Haikun (Quincy) Huang, Ph.D.

Senior Research Scientist | XR / AI | Computational Design | Graphics-HCI | Unity Research Systems

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Research Profile

Senior Research Scientist in the Department of Computer Science at George Mason University developing AI-driven computational design tools for human-centered virtual, augmented, and mixed reality. My research integrates optimization, simulation, graphics-HCI, machine learning, and game-engine systems to synthesize adaptive 3D content, immersive training experiences, spatial media, and deployable research platforms.

Author of 25 peer-reviewed publications across ACM CHI, ACM TOG/SIGGRAPH, IEEE VR/TVCG, ICRA, IROS, and related venues. Recognition includes a CHI Best Paper Honorable Mention, an IEEE VR Best Journal Paper nomination, and the UMass Boston graduate program award for the dissertation AI-driven Computational Design Tools for Synthesizing Human-centric Design.

Research Interests

Primary areas: XR/VR/AR/MR; AI-assisted 3D content creation; computational design; human-centered simulation and training; graphics-HCI; game engines for research.

Methods: optimization, mixed-integer programming, MCMC/simulated annealing, multi-objective design search, visual analytics, machine learning, scene semantics, and user-centered evaluation.

Current Positions

Senior Research Scientist, Department of Computer Science, George Mason University July 2026–present

- Lead XR, computational design, and immersive simulation research while translating research prototypes into maintainable Unity and AI systems.

Adjunct Professor, George Mason University 2024–present

- Teach VR Game Design, Intro to Game Design, and Virtual Reality through project-based XR development and research-engineering workflows.

Unity Asset Creator and Research Tool Developer, Two Cats Code 2016–present

- Develop reusable Unity systems for visual scripting, Python integration, optimization, recording/replay, and research prototyping.

Co-Founder and CTO, Great Victory Legends, Inc. present

- Lead applied XR and game R&D that turns computational-design research into deployable tools, VR products, and campus-facing prototypes.

Previous Research Position

Postdoctoral Research Fellow, Department of Computer Science, George Mason University 2020–June 2026

- Conducted XR, computational design, and immersive simulation research in the Design Computing and eXtended Reality research group; mentored Ph.D., master's, and undergraduate researchers.

Education

Ph.D. in Computer Science, University of Massachusetts Boston 2016–2020

- Dissertation: AI-driven Computational Design Tools for Synthesizing Human-centric Design.

B.S. in Computer Science, University of Massachusetts Boston 2012–2016

B.S. in E-Commerce, South China University of Technology 2006–2008

Application Development, South China Institute of Software Engineering, Guangzhou University 2003–2006

Research Systems and Technical Artifacts

Flow Core: Strongly typed visual scripting, finite-state machine, behavior tree, GOAP, and stack-graph framework for reusable Unity interaction and research logic.

UPython: Structured two-way C#-Python communication for AI, analytics, and authoring workflows inside Unity game and editor pipelines.

Optimizer: Modular Unity framework for MCMC/simulated annealing, multi-objective optimization, pluggable evaluators, design search, logging, and reproducible replay.

Recorder: High-performance timestamped simulation-state recording and replay for rewind, ghost comparison, experiment review, and downstream AI analysis.

GMU FUSE VR Fitness: Campus-facing VR cycling and fitness prototype translating exertion-aware path-generation research into real-time, goal-aware level generation and replay.

Two Cats Code: Research-to-toolchain publication channel for maintained Unity systems, including Flow Core, UPython, event, data, pooling, and UI utilities.

Teaching and Mentoring

Adjunct Professor, George Mason University 2024–present

- Courses: GAME 399 VR Game Design, CS 325 Intro to Game Design, and CS 452 Virtual Reality.
- Connect AI, game engines, VR interaction design, and professional software development through project-based instruction.

Research Mentor and Technical Trainer, George Mason University 2022–present

- Mentor Ph.D., master's, and undergraduate students in Unity, XR prototyping, optimization, Python integration, and deployable research systems.

Teaching Assistant, University of Massachusetts Boston 2017–2020

- Courses: Computer Games Programming, Computer Vision, Programming in C, and Computer Architecture and Organization.

Awards, Honors, and Certification

- Best Paper Honorable Mention, ACM CHI, 2019.
- Best Journal Paper Nominee, IEEE VR, 2022.
- Second Place, ICIR Application Competition on Intelligent Reality (Students Track), 2021.
- UMass Boston graduate program award, 2020.
- Unity Certified Professional: Programmer, 2025.

