

Area of Expertise

My research in the newly established field of Immersive Analytics weaves the threads of several research areas, including human-computer interaction, augmented and virtual reality, information visualization and visual analytics, wearable technologies, collaborative and social computing, and design of novel interaction techniques. By bringing together knowledge from these areas I aim to better understand the relevant human factors for allowing meaningful interaction and sensemaking with the next generation of wearable and immersive computing interfaces. My research focuses on moving toward productive interfaces for emerging technologies, and embodied ecosystems that blend naturally into our physical and social environments.

Education

PhD in Human-Computer Interaction	2016
GPA: 4.44 / 4.5	
University of Manitoba, Winnipeg, Canada	
Department of Computer Science, Faculty of Science	
Thesis: "Spatial Analytic Interfaces"	
Committee: Dr. Pourang Irani (Supervisor)	
Dr. Neil Bruce (Computer Science, University of Manitoba)	
Dr. Bertram Unger (Internal Medicine, University of Manitoba)	
Dr. Ravin Balakrishnan (University of Toronto)	
BSc with First Class Honours in Computer Science	2007
GPA: 3.88 / 4.5	
University of Manitoba, Winnipeg, Canada	
Thesis project: "Policy Gradient Sarsa in Optimization of Biped Walking Gaits"	
BMus in Music Theory	2005
University of Calgary, Calgary, Alberta, Canada	
Minor in Computer Science	
Diploma in Music	1997
Capilano University, North Vancouver, B.C., Canada	

Employment and Professional Experience**Current**

Senior Lecturer	2018 - present
Monash University, Melbourne, Australia	
Data Visualisation and Immersive Analytics Lab	

Past Appointments

Visiting Fellow	2022
University of New South Wales	
Expanded Perception and Interaction Centre (EPI Centre)	
Host: Associate Prof. Tomasz Bednarz, Director, EPI Centre	
Postdoctoral Research Fellow	2016-2018
University of South Australia	
Empathic Computing Lab	
Supervisor: Dr. Mark Billingham	

Research Intern Autodesk Research, Toronto, Ontario, Canada User Interface Research Group, George Fitzmaurice, Director Supervisors: Dr. Tovi Grossman, Dr. Fraser Anderson	2015, 2016
Visiting Researcher Media Interaction Lab, University of Applied Sciences, Hagenberg, Austria Supervisor: Dr. Michael Haller	2012
Research Intern Human Computer Interaction Laboratory, University of Manitoba & Nokia Products Ltd., Vancouver, B.C. Supervisor: Dr. Pourang Irani	2010-2011
Research Assistant Human Computer Interaction Laboratory, University of Manitoba Supervisor: Dr. Pourang Irani	2010
Autonomous Agents Laboratory, University of Manitoba Supervisor: Dr. Jacky Baltes	2006, 2007

Teaching and Supervision

Teaching Experience

Sonics Co-lecturer, Monash University Developed unit and all materials in collaboration with chief examiner, new to Monash in 2021	2020-2022
Virtual and Augmented Reality Chief Examiner, Monash University Developed unit and all materials, new to Monash in 2019	2019-2022
Object Oriented Programming Sessional Lecturer, University of Manitoba	2016
Human-Computer Interaction I Sessional Lecturer, University of Manitoba	2015

Teaching Assistant

Introductory Computer Science I Lab Instructor, Marker, University of Manitoba	2007, 2013-2014
Data Structures and Algorithms Lab Instructor, University of Manitoba	2013
Introductory Computer Science II Lab Instructor, University of Manitoba	2013
Object Orientation Marker, University of Manitoba, Winnipeg, Canada	2007

PhD Examining and Review Panels

Internal Annual Milestone Review Panels

Vahid Pooryousef , Monash University	2022-
Xengxing Li , Monash University	2022-

Sam Trolland , Monash University	2022-
Salah AlAdhath , Monash University	2021-
Ankit Shringi , Monash University	2020-
Benjamin Lee , Monash University	2020-2022
Aldrich Clarence , Monash University	2019-2022
Md Mohaimenuzzaman , Monash University	2019-2021
Peter Hoghton , Monash University	2018-2020

External PhD Examiner

Carmen Hull , University of Calgary	2022
Jacob Young , University of Otago	2020

Supervision Experience

	Career Student Numbers		
	To Begin	In Progress	Completed
Postdoctoral Fellows	-	-	1
Doctoral	1	10	1
Masters Minor Thesis	-	-	7
Undergraduate Honours Thesis	-	-	5

