

Evan Suma Rosenberg

Assistant Professor, University of Minnesota

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Education

- May 2010 **Ph.D. in Computer Science**, University of North Carolina at Charlotte
Advisor: Larry F. Hodges
- May 2005 **B.A. in Computer Science**, Ithaca College

Professional Appointments

University of Minnesota, Twin Cities

- 2018 - Assistant Professor, Department of Computer Science & Engineering

University of Southern California

- 2013 - 2018 Research Assistant Professor, Department of Computer Science
- 2012 - 2013 Senior Research Associate, Institute for Creative Technologies
- 2010 - 2012 Postdoctoral Research Associate, Institute for Creative Technologies

University of North Carolina at Charlotte

- 2008 - 2009 Adjunct Lecturer, Department of Computer Science

Honors and Awards

- 2018 Technology Commercialization Award, USC Stevens Center for Innovation
- 2018 Steering Committee Chair, ACM Symposium on Spatial User Interaction
- 2018 Keynote, IEEE VR Workshop on Everyday Virtual Reality
- 2017 Google VR Research Award
- 2017 General Chair, IEEE Virtual Reality
- 2016 Keynote, Seoul Creative Dream Conference
- 2015 First Place, ACM SIGGRAPH Immersive Realities AR/VR Contest
- 2015 Keynote, International Symposium on Visual Computing
- 2015 Best Poster Award, ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games
- 2014 Best Poster Award, ACM Symposium on Spatial User Interaction
- 2014 Best Poster Honorable Mention, IEEE Virtual Reality
- 2014 Best Research Demo Honorable Mention, IEEE Virtual Reality
- 2013 General Chair, ACM Symposium on Spatial User Interaction
- 2012 Best Paper Honorable Mention, IEEE Virtual Reality
- 2012 Best Research Demo, IEEE Virtual Reality
- 2011 Best Technote Award, IEEE Symposium on 3D User Interfaces
- 2011 Best Paper Award, Interservice/Industry Training, Simulation, and Education Conference
- 2009 Edward C. Giles Dissertation-Year Graduate Fellowship
- 2007 Best Paper Award, IEEE Symposium on 3D User Interfaces

Grants and Contracts

External Funding Received at the University of Minnesota

National Science Foundation, *CHS: Medium: Prediction, Early Detection, and Mitigation of Virtual Reality Simulator Sickness*, Evan Suma Rosenberg (PI), Victoria Interrante (Co-PI), and Thomas Stoffregen (Co-PI), 2019-2023, \$1.1 million.

National Science Foundation, *REU Site: Computational Methods for Discovery Driven by Big Data*, George Karypis (PI) and Evan Suma Rosenberg (Co-PI, added in 2020), 2018-2021, \$370,390.

University of Southern California (subaward), *Mixed Reality Interfaces for Collaborative Decision Augmentation*, Evan Suma Rosenberg (PI), 8/27/2018 - 9/30/2019, \$90,818.

External Funding Received at the University of Southern California

National Science Foundation, *REU Site: Research in Interactive Virtual Experiences*, Evan Suma (PI) and Andrew Gordon (Co-PI), 2016-2019, \$376,963.

Google, *Redirect-an-go: Room-Scale VR in Cluttered Physical Spaces*, Evan Suma Rosenberg (PI), 2017-2018, \$75,950.

Army Research Office, *Mixed Reality and Human Sensor (MRHS) R&D Platform*, Evan Suma Rosenberg (PI), 2016-2018, \$648,000.

Army Research Office, *Mixed, Virtual, and Augmented Reality Research and Development*, Project Leaders: Todd Richmond, Evan Suma Rosenberg, and David Krum, 2018, \$574,000.

Army Research Office, *Deformable Haptic Surfaces Using Micro-Actuators*, Mark Bolas (PI) and Evan Suma (Co-PI), 2015-2017, \$500,000.

Army Research Office, *Mixed Reality Research and Development*, Project Leaders: Todd Richmond, David Krum, and Evan Suma, 2014-2017, \$4.6 million.

Army Research Office, *Walking with Avatars: Joint Locomotion Actions in Immersive Virtual Environments*, Evan Suma (PI) and Mark Bolas (Co-PI), 2015-2016, \$300,000.

National Science Foundation, *REU Site: Research in Interactive Virtual Experiences*, Evan Suma (PI) and Mark Bolas (Co-PI), 2013-2016, \$359,449.

Office of Naval Research, *Mapping the Field of View*, Mark Bolas (PI), Adam Jones, Evan Suma (Co-PI), and David Krum, 2013-2015, \$506,141.

Office of Naval Research, *E2C2: Enhanced Environment for Communication and Collaboration*, Todd Richmond (PI), Mark Bolas, and Evan Suma (Co-PI), 2013-2015, \$3.1 million.

Army Research Office, *Mixed Reality Research and Development*, Project Leaders: Mark Bolas, David Krum, and Evan Suma, 2012-2014, \$3.1 million.

Defense Advanced Research Projects Agency, *Detection and Computational Analysis of Psychological Signals*, Mark Bolas and Evan Suma (Co-PI), 2011-2013, \$668,716 of \$4.5 million awarded to Skip Rizzo (PI).

Army Research Office, *Mixed Reality Research and Development*, Project Leaders: Mark Bolas, David Krum, and Evan Suma, 2010-2011, \$1.3 million.

Internal Funding

Digital Technology Initiative Seed Grant, *Foundational Architectures for Edge-Assisted Immersive Computing*, Evan Suma Rosenberg (PI), Feng Qian (Co-PI), and Dan Keefe (Co-PI), 2019-2020, \$50,000.

Instructional Technology Funds, *Oculus Quest Headsets*, College of Science and Engineering, 2019, \$40,000.