Research Service

Peer review: ACM CHI, ACM SIGGRAPH, IEEE VR, ISMAR, VRST, CHI PLAY, ICRA, AutomotiveUI, IMWUT, JOVE, CASA, ACHI, Frontiers in Virtual Reality, and related venues.

Workshop organization: Co-organizer, TrainingXR Workshop, IEEE VR, 2020.

Proposal experience: Contributed to NSF worker-AI teaming research addressing workforce participation in construction.

Additional Professional Experience

Data Analysis Engineer, Guangzhou Kingpoint Co., Ltd., China 2008–2009

- Provided on-site data analysis support for China Mobile Guangzhou Branch, including customer-package design data.

Technical Skills

Programming: C#, C/C++, Python, Java, Unity editor tooling, reusable gameplay and research systems.

XR and graphics: VR/AR/MR prototyping, interaction design, spatial audio, scene semantics, gaze and visual-attention analysis, immersive training.

AI and optimization: machine-learning workflows, MCMC, simulated annealing, mixed-integer programming, multi-objective optimization, procedural content generation, visual analytics.

Publications

Yongqi Zhang, Erdem Murat, Liuchuan Yu, **Haikun Huang**, Minsoo Choi, Christos Mousas, Lap-Fai Yu. "HieraVisVR: Hierarchical Visual Analytics for Motion-Centric VR Playtesting." ACM CHI 2026, Article 629 (2026).

Liuchuan Yu, Ching-Yu Cheng, William F. Ranc, Joshua Dow, Michael Szilagyi, **Haikun Huang**, Sungsoo Ray Hong, Behzad Esmaeili, Lap-Fai Yu. "Col-Con: A Collaborative and Configurable VR Platform for Construction—A Pipe Installation Case Study." Virtual Reality 30, Article 59 (2026).

Yongqi Zhang, Chuan Yan, **Haikun Huang**, Simon Su, Lap-Fai Yu. "Mixed-Integer Programming for Adaptive VR Workflow Training." HCII 2024 — Virtual, Augmented and Mixed Reality, pp. 325–344 (2024).

Joel Martin, **Haikun Huang**, Ronald Johnson, Lap-Fai Yu, Erica Jansen, Rebecca Martin, Chelsea Yager, Ali Boolani. "Association between Self-reported Sleep Quality and Single-task Gait in Young Adults: A Study Using Machine Learning." Sleep Science 16(4), e399–e407 (2023).

Wanwan Li, Changyang Li, Minyoung Kim, **Haikun Huang**, Lap-Fai Yu. "Location-Aware Adaptation of Augmented Reality Narratives." ACM CHI 2023, Article 33 (2023).

Lai Sum Yim*, Quang T. N. Vo*, Ching-I Huang, Chi-Ruei Wang, Wren McQueary, Hsueh-Cheng Wang, **Haikun Huang**, Lap-Fai Yu (*equal contribution). "WFH-VR: Teleoperating a Robot Arm to Set a Dining Table across the Globe via Virtual Reality." IEEE/RSJ IROS 2022, pp. 4927–4934 (2022).

Changyang Li, Wanwan Li, **Haikun Huang**, Lap-Fai Yu. "Interactive Augmented Reality Storytelling Guided by Scene Semantics." ACM Transactions on Graphics 41(4), Article 91 / SIGGRAPH 2022 (2022).

Wanwan Li, **Haikun Huang**, Tomay Solomon, Behzad Esmaeili, Lap-Fai Yu. "Synthesizing Personalized Construction Safety Training Scenarios for VR Training." IEEE Transactions on Visualization and Computer Graphics 28(5), pp. 1993–2002 / IEEE VR 2022 (2022).

Michael S. Solah*, **Haikun Huang***, Jiachuan Sheng, Tian Feng, Marc Pomplun, Lap-Fai Yu (*equal contribution). "Mood-Driven Colorization of Virtual Indoor Scenes." IEEE Transactions on Visualization and Computer Graphics 28(5), pp. 2058–2068 / IEEE VR 2022 (2022). *[Co-first author; Best Journal Paper Nominee]*

Changyang Li, **Haikun Huang**, Jyh-Ming Lien, Lap-Fai Yu. "Synthesizing Scene-Aware Virtual Reality Teleport Graphs." ACM Transactions on Graphics 40(6), Article 229 / SIGGRAPH Asia 2021 (2021).

Yongqi Zhang, **Haikun Huang**, Erion Plaku, Lap-Fai Yu. "Joint Computational Design of Workspaces and Workplans." ACM Transactions on Graphics 40(6), Article 228 / SIGGRAPH Asia 2021 (2021).