Postdoctoral Fellows

Florence Wang , Monash University. Primary Supervisor Immersive Spatial Visualisation of Smart Grid Data 8-month secondment from CSIRO	2018-2019
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Doctoral Students

Linjia He , Monash University. Primary Supervisor – To begin April 2023 Visualising Cognitive Workload in Immersive Environments	2023-
Fucui Ke , Monash University. Associate Supervisor AI-powered Monitoring and Prediction to Improve Site Safety	2022-
Siyi Liu , Monash University. Primary Supervisor Hyper-Natural Superpower Interaction in Immersive Environments	2022-
Kabir Ahmed Rufai , Monash University. Primary Supervisor Enhancing Neuro-Oncological Procedures using Immersive Visualisation	2022-
Jian Tsen Goh , Monash University (Faculty of Engineering). Associate Supervisor Contextual Visualization of Crane Lift Information for Real-time Execution in Modular Integrated Construction	2021-
Shaozhang Dai , Monash University. Primary Supervisor Robot-Assisted Haptic Feedback for Immersive Analytics	2021-
Ze Dong , University of Canterbury, Associate Supervisor (external) Multi-scale and Multimodal Remote Collaboration for Immersive Analytics	2021-
Yi Li , Monash University. Primary Supervisor Modeling User Fatigue for Immersive Interaction	2021-

Zeinab Ghaemi , Monash University. Associate Supervisor Proxemic Maps for Immersive Visualisation	2021-
Yidan Zhang , Monash University. Associate Supervisor Applications Exploiting Immersive Technologies for Increasing Building User Energy Awareness	2020-
Jiazhou (Joe) Liu , Monash University. Associate Supervisor Small Multiples Visualisation for BIM Data in Immersive Environments	2019-
Kadek Ananta Satriadi , Monash University. Associate Supervisor Multiscale Geovisualisation in Immersive Environments Now Postdoctoral Fellow at University of South Australia	2018-2021

Masters Minor Thesis Students

Shaozhang Dai , Monash University. Primary Supervisor Haptic Feedback for Immersive Analytics	2021
Navajeet Dash , Monash University. Primary Supervisor Visualising Smart Grid Data in Augmented Reality	2021
Siyi Liu , Monash University. Primary Supervisor Force-Based Foot Gesture Navigation in Immersive Environments	2020-2021
Xin Zhang , Minor Thesis Project, Monash University. Co-Supervisor Interactive Displays of Sustainability Data	2019-2020
Miao Wang , Minor Thesis Project, Monash University. Co-Supervisor Map Wayfinding in Augmented Reality	2019
Shahriar Islam , Minor Thesis Project, Monash University. Primary Supervisor Leveraging Eye-Gaze for Adaptive Maps and Interactions	2018-2019
Jiazhou (Joe) Liu , Minor Thesis Project, Monash University. Co-Supervisor Small Multiples Visualisation for BIM Data in Immersive Environments	2018

Undergraduate Honours Thesis Students

Ang (Leon) Li , Honours Thesis Project, Monash University. Primary Supervisor Immersive Visualisation of Human Motion Gesture Data	2021
Yuchen Wang , Honours Thesis Project, Monash University. Primary Supervisor Immersive Authoring of In-Situ Visualisation of BIM Data	2018-2019
Christopher Austin , Honours Thesis Project, Monash University. Co-Supervisor Elicitation study investigating hand and foot gesture interaction for immersive maps in augmented reality	2018
Simond Lee , Honours Thesis Project, Monash University. Co-Supervisor Selecting Points of Interests on Maps in Virtual/Augmented Reality	2018
Nian (Harry) Chen , Honours Thesis Project, Monash University. Co-Supervisor Layer Control Systems for Augmented Reality Maps	2018

Other Mentorship

Bradley Herbert , PhD, University of South Australia. Project supervisor. Combining Augmented Reality with Intelligent Tutoring Systems	2017-2021
Gaganpreet Singh , MSc, University of Manitoba. Project supervisor. Combining Sensors from Multiple Devices for Interaction in Mobile-Wearable Ecosystems	2016
Md. Monirul Islam , MSc, University of Manitoba. Project supervisor. Multiple Coordinated Views for Everyday Analytics on Head-Worn Displays	2016

Brendan Li , University of Manitoba Project supervisor. Supervised work as research assistant. Developed utilities for lab CAVE system	2013-2016
JunHyeok Kim , University of Manitoba Project supervisor. Supervised undergraduate research project on interaction with flying displays	2015
Nathan Loewen , University of Manitoba Project supervisor. Managed work on product development	2015
Ashkon Hakimi , University of Manitoba Project supervisor. Supervised work as research assistant for Pourang Irani. Transcribed user study data	2014
Rory Finnegan , University of Manitoba Project supervisor. Supervised work as research assistant in 3D interface programming	2013
Levko Ivanchuk , BSc, University of Manitoba Project supervisor. Developed user interface for mobile collaboration, ran user studies	2012

