

Haikun (Quincy) Huang, Ph.D.

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

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Research Profile

Computer scientist and XR researcher developing AI-driven computational design tools for human-centered virtual, augmented, and mixed reality systems. My work combines optimization, simulation, graphics/HCI, machine learning, and game-engine systems to synthesize adaptive 3D content, immersive training scenarios, spatial media, and deployable research platforms.

I have published 24+ peer-reviewed papers in ACM CHI, ACM TOG/SIGGRAPH, IEEE VR/TVCG, ICRA, IROS, and related venues. My work has received a CHI Best Paper Honorable Mention, an IEEE VR Best Paper Award nomination, and the UMass Boston graduate program award for my 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, user-centered evaluation.

Current Positions

Postdoctoral Research Fellow, Department of Computer Science, George Mason University 2020-present

- Conduct XR, computational design, and immersive simulation research in the Design Computing and eXtended Reality research group.
- Provide technical research support and mentoring for Ph.D., master's, and undergraduate students building VR/AR systems and Unity-based prototypes.

Adjunct Professor, George Mason University 2024-present

- Teach VR Game Design, Intro to Game Design, and Virtual Reality, emphasizing project-based XR development and AI/game-engine workflows.

Unity Asset Creator and Research Tool Developer, Two Cats Code / Unity Asset Store 2016-present

- Design reusable Unity systems for visual scripting, Python integration, optimization, recording/replay, event routing, pooling, and research prototyping.

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

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

Education

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

- Dissertation: AI-driven Computational Design Tools for Synthesizing Human-centric Design.
- Award: UMass Boston graduate program award, 2020.

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

Optimizer: A modular Unity optimization framework for design and parameter search, supporting MCMC/simulated annealing, multi-objective Pareto optimization, pluggable evaluators, acceptance strategies, and logging/replay for reproducible experiments.

Recorder: A high-performance Unity recording and replay system that captures timestamped simulation-state snapshots across modular segments, enabling reliable playback, rewind, ghost-mode comparison, and downstream AI analysis.

UPython: A Unity plugin for structured two-way communication between C# and Python, enabling Python-powered AI, analytics, and authoring workflows directly inside Unity game and editor pipelines.

FlowCore: A strongly typed visual scripting, FSM, behavior tree, GOAP, and stack-graph framework for Unity, used to build reusable interaction logic for XR/game research prototypes and production tools.

GMU FUSE fitness gamification: Led undergraduate implementation of a VR cycling/fitness system that translates patented exertion-aware path-generation research into a campus-facing application. Optimizer generates goal-aware levels in real time; Recorder captures play data for replay, ghost racing, and AI-supported analysis.

Unity Asset Store portfolio: Published developer tools including event systems, data managers, pooling utilities, UI animation components, UPython, and FlowCore, demonstrating a research-to-toolchain path from prototype to maintained software.

Awards, Honors, and Certification

- Best Paper Honorable Mention, ACM CHI, 2019.
- Best Paper Award Nomination, IEEE VR, 2022.
- Second Place, ICIR Student Track, 2021.
- UMass Boston graduate program award, 2020.
- Unity Certified Professional: Programmer, 2025.
- National Education Bureau of China certificates in elementary and advanced game development, 2009-2011.

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 FW-HTF-R: Collaborative Research: Worker-AI Teaming to Enable ADHD Workforce Participation in the Construction Industry of the Future.

Teaching and Mentoring

Adjunct Instructor, George Mason University 2024-present

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

Research Mentor and Technical Trainer, DCXR Lab, George Mason University 2022-present

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

Teaching Assistant, University of Massachusetts Boston 2017-2020

- Courses: CS461 Computer Games Programming, CS675 Computer Vision, CS240 Programming in C, CS341 Computer Architecture and Organization.

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 support.

Game Development Columnist, Chinese game-development forums prior

- Published practical articles for developers on game development and Unity workflows.

Technical Skills

Programming: C#, C/C++, Python, Java, Unity C# tooling, data-oriented gameplay systems, editor extensions.

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

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

Systems: Unity engine architecture, asset-store packaging, recording/replay systems, C#-Python bridges, multiplayer/interactive prototypes, reproducible experiment logging.

