools, internationally awarded applications, applied VR games, scalable frameworks for liquid access and deployment of Web3D/WebXR applications, web services for HS infrastructures within national and international projects. He also focuses his research on re-contextualization interaction models and encoding models targeting visual/immersive analytics for large amounts of user interactions.

H-INDEX

16 (Scopus); 10 (Web of Science); 21 (Google Scholar)

WORK EXPERIENCE

2022 – Present

Researcher @ CNR ISPC

`https://www.ispc.cnr.it/en/`

Research and development activities:

– Real-time 3D visualization of complex data, development and deployment of Web3D/WebXR and desktop 3D applications
– Immersive VR (HMD) presentation and interaction
– Services and tools to process, present and interact with online 3D content including collaborative logic
– Natural interaction, 3D user interfaces and spatial UIs

Scientific/Technical responsibilities:

– Leader of Work Package 4 "Hybrid Collaborative Simulation Environment" and tech leader of WG1 in ECCCH COLOURS project (`https://colours-eccch.eu/`)
– Research Unit responsible in the PNRR PRIN project MetaMic ("The metaverse of the unbuilt architecture of M. Buonarroti") funded by European Union NextGenerationEU and Italian Ministry of University and Research
– Leader of Work Package 6 "Resources Accessibility: Servification, Virtualization and Remotization" in H2IOSC (Humanities and Heritage Italian Open Science Cloud - `https://www.h2iosc.cnr.it/`)
– Scientific responsible for unit #14 in SHINE (Strengthening the Italian Nodes of E-RIHS - `http://www.e-rihs.it/`) DigiLab

Peer review activities:

– Computers & Graphics (Elsevier)
– VIRE (Virtual Reality journal - Springer)
– DAACH (Digital Applications in Archaeology and Cultural Heritage - Elsevier)
– CULHER (Journal of Cultural Heritage - Elsevier)

2014 – 2022	**Research Fellow @ CNR ISPC**

2013–2014	**Scolarship @ CNR ITABC**

Open-source C++ tools for online editing of 3D scenes and user interfaces

2010	**Scolarship @ Padua University**

Development of C++ plugin OSG4Web and back-end components (coordinated by CNR ITABC) for "Aquae Patavinae" project

2008	**Term contract @ CNR ITABC**

EDUCATION AND TRAINING

2019 **PhD - Thesis Title: "Image-based encoding of non-linear user interactions for Web3D"**

Dept. of Computer Science, Sapienza University, Rome (Italy)

2014 **V-Move Mobility Program**

Dept. of Design Sciences, LTH, Lund University (Sweden)

Visiting researcher at IKDC (Ingvar Kamprad Designcentrum). Research Topics: 3D User Interfaces, Gesture-based Interaction, Game Interaction Design

2013 **Master of Science**

Dept. of Computer Science, University of Bologna, Italy

2006 **Bachelor of Science**

Dept. of Computer Science, University of Bologna, Italy

RESEARCH PRODUCTS

2015–Present **ATON Framework**

ATON is a framework to create liquid and collaborative Web3D/WebXR apps (presenters, applied games, tools, etc...) interacting with CH objects and 3D scenes on the web, through common web browsers. It allows to craft scalable and cross-device web-apps (mobile, desktop and immersive VR) exploiting modern and interoperable web standards, without any installation required for final users. It is employed in several national and international projects, with a growing international community. [15][2][14] [23][7][1][24][21][28][22][29] [34].

🔗 `https://aton.ispc.cnr.it/site/`

🔗 `https://github.com/phoenixbf/aton`

2024–Present **Interlumo**

Interlumo offers a suite of modular and cloud-based services targeting researchers, professionals, analysts willing to study and understand large amounts of interactions generated by remote applications, public installations, virtual/physical spaces, online web-apps and much more. It offers customizable components for capture, processing and inspection through collaborative Visual/Immersive Analytics Web3D/WebXR tools. [8][17][22][21][25][6][4][5]