Publications


Career Publication Count (h-index = 28)	
Refereed Journal Articles	15
Refereed Conference Full Papers	22
Refereed Conference Short Papers	6
Book Chapters	2
Workshop Organisation	5
Workshop Papers	5
Extended Abstracts (Posters and Demos)	10
Patents/Patent Applications	2/2
Other Research Contributions	2

Refereed Journal Articles

- [J.15] Jiazhou Liu, Arnaud Prouzeau, **Barrett Ens**, Tim Dwyer. 2022. Effects of Display Layout on Spatial Memory for Immersive Environments. *Proceedings of the ACM on Human-Computer Interaction* (ISS '22), 1-11.
- [J.14] Shaozhang Dai, Jim Smiley, **Barrett Ens**, Lonni Besancon. 2022. RoboHapalytics: A Robot Assisted Haptic Controller for Immersive Analytics. *IEEE Transactions on Visualization and Computer Graphics*. IEEE (IEEE VIS '22), accepted.
- [J.13] Zeinab Ghaemi, Ulrich Engelke, **Barrett Ens** and Bernhard Jenny. 2022. Proxemic maps for immersive visualization. *Cartography and Geographic Information Science*. Taylor & Francis, 1-15.
- [J.12] Bradley Herbert, Grant Wigley, **Barrett Ens** and Mark Billingham. 2021. Cognitive load considerations for Augmented Reality in network security training. *Computers & Graphics*. Elsevier.
- [J.11] Xin Zou, Steve O'Hern, **Barrett Ens**, Selby Coxon, Pascal Mater, Raymond Chow, Michael Neylan and Hai L. Vu. 2021. On-road virtual reality autonomous vehicle (VRV) simulator: An empirical study on user experience. *Transportation Research Part C: Emerging Technologies*. Elsevier, Vol 126.
- [J.10] **Barrett Ens**, Sarah Goodwin, Arnaud Prouzeau, Fraser Anderson, Florence Y. Wang, Samuel Gratzl, Zac Lucarelli, Brendan Moyle, Jim Smiley and Tim Dwyer. 2020. Uplift: A Tangible and Immersive Tabletop System for Casual Collaborative Visual Analytics. *IEEE Transactions on Visualization and Computer Graphics*. IEEE, Vol. 27 (2), 1193-1203.

- [J.9] Kadek Ananta Satriadi, **Barrett Ens**, Maxime Cordeil, Tobias Czauderna and Bernhard Jenny. 2020. Maps Around Me: 3D Multiview Layouts in Immersive Spaces. *Proceedings of the ACM on Human-Computer Interaction*. ACM, Vol. 4 (ISS '20).
- [J.8] Christopher R Austin, **Barrett Ens**, Kadek Ananta Satriadi and Bernhard Jenny. 2020. Elicitation study investigating hand and foot gesture interaction for immersive maps in augmented reality. *Cartography and Geographic Information Science*. Taylor and Francis, Vol 47 (3), 214-228.
- [J.7] Difeng Yu, Hai-Ning Liang, Xueshi Lu, Kaixuan Fan and **Barrett Ens**. 2019. Modeling Endpoint Distribution of Pointing Selection Tasks in Virtual Reality Environments. *Transactions on Graphics*. ACM, Vol 38 (6), 1-13. [J.6] **Barrett Ens**, Joel Lanir, Anthony SL Tang, Scott Bateman, Gun A Lee, Thammathip Piumsomboon and Mark Billinghurst. 2019. Revisiting Collaboration through Mixed Reality: The Evolution of Groupware-Supplemental Visualization. *International Journal of Human-Computer Studies*. Elsevier, 81-98.
- [J.5] Thammathip Piumsomboon, Arindam Dey, **Barrett Ens**, Gun Lee and Mark Billinghurst. 2019. The Effects of Sharing Awareness Cues in Collaborative Mixed Reality. *Frontiers in Robotics and AI*. Frontiers, Vol. 6, 5.
- [J.4] Bradley Herbert, **Barrett Ens**, Amali Weerasinghe, Mark Billinghurst and Grant Wigley. 2018. Design Considerations for Combining Augmented Reality with Intelligent Tutors. *Computers and Graphics*, Pergamon, Vol. 77, 166-182.
- [J.3] Thammathip Piumsomboon, Gun A Lee, **Barrett Ens**, Bruce H Thomas and Mark Billinghurst. 2018. Superman vs Giant: A Study on Spatial Perception for a Multi-Scale Mixed Reality Flying Telepresence Interface. *IEEE Transactions on Visualization and Computer Graphics*, IEEE, Vol. 24, 2974-2982.
- [J.2] **Barrett Ens** and Pourang Irani. 2016. Spatial Analytic Interfaces: Spatial User Interfaces for In-Situ Visual Analytics. *Computer Graphics and Applications*. IEEE, 66-79. * Selected for presentation at a special session of the IEEE VIS '16 conference.
- [J.1] **Barrett Ens**, Rasit Eskicioglu and Pourang Irani. 2012. Guidelines for Designing Awareness-Augmented Mobile DUIs. *International Journal of Human-Computer Interaction*. Lozano, D and M.R. Victor, Eds. Taylor & Francis, Vol. 28, 730-736.