Publications

The following codes are used to describe my role in multi-author publications:

[lead] – lead author leading the intellectual contribution and writing

[advisor] – supervised student(s) who lead the intellectual contribution and writing

[equal] – an equal partner in the intellectual contribution and writing

[collab] – an active collaborator, contributing to the intellectual contribution and writing

Refereed Journal Articles

- [J1] N. Nilsson, T. Peck, G. Bruder, E. Hodgson, S. Serafin, E. Suma Rosenberg, M. Whitton, and F. Steinicke. 15 years of research on redirected walking in immersive virtual environments. *IEEE Computer Graphics and Applications*, 38(2):44–56, 2018. <https://doi.org/10.1109/MCG.2018.111125628> [collab]
- [J2] A. Feng, E. Suma Rosenberg, and A. Shapiro. Just-in-time, viable, 3-D avatars from scans. *Computer Animation and Virtual Worlds*, 28(3-4):e1769, 2017. <https://doi.org/10.1002/cav.1769> [equal]
- [J3] C. Mauceri, E. Suma, S. Finkelstein, and R. Souvenir. Evaluating visual query methods for articulated motion video search. *International Journal of Human-Computer Studies*, 77:10–22, 2015. <https://doi.org/10.1016/j.ijhcs.2014.12.009> [equal]
- [J4] D.H. Jeong, S. Ji, E. Suma, B. Yu, and R. Chang. Designing a collaborative visual analytics system to support users’ continuous analytical processes. *Human-centric Computing and Information Sciences*, 5(5), 2015. <https://doi.org/10.1186/s13673-015-0023-4> [collab]
- [J5] A. Shapiro, A. Feng, R. Wang, H. Li, M. Bolas, G. Medioni, and E. Suma. Rapid avatar capture and simulation using commodity depth sensors. *Computer Animation and Virtual Worlds*, 15(3-4):201–211, 2014. <https://doi.org/10.1002/cav.1579> [equal]
- [J6] E. Suma, D. Krum, B. Lange, S. Koenig, A. Rizzo, and M. Bolas. Adapting user interfaces for gestural interaction with the Flexible Action and Articulated Skeleton Toolkit. *Computers & Graphics*, 37(3):193–201, 2013. <https://doi.org/10.1016/j.cag.2012.11.004> [lead]
- [J7] E. Suma, Z. Lipps, S. Finkelstein, D. Krum, and M. Bolas. Impossible Spaces: Maximizing natural walking in virtual environments with self-overlapping architecture. *IEEE Transactions on Visualization and Computer Graphics (Proceedings Virtual Reality)*, pages 555–564, 2012. <https://doi.org/10.1109/TVCG.2012.47> **[Best Paper Honorable Mention]** [lead]
- [J8] B. Lange, S. Koenig, C. Chang, E. McConnell, E. Suma, M. Bolas, and A. Rizzo. Designing informed game-based rehabilitation tasks leveraging advances in virtual reality. *Disability and Rehabilitation*, 34(22):1863–1870, 2012. <https://doi.org/10.3109/09638288.2012.670029> [collab]

- [J9] S. Babu, E. Suma, L. Hodges, and T. Barnes. Learning cultural conversational protocols with immersive interactive virtual humans. *International Journal of Virtual Reality*, 10(4):25–35, 2011. <https://doi.org/10.20870/IJVR.2011.10.4.2826> [collab]
- [J10] D. Krum, E. Suma, and M. Bolas. Augmented reality using personal projection and retroreflection. *Personal and Ubiquitous Computing*, 16(1):17–26, 2011. <https://doi.org/10.1007/s00779-011-0374-4> [collab]
- [J11] S. Finkelstein, A. Nickel, Z. Lipps, Z. Wartell, T. Barnes, and E. Suma. Astrojumper: Motivating exercise with an immersive virtual reality exergame. *Presence: Teleoperators & Virtual Environments*, 20(1):78–92, 2011. https://doi.org/10.1162/pres_a_00036 [advisor]
- [J12] A. Rizzo, B. Lange, E. Suma, and M. Bolas. Virtual reality and interactive digital game technology: New tools to address obesity and diabetes. *Journal of Diabetes Science and Technology*, 5(2):256–264, 2011. <https://doi.org/10.1177/193229681100500209> [collab]
- [J13] E. Suma, S. Finkelstein, M. Reid, S. Babu, A. Ulinski, and L.F. Hodges. Evaluation of the cognitive effects of travel technique in complex real and virtual environments. *IEEE Transactions on Visualization and Computer Graphics*, 16(4):690–702, 2010. <https://doi.org/10.1109/TVCG.2009.93> [lead]
- [J14] S. Koepnick, R. Hoang, M. Sgambati, D. Coming, E. Suma, and W. Sherman. RIST: Radiological immersive survey training for two simultaneous users. *Computers & Graphics*, 34(6):665–676, 2010. <https://doi.org/10.1016/j.cag.2010.09.008> [collab]
- [J15] R. Chang, A. Lee, M. Ghoniem, R. Kosara, W. Ribarsky, J. Yang, E. Suma, C. Ziemkiewicz, D. Kern, and A. Sudjianto. Scalable and interactive visual analysis of financial wire transactions for fraud detection. *Journal of Information Visualization*, 7:63–76, 2008. <https://doi.org/10.1057/palgrave.ivs.9500172> [collab]

Book Chapters

- [B1] M. Azmandian, R. Yahata, and E. Suma Rosenberg. Exploring large environments with redirected walking. In *VR Developer Gems*. A K Peters/CRC Press, 2019. <https://doi.org/10.1201/b21598> [advisor]
- [B2] E. Suma, D. Krum, and M. Bolas. Redirected walking in mixed reality training applications. In *Human Walking in Virtual Environments: Perception, Technology, and Applications*, pages 319–331. Springer, 2013. https://doi.org/10.1007/978-1-4419-8432-6_14 [lead]
- [B3] D. Krum, E. Suma, and M. Bolas. Sharing and stretching space with full body tracking. In *Whole Body Interaction*, pages 51–62. Springer London, 2011. https://doi.org/10.1007/978-0-85729-433-3_5 [collab]

