

Danhua Zhang

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Research Profile

Computer Science Ph.D. candidate building and evaluating interactive AI and immersive systems. Combines real-time system development in Unity/C# and Python with multimodal AI integration, experimental design, mixed-methods user studies, and statistical analysis. Experience includes embodied virtual agents, healthcare training, authentication interfaces, and social interaction in VR.

Education

University of Minnesota Twin Cities , Minneapolis, MN Ph.D., Computer Science	Sep. 2019–May 2027 (expected)
University of Minnesota Twin Cities , Minneapolis, MN M.S., Computer Science	Sep. 2017–Nov. 2020
Sun Yat-sen University , Guangzhou, China B.S., Computational Mathematics	Aug. 2013–June 2017

Technical & Research Skills

Programming: Python, C#, C/C++, JavaScript, TypeScript.

Systems & Prototyping: Unity, Unreal Engine, FastAPI, WebSockets, OpenXR, Photon PUN 2; Blender, Character Creator, iClone, Maya; GLSL/HLSL.

Interactive AI: Speech recognition (ASR), LLM orchestration, speech synthesis (TTS), generated humanoid motion, multimodal interaction, multi-agent coordination.

Research Methods: Experimental design, mixed-methods user studies, participant interviews, quantitative and qualitative analysis, statistical analysis, data visualization.

Research Experience

<i>Research Assistant, University of Minnesota</i>	Sep. 2019–Present
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Multimodal Embodied Agent Systems in VR	June 2024–Present
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- Built a real-time multimodal, multi-agent VR platform connecting a Unity/C# client with a Python/FastAPI backend through WebSockets.
- Integrated ASR, LLM orchestration, TTS, and generated humanoid motion to connect user input with conversational and embodied avatar responses.
- Developed interactive 3D avatars supporting verbal and spatial interaction; research includes multi-agent coordination and spatial behavior in immersive environments.

Virtual Patient Simulation for Nursing Training	Sep. 2021–Dec. 2023
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- Collaborated with nursing experts to design a VR system for evaluating nursing competency; implemented two interactive Unity scenarios with patient avatars and real-time verbal feedback.
- Conducted two mixed-methods user studies involving 18 nursing students to support iterative design; developed interview questions, interviewed participants, and collected quantitative subjective evaluations.

Research Experience (continued)

VR Authentication and User Evaluation

Jan.–Oct. 2023

- Designed a VR authentication method combining symbolic input and contextual cues; implemented a 3D interactive compass using Unreal Engine.
- Conducted a within-subject, multi-session study with 32 participants comparing symbolic, contextual, and combined authentication; evaluated entry efficiency, recall, subjective memorability, and resistance to observational attacks.
- The combined interface enabled faster entry than context-only authentication and higher subjective memorability than symbols alone; published at IEEE ISMAR 2024 as co-first author.

Knee Surgery Training in VR

June–Dec. 2023

- Collaborated with two orthopedic experts to build a Unity training prototype for a specialized knee surgery procedure; created more than 12 medical instrument models in Blender.
- Implemented instrument and anatomy interactions, learning-summary panels, and automatic video pauses at eight critical learning points. The prototype was evaluated by six surgeons.

Communication Technology and Social Behavior in VR

Sep. 2020–Dec. 2022

- Partnered with psychologists to study social behavior in web conferencing and VR; built a multi-user Quest application with voice and animation synchronization using Unity/C# and Photon PUN 2.
- Built a host-control application for Windows and macOS; trained more than 10 undergraduate research assistants to use the system.

Postural Sway and Motion Sickness in VR

Sep. 2019–May 2020

- Collaborated with kinesiologists to study postural sway and motion sickness; implemented software to collect raw balance-board and VR-device data for measurement.

COVID-Vision: Multi-user VR Social-Distancing Experience

- First-authored a paper describing a Unity/Photon PUN 2 grocery-store simulation combining shopping interactions, non-player characters, and live-user avatars; the published system supports up to 20 concurrent live users.
- The experience visualizes interpersonal safe zones and provides post-task proximity feedback to support reflection on encounters with other users and avatars.

Current Research in Progress

Spatial Formation in Multi-Agent VR

Investigating spatial formation in immersive human–agent interaction as the final thesis project. Manuscript and study planning are in progress; participant evaluation is pending IRB approval.

