

Markus Tatzgern

Curriculum Vitae

Personal Information

Position FH-Professor, Salzburg University of Applied Sciences
Nationality Austria
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Web <http://markustatzgern.com> Note: The webpage contains detailed information about my research including papers and videos.

Research Interest

Augmented/Virtual/Mixed Reality, Visualization, Human-Computer Interaction

Professional

- since 06/2018 **FH-Professor**, Mixed Reality and Game Development, Salzburg University of Applied Science, Austria
- since 09/2015 **Senior Lecturer**, Mixed Reality and Game Development, Salzburg University of Applied Science, Austria
- o Head of Game Development and Mixed Reality
 - o Research and development of interactive Virtual, Augmented and Mixed Reality applications, visualizations and interfaces
 - o Curriculum development for bachelor and master program MultiMediaTechnology
- 02/2009–08/2015 **Research Assistant**, Institute for Computer Graphics and Vision, Graz University of Technology, Austria
- o Researched and published Mixed and Augmented Reality interfaces that allow users to explore the real world
 - o Developed a mobile platform for remote collaboration in Augmented Reality

- 04/2006–11/2008 **Software Developer**, Institute of Applied Geosciences, Graz University of Technology, Austria
- Developed software for documenting tunnel construction
 - Coordinated a team of developers
 - Engaged in all stages of software development from requirement specification to deployment and customer support

Education

- 2015 Doctoral Program in Computer Science, Graz University of Technology
- Thesis: "Situating Visualization in Augmented Reality"
 - Supervisor: Prof. Dr. Dieter Schmalstieg, Co-supervisor: Dr. Denis Kalkofen, Referee: Prof. Dr. Kiyoshi Kiyokawa
 - Graduated with highest distinction
- 2008 Master's Program (**MSc**, DI), Graz University of Technology
- Thesis: "A Framework for Automatically Creating 3D Explosion Diagrams"
 - Supervisor: Prof. Dr. Dieter Schmalstieg, Co-supervisor: Dr. Denis Kalkofen
 - Graduated with highest distinction
- 2005 Bachelor's Program (**BSc**, Bakk.techn.), Graz University of Technology

Projects

- 05/2022–04/2025 **CIRCUIT: Towards Comprehensive CBCT Imaging Pipelines for Real-time Acquisition, Analysis, Interaction and Visualization**
Funded by the Austrian Research Promotion Agency / FFG Bridge (no FO999891105), Austria
Industry partner: medPhoton GmbH
Budget: 470.000 €
Role: Principal investigator, project acquisition
- 05/2022–04/2026 **doc.hci – Designing Meaningful Human-Technology Relations**
Funded by FWF Austrian Science Fund, Austria
Research partner: Paris Lodron University Salzburg
Budget: 1.0M €
Role: Co-investigator, project acquisition
- 03/2021–02/2024 **EdTech Salzburg - Augmented Learning Lab**
Funded by Federal State Government of Salzburg, Austria
Research partner: Salzburg University of Education Stefan Zweig, Paris Lodron University Salzburg
Budget: 1.1M €
Role: Principal investigator, project acquisition

- 06/2020-05/2023 **Adaptive Visualization for Augmented Reality**
 Funded by the Austrian Research Promotion Agency / FFG Bridge (no 877104), Austria
 Industry partner: Wikitude GmbH
 Budget: 383.000 Euro
 Role: Project acquisition, Principal Investigator
- 03/2020-08/2022 **EdTech in the University Education of Healthcare Professionals**
 Funded by the Federal State Government of Salzburg, Austria
 Research partner: Physiotherapy of Salzburg University of Applied Sciences
 Budget: 110.000 Euro
 Role: Project acquisition, Principal Investigator
- 03/2020-08/2021 **Investigating Virtual Reality Environments for the Chemistry Curriculum**
 Funded by the Joachim Hertz Foundation, Germany
 Research partner: Paris Lodron University of Salzburg
 Budget: 18.000 €
 Role: Project acquisition, Technical Lead, Co-Investigator
- 01/2019-06/2021 **Collaborative Engagement in Digital Marketing Tools using Virtual Reality / Augmented Reality to Enhance Entrepreneurial Resilience?**
 Funded by Federal State Government of Lower Austria, Austria
 Research partner: New Design University St. Pölten
 Role: Project acquisition, Technical Lead, Co-Investigator
- 12/2017-11/2020 **Ecomedicine VR Physiology Lab: Information and communication technology drives innovation for health products and services**
 Funded by Federal State Government of Salzburg, Austria
 Research partner: Paracelsus Medical Private University
 Budget: 880.000 €
 Role: Project acquisition, Technical Lead, Co-Investigator
- 03/2017-02/2019 **Optimizing the Online Shopping Experience using Virtual Reality**
 Funded by Federal State Government of State Salzburg, Austria
 Budget: 120.000 €
 Role: Project acquisition, Technical Lead, Co-Investigator
- 03/2010-08/2015 **Christian Doppler Laboratory for Handheld Augmented Reality**
 Funded by Christian Doppler Society
 Industrial partner: Qualcomm Inc.
 Role: Researcher
- 01/2008-12/2008 **IPCity, Integrated Project on Interaction and Presence in Urban Environments**
 Funded by European Union under contract FP-2004-IST-4-27571
 Role: Researcher