Peer-Reviewed Conference Papers

- [C1] J. Thomas and E. Suma Rosenberg. A general reactive algorithm for redirected walking using artificial potential functions. In *IEEE Conference on Virtual Reality and 3D User Interfaces*, 2019. <https://doi.org/10.1109/VR.2019.8797983> [advisor]
- [C2] C. Hutton, S. Ziccardi, J. Medina, and E. Suma Rosenberg. Individualized calibration of rotation gain thresholds for redirected walking. In *International Conference on Artificial Reality and Telexistence & Eurographics Symposium on Virtual Environments*, 2018. <https://doi.org/10.2312/egve.20181315> [advisor]

- [C3] C. Chen and E. Suma Rosenberg. Dynamic omnidirectional texture synthesis for photorealistic virtual content creation. In *Adjunct Proceedings of the IEEE International Symposium on Mixed and Augmented Reality*, 2018. <https://doi.org/10.1109/ISMAR-Adjunct.2018.00040> [advisor]
- [C4] C. Chen, M. Bolas, and E. Suma Rosenberg. View-dependent virtual reality content from RGB-D images. In *IEEE International Conference on Image Processing*, pages 2931–2935, 2017. <https://doi.org/10.1109/ICIP.2017.8296819> [advisor]
- [C5] J. Thomas, M. Azmandian, S. Grunwald, D. Le, D. Krum, S. Kang, and E. Suma Rosenberg. Effects of personalized avatar texture fidelity on identity recognition in virtual reality. In *International Conference on Artificial Reality and Telexistence & Eurographics Symposium on Virtual Environments*, pages 97–100, 2017. <http://dx.doi.org/10.2312/egve.20171345> [advisor]
- [C6] M. Azmandian, T. Grechkin, and E. Suma Rosenberg. An evaluation of strategies for two user redirected walking in shared physical spaces. In *IEEE Virtual Reality*, pages 91–98, 2017. <https://doi.org/10.1109/VR.2017.7892235> [advisor]
- [C7] T. Grechkin, J. Thomas, M. Azmandian, M. Bolas, and E. Suma. Revisiting detection thresholds for redirected walking: Combining translation and curvature gains. In *ACM Symposium on Applied Perception*, pages 113–120, 2016. <https://doi.org/10.1145/2931002.2931018> [advisor]
- [C8] D. Casas, A. Feng, O. Alexander, G. Fyffe, P. Debevec, R. Ichikari, H. Li, K. Olszewski, E. Suma, and A. Shapiro. Rapid photorealistic blendshape modeling from RGB-D sensors. In *International Conference on Computer Animation and Social Agents*, pages 121–129, 2016. <https://doi.org/10.1145/2915926.2915936> [collab]
- [C9] M. Azmandian, T. Grechkin, M. Bolas, and E. Suma. Automated path prediction for redirected walking using navigation meshes. In *IEEE Symposium on 3D User Interfaces*, pages 63–66, 2016. <https://doi.org/10.1109/3DUI.2016.7460032> [advisor]
- [C10] M. Azmandian, T. Grechkin, M. Bolas, and E. Suma. Physical space requirements for redirected walking: How size and shape affect performance. In *International Conference on Artificial Reality and Telexistence and Eurographics Symposium on Virtual Environments*, pages 93–100, 2015. <http://dx.doi.org/10.2312/egve.20151315> [advisor]
- [C11] A. Feng, G. Lucas, S. Marsella, E. Suma, C. Chiu, D. Casas, and A. Shapiro. Acting the part: The role of gesture on avatar identity. In *ACM SIGGRAPH Conference on Motion in Games*, pages 49–54, 2014. <https://doi.org/10.1145/2668064.2668102> [collab]
- [C12] K. Vasylevska, H. Kaufmann, M. Bolas, and E. Suma. Flexible Spaces: Dynamic layout generation for infinite walking in virtual environments. In *IEEE Symposium on 3D User Interfaces*, pages 39–42, 2013. <https://doi.org/10.1109/3DUI.2013.6550194> [advisor]
- [C13] E. Suma, G. Bruder, F. Steinicke, D. Krum, and M. Bolas. A taxonomy for deploying redirection techniques in immersive virtual environments. In *IEEE Virtual Reality*, pages 43–46, 2012. <https://doi.org/10.1109/VR.2012.6180877> [lead]
- [C14] D. Krum, E. Suma, and M. Bolas. Spatial misregistration of virtual human audio: Implications of the precedence effect. In *International Conference on Intelligent Virtual Agents*, pages 139–145, 2012. https://doi.org/10.1007/978-3-642-33197-8_14 [collab]