Refereed Conference Full Papers

- [C.22] Kadek Ananta Satriadi, Jim Smiley, **Barrett Ens**, Maxime Cordeil, Tobias Czauderna, Benjamin Lee, Ying Yang, Tim Dwyer, and Bernhard Jenny. 2022. Tangible Globes for Data Visualisation in Augmented Reality. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '22)*, 1-16.
- [C.21] Yidan Zhang, **Barrett Ens**, Kadek Ananta Satriadi, Arnaud Prouzeau and Sarah Goodwin. 2022. TimeTables: Embodied Exploration of Immersive Spatio-Temporal Data. In *Proceedings of the IEEE Conference on Virtual Reality and 3D User Interfaces (VR '22)*, Christchurch, New Zealand, 599-605. **Received best paper award nomination (top 13%)** 
- [C.20] **Barrett Ens**, Benjamin Bach, Maxime Cordeil, Ulrich Engelke, Marcos Serrano, Wesley Willett, Arnaud Prouzeau, Christoph Anthes, Wolfgang Büschel, Cody Dunne, Tim Dwyer, Jens Grubert, Jason H Haga, Nurit Kirshenbaum, Dylan Kobayashi, Tica Lin, Monsurat Olaosebikan, Fabian Pointecker, David Saffo, Nazmus Saquib, Dieter Schmalstieg, Danielle Albers Szafir, Matt Whitlock and Yalong Yang. 2021. Grand Challenges in Immersive Analytics. In *Proceedings of CHI Conference on Human Factors in Computing Systems (CHI '21)*, Yokohama, Japan. ACM.
- [C.19] Kadek Ananta Satriadi, **Barrett Ens**, Tobias Czauderna, Maxime Cordeil and Bernhard Jenny. 2021. Quantitative Data Visualisation on Virtual Globes. In *Proceedings of CHI Conference on Human Factors in Computing Systems (CHI '21)*, Yokohama, Japan. ACM.
- [C.18] Kurtis Thorvald Danyluk, **Barrett Ens**, Bernhard Jenny and Wesley Willett. 2021. A Design Space Exploration of Worlds in Miniature. In *Proceedings of CHI Conference on Human Factors in Computing Systems (CHI '21)*, Yokohama, Japan. ACM.