Peer-Reviewed Publications

AirRes Mask: A Precise and Robust Virtual Reality Breathing Interface Utilizing Breathing Resistance as Output Modality. Markus Tatzgern, Michael Domhardt, Martin Wolf, Michael Cenger, Gerlinde Emsenhuber, Radomir Dinic, Nathalie Gerner, Arnulf Hartl, CHI Conference on Human Factors in Computing Systems (**CHI'22**), 14 pages, 2022, **Honorable Mention for Best Paper**

Comparing low sensory enabling (LSE) and high sensory enabling (HSE) virtual product presentation modes in e-commerce. Arno Kinzinger, Winfried Steiner, Markus Tatzgern, Christine Vallaster, Information Systems Journal, p. 1-30, 2022

Towards Eye-Perspective Rendering for Optical See-Through Head-Mounted Displays. Gerlinde Emsenhuber, Michael Domhardt, Tobias Langlotz, Denis Kalkofen, Markus Tatzgern, IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (**VRW'22**), p. 1-2, 2022

Exploring Input Approximations for Control Panels in Virtual Reality. Markus Tatzgern, Christoph Birgmann, IEEE Virtual Reality and 3D User Interfaces (**VR'21**), 2021, p. 1-9

Video-Annotated Augmented Reality Assembly Tutorials. Masahiro Yamaguchi, Shohei Mori, Peter Mohr, Markus Tatzgern, Ana Stanescu, Hideo Saito, Denis Kalkofen, Proceedings of the 33rd Annual ACM Symposium on User Interface Software and Technology (**UIST'20**), p. 1010–22, 2020

TrackCap: Enabling Smartphones for 3D Inter-action on Mobile Head-Mounted Displays. Peter Mohr, Markus Tatzgern, Tobias Langlotz, Andreas Lang, Dieter Schmalstieg, Denis Kalkofen, Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (**CHI'19**), p. 1-11, 2019

Augmented Reality Brings the Real World into Natural History Dioramas with Data Visualizations and Bioacoustics at the Carnegie Museum of Natural History. Maria Harrington, Markus Tatzgern, Tom Langer, John Wenzel, Curator: The Museum Journal 62 (2), p. 177-193, 2019

Retargeting Video Tutorials Showing Tools With Surface Contact to Augmented Reality. Peter Mohr, David Mandl, Markus Tatzgern, Eduardo Veas, Dieter Schmalstieg and Denis Kalkofen, ACM Conference on Human Factors in Computing Systems (**CHI'17**), p. 6547-6558, 2017

Adaptive User Perspective Rendering for Handheld Augmented Reality. Peter Mohr, Markus Tatzgern, Jens Grubert, Dieter Schmalstieg, Denis Kalkofen, IEEE Symposium on 3D User Interfaces (**3DUI'17**), p. 176-181, 2017, **Honorable Mention for Best Paper**

Temporal Coherence Strategies for Augmented Reality Labeling. Jacob Boesen Madsen, Markus Tatzgern, Claus B. Madsen, Dieter Schmalstieg, Denis Kalkofen, IEEE Transactions on Visualization and Computer Graphics (**TVCG'16**), p. 1415-1423, 2016

Adaptive Information Density for Augmented Reality Displays. Markus Tatzgern, Valeria Orso, Denis Kalkofen, Giulio Jacucci, Luciano Gamberini, Dieter Schmalstieg, IEEE Virtual Reality (**VR'16**), p. 83-92, 2016

Exploring real world points of interest: Design and evaluation of object-centric exploration techniques for augmented reality. Markus Tatzgern, Raphael Grasset, Eduardo Veas, Denis Kalkofen, Hartmut Seichter, Dieter Schmalstieg, **Pervasive and Mobile Computing**, p. 55-70, 2015