- [C15] E. Suma, S. Clark, S. Finkelstein, Z. Wartell, D. Krum, and M. Bolas. Leveraging change blindness for redirection in virtual environments. In *IEEE Virtual Reality*, pages 159–166, 2011. <https://doi.org/10.1109/VR.2011.5759455> [lead]
- [C16] E. Suma, D. Krum, S. Finkelstein, and M. Bolas. Effects of redirection on spatial orientation in real and virtual environments. In *IEEE Symposium on 3D User Interfaces*, pages 35–38, 2011. <https://doi.org/10.1109/3DUI.2011.5759214> [**Best Short Paper Award**] [lead]
- [C17] B. Lange, E. Suma, B. Newman, T. Phan, C. Chang, A. Rizzo, and M. Bolas. Leveraging unencumbered full body control of animated virtual characters for game-based rehabilitation. In *HCI International*, pages 243–252, 2011. https://doi.org/10.1007/978-3-642-22024-1_27 [collab]
- [C18] B. Lange, C. Chang, E. Suma, B. Newman, A. Rizzo, and M. Bolas. Development and evaluation of low cost game-based balance rehabilitation tool using the Microsoft Kinect sensor. In *IEEE Engineering in Medicine and Biology Conference*, pages 1831–1834, 2011. <https://doi.org/10.1109/IEMBS.2011.6090521> [collab]
- [C19] E. Suma, S. Finkelstein, S. Clark, P. Goolkasian, and L.F. Hodges. Effects of travel technique and gender on a divided attention task in a virtual environment. In *IEEE Symposium on 3D User Interfaces*, pages 27–34, 2010. <https://doi.org/10.1109/3DUI.2010.5444726> [lead]
- [C20] A. Ulinski, Z. Wartell, P. Goolkasian, E. Suma, and L.F. Hodges. Selection performance based on classes of bimanual actions. In *IEEE Symposium on 3D User Interfaces*, pages 51–58, 2009. <https://doi.org/10.1109/3DUI.2009.4811205> [collab]
- [C21] E. Suma, C. Sinclair, J. Babbs, and R. Souvenir. A sketch-based approach for detecting common human actions. In *International Symposium on Visual Computing*, pages 418–427, 2008. https://doi.org/10.1007/978-3-540-89639-5_40 [lead]
- [C22] E. Suma, S. Babu, and L.F. Hodges. Comparison of travel techniques in a complex, multi-level 3D environment. In *IEEE Symposium on 3D User Interfaces*, pages 147–153, 2007. <https://doi.org/10.1109/3DUI.2007.340788> [**Best Paper Award**] [lead]
- [C23] S. Babu, E. Suma, T. Barnes, and L.F. Hodges. Can immersive virtual humans teach social conversational protocols? In *IEEE Virtual Reality*, pages 215–218, 2007. <https://doi.org/10.1109/VR.2007.352484> [collab]
- [C24] R. Chang, M. Ghoniem, R. Kosara, W. Ribarsky, J. Yang, E. Suma, C. Ziemkiewicz, D. Kern, and A. Sudjianto. WireVis: Visualization of categorical, time-varying data from financial transactions. In *IEEE Visual Analytics Science and Technology*, pages 155–162, 2007. <https://doi.org/10.1109/VAST.2007.4389009> [collab]

Peer-Reviewed Talks and Exhibits

- [T1] A. Feng, E. Suma Rosenberg, and A. Shapiro. Just-in-time, viable, 3D avatars from scans. In *ACM SIGGRAPH Talks*, number 19, 2017. <https://doi.org/10.1145/3084363.3085045> [equal]
- [T2] E. Suma, M. Azmandian, T. Grechkin, T. Phan, and M. Bolas. Making small spaces feel large: Infinite walking in virtual reality. In *ACM SIGGRAPH Emerging Technologies*, number 16, 2015. <https://doi.org/10.1145/2782782.2792496> [lead]

- [T3] D. Casas, O. Alexander, A. Feng, G. Fyffe, R. Ichikari, P. Debevec, R. Wang, E. Suma, and A. Shapiro. Blendshapes from commodity RGB-D sensors. In *ACM SIGGRAPH Talks*, number 33, 2015. <https://doi.org/10.1145/2775280.2792540> [collab]
- [T4] D. Casas, O. Alexander, A. Feng, G. Fyffe, R. Ichikari, P. Debevec, R. Wang, E. Suma, and A. Shapiro. My digital face. In *ACM SIGGRAPH Real-Time Live*, 2015. [equal]
- [T5] A. Feng, A. Shapiro, R. Wang, M. Bolas, G. Medioni, and E. Suma. Rapid avatar capture and simulation using commodity depth sensors. In *ACM SIGGRAPH Talks*, number 16, 2014. <https://doi.org/10.1145/2614106.2614182> [equal]
- [T6] A. Feng, A. Shapiro, R. Wang, M. Bolas, G. Medioni, and E. Suma. Make me an avatar. In *ACM SIGGRAPH Real-Time Live*. [equal]

Defense Conference Papers

- [D1] M. Dennison, J. Thomas, T. Trout, and E. Suma Rosenberg. Assessing the quantitative and qualitative effects of using mixed reality for operational decision making. In *International Command and Control Research & Technology Symposium*, 2018. [equal]
- [D2] T. Trout, S. Russell, A. Harrison, R. Spicer, E. Suma Rosenberg, and J. Thomas. Collaborative mixed reality (MxR) and networked decision making. In *Proc. SPIE 10653, Next-Generation Analyst VI*, page 106530N, 2018. <https://doi.org/10.1117/12.2309959> [collab]
- [D3] R Spicer, S. Russell, and E. Suma Rosenberg. The mixed reality of things: Emerging challenges for human-information interaction. In *Proc. SPIE 10207, Next-Generation Analyst V*, page 102070A, 2017. <https://doi.org/10.1117/12.2268004> [advisor]
- [D4] R. McAlinden, E. Suma, T. Grechkin, and M. Enloe. Procedural reconstruction of simulation terrain using drones. In *Interservice/Industry Training, Simulation, and Education Conference*, 2015. [collab]
- [D5] B. Lange, A. Rizzo, C. Chang, E. Suma, and M. Bolas. Markerless full body tracking: Depth-sensing technology within virtual environments. In *Interservice/Industry Training, Simulation, and Education Conference*, 2011. **[Best Paper Award]** [collab]

Workshop Papers

- [W1] F. Wu, J. Thomas, S. Chinnola, and E. Suma Rosenberg. Exploring communication modalities to support collaborative guidance in virtual reality. In *IEEE VR Workshop on 3D Content Creation for Simulated Training in eXtended Reality*, 2020, to appear. [advisor]
- [W2] J. Thomas and E. Suma Rosenberg. Reactive alignment of virtual and physical environments using redirected walking. In *IEEE VR Workshop on Everyday Virtual Reality*, 2020, to appear. [advisor]
- [W3] F. Wu and E. Suma Rosenberg. Combining dynamic field of view modification with physical obstacle avoidance. In *IEEE VR Workshop on Immersive Sickness Prevention*, 2019. <https://doi.org/10.1109/VR.2019.8798015> [advisor]
- [W4] H. Chen, S. Chen, and E. Suma Rosenberg. Redirected walking strategies in irregularly shaped and dynamic physical environments. In *IEEE VR Workshop on Everyday Virtual Reality*, 2018. [advisor]