Amilcar Gomez Samayoa*, Javier Talavera*, Siem G. Sium, Biao Xie, **Haikun Huang**, Lap-Fai Yu (*equal contribution). "Building a Motion-Aware, Networked Do-It-Yourself Holographic Display." IEEE International Conference on Intelligent Reality (ICIR) 2021 (2021). *[Second Place, Application Competition on Intelligent Reality (Students Track)]*

Yujia Wang, Wei Liang, **Haikun Huang**, Yongqi Zhang, Dingzeyu Li, Lap-Fai Yu. "Toward Automatic Audio Description Generation for Accessible Videos." ACM CHI 2021, Article 277 (2021).

Biao Xie, Huimin Liu, Rawan Alghofaili, Yongqi Zhang, Yeling Jiang, Flavio Destri Lobo, Changyang Li, Wanwan Li, **Haikun Huang**, Mesut Akdere, Christos Mousas, Lap-Fai Yu. "A Review on Virtual Reality Skill Training Applications." Frontiers in Virtual Reality 2, Article 645153 (2021).

Haikun Huang, Yuxuan Zhang, Tomer Weiss, Rebecca W. Perry, Lap-Fai Yu. "Interactive Design of Gallery Walls via Mixed Reality." IEEE AIVR 2020, pp. 17–26 (2020). *[First author]*

Wanwan Li*, Biao Xie*, Yongqi Zhang, Walter Meiss, **Haikun Huang**, Lap-Fai Yu (*equal contribution). "Exertion-Aware Path Generation." ACM Transactions on Graphics 39(4), Article 115 / SIGGRAPH 2020 (2020).

Elisa F. Ogawa, **Haikun Huang**, Lap-Fai Yu, Philimon N. Gona, Richard K. Fleming, Suzanne G. Leveille, Tongjian You. "Effects of Exergaming on Cognition and Gait in Older Adults at Risk for Falling." Medicine & Science in Sports & Exercise 52(3), pp. 754–761 (2020).

Yongqi Zhang*, Biao Xie*, **Haikun Huang**, Elisa Ogawa, Tongjian You, Lap-Fai Yu (*equal contribution). "Pose-Guided Level Design." ACM CHI 2019, Article 554 (2019). *[CHI 2019 Best Paper Honorable Mention]*

Rawan Alghofaili, Yasuhito Sawahata, **Haikun Huang**, Hsueh-Cheng Wang, Takaaki Shiratori, Lap-Fai Yu. "Lost in Style: Gaze-driven Adaptive Aid for VR Navigation." ACM CHI 2019, Article 348 (2019).

Haikun Huang*, Michael S. Solah*, Dingzeyu Li, Lap-Fai Yu (*equal contribution). "Audible Panorama: Automatic Spatial Audio Generation for Panorama Imagery." ACM CHI 2019, Article 621 (2019). *[First author]*

Rawan Alghofaili, Michael S. Solah, **Haikun Huang**, Yasuhito Sawahata, Marc Pomplun, Lap-Fai Yu. "Optimizing Visual Element Placement via Visual Attention Analysis." IEEE VR 2019, pp. 464–473 (2019).

Haikun Huang, Ni-Ching Lin, Lorenzo Barrett, Darian Springer, Hsueh-Cheng Wang, Marc Pomplun, Lap-Fai Yu. "Automatic Optimization of Wayfinding Design." IEEE Transactions on Visualization and Computer Graphics 24(9), pp. 2516–2530 (2018). *[First author]*

Tzu-Kuan Chuang, Ni-Ching Lin, Jih-Shi Chen, Chen-Hao Hung, Yi-Wei Huang, Chunchih Teng, **Haikun Huang**, Lap-Fai Yu, Laura Giarré, Hsueh-Cheng Wang. "Deep Trail-Following Robotic Guide Dog in Pedestrian Environments for People Who Are Blind and Visually Impaired—Learning from Virtual and Real Worlds." IEEE ICRA 2018, pp. 5849–5855 (2018).

Biao Xie*, Yongqi Zhang*, **Haikun Huang**, Elisa Ogawa, Tongjian You, Lap-Fai Yu (*equal contribution). "Exercise Intensity-Driven Level Design." IEEE Transactions on Visualization and Computer Graphics 24(4), pp. 1661–1670 (2018).

Haikun Huang, Ni-Ching Lin, Lorenzo Barrett, Darian Springer, Hsueh-Cheng Wang, Marc Pomplun, Lap-Fai Yu. "Analyzing Visual Attention via Virtual Environments." SIGGRAPH Asia 2016 Workshop on Virtual Reality Meets Physical Reality, Article 8 (2016). *[First author]*