Hedgehog Labeling: View Management Techniques for External Labels in 3D Space. Markus Tatzgern, Denis Kalkofen, Raphael Grasset, Dieter Schmalstieg, IEEE Virtual Reality (**VR'14**), p. 27-32, 2014

Transitional Augmented Reality Navigation for Live Captured Scenes. Markus Tatzgern, Raphael Grasset, Denis Kalkofen, Dieter Schmalstieg, IEEE Virtual Reality (**VR'14**), p. 21-26, 2014

Dynamic compact visualizations for augmented reality. Markus Tatzgern, Denis Kalkofen, Dieter Schmalstieg, IEEE Virtual Reality (**VR'13**), p. 3-6, 2013

Exploring Distant Objects with Augmented Reality. Markus Tatzgern, Raphael Grasset, Eduardo Veas, Denis Kalkofen, Hartmut Seichter, Dieter Schmalstieg, Joint Virtual Reality Conference of **EGVE\EuroVR'13**, p. 49-56, 2013

Image-driven view management for augmented reality browsers. Raphael Grasset, Tobias Langlotz, Denis Kalkofen, Markus Tatzgern, Dieter Schmalstieg, International Symposium on Mixed and Augmented Reality (**ISMAR'12**), p. 177-186, 2012

Multi-perspective Compact Explosion Diagrams. Markus Tatzgern, Denis Kalkofen, Dieter Schmalstieg, **Computers & Graphics**, p. 135-147, 2011

Compact explosion diagrams. Markus Tatzgern, Denis Kalkofen, Dieter Schmalstieg, Non-Photorealistic Animation and Rendering (**NPAR'10**), p. 17-26, 2010

Explosion Diagrams in Augmented Reality. Denis Kalkofen, Markus Tatzgern, Dieter Schmalstieg, IEEE Virtual Reality (**VR'09**), p. 71-78, 2009

Workshops Publications and Tutorials

Perceptual Issues of Augmented Reality Visualization. Markus Tatzgern, Shohei Mori, Christoph Ebner, David Mandl, Kasper Ladefoged, Peter Mohr, Denis Kalkofen, **Tutorial on Rendering and Visualization in Mixed Reality**, Conference of the European Association for Computer Graphics (**Eurographics'21**), 2021

Embedded Virtual Views for Augmented Reality Navigation. Markus Tatzgern, Denis Kalkofen, Raphael Grasset, Dieter Schmalstieg, **Workshop on Visualization in Mixed Reality Environments**, International Symposium on Mixed and Augmented Reality (**ISMAR'11**), 2011

Patents

- 2015 Hierarchical Clustering for View Management Augmented Reality. Markus Tatzgern, Denis Kalkofen, Dieter Schmalstieg, Raphael Grasset. WO Patent, Publication number WO2015142576A1, September 2015
- 2013 Image-Driven View Management for Annotations. Raphael Grasset, Markus Tatzgern, Tobias Langlotz, Denis Kalkofen and Dieter Schmalstieg. WO Patent, Publication number WO2013176830A1, November 2013
- 2012 Efficient Information Presentation for Augmented Reality. Markus Tatzgern, Denis Kalkofen and Dieter Schmalstieg. WO Patent, Publication number WO2012033768A2, March 2012

Awards

- 2022 Honorable Mention for Best Paper at the 2022 at the ACM CHI Conference on Human Factors in Computing Systems (CHI'22) for the paper "AirRes Mask: A Precise and Robust Virtual Reality Breathing Interface Utilizing Breathing Resistance as Output Modality"
- 2017 Honorable Mention for Best Paper at the 2017 IEEE Symposium on 3D User Interfaces (3DUI) for the paper "Adaptive User Perspective Rendering for Handheld Augmented Reality"

2011, 2013, 2015 Recognized Inventor at Graz University of Technology

Professional Activities

Program Committee

- 2023 IEEE Virtual Reality and 3D User Interfaces (VR), conference and journal track (IEEE Transactions on Visualization and Computer Graphics)
- 2022 IEEE International Conference on Artificial Intelligence & Virtual Reality (AIVR)
- 2022 IEEE Virtual Reality and 3D User Interfaces (VR), journal track (IEEE Transactions on Visualization and Computer Graphics)
- 2021 IEEE International Symposium on Mixed and Augmented Reality (ISMAR), journal track (IEEE Transactions on Visualization and Computer Graphics)
- 2020 IEEE International Symposium on Mixed and Augmented Reality (ISMAR), conference track
- 2016, 2019-2022 IEEE Virtual Reality and 3D User Interfaces (VR)
- 2019 ACM Symposium on Virtual Reality Software and Technology (VRST)
- 2018 FH Forschungsforum, Chair: Digitized - Transformation durch Augmented und Virtual Reality