- [W5] M. Azmandian, T. Grechkin, M. Bolas, and E. Suma. The Redirected Walking Toolkit: A unified development and deployment platform for exploring large virtual environments. In *IEEE VR Workshop on Everyday Virtual Reality*, 2016. <https://doi.org/10.1109/WEVR.2016.7859537> [advisor]
- [W6] S. Finkelstein, Z. Lipps, T. Barnes, Z. Wartell, and E. Suma. Evaluation of the exertion and motivation factors of a virtual reality exercise game for children with autism. In *IEEE VR Workshop on Virtual and Augmented Assistive Technology*, 2013. <https://doi.org/10.1109/VAAT.2013.6786186> [advisor]
- [W7] E. Suma, B. Lange, A. Rizzo, D. Krum, and M. Bolas. FFAST-R: Defining a core mechanic for designing gestural interfaces. In *The 3rd Dimension of CHI: Touching and Designing 3D User Interfaces*, pages 35–42, 2012. [lead]
- [W8] N. Burba, M. Bolas, D. Krum, and E. Suma. Unobtrusive measurement of subtle nonverbal behaviors with the Microsoft Kinect. In *IEEE VR Workshop on Ambient Information Technologies*, pages 10–13, 2012. <https://doi.org/10.1109/VR.2012.6180952> [advisor]
- [W9] E. Suma, D. Krum, and M. Bolas. Redirection on mixed reality walking surfaces. In *IEEE VR Workshop on Perceptual Illusions in Virtual Environments*, pages 33–35, 2011. [lead]
- [W10] E. Suma, S. Clark, S. Finkelstein, and Z. Wartell. Leveraging change blindness for walking in virtual environments. In *IEEE VR Workshop on Perceptual Illusions in Virtual Environments*, page 10, 2010. [lead]
- [W11] E. Suma, S. Finkelstein, S. Clark, and Z. Wartell. An approach to redirect walking by modifying virtual world geometry. In *IEEE VR Workshop on Perceptual Illusions in Virtual Environments*, pages 16–18, 2009. [lead]

Posters and Research Demos

- [P1] S. Aseeri, S. Marin, R. Landers, V. Interrante, and E. Suma Rosenberg. Embodied realistic avatar system with body motions and facial expressions for communication in virtual reality applications. In *IEEE Conference on Virtual Reality and 3D User Interfaces*, 2020, to appear. [advisor]
- [P2] C. Hutton, N. Sohre, B. Davis, S. Guy, and E. Suma Rosenberg. An augmented reality motion planning interface for robotics. In *IEEE Conference on Virtual Reality and 3D User Interfaces*, 2019. <https://doi.org/10.1109/VR.2019.8798010> [advisor]
- [P3] C. Chen and E. Suma Rosenberg. Automatic generation of dynamically relightable virtual objects with consumer-grade depth cameras. In *IEEE Conference on Virtual Reality and 3D User Interfaces*, 2019. <https://doi.org/10.1109/VR.2019.8798037> [advisor]
- [P4] C. Chen and E. Suma Rosenberg. Virtual content creation using dynamic omnidirectional texture synthesis. In *IEEE Conference on Virtual Reality and 3D User Interfaces*, pages 521–522, 2018. <https://doi.org/10.1109/VR.2018.8446410> [advisor]
- [P5] H. Chen, S. Chen, and E. Suma Rosenberg. Redirected walking in irregularly shaped physical environments with dynamic obstacles. In *IEEE Conference on Virtual Reality and 3D User Interfaces*, pages 523–524, 2018. <https://doi.org/10.1109/VR.2018.8446563> [advisor]

- [P6] C. Hutton, S. Ziccardi, J. Medina, and E. Suma Rosenberg. Please don't puke: Early detection of severe motion sickness in VR. In *IEEE Conference on Virtual Reality and 3D User Interfaces*, pages 579–580, 2018. <https://doi.org/10.1109/VR.2018.8446382> [advisor]
- [P7] C. Chen, M. Bolas, and E. Suma Rosenberg. Rapid creation of photorealistic virtual reality content with consumer depth cameras. In *IEEE Virtual Reality*, pages 473–474, 2017. <https://doi.org/10.1109/VR.2017.7892385> [advisor]
- [P8] C. Chen, M. Bolas, and E. Suma. Real-time 3D rendering using depth-based geometry reconstruction and view-dependent texture mapping. In *ACM SIGGRAPH Posters*, number 84, 2016. <https://doi.org/10.1145/2945078.2945162> [advisor]
- [P9] C. Hutton and E. Suma. A realistic walking model for enhancing redirection in virtual reality. In *IEEE Virtual Reality*, pages 183–184, 2016. <https://doi.org/10.1109/VR.2016.7504714> [advisor]
- [P10] N. Nilsson, E. Suma, R. Nordahl, M. Bolas, and S. Serafin. Estimation of detection thresholds for audiovisual rotation gains. In *IEEE Virtual Reality*, pages 241–242, 2016. <https://doi.org/10.1109/VR.2016.7504743> [collab]
- [P11] M. Bolas, A. Kuruvilla, S. Chintalapudi, F. Rabelo, V. Lympouridis, C. Barron, E. Suma, C. Matamoros, C. Brous, A. Jasina, Y. Zheng, A. Jones, P. Debevec, and D. Krum. Creating near-field VR using stop motion characters and a touch of light-field rendering. In *ACM SIGGRAPH Posters*, number 19, 2015. <https://doi.org/10.1145/2787626.2787640> [collab]
- [P12] D. Casas, O. Alexander, A. Feng, G. Fyffe, I. Ryosuke, , P. Debevec, R. Wang, E. Suma, and A. Shapiro. Rapid photorealistic blendshapes from commodity RGB-D sensors. In *ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games*, page 134, 2015. <https://doi.org/10.1145/2699276.2721398> [**Best Poster Award**] [collab]
- [P13] T. Grechkin, M. Azmandian, M. Bolas, and E. Suma. Towards context-sensitive reorientation for real walking in virtual reality. In *IEEE Virtual Reality*, pages 185–186, 2015. <https://doi.org/10.1109/VR.2015.7223357> [advisor]
- [P14] M. Azmandian, R. Yahata, M. Bolas, and E. Suma. An enhanced steering algorithm for redirected walking in virtual environments. In *IEEE Virtual Reality*, pages 65–66, 2014. <https://doi.org/10.1109/VR.2014.6802053> [**Best Poster Honorable Mention**] [advisor]
- [P15] A. Shapiro, A. Feng, R. Wang, G. Medioni, M. Bolas, and E. Suma. Automatic acquisition and animation of virtual avatars. In *IEEE Virtual Reality*, pages 185–186, 2014. <https://doi.org/10.1109/VR.2014.6802113> [**Best Research Demo Honorable Mention**] [equal]
- [P16] J. Thomas, R. Bashyal, S. Goldstein, and E. Suma. MuVR: A multi-user virtual reality platform. In *IEEE Virtual Reality*, pages 115–116, 2014. <https://doi.org/10.1109/VR.2014.6802078> [advisor]
- [P17] R. Spicer, R. Yahata, M. Bolas, and E. Suma. A raycast approach to hybrid touch / motion capture virtual reality user experience. In *ACM Symposium on Spatial User Interaction*, page 160, 2014. <https://doi.org/10.1145/2659766.2661226> [**Best Poster Award**] [advisor]
- [P18] C. Chen, R. Spicer, R. Yahata, M. Bolas, and E. Suma. Real-time and robust grasping detection. In *ACM Symposium on Spatial User Interaction*, page 159, 2014. <https://doi.org/10.1145/2659766.2661224> [advisor]