- [C.17] Pin-Sung Ku, Jun Gong, Te-Yen Wu, Yixin Wei, Yiwen Tang, **Barrett Ens** and Xing-Dong Yang. 2020. Zippro: The Design and Implementation of An Interactive Zipper. In *Proceedings of CHI Conference on Human Factors in Computing Systems (CHI '20)*, Honolulu, USA. ACM, 1-13.
- [C.16] Jiazhou Liu, Arnaud Prouzeau, **Barrett Ens** and Tim Dwyer. 2020. Design and Evaluation of Interactive Small Multiples Data Visualisation in Immersive Spaces. In *Proceedings of the IEEE Conference on Virtual Reality and 3D User Interfaces (VR '20)*, Atlanta, GA, USA. IEEE, 588-597.
- [C.15] Arnaud Prouzeau, Yuchen Wang, **Barrett Ens**, Wesley Willett and Tim Dwyer. 2020. Corsican Twin: Authoring In Situ Augmented Reality Visualisations in Virtual Reality. In *Proceedings of the International Conference on Advanced Visual Interfaces (AVI '20)*, Salerno, Italy. ACM, 1-9.
Received best paper award (top 1%) 🏆
- [C.14] Arnaud Prouzeau, Antoine Lhuillier, **Barrett Ens**, Daniel Weiskopf and Tim Dwyer. 2019. Visual Link Routing in Immersive Visualisation. In *Proceedings of the International Conference on Interactive Surfaces and Spaces (ISS '19)*, Daejeon, South Korea. ACM.
- [C.13] Arnaud Prouzeau, Maxime Cordeil, Clement Robin, **Barrett Ens**, Bruce H Thomas and Tim Dwyer. 2019. Scaptics and Highlight-Planes: Immersive Interaction Techniques for Finding Occluded Features in 3D Scatterplots. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19)*, Glasgow, Scotland, UK. ACM.
- [C.12] Thammathip Piumsomboon, Gun A Lee, Andrew Irlitti, **Barrett Ens**, Bruce H Thomas and Mark Billinghamurst. 2019. On the Shoulder of the Giant: A Multi-Scale Mixed Reality Collaboration with 360 Video Sharing and Tangible Interaction. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19)*, Glasgow, Scotland, UK. ACM.
- [C.11] Kadek Ananta Satriadi, **Barrett Ens**, Maxime Cordeil, Tobias Czauderna, Wesley J Willett and Bernhard Jenny. 2019. Augmented Reality Map Navigation with Freehand Gestures. In *Proceedings of the 2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR '19)* Osaka, Japan. IEEE, 593-603.
- [C.10] Thammathip Piumsomboon, Gun A Lee, Jonathon D Hart, **Barrett Ens**, Robert W Lindeman, Bruce H Thomas, and Mark Billinghamurst. 2019. Mini-Me: An Adaptive Avatar for Mixed Reality Remote Collaboration. In *Proceedings of the 2018 CHI Conference on Human Factors In Computing Systems (CHI '18)* Montreal, Canada. ACM, 46.
- [C.9] Mikko Kytö, **Barrett Ens**, Thammathip Piumsomboon, Gun A Lee and Mark Billinghamurst. 2019. Pinpointing: Precise Head-and Eye-Based Target Selection for Augmented Reality. In *Proceedings of the 2018 CHI Conference on Human Factors In Computing Systems (CHI '18)* Montreal, Canada. ACM, 81.
Received best paper award (top 1%) 🏆
- [C.8] **Barrett Ens**, Fraser Anderson, Tovi Grossman, Michelle Annett, Pourang Irani and George Fitzmaurice. 2017. Ivy: Exploring Spatially Situated Visual Programming for Authoring and Understanding Intelligent Environments. In *Proceedings of Graphics Interface (GI '17)*, Edmonton, AB, Canada. CHCCS, 155-162.
- [C.7] **Barrett Ens**, Tovi Grossman, Fraser Anderson, Justin Matejka and George Fitzmaurice. 2015. Candid Interaction: Revealing Hidden Mobile and Wearable Computing Activities. In *Proceedings of the 28th annual ACM symposium on User interface software and technology (UIST '15)*, Charlotte, NC, USA. ACM, 467-476.
- [C.6] **Barrett Ens**, Juan David Hincapié-Ramos and Pourang Irani. 2014. Ethereal Planes: A Design Framework for 2D Information Spaces In 3D Mixed Reality Environments. In *Proceedings of the 2nd symposium on Spatial user interactions (SUI '14)*, Honolulu, USA. ACM, 2-10.
- [C.5] **Barrett Ens**, Daniel Rea, Roiy Shpaner, Hadi Hemmati, James E. Young and Pourang Irani. 2014. ChronoTwigger: A Visual Analytics Tool for Understanding Source and Test Co-Evolution. In *Proceedings of the 2nd IEEE Working Conference on Software Visualization (VISOFT '14)*, Victoria, Canada. IEEE, 117-126.
- [C.4] **Barrett Ens**, Rory Finnegan and Pourang Irani. 2014. The Personal Cockpit: A Spatial Interface for Effective Task Switching on Head-Worn Displays. In *Proceedings of the SIGCHI Conference on Human Factors and Computing Systems (CHI '14)*, Toronto, Canada. ACM, 3171-3180.

- [C.3] Marcos Serrano, **Barrett Ens** and Pourang Irani. 2014. Exploring the use of Hand-To-Face Input for Interacting With Head-Worn Displays. In *Proceedings of the SIGCHI Conference on Human Factors and Computing Systems (CHI '14)*, Toronto, Canada. ACM, 3181-3190.
- [C.2] Hong Zhang, Xing-Dong Yang, **Barrett Ens**, Hai-Ning Liang, Pierre Boulanger and Pourang Irani. 2012. See Me, See You: A Lightweight Method for Discriminating User Touches on Tabletop Displays. In *Proceedings of the Annual Conference on Human Factors in Computing Systems (CHI '12)*, Austin, Texas, ACM, 2327-2336.
- [C.1] **Barrett Ens**, David Ahlström, Andy Cockburn and Pourang Irani. 2011. Characterizing User Performance with Assisted Direct Off-Screen Pointing. In *Proceedings of the 13th International Conference on Human Computer Interaction with Mobile Devices and Services (MobileHCI '11)*, Stockholm, Sweden. ACM, 485-494.