🔗 `https://interlumo.ispc.cnr.it/`

🔗 `https://github.com/phoenixbf/kapto`

🔗 `https://github.com/phoenixbf/merkhet-app`

2024–Present   MuLaX

MuLaX (Multi-Layer eXtensible eXplorer) is a Web3D/WebXR tool designed and developed under the PERCEIVE EU project, offering users new ways to access, discover and examine diagnostic processes on multi-layered collections through a standard web browser. [3]

✆ `https://perceive-horizon.eu/index.php/results/perceive-tools/tool-mulax/`

git `https://github.com/phoenixbf/mulax`

2019–Present   PRISMIN

"Processing and transfeR of Interaction States and Mappings through Image-based eNcoding": a formalized model [17][22][21] [25][6] investigated and developed during the PhD thesis to encode user interactions as lightweight images exchanged in networked Web3D/WebXR contexts. The model offers "interaction prisms" that can be employed to *refract* interaction states and bake them into 2D images.

git `https://github.com/phoenixbf/prismin`

2018–Present μVR Model

The μVR model [27] combines real-walking techniques and an adaptive, multi-scale interaction to craft immersive VR re-contextualization applications and games. The developed model aims to completely avoid or minimize motion sickness through physical motions, fully exploiting the tracked area (6-DOF HMDs).

✆ `http://osiris.itabc.cnr.it/scenebaker/index.php/projects/uvr/`

git `https://github.com/phoenixbf/uVRmodel`

2018–Present   EMviq

EMviq [26],[32] is a complete, interactive 4D visualization and interrogation tool for GraphDBs, focused on automatic extraction of semantic descriptors from GraphML data. The tool offers interactive 3D visualization - including immersive VR - ease-of-use and integration with cloud services in order to establish a fast and robust pipeline within a multi-disciplinary team.

✆ `http://osiris.itabc.cnr.it/scenebaker/index.php/projects/emviq/`

git `https://github.com/phoenixbf/emviq`

2018   NIXAMP

Scalable web-based infrastructure [28] for augmentation, dissemination and interactive presentation of 3D models (museums collections) with responsive, cross-device VR visualization over local networks.

2016   DPF

A compact data model developed [35] for omnidirectional image-based data transport in order to perform egocentric encoding of immersive virtual environments, targeting online VR dissemination (WebVR/XR), now integrated into the ATON framework.

✆ `http://osiris.itabc.cnr.it/scenebaker/index.php/projects/dpf/`

git `https://github.com/phoenixbf/dpf`

2016   ovrWalker

Desktop application for immersive (VR) visualization and exploration of multi-resolution 3D environments through Head-mounted displays and gesture-based sensors. Special components allow also to automatically trace/record user sessions for visual inspection after public events.

✆ `http://osiris.itabc.cnr.it/scenebaker/index.php/projects/osglab/ovrwalker/`

✆ `http://www.itabc.cnr.it/progetti/ovrwalker`

2014 ARIADNE Landscape Services

A set of online services [23] developed for ARIADNE European Infrastructure (`http://www.ariadne-infrastructure.eu/`), focused on processing, management and presentation of large 3D interactive terrain datasets within a collaborative, cloud-based workflow among different professionals. Services are developed using responsive HTML5 and WebGL for desktop and mobile browsers

🔗 `http://landscape.ariadne-infrastructure.eu/`

🎬 `https://www.youtube.com/watch?v=45VlGg7HLcc`

2015 Admotum

A gesture-based serious game [36] for public exhibits that allows visitors to interact with virtual reconstructed environments to find and collect 3D objects following a treasure hunting game model. Modular architecture allows an extended and collaborative gesture-based gameplay among multiple visitors

🎬 `https://www.youtube.com/watch?v=RKRs6pkbksU`

2014 Imago Bononiae

A gesture-based serious game [37] for public exhibits, focused on the interactive exploration of a large 3D reconstruction of Bologna during the Roman age using natural interaction (Kinect sensor). The user task is to discover and collect 3 different "peritiae" (skills), each unlocking a new gestural ability (natural interaction)

🎬 `https://www.youtube.com/watch?v=mm08iplSfLA`

AWARDS

2015 "AiRome/Admotum" (Extended Natural Interaction)