- [P19] M. Azmandian, M. Bolas, and E. Suma. Countering user deviation during redirected walking. In *ACM Symposium on Applied Perception*, page 129, 2014. <https://doi.org/10.1145/2628257.2628352> [advisor]
- [P20] K. Vasylevska, H. Kaufmann, M. Bolas, and E. Suma. Flexible spaces: A virtual step outside of reality. In *IEEE Virtual Reality*, pages 109–110, 2013. <https://doi.org/10.1109/VR.2013.6549386> [advisor]
- [P21] Y. Huang, M. Bolas, and E. Suma. Fusing depth, color, and skeleton data for enhanced real-time hand segmentation. In *ACM Symposium on Spatial User Interaction*, page 85, 2013. <https://doi.org/10.1145/2491367.2491401> [advisor]
- [P22] J. Jones, E. Suma, D. Krum, and M. Bolas. Comparability of narrow and wide field-of-view head-mounted displays for medium-field distance judgments. In *ACM Symposium on Applied Perception*, page 119, 2012. <https://doi.org/10.1145/2338676.2338701> [collab]
- [P23] P. Hoberman, D. Krum, E. Suma, and M. Bolas. Immersive training games for smartphone-based head mounted displays. In *IEEE Virtual Reality*, pages 151–152, 2012. <https://doi.org/10.1109/VR.2012.6180926> [collab]
- [P24] D. Krum, E. Suma, and M. Bolas. Virtual reality to go: A USC ICT mixed reality lab demonstration. In *IEEE Virtual Reality*, pages 179–180, 2012. <https://doi.org/10.1109/VR.2012.6180939> [Best Research Demo Award] [equal]
- [P25] D. Krum, E. Suma, and M. Bolas. Spatial misregistration of virtual human audio: Implications of the precedence effect. In *IEEE Symposium on 3D User Interfaces*, pages 147–148, 2012. <https://doi.org/10.1109/3DUI.2012.6184204> [collab]
- [P26] E. Suma, B. Lange, A. Rizzo, D. Krum, and M. Bolas. FFAST: The Flexible Action and Articulated Skeleton Toolkit. In *IEEE Virtual Reality*, pages 247–248, 2011. <https://doi.org/10.1109/VR.2011.5759491> [lead]
- [P27] J. L. Olson, D. Krum, E. Suma, and M. Bolas. A design for a smartphone-based head mounted display. In *IEEE Virtual Reality*, pages 233–234, 2011. <https://doi.org/10.1109/VR.2011.5759484> [collab]
- [P28] E. Suma, D. Krum, and M. Bolas. Sharing space in mixed and virtual reality environments using a low-cost depth sensor. In *International Symposium on VR Innovation*, pages 353–354, 2011. <https://doi.org/10.1109/ISVRI.2011.5759673> [lead]
- [P29] D. Jeong, E. Suma, T. Butkiewicz, W. Ribarsky, and R. Chang. A continuous analysis process between desktop and collaborative visual analytics environments. In *IEEE Visual Analytics Science and Technology*, pages 231–232, 2010. <https://doi.org/10.1109/VAST.2010.5652958> [collab]
- [P30] S. Finkelstein, A. Nickel, T. Barnes, and E. Suma. Astrojumper: Motivating children with autism to exercise using a VR game. In *ACM Conference on Human Factors in Computing Systems (CHI)*, pages 4189–4194, 2010. <https://doi.org/10.1145/1753846.1754124> [advisor]
- [P31] E. Suma, S. Clark, S. Finkelstein, and Z. Wartell. Exploiting change blindness to expand walkable space in a virtual environment. In *IEEE Virtual Reality*, pages 305–306, 2010. <https://doi.org/10.1109/VR.2010.5444752> [lead]
- [P32] S. Finkelstein, A. Nickel, T. Barnes, and E. Suma. Astrojumper: Designing a virtual reality exergame to motivate children with autism to exercise. In *IEEE Virtual Reality*, pages 267–268, 2010. <https://doi.org/10.1109/VR.2010.5444770> [collab]