Coauthored Research

- **Peripheral teleportation (2025):** Coauthored a between-subjects study with 90 participants comparing a peripheral rest-frame technique, field-of-view restriction, and unrestricted locomotion. The paper reports reduced discomfort and longer exposure with peripheral teleportation.
- **Path integration (2026):** Coauthored a preregistered experiment with 48 participants examining spatial updating under two cybersickness mitigation techniques. Field-of-view restriction increased homing error; results for peripheral teleportation were inconclusive.
- **Cybersickness research methods (2026):** Coauthored a meta-analysis of 55 studies in 50 papers, examining washout periods, carryover effects, and statistical power to inform experimental-design guidelines.
- **Judder masking (under review at Eurographics):** Coauthored research on phase-shifted Gabor noise for foveated rendering, including a five-participant exploratory study and a 12-participant validation experiment measuring perceived motion smoothness and image distraction.

Peer-Reviewed Publications

- Nie, T., Cantory, V., Hutton Pospick, C., **Zhang, D.**, Tan, H., Adeniyi, S., Wu, F., Zielasko, D., Adhanom, I.B., and Rosenberg, E.S. (2026). Revenge of the Sick: A Meta-Analysis of Washout Periods in Cybersickness Research. *IEEE Transactions on Visualization and Computer Graphics*, 32(9), 8033–8052.
- Nie, T., Huang, Y., Cantory, V., **Zhang, D.**, and Rosenberg, E.S. (2026). Effects of Field-of-View Restriction and Peripheral Teleportation on Path Integration during Virtual Locomotion. *IEEE Transactions on Visualization and Computer Graphics (Proc. IEEE ISMAR 2026)*.
- Nie, T., Hutton Pospick, C., Cantory, V., **Zhang, D.**, DeGuzman, J.J., Interrante, V., Adhanom, I.B., and Rosenberg, E.S. (2025). Peripheral Teleportation: A Rest Frame Design to Mitigate Cybersickness During Virtual Locomotion. *IEEE Transactions on Visualization and Computer Graphics*, 31(5), 2891–2900.
- Huang, Y., **Zhang, D.**, and Rosenberg, E.S. (2024). Direction-Based Authentication: Combining Symbolic Input and Contextual Cues for Virtual Reality Password Entry. *IEEE ISMAR*, 681–689. Co-first author.
- Huang, Y., **Zhang, D.**, and Rosenberg, E.S. (2023). DBA: Direction-Based Authentication in Virtual Reality. *IEEE VR Abstracts and Workshops (VRW)*, 953–954. Equal contribution.
- **Zhang, D.**, Khadar, M., Schumacher, B., Raveendra, M., Adeniyi, S., Wu, F., Aseeri, S., and Rosenberg, E.S. (2021). COVID-Vision: A Virtual Reality Experience to Encourage Mindfulness of Social Distancing in Public Spaces. *IEEE VR Abstracts and Workshops (VRW)*, 697–698.

Manuscripts Under Review

- **Zhang, D.**, Bradley, C., Kissell, C., Hutton Pospick, C., Yong, S., Jin, Q., Nie, T., and Rosenberg, E.S. Iterative Design and Evaluation of a VR Nursing Training System: Insights from Clinicians and Student Learners. arXiv:2610.19152 (2026). Preprint; under review at *ACM Transactions on Computing for Healthcare*.
- **Zhang, D.**, Rosenberg, E.S., Hao, P., Cantory, V., Wu, F., Tang, Z., Tan, H., Nie, T., Wu, Q., and Du, R. HaiVR: Designing Multimodal Human-Agent Interaction for Group Conversations in Virtual Reality. Under review at *ACM CHI*.
- Tan, H., Nie, T., Cantory, V., **Zhang, D.**, Interrante, V., and Rosenberg, E.S. Reshaping the Tunnel: Mitigating Cybersickness through Motion-Contoured Field-of-View Restriction. Under review at *IEEE VR*.
- Cantory, V., **Zhang, D.**, Interrante, V., and Didyk, P. (2026). Masking Judder in Foveated Rendering with Phase-Shifted Noise. arXiv:2610.10811. Under review at *Eurographics*.

Teaching Experience

Graduate Teaching Assistant, University of Minnesota

Sep. 2022–Present

CSCI 5607 Computer Graphics 1 (Fall 2025); CSCI 5609 Visualization (Spring 2025); CSCI 2033 Linear Algebra (Fall 2024); CSCI 4611 Programming Interactive Computer Graphics and Games (Spring 2024); CSCI 4511W Introduction to Artificial Intelligence (Fall 2022–Spring 2023).

Research Service

Peer Reviewer: IEEE VR (2027, 2026); ACM SUI and ACM VRST (2026); ACM CHI, ACM VRST, IEEE VR, and IEEE ISMAR (2024–2025); ACM SUI (2024); UbiComp/ISWC Notes and Briefs (2023).

Reference

Evan Suma Rosenberg, Ph.D. advisor

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