Publications

- Yongqi Zhang, Erdem Murat, Liuchuan Yu, **Haikun Huang**, Minsoo Choi, Christos Mousas, and Lap-Fai Yu. HieraVisVR: Hierarchical Visual Analytics for Motion-Centric VR Playtesting. ACM CHI, 2026.
- Liuchuan Yu, Kangjian Cheng, Wenxuan Zhao, Luyao Niu, **Haikun Huang**, Fadzli Mohamed Nazri, and Lap-Fai Yu. Col-Con: A Collaborative and Configurable VR Platform for Construction. Virtual Reality, 2026.
- Yongqi Zhang, Chuan Yan, **Haikun Huang**, Simon Su, and Lap-Fai Yu. Mixed-Integer Programming for Adaptive VR Workflow Training. International Conference on Human-Computer Interaction, 2024.
- Yongqi Zhang, Shenglan Du, Ying Hu, **Haikun Huang**, and Lap-Fai Yu. Location-Aware Adaptation of Augmented Reality Narratives. ACM CHI, 2023.
- S. P. A. Dhlamini, A. E. Mahmoud, M. W. Rogers, **Haikun Huang**, and M. T. Alsubaie. Association between Self-reported Sleep Quality and Single-task Gait in Young Adults: A Study Using Machine Learning. Sleep Science, 2023.
- Yongqi Zhang, Qiwei Li, **Haikun Huang**, Ying Hu, Lap-Fai Yu, and Miao Song. Interactive Augmented Reality Storytelling Guided by Scene Semantics. ACM Transactions on Graphics / SIGGRAPH, 2022.
- Haikun Huang**, Jeffery DiVerdi, Christos Mousas, and Lap-Fai Yu. Synthesizing Personalized Construction Safety Training Scenarios for VR Training. IEEE Transactions on Visualization and Computer Graphics, IEEE VR special issue, 2022.
- Haikun Huang**, Wenxuan Zhao, Yongqi Zhang, and Lap-Fai Yu. Mood-Driven Colorization of Virtual Indoor Scenes. IEEE Transactions on Visualization and Computer Graphics, IEEE VR special issue, 2022. *Equal contribution*.
- L. Chen, Y. Bai, S. Kaleshi, A. Al Zayer, **Haikun Huang**, A. Abbasi, C. Mousas, and L. F. Yu. WFH-VR: Teleoperating a Robot Arm to Set a Dining Table across the Globe via Virtual Reality. IROS, 2022.
- Yongqi Zhang, **Haikun Huang**, Weiwei Xu, and Lap-Fai Yu. Synthesizing Scene-Aware Virtual Reality Teleport Graphs. ACM Transactions on Graphics / SIGGRAPH Asia, 2021.
- Hongzi Zhu, Marcel Su, **Haikun Huang**, and Lap-Fai Yu. Joint Computational Design of Workspaces and Workplans. ACM Transactions on Graphics / SIGGRAPH Asia, 2021.
- D. Lu, L. Yu, W. Zhao, R. Shi, **Haikun Huang**, and L. F. Yu. Building a Motion-Aware, Networked Do-It-Yourself Holographic Display. ICIR, 2021.
- Y. D. Carpio, **Haikun Huang**, A. Deiparine, M. K. LaBerge, J. A. Walsh, and L. F. Yu. A Review on Virtual Reality Skill Training Applications. Frontiers in Virtual Reality, 2021.
- U. Mahmud, A. Al Zayer, E. Kandalaft, E. T. Won, and **Haikun Huang**. Toward Automatic Audio Description Generation for Accessible Videos. ACM CHI, 2021.
- Wanwan Li, Lap-Fai Yu, Dinesh Manocha, and **Haikun Huang**. Exertion-Aware Path Generation. ACM Transactions on Graphics / SIGGRAPH, 2020.
- Zihao He, **Haikun Huang**, and Lap-Fai Yu. Interactive Design of Gallery Walls via Mixed Reality. AIVR, 2020.
- A. Al Zayer, I. MacNeilage, **Haikun Huang**, and L. F. Yu. Automatic Optimization of Wayfinding Design. IEEE Transactions on Visualization and Computer Graphics, 2020.
- Haikun Huang**, Jing Lun Lo, G. W. Sasaki, Mohamed Khamis, and Andreas Bulling. Lost in Style: Gaze-driven Adaptive Aid for VR Navigation. ACM CHI, 2019.
- Lap-Fai Yu, Sai-Kit Yeung, Demetri Terzopoulos, and **Haikun Huang**. Pose-Guided Level Design. ACM CHI, 2019. *Best Paper Honorable Mention*.
- Haikun Huang**, Jing Lun Lo, and Lap-Fai Yu. Audible Panorama: Automatic Spatial Audio Generation for Panorama Imagery. ACM CHI, 2019. *Equal contribution*.
- Haikun Huang**, Christos Mousas, and Lap-Fai Yu. Optimizing Visual Element Placement via Visual Attention Analysis. IEEE VR, 2019.
- S. Andrushko, D. Ventura, M. Alsubaie, A. Dhlamini, K. S. H. Lim, **Haikun Huang**, C. Mousas, and M. W. Rogers. Effects of Exergaming on Cognition and Gait in Older Adults at Risk for Falling. Medicine and Science in Sports and Exercise, 2019.
- Wanwan Li, Lap-Fai Yu, Dinesh Manocha, and **Haikun Huang**. Exercise Intensity-driven Level Design. IEEE Transactions on Visualization and Computer Graphics, IEEE VR special issue, 2018.
- S. Kayukawa, K. Higuchi, J. Guerreiro, S. Morishima, Y. Sato, K. Kitani, C. Asakawa, and **Haikun Huang**. Deep Trail-Following Robotic Guide in Pedestrian Environments for People who are Blind and Visually Impaired. ICRA, 2018.
- A. Al Zayer, I. MacNeilage, **Haikun Huang**, and L. F. Yu. Analyzing Visual Attention via Virtual Environments. SIGGRAPH Asia Workshop, 2016.