Awarded by 2015 Digital Heritage International Congress and V-MusT.net as "Best Exposition - Quality of Content"

🔗 `http://www.digitalheritage2015.org/awards/`

2013 "Imago Bononiae" (Natural Interaction)

Awarded by 2013 Digital Heritage International Congress and V-MusT.net as "Best Exposition - Quality of Content"

🔗 `http://www.digitalheritage2013.org/awards/`

2008 "Virtual Rome" project

eContent Award (eLearning category)

🔗 `http://www.econtentaward.it/2008/Press/Classifica_Finale.asp`

PUBLICATIONS

[1] Chiara Florise Amadei, Marcello Massidda, Sofia Menconero, Giorgio Gosti, and **Bruno Fanini**. "Early Stage of Community-Driven UI/UX Refactoring of the Open-Source ATON Framework". In: *Digital Heritage*. Ed. by Stefano Campana, Daniele Ferdani, Holger Graf, Gabriele Guidi, Zackary Hegarty, Sofia Pescarin, and Fabio Remondino. The Eurographics Association, 2025. ISBN: 978-3-03868-277-6. DOI: `10.2312/dh.20253115`.

[2] **Bruno Fanini**, Giorgio Gosti, Chiara Florise Amadei, and Sofia Menconero. "Shaping a Web3D framework for different scientific communities: ATON as a service in H2IOSC". In: *Digital Heritage*. Ed. by Stefano Campana, Daniele Ferdani, Holger Graf, Gabriele Guidi, Zackary Hegarty, Sofia Pescarin, and Fabio Remondino. The Eurographics Association, 2025. ISBN: 978-3-03868-277-6. DOI: `10.2312/dh.20253055`.

[3] **Bruno Fanini**, Marcello Massidda, Daniele Ferdani, Federica Bonifazi, Donata Magrini, Roberta Iannaccone, and Cristiana Barandoni. "Interactive and immersive discovery of diagnostic processes on multi-layered 3D collections on the web: the MuLaX tool". In: *Digital Heritage*. Ed. by Stefano Campana, Daniele Ferdani, Holger Graf, Gabriele Guidi, Zackary Hegarty, Sofia Pescarin, and Fabio Remondino. The Eurographics Association, 2025. ISBN: 978-3-03868-277-6. DOI: 10.2312/dh.20253102.

[4] Giorgio Gosti, Sofia Menconero, Chiara Florise Amadei, and **Bruno Fanini**. "Procezo: Data Processing Services for 3D Analytics". In: *Digital Heritage*. Ed. by Stefano Campana, Daniele Ferdani, Holger Graf, Gabriele Guidi, Zackary Hegarty, Sofia Pescarin, and Fabio Remondino. The Eurographics Association, 2025. ISBN: 978-3-03868-277-6. DOI: 10.2312/dh.20253099.

[5] Valeria Minisini, Giorgio Gosti, and **Bruno Fanini**. "The IlluminAI project: a deep neural network and immersive visualization system to enhance illuminated manuscripts". In: *Digital Heritage*. Ed. by Stefano Campana, Daniele Ferdani, Holger Graf, Gabriele Guidi, Zackary Hegarty, Sofia Pescarin, and Fabio Remondino. The Eurographics Association, 2025. ISBN: 978-3-03868-277-6. DOI: 10.2312/dh.20253119.

[6] Danilo Avola, Luigi Cinque, Angelo Di Mambro, Alessio Fagioli, Marco Raoul Marini, Daniele Pannone, **Bruno Fanini**, Gian Luca Foresti, et al. "Spatio-Temporal Image-Based Encoded Atlases for EEG Emotion Recognition". In: *International Journal of Neural Systems* 34.5 (2024), p. 2450024.

[7] Roberto Balzani, Sebastian Barzaghi, Gabriele Bitelli, Federica Bonifazi, Alice Bordignon, Luca Cipriani, Simona Colitti, Federica Collina, Marilena Daquino, Francesca Fabbri, et al. "Saving temporary exhibitions in virtual environments: The Digital Renaissance of Ulisse Aldrovandi–Acquisition and digitisation of cultural heritage objects". In: *Digital Applications in Archaeology and Cultural Heritage* 32 (2024), e00309.