Refereed Conference Short Papers

- [Cs.6] Thammathip Piumsomboon, Arindam Day, **Barrett Ens**, Youngho Lee, Gun Lee and Mark Billinghurst. 2017. Exploring enhancements for remote mixed reality collaboration. *SIGGRAPH Asia Mobile Graphics & Interactive Applications*. ACM. Article 16, 1-5.
- [Cs.5] Huidong Bai, Alaeddin Nassani, **Barrett Ens** and Mark Billinghurst. 2017. Asymmetric Bimanual Interaction for Mobile Virtual Reality. *Proceedings of the International Conference on Artificial Reality and Telexistence & Eurographics Symposium on Virtual Environments*. Eurographics Association. 83-86.
- [Cs.4] **Barrett Ens**, Fraser Anderson, Tovi Grossman, Michelle Annett, Pourang Irani and George Fitzmaurice. 2017. Won by a Head: A Platform Comparison of Smart Object Linking in Virtual Environments. *Proceedings of the International Conference on Artificial Reality and Telexistence & Eurographics Symposium on Virtual Environments*. Eurographics Association. 17-20.
- [Cs.3] **Barrett Ens**, Ahmad Byagowi, Teng Han, Juan David Hincapié-Ramos and Pourang Irani. 2016. Combining Ring Input with Hand Tracking for Precise, Natural Interaction with Spatial Analytic Interfaces. In *Proceedings of the 4th Symposium on Spatial User Interactions (SUI '16)*, Tokyo, Japan. ACM, 99-102. **Received best short paper award** 🏆
- [Cs.2] **Barrett Ens**, David Ahlström and Pourang Irani. 2016. Moving Ahead with Peephole Pointing: Modelling Object Selection with Head-Worn Display Field of View Limitations. In *Proceedings of the 4th Symposium on Spatial User Interactions (SUI '16)*, Tokyo, Japan. ACM, 107-110.
- [Cs.1] **Barrett Ens**, Eyal Ofek, Neil Bruce and Pourang Irani. 2015. Spatial constancy of surface-embedded layouts across multiple environments. In *Proceedings of the 3rd Symposium on Spatial User Interactions (SUI '15)*, Los Angeles, USA. ACM, 65-68.

Book Chapters

- [B.2] **Barrett Ens**, Eyal Ofek, Neil Bruce and Pourang Irani. 2016. Shared Façades: Surface-Embedded Layout Management for Ad Hoc Collaboration using Head-Worn Displays. *Collaboration Meets Interactive Surfaces and Spaces (CMISS) - Theory and Practice*. Anslow, C., Campos, P. and Jorge, J, Eds. Springer Verlag, 153-176.
- [B.1] **Barrett Ens**, Rasit Eskicioglu and Pourang Irani. 2011. Visually Augmented Interfaces for Co-Located Mobile Collaboration. *Distributed User Interfaces: Designing Interfaces for the Distributed Ecosystem*. J. Gallud, R. Tesoriero and M.R. Victor, Eds. Springer Verlag, 169-176.

Workshop Organisation


- [Wo.5] Marcos Serrano, Kadek Satriadi, Yalong Yang, Barrett Ens, Arnaud Prouzeau and Stefanie Zollmann. 2022. *Workshop on Immersive Analytics Spaces and Surfaces (ACM ISS '22)*. Wellington, NZ. ACM.

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- [Wo.4] **Barrett Ens**, Maxime Cordeil, Chris North, Tim Dwyer, Lonni Besançon, Arnaud Prouzeau, Jiazhou Liu, Andrew Cunningham, Adam Drogemuller, Kadek Anata Satriadi and Bruce H. Thomas. 2022. *Immersive Analytics 2.0: Spatial and Embodied Sensemaking (CHI EA '22)*. New Orleans, USA. ACM.
- [Wo.3] Mark Billinghurst, Arindam Dey, **Barrett Ens**, Tobias Loetscher, Suranga Nanayakkara, and Mingze Xi. 2022. *Workshop on Health & Safety in VR and AR (IEEE VR '22)*. Christchurch, NZ. IEEE.
- [Wo.2] **Barrett Ens**, Benjamin Bach, Maxime Cordeil, Ulrich Engelke, Marcos Serrano and Wesley Willett. 2020. *Envisioning Future Productivity for Immersive Analytics (CHI EA '20)*. Honolulu, Hawaii. ACM.
- [Wo.1] Benjamin Bach, Maxime Cordeil, Ulrich Engelke, **Barrett Ens**, Marcos Serrano and Wesley Willett. 2019. *Extended Abstracts of the Conference on Human Factors in Computing Systems (CHI EA '19)*, Glasgow, Scotland, UK. ACM.