Other Roles

- since 2021 Editorial Board of Journal Virtual Reality & Intelligent Hardware
- since 2020 Editorial Board of Augmented Reality: Review Editor for Frontiers in Virtual Reality

- 2022 Doctoral Consortium Reviewer at IEEE International Symposium on Mixed and Augmented Reality (ISMAR)
- 2020,2021 Doctoral Consortium Mentor at IEEE International Symposium on Mixed and Augmented Reality (ISMAR)
- Reviewing
- 2020 ACM Symposium on User Interface Software and Technology (UIST)
- since 2009 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)
- since 2011 IEEE Virtual Reality (VR)
- since 2011 Computers & Graphics (C&G)
- since 2013 ACM Conference on Human Factors in Computing Systems (CHI)
- since 2017 IEEE Transactions on Visualization and Computer Graphics
- since 2016 ACM Symposium on Virtual Reality Software and Technology (VRST)
- 2022 IEEE Computer Graphics and Applications (CG&A)
- 2012 Eurographics
- 2012 ACM International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI)
- 2015 ACM Symposium on Spatial User Interaction (SUI)
- 2015 International Conference on Mobile and Ubiquitous Multimedia (MUM)
- 2016 Journal of Virtual Reality and Broadcasting (JVRB)
- 2017, 2018 Austrian Research Promotion Agency (FFG)
- 2020 ACM Interaction Design and Children (IDC)
- Invited Talks
- 2018 Digitalization in Architecture and Construction - Use Cases of Virtual and Augmented Reality, Brennpunkt Alpines Bauen, Austria
- 2018 Virtual and Augmented Reality - Technological Maturity and Applications in Tourism, Brennpunkt eTourism, Austria
- 2018 State-of-the-Art of Virtual and Augmented Reality Technology and Applications, Austrian Armed Forces, Austria
- 2018 Virtual Reality in E-commerce, Marketing Club Salzburg, Austria
- 2018 Augmented and Virtual Reality for Medical Education and Health Care, 1. Salzburger Forum für Medizin und Digitalisierung, Paracelsus Medical University, Salzburg, Austria
- 2017 Augmented and Virtual Reality: A building block of industry 4.0 / Augmented und Virtual Reality: Ein Baustein von Industrie 4.0, Alles Holz 4.0 oder was, Holzcluster, Salzburg, Austria
- 2017 Virtual and Augmented Reality in Education / Virtual und Augmented Reality für den Bildungsbereich, eEducation Praxistagung, Pädagogische Hochschule Salzburg, Salzburg, Austria
- 2015 Augmented Reality Technology and Applications, Center for Human-Computer Interaction, University of Salzburg, Salzburg, Austria