- [P33] E. Suma, S. Finkelstein, M. Reid, A. Ulinski, and L.F. Hodges. Real walking increases simulator sickness in navigationally complex virtual environments. In *IEEE Virtual Reality*, pages 245–246, 2009. <https://doi.org/10.1109/VR.2009.4811037> [lead]
- [P34] S. Finkelstein, A. Nickel, L. Harrison, E. Suma, and T. Barnes. cMotion: A new game design to teach emotion recognition and programming logic to children using virtual humans. In *IEEE Virtual Reality*, pages 249–250, 2009. <https://doi.org/10.1109/VR.2009.4811039> [collab]
- [P35] S. Stansfield, T. Butkiewicz, E. Suma, and M. Kane. Interactive virtual client for teaching occupational therapy evaluative processes. In *ACM SIGACCESS Conference on Computers & Accessibility*, pages 186–187, 2005. <https://doi.org/10.1145/1090785.1090822> [equal]
- [P36] S. Stansfield, C. Dennis, and E. Suma. Emotional and performance attributes of a VR game: A study of children. In *Medicine Meets Virtual Reality*, pages 515–518, 2005. [equal]

Edited Special Issues and Conference Proceedings

- [E1] E. Suma Rosenberg, D.M. Krum, Z. Wartell, B. Mohler, S.V. Babu, F. Steinicke, and V. Interrante, editors. *IEEE Virtual Reality Conference Proceedings*. IEEE, 2017. [lead]
- [E2] T. Hollerer, V. Interrante, A. Lecuyer, and E. Suma, editors. *IEEE Virtual Reality Conference Proceedings*. IEEE, 2016. [equal]
- [E3] F. Steinicke, E. Suma, and W. Stuerzlinger, editors. *Special Section on Spatial User Interaction*. Computers & Graphics, Elsevier, 2015. [equal]
- [E4] A. Banic, E. Suma, F. Steinicke, and W. Stuerzlinger, editors. *SUI '15: Proceedings of the 3rd ACM Symposium on Spatial User Interaction*. ACM, 2015. [equal]
- [E5] A. Wilson, F. Steinicke, E. Suma, and W. Stuerzlinger, editors. *SUI '14: Proceedings of the 2nd ACM Symposium on Spatial User Interaction*. ACM, 2014. [equal]
- [E6] E. Suma, W. Stuerzlinger, and F. Steinicke, editors. *SUI '13: Proceedings of the 1st Symposium on Spatial User Interaction*. ACM, 2013. [lead]

Patents

- [PA1] M. Bolas, J. Adam Jones, I. McDowall, and E. Suma. Dynamic field of view throttling as a means of improving user experience in head mounted virtual environments. *U.S. Patent 9,645,395*, filed March 17, 2014, issued May 9, 2017. <https://www.google.com/patents/US9645395> [equal]
- [PA2] E. Suma, G. Medioni, M. Bolas, A. Shapiro, W. Feng, and R. Wang. Rapid avatar capture and simulation using commodity depth sensors. *U.S. Patent Application 14/694,670*, filed April 23, 2015. <https://www.google.com/patents/US20150356767> [equal]

Software Development

- [S1] M. Azmandian, , T. Grechkin, M. Bolas, and E. Suma Rosenberg. Redirected Walking Toolkit. <http://projects.ict.usc.edu/mxr/rdwt/> [advisor]
- [S2] E. Suma Rosenberg, R. Wang, A. Feng, and A. Shapiro. Fast Avatar Capture. <http://smartbody.ict.usc.edu/fast-avatar-capture-software-download> [equal]

- [S3] E. Suma Rosenberg, B. Lang, S. Rizzo, D. Krum, and M. Bolas. Flexible Action and Articulated Skeleton Toolkit. <http://projects.ict.usc.edu/mxr/faast/> [lead]

Presentations

Keynote Talks

- IEEE VR Workshop on Everday Virtual Reality (March 18, 2018)
- Seoul Creative Dream Conference (July 10, 2016)
- International Symposium on Visual Computing (December 14, 2015)

Invited Talks

- Iowa State University, XR Advance Seminar Series (Spring 2019)
- University of Florida, Human-Centered Computing Seminar (Fall 2017)
- United States Military Academy at West Point (Spring 2017)
- Georgia Institute of Technology, GVI Brown Bag (Fall 2016)
- Harvey Mudd College, Computer Science Colloquium (Fall 2016)
- University of California, Merced, Cognitive Science Seminar (Fall 2016)
- Google (Fall 2016)
- Microsoft Research (Spring 2016)
- University of North Carolina at Charlotte, Viscenter Seminar (Fall 2015)
- Aalborg University Copenhagen (Fall 2012)
- University of North Carolina at Chapel Hill (Spring 2012)
- University of North Carolina at Charlotte, Graduate Seminar (Spring 2012)
- Clemson University, Visual/Human Centered Computing Seminar (Spring 2012)
- Carnegie Mellon University, HCII Seminar Series (Fall 2011)
- Workshop on Facial and Bodily Expressions for Control and Adaptation of Games (Spring 2011)
- Clemson University, Human-Centered Computing and Visual Computing Seminars (Spring 2010)
- University of North Carolina at Charlotte, Graduate Seminar (Spring 2010)

Panels

- Novel Approaches for SEARIS, *Workshop on Software Engineering and Architectures for Realtime Interactive Systems* (2019)
- AR and VR Futures, *ACM Conference on Computer Graphics & Interactive Techniques* (2017)
- Lessons to Game Developers from IEEE VR, *IEEE Virtual Reality* (2016)
- Lessons from IEEE Virtual Reality, *Game Developer's Conference* (2016)
- Next Gen Evaluation of VR Interfaces, *IEEE Virtual Reality* (2015)
- The Changing Face of VR Systems, *Workshop on Software Engineering and Architectures for Realtime Interactive Systems* (2013)
- Open Source Software for RIS, *Workshop on Software Engineering and Architectures for Realtime Interactive Systems* (2012)
- New Directions in Redirection, *IEEE Virtual Reality* (2011)
- Visualization and Simulation on Immersive Display Devices, *International Symposium on Visual Computing* (2008)

Teaching

University of Minnesota

- Spring 2020 CSCI 1133: Introduction to Computing and Programming Concepts
- Fall 2019 CSCI 5619: Virtual Reality and 3D Interaction
- Fall 2018 CSCI 8980: Immersive User Interfaces