[8] **Bruno Fanini** and Giorgio Gosti. "A New Generation of Collaborative Immersive Analytics on the Web: Open-Source Services to Capture, Process and Inspect Users' Sessions in 3D Environments". In: *Future Internet* 16.5 (2024), p. 147.

[9] Daniele Ferdani, Diego Ronchi, **Bruno Fanini**, Rachele Manganelli Del Fà, Enzo d'Annibale, Alice Bordignon, and Sofia Pescarin. "Brancacci Chapel in Florence: Surveying and Real-Time 3d Simulation for Conservation and Communication Purposes". In: *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences* 48 (2023), pp. 535–540.

[10] Sofia Pescarin, Ivana Cerato, Enzo d'Annibale, **Bruno Fanini**, Daniele Ferdani, Rachele Manganelli Del Fà, Alessandra Marasco, Marcello Massidda, Augusto Palombini, and Diego Ronchi. "Hybrid XR Collaborative and Guided Experiences in Cultural Heritage: Brancacci POV Prototype." In: *GCH*. 2023, pp. 157–161.

[11] Eva Pietroni, Alessandra Chirivì, **Bruno Fanini**, and Alberto Bucciero. "An Innovative Approach to Shape Information Architecture Related to Ancient Manuscripts, Through Multi-layered Virtual Ecosystems. From Codex4D to DataSpace Project". In: *International Conference on Extended Reality*. Springer. 2023, pp. 247–267.

[12] **Bruno Fanini**, Emanuel Demetrescu, Alberto Bucciero, Alessandra Chirivi, Francesco Giuri, Ivan Ferrari, and Nicola Delbarba. "Building blocks for multi-dimensional WebXR inspection tools targeting cultural heritage". In: *International Conference on Extended Reality*. Springer. 2022, pp. 373–390.

[13] Simone Berto, Emanuel Demetrescu, **Bruno Fanini**, Jacopo Bonetto, and Giuseppe Salemi. "Analysis and Validation of the 3D Reconstructive Process through the Extended Matrix Framework of the Temple of the Roman Forum of Nora (Sardinia, CA)". In: *Environmental Sciences Proceedings* 10.1 (2021), p. 18.

[14] **Bruno Fanini**, Daniele Ferdani, and Emanuel Demetrescu. "Temporal lensing: an interactive and scalable technique for Web3D/WebXR applications in cultural heritage". In: *Heritage* 4.2 (2021), pp. 710–724.

[15]   **Bruno Fanini**, Daniele Ferdani, Emanuel Demetrescu, Simone Berto, and Enzo d'Annibale. "ATON: An Open-Source Framework for Creating Immersive, Collaborative and Liquid Web-Apps for Cultural Heritage". In: *Applied Sciences* 11.22 (2021), p. 11062.

[16]   Emanuel Demetrescu, Enzo d'Annibale, Daniele Ferdani, and **Bruno Fanini**. "Digital replica of cultural landscapes: An experimental reality-based workflow to create realistic, interactive open world experiences". In: *Journal of Cultural Heritage* 41 (2020), pp. 125–141.

[17]   **Bruno Fanini** and Luigi Cinque. "Encoding, Exchange and Manipulation of Captured Immersive VR Sessions for Learning Environments: the PRISMIN Framework". In: *Applied Sciences* 10.6 (2020), p. 2026.

[18]   Daniele Ferdani, **Bruno Fanini**, Maria Claudia Piccioli, Fabiana Carboni, and Paolo Vigliarolo. "3D reconstruction and validation of historical background for immersive VR applications and games: The case study of the Forum of Augustus in Rome". In: *Journal of Cultural Heritage* (2020).

[19]   Alessandro Luigini, **Bruno Fanini**, Alessandro Basso, and Demis Basso. "Heritage education through serious games. A web-based proposal for primary schools to cope with distance learning". In: *VITRUVIO-International Journal of Architectural Technology and Sustainability* 5.2 (2020), pp. 73–85. URL: https://doi.org/10.4995/vitruvio-ijats.2020.14665.