2015 Next Generation Augmented Reality Games, Extended Games Day, Hochschule der Medien, Stuttgart, Germany

Press

- 2022 "Kokeelliset virtuaalilasit säätelevät käyttäjän hapensaantia ja voivat tehdä elämyksestä todentuntuisemman" / "Experimental virtual glasses regulate the user's oxygen supply and can make the experience more realistic", hs.fi / Helsingin Sanomat (online), 19 May, Finland
- 2022 "Introducing 'AirRes Mask' that can introduce the concept of 'breathing' into VR", Gigazine (online), 16 May, Japan
- 2022 "This mask makes breathing in virtual reality more realistic", edition.cnn.com / CNN Business (online), 15 May
- 2022 "This Bizarre VR Gas Mask Makes Breathing in VR More Difficult", vrscout.com / VRScout (online), 13 May
- 2022 "Virtual reality mask adds realism by making it harder to breath", newscientist.com, 11 May
- 2022 "Forschungsarbeit ausgezeichnet" / "Research Award", science.apa.at / Austria Presse Agentur, 6 May, Austria
- 2022 "Augmented Reality startet im Unterricht" / "Augmented Reality starts in the class room", Kronen Zeitung Salzburg (print), 1 May, Austria
- 2022 "Nach dem Bauernhof ist die Stromerzeugung an der Reihe"/"After the farm, it's the electricities turn", Salzburger Nachrichten (print), 29 April, Austria
- 2022 "Sachunterricht mit Augmented Reality in Salzburgs Volksschulen" / "Augmented Reality for Primary School Educatio in Salzburg", meinbezirk.at, 26 April, Austria
- 2022 "Über die App direkt in den Bauernhof" / "Via Mobile App into the Farm", Salzburger Nachrichten (Print), 22 April, Austria
- 2022 "Warum!", Science Communication Magazine of Salzburg University of Applied Sciences, Salzburger Nachrichten (print), 19 February, Austria
- 2021 "Wie viel Potenzial steckt in Augmented Reality" / "The potential of Augmented Reailty", doIT digitale Karriere-Perspektiven, Der Standard (print), 27 November, Austria
- 2021 "Lernen gelingt mit digitalen Helfern" / "Learning with digital support", Salzburger Nachrichten (print), 24. April, Austria
- 2021 "Fannys Friday: Game Science", ORF / Austrian Broadcasting Corporation (television) - tvthek.orf.at, 8 January, Austria
- 2020 "Teaching Chemistry in a Virtual Laboratory"/"Chemie vermitteln lernen im virtuellen Labor", Die Presse (print) - diepresse.com, 12 December, Austria
- 2020 "Practicing chemistry in the virtual laboratory"/"Im virtuellen Labor für Chemie üben", Salzburger Nachrichten (print), 23 October, Austria
- 2020 "Using VR in Chemistry Education"/"Mit der VR-Brille im Chemielabor", Salzburger Woche (print), 18 June, Austria

- 2020 "Going for a virtual walk in nature" / "Virtuell raus in die Natur", Kronen Zeitung (print) / krone.at, 10 April, Austria
- 2019 "Research and Innovation - Shopping in Virtual Reality" / "Forschung und Innovation - Bin dann mal shoppen im virtuellen Raum", Salzburger Nachrichten / sn.at, 25 October, Austria
- 2019 "Augmented Reality in the Work Place" / TV report on station "Österreichischer Rundfunk" ("Austrian Broadcasting Corporation"), 4 March, Austria
- 2019 "Can virtual nature also heal" / "Kann Mutter Natur auch virtuell helfen?", Der Standard / derstandard.at, 6 February, Austria
- 2018 "New Carnegie Museum app shows threat to wildflower diversity in the woods", Pittsburgh Post-Gazette / post-gazette.com, 26 December, USA
- 2018 "Augmented Reality App Shows How Deer Overpopulation Affects Western PA's Forests", Pittsburgh's NPR News Station / wesa.fm, 19 December, USA
- 2018 "Virtual Reality in Education" / "Kommt die Bildung bald per Brille", Pädagogisches Magazin für Schule, Beruf und Gesellschaft, Nr. 2/4, Austria
- 2018 "Virtual Reality in Education" / "Kommt die Bildung bald per Brille", Salzburger Nachrichten, 10 March, Austria
- 2018 Project Online Shopping using Virtual Reality featured in article "FH Salzburg: Knowledge and Specialists for Businesses" / "FH Salzburg: Mehr Fachwissen und Fachleute für die Wirtschaft", Salzburger Wirtschaft, Nr. 3/44, Austria
- 2018 Project Online Shopping using Virtual Reality featured in article "FH Salzburg - Review of 2017" / "FH Salzburg - Ein Rückblick ins Jahr 2017", Salzburg Magazin, Regional TV Salzburg, Austria
- 2017 Digital Innovation in the Wood Industry / Digitalisierung in der Holzbranche, Salzburger Wirtschaft, Nr. 34/44, Austria

Teaching Experience

Salzburg University of Applied Sciences, Bachelor Level

- since 2015 Student Project Coaching
- since 2015 Game Development 1 (Lecture and Lab)
- 2016-2020 Game Development 2 (Lecture and Lab)
- 2016-2021 Computer Graphics (Lecture and Lab)
 - 2016 Advanced Topics of Game Development and Augmented Reality (Lecture and Lab)
- since 2016 Scientific Communication (Seminar)
 - Salzburg University of Applied Sciences, Master Level
 - since 2017 Real-Time Visualization (Lecture and Lab)
 - since 2017 Mixed Reality Technologies (Lecture and Lab)
 - since 2019 Research Seminar (Seminar)
 - since 2016 Scientific Communication (Seminar)
 - 2020 Interaction Approaches & Technologies (Lecture and Lab)

2016 Mixed Reality Interaction (Lecture and Lab)

■ Supervision

Regular supervision of bachelor theses (40 finished) and master theses (17 finished).