Workshop Papers

- [W.5] Adam Drogemuller, **Barrett Ens**, Jiazhou Liu, Andrew Cunningham, Arnaud Prouzeau, Maxime Cordeil, Bruce H. Thomas and Tim Dwyer. 2020. Towards a Systematic Review of Embodied Interaction in Empirical Studies. In *Workshop on Envisioning Future Productivity for Immersive Analytics (CHI '20)*. Honolulu, Hawaii.
- [W.4] Marcos Serrano, **Barrett Ens**, Xing-Dong Yang and Pourang Irani. 2015. Desktop-Gluey: Augmenting Desktop Environments with Wearable Devices. In *Workshop on Mobile Collocated Interactions With Wearables (MobileHCI '15)*, Copenhagen, Denmark.
- [W.3] Marcos Serrano, Khalad Hasan, **Barrett Ens**, Xing-Dong Yang and Pourang Irani. 2015. Smartwatches + Head-Worn Displays: The 'New' Smartphone. In *Workshop on Mobile Collocated Interactions: From Smartphones to Wearables (CHI '15)*, Seoul, Korea.
- [W.2] **Barrett Ens** and Pourang Irani. 2014. Personal Command and Control: A Spatial Interface for Head-Worn Displays as a Platform for Everyday Visual Analytics. In *Workshop on Personal Visual Analytics (DIS '14)*, Vancouver, Canada.
- [W.1] **Barrett Ens**, Rasit Eskicioglu and Pourang Irani. 2011. Visually Augmented Interfaces for Improving Awareness in Mobile Collaboration. In *Workshop on Distributed User Interfaces (CHI '11)*. Vancouver, Canada.

Extended Abstracts (Posters and Demos)

- [E.10] Ze Dong, Adrian Clark, **Barrett Ens** and Thammathip Piumsomboon. 2022. Localization in Immersive Analytics with World-In-Miniature, Landmarks and Constellations. In *ACM Symposium on Spatial User Interaction (SUI)*.
- [E.10] Ang Li, Jiazhou Liu, Max Cordeil and **Barrett Ens**. 2022. Demonstrating Immersive Gesture Exploration with GestureExplorer. In *IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*. **Received best demo award** 
- [E.9] Ang Li, Jiazhou Liu, Max Cordeil and **Barrett Ens**. 2022. Initial Evaluation of Immersive Gesture Exploration with GestureExplorer. In *IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*.
- [E.8] Siyi Liu, Gun Lee, Yi Li, Thammathip Piumsomboon and **Barrett Ens**. 2021. Force-Based Foot Gesture Navigation in Virtual Reality. In *ACM Symposium on Virtual Reality Software and Technology (VRST '21)*.
- [E.7] Bradley Herbert, Grant Wigley, **Barrett Ens** and Mark Billinghurst. 2020. Perceptions of Integrating Augmented Reality into Network Cabling Tutors. In *IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct '20)*. IEEE, 231-236.
- [E.6] **Barrett Ens**, Aaron Quigley, Hui-Shyong Yeo, Pourang Irani, Thammathip Piumsomboon and Mark Billinghurst. 2018. Counterpoint: Exploring Mixed-Scale Gesture Interaction for AR Applications. In *Extended Abstracts of the Conference on Human Factors in Computing Systems (CHI EA '18)*.