[20]   Sofia Pescarin, **Bruno Fanini**, Daniele Ferdani, Keith Mifsud, and Andrew Hamilton. "Optimising Environmental Educational Narrative Videogames: The Case of 'A Night in the Forum'". In: *Journal on Computing and Cultural Heritage (JOCCH)* 13.4 (2020), pp. 1–23.

[21]   **Bruno Fanini** and Luigi Cinque. "An Image-based Encoding to Record and Track Immersive VR Sessions". In: *Computational Science and Its Applications – ICCSA 2019*. Ed. by Sanjay Misra, Osvaldo Gervasi, Beniamino Murgante, Elena Stankova, Vladimir Korkhov, Carmelo Torre, Ana Maria A.C. Rocha, David Taniar, Bernady O. Apduhan, and Eufemia Tarantino. Springer International Publishing, 2019, pp. 299–310. ISBN: 978-3-030-24296-1.

[22]   **Bruno Fanini** and Luigi Cinque. "Encoding immersive sessions for online, interactive VR analytics". In: *Virtual Reality* (2019). ISSN: 1359-4338. DOI: 10.1007/s10055-019-00405-w. URL: http://doi.org/10.1007/s10055-019-00405-w.

[23]   **Bruno Fanini**, Sofia Pescarin, and Augusto Palombini. "A cloud-based architecture for processing and dissemination of 3D landscapes online". In: *Digital Applications in Archaeology and Cultural Heritage* (2019), e00100.

[24]   Massimiliano Lo Turco, Paolo Piumatti, Michele Calvano, Elisabetta Caterina Giovannini, Noemi Mafrici, Andrea Tomalini, and **Bruno Fanini**. "Interactive Digital Environments for Cultural Heritage and Museums. Building a digital ecosystem to display hidden collections". In: *DISEGNARECON* 12.23 (2019), pp. 7–1.

[25]   **Bruno Fanini** and Luigi Cinque. "Encoding VR sessions: image-based techniques to record and inspect immersive experiences". In: *2018 3rd Digital Heritage International Congress (DigitalHERITAGE) held jointly with 2018 24th International Conference on Virtual Systems & Multimedia (VSMM 2018)*. IEEE. 2018, pp. 1–8. DOI: https://doi.org/10.1109/DigitalHeritage.2018.8810070.

[26]   **Bruno Fanini** and Emanuel Demetrescu. "Carving Time and Space: A Mutual Stimulation of IT and Archaeology to Craft Multidimensional VR Data-Inspection". In: *International and Interdisciplinary Conference on Digital Environments for Education, Arts and Heritage*. Springer. 2018, pp. 553–565. DOI: 10.1007/978-3-030-12240-9_58.

[27]   **Bruno Fanini**, Alfonsina Pagano, and Daniele Ferdani. "A Novel Immersive VR Game Model for Recontextualization in Virtual Environments: The μVR Model". In: *Multimodal Technologies and Interaction* (2018). DOI: 10.3390/mti2020020. URL: http://doi.org/10.3390/mti2020020.

[28] S. Gonizzi Barsanti, S. G. Malatesta, F. Lella, **B. Fanini**, F. Sala, E. Dodero, and L. Petacco. "The Winckelmann300 Project: Dissemination of Culture with Virtual Reality at the Capitoline Museum in Rome". In: *ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences* XLII-2 (2018), pp. 371–378. DOI: 10.5194/isprs-archives-XLII-2-371-2018. URL: https://www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XLII-2/371/2018/.

[29] Augusto Palombini, **Bruno Fanini**, and Alfonsina Pagano. "The Virtual Museum of the Upper Calore Valley". In: *International and Interdisciplinary Conference on Digital Environments for Education, Arts and Heritage*. Springer. 2018, pp. 726–736. DOI: 10.1007/978-3-030-12240-9_74.