University of Southern California

- Fall 2017 CSCI 699: Virtual Reality and 3D User Interfaces

University of North Carolina at Charlotte

- Spring 2009 ITCS 1214L: Intro to Computer Science Lab
- Fall 2008 ITCS 1214L: Intro to Computer Science Lab
- Summer 2008 ITCS 1214: Intro to Computer Science

Advising and Mentoring

Undergraduate Students Supervised

- Current Christopher You, Muhammad Ahsan
- 2019 Austin Hayes, Sam Adeniyi, Thomas Fisher II
- 2017 Shelby Ziccardi, Julio Medina, Daniel Kawalsky
- 2016 Sonia Grunwald, Donna Le
- 2015 Courtney Hutton (Ph.D. Student, UMN)
- 2014 Dillon Just
- 2013 Jerald Thomas (Ph.D. Student, UMN), Samantha Goldstein, Raghav Bashyal
- 2010 Seth Clark
- 2009 - 2010 Dr. Samantha Finkelstein (Ph.D., CMU)

Master's Students Supervised

- Current Dengyuan Wang, Tongyu Nie
- 2019 Yinqiao Zheng, Danhua Zhang (Ph.D. Student, UMN)
- 2011 - 2012 Nathan Burba (CEO, Survios)
- 2011 - 2012 Robyn Gray (Co-Founder, Otherworld Interactive)

Doctoral Students Supervised

- Current Jerald Thomas, Courtney Hutton, Fei Wu, Danhua Zhang, Daniel Keyes, Sahar Aseeri
- 2014 - 2018 Dr. Chih-Fan Chen (ObEN)
Dissertation Title: Rapid Creation of Photorealistic Virtual Reality Content with Consumer Depth Cameras
- 2013 - 2017 Dr. Mahdi Azmandian (Sony Playstation Magic Lab)
Dissertation Title: Design and Evaluation of Adaptive Redirected Walking Systems

Doctoral Committees

- 2020 Fenix Chen, Computer Science, Proposal Committee Member
- 2020 Xing Liu, Computer Science, Proposal Committee Member

2019 Seth Johnson, Computer Science, Proposal Committee Member
2019 Nick Sohre, Computer Science, Proposal Committee Member
2019 Irene Ye Yuan, Computer Science, Preliminary Committee Member
2019 Zhihang Deng, Computer Science, Dissertation Committee Member
2019 Kyungyoon Kim, Computer Science, Proposal Committee Member
2019 Jung Who Nam, Computer Science, Proposal Committee Member
2019 Christopher Curry, Kinesiology, Preliminary Committee Member
2018 Ying Lu, Computer Science, Dissertation Committee Member

Postdoctoral Fellows Supervised

2015 - 2016 Dr. Timofey Grechkin (Magic Leap)

Visiting Scholars Hosted

2016 Dr. Pablo Figueroa
2011 Dr. Gerd Bruder

Service and Professional Activities

Organization of Conferences, Workshops, and Panels

General Chair, IEEE Virtual Reality (2017-2018)
General Chair, ACM Symposium on Spatial User Interaction (2013)
Program Chair, IEEE Virtual Reality (2016)
Program Chair, ACM Symposium on Spatial User Interaction (2014-2016)
Steering Committee Chair, ACM Symposium on Spatial User Interaction (2018-2020)
Steering Committee, ACM Symposium on Spatial User Interaction (2015-2019)
Organizing Committee, IEEE Virtual Reality (2010-2018, 2020)
Organizing Committee, IEEE Symposium on 3D User Interfaces (2011-2013)
Program Committee, IEEE Virtual Reality (2012-2014, 2018-2020)
Program Committee, IEEE International Symposium on Mixed and Augmented Reality (2019)
Program Committee, ACM Conference on Human Factors in Computing Systems (CHI) (2013)
Program Committee, ACM Virtual Reality Software and Technology (2009-2014, 2018-2019)
Program Committee, ACM International Conference on Multimodal Interaction (2012)
Program Committee, ACM Symposium on Applied Perception (2018)
Program Committee, Foundations of Digital Games (2012, 2014)
Program Committee, International Symposium on Visual Computing (2011-2013)
Program Committee, SPIE Virtual, Augmented, and Mixed Reality Technology for Multi-Domain Operations (2020)
Real-Time Live Subcommittee, ACM Conference on Computer Graphics & Interactive Techniques (2012)
Organizer, Workshop on Immersive Sickness Prevention (2020)
Organizer, Workshop on Off-The-Shelf Virtual Reality (2012-2013)
Co-organizer, Workshop on Ambient Information Technologies (2013)
Program Committee, Workshop on Perceptual Illusions in Virtual Environments (2011-2012)
Organizer, Panel on “New directions in redirection,” IEEE Virtual Reality (2011)

Peer-Review Experience

ACM Conference on Computer Graphics & Interactive Techniques (SIGGRAPH)
ACM Conference on Computer Graphics & Interactive Techniques in Asia (SIGGRAPH Asia)
ACM Conference on Human Factors in Computing Systems (CHI)
ACM International Conference on Multimodal Interaction
ACM Symposium on Applied Perception
ACM Symposium on User Interface Software and Technology
ACM Symposium on Virtual Reality Software and Technology
Computers & Graphics (Elsevier)
Foundations of Digital Games
Human Factors (SAGE)
IEEE Symposium on 3D User Interfaces
IEEE Transactions on Visualization and Computer Graphics
IEEE Virtual Reality
International Conference on Pattern Recognition
International Journal of Human-Computer Studies
International Symposium on Mixed and Augmented Reality
Joint Virtual Reality Conference EGVE - ICAT - EuroVR
Pattern Recognition Letters (Elsevier)
Presence: Teleoperators & Virtual Environments (MIT Press)
Virtual Reality (Springer)

Review Panels for External Funding Agencies

National Science Foundation (2019, 2017, 2015, 2014)

Professional Organizations

Member, Association for Computing Machinery (ACM)
Senior Member, Institute of Electrical and Electronics Engineers (IEEE)