[30] Sofia Pescarin, Enzo D'Annibale, **Bruno Fanini**, and Daniele Ferdani. "Prototyping on site Virtual Museums: the case study of the co-design approach to the Palatine hill in Rome (Barberini Vineyard) exhibition". In: *2018 3rd Digital Heritage International Congress (DigitalHERITAGE) held jointly with 2018 24th International Conference on Virtual Systems & Multimedia (VSMM 2018)*. IEEE. 2018, pp. 1–8.

[31] Eva Pietroni, Alfonsina Pagano, and **Bruno Fanini**. "UX Designer and Software Developer at the Mirror: Assessing Sensory Immersion and Emotional Involvement in Virtual Museums". In: *Studies in Digital Heritage* 2.1 (2018), pp. 13–41.

[32] Emanuel Demetrescu and **Bruno Fanini**. "A white-box framework to oversee archaeological virtual reconstructions in space and time: Methods and tools". In: *Journal of Archaeological Science: Reports* 14 (2017), pp. 500–514. ISSN: 2352-409X. DOI: https://doi.org/10.1016/j.jasrep.2017.06.034.

[33] Carlo Meghini, Roberto Scopigno, Julian Richards, Holly Wright, Guntram Geser, Sebastian Cuy, Johan Fihn, **Bruno Fanini**, Hella Hollander, Franco Niccolucci, et al. "ARIADNE: a research infrastructure for archaeology". In: *Journal on Computing and Cultural Heritage (JOCCH)* 10.3 (2017), p. 18.

[34] A. Antal, E. Bota, E. Demetrescu, C. Ciongradi, **B. Fanini**, E. d'Annibale, C. Dima, and Ferdani D. "A complete workflow from the data collection on the field to the deployment of a Virtual Museum: the case of Virtual Sarmizegetusa." In: (2016).

[35] **Bruno Fanini** and Enzo d'Annibale. "A framework for compact and improved panoramic VR dissemination". In: *Proceedings of the 14th Eurographics Workshop on Graphics and Cultural Heritage*. Eurographics Association. 2016, pp. 33–42.

[36] **Bruno Fanini**, Enzo d'Annibale, Emanuel Demetrescu, Daniele Ferdani, and Alfonsina Pagano. "Engaging and shared gesture-based interaction for museums the case study of K2R international expo in Rome". In: *2015 Digital Heritage*. Vol. 1. IEEE. 2015, pp. 263–270.

[37] **Bruno Fanini** and Alfonsina Pagano. "Interface design for serious game visual strategies the case study of "Imago Bononiae"". In: *2015 Digital Heritage*. Vol. 2. IEEE. 2015, pp. 623–626.

[38] **Bruno Fanini**. "A 3D interface to explore and manipulate multi-scale virtual scenes using the leap motion controller". In: *ACHI 2014, The Seventh International Conference on Advances in Computer-Human Interactions*. Citeseer. 2014, pp. 258–263.

[39] **Bruno Fanini** and Luigi Calori. "3D interactive visualization of crowd simulations at urban scale". In: *9°Congresso Citta' e Territorio Virtuale, Roma, 2, 3 e 4 ottobre 2013*. Universita' degli Studi Roma Tre. 2014, pp. 276–284.

[40] Antonio Baglivo, Francesca Delli Ponti, Daniele De Luca, Antonella Guidazzoli, Maria Chiara Liguori, and **Bruno Fanini**. "X3D/X3DOM, Blender Game Engine and OSG4WEB: open source visualisation for cultural heritage environments". In: *2013 Digital Heritage International Congress (DigitalHeritage)*. Vol. 2. IEEE. 2013, pp. 711–718.

[41] **Bruno Fanini**, Luigi Calori, Daniele Ferdani, and Sofia Pescarin. "Interactive 3D landscapes on line". In: *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences* 38.5/W16 (2011).

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[44] Sofia Pescarin, Daniele Ferdani, **Bruno Fanini**, Ivana Cerato, and Guido Lucci Baldassari. "Handling transparency in 3d reconstructed on line environments: Aquae patavinae vr case study". In: *CAA 2012*. 2011.

[45] Sofia Pescarin, Augusto Palombini, Valentina Vassallo, Luigi Calori, Carlo Camporesi, **Bruno Fanini**, and Maurizio Forte. *Virtual Rome*. 2009.