- [E.5] Lynda Gerry, **Barrett Ens**, Adam Drogemuller, Bruce Thomas and Mark Billingham. 2018. Levity: A Virtual Reality System that Responds to Cognitive Load. In *Extended Abstracts of the Conference on Human Factors in Computing Systems (CHI EA '18)*.
- [E.4] Thammathip Piumsomboon, Arindam Dey, **Barrett Ens**, Gun Lee and Mark Billingham. 2017. CoVAR: Mixed-Platform Remote Collaborative Augmented and Virtual Realities System with Shared Collaboration Cues. In *International Symposium on Mixed and Augmented Reality (ISMAR-Adjunct '17)*. IEEE, 218-219.
- [E.3] Hui-Shyong Yeo, **Barrett Ens** and Aaron Quigley. 2017. Tangible UI by Object and Material Classification with Radar. In *SIGGRAPH Asia Emerging Technologies (SA '17)*.
- [E.2] **Barrett Ens**, Aaron Quigley, Hui-Shyong Yeo, Pourang Irani and Mark Billingham. 2017. Multi-Scale Gestural interaction for Augmented Reality. In *SIGGRAPH Asia Mobile Graphics & Interactive Applications (SA '17)*.
- [E.1] Barrett Ens, Aaron Quigley, Hui-Shyong Yeo, Pourang Irani, Thammathip Piumsomboon and Mark Billingham. 2017. Exploring Mixed-Scale Gesture Interaction. In *SIGGRAPH Asia Posters (SA '17)*.

Patents

- [P.4] Sharing Computer Application Activities. Tovi Grossman, George Fitzmaurice, Justin Matejka, **Barrett Ens** and Fraser Anderson. 2022. US Patent 11323495.
- [P.3] Sharing Computer Application Activities. Tovi Grossman, George Fitzmaurice, Justin Matejka, **Barrett Ens** and Fraser Anderson. 2021. US Patent 11190560.
- [P.2] Three dimensional visual programming interface for a network of devices. **Barrett Ens**, Fraser Anderson, George Fitzmaurice and Tovi Grossman. 2018. US Patent App. 15717876.
- [P.1] Sharing Computer Application Activities. **Barrett Ens**, Fraser Anderson, George Fitzmaurice and Tovi Grossman. 2018. US Patent App. 15636517.

Other Research Contributions

- [O.2] Michael de Denus and **Barrett Ens**. 2007. University of Manitoba RoboCup team description. The 11th Annual Robo Symposium and Competition, Atlanta Georgia. **3rd place in Mixed Reality League** 🏆
- [O.1] Chi Tai Cheng, **Barrett Ens** and Shane Yanke. 2006. University of Manitoba FIRA team description. The 11th FIRA RoboWorld Cup and Congress, Dortmund, Germany.

Funding, Awards and Distinctions

External Grants and Funding

*figures are in CAD

Real-time EH&S Intervention to Improve Site Safety , \$160,000 Building 4.0 CRC, Collaboration with Lendlease	2023
AI-powered Monitoring and Prediction to Improve Site Safety , \$120,000 Building 4.0 CRC PhD Scholarship	2022
VR/AR Technologies in Vocational Education and Training , \$80,000 Building 4.0 CRC, Collaboration with Holmesglen, Institute of TAFE, Master Builders Association of Victoria	2021
Augmented Reality to Support Battle Ready Platforms , \$50,000 Contract Research Collaboration with Defence Science and Technology Group	2020
Extended Verbal Diary for PWS , \$92,000 Contract Research Collaboration with Prader-Willi Syndrome Association of Victoria	2020
Cognitive Buildings Project , \$242,000 Contract Research Collaboration with Honeywell	2018-2019

NSERC Postdoctoral Fellowship , \$45,000 / year for 2 years Rank 5 / 55 applications in the Selection Committee for Computer Sciences	2016
NSERC Idea to Innovation Grant , Phase I: \$95,000 + \$60,000 supplement Awarded to my advisor for proposal based directly on my PhD research. Co-authored proposal and ongoing advisory role in product development	2015-2016
Mitacs ENGAGE Grant , \$25,000 Funding for two co-op students for industry extensions of my PhD research.	2015
Guaranteed Funding Package , \$20,000 / year University of Manitoba (amount reduced due to funding cap)	2012
NSERC PGS , \$21,000 / year University of Manitoba	2012
Manitoba Graduate Scholarship , \$15,000 University of Manitoba	2011
University of Manitoba Graduate Fellowship , \$12,000 University of Manitoba (declined due to acceptance of MGS)	2011
Faculty of Science Research Award , \$4000 University of Manitoba	2006

Awards

Best Paper Nomination IEEE VR 2022	2022
Best Demo Honorable Mention IEEE VR 2022	2022
Best Paper Award AVI 2020	2020
Intelligent Transport Systems Australia National Research Award “VRAV: Augmented On-Road Driving Simulator for Autonomous Vehicles Using Virtual Reality”	2019
Best Paper Award CHI 2018	2018
Distinguished Dissertation Award University of Manitoba	2017
Best Short Paper Award SUI 2016	2016
Special Recognition for Exceptional Reviews UIST 2015, 2016	2015-2016
Dean’s Honour List University of Manitoba	2005-2007
Robocup Mixed Reality League Third prize in mixed reality league at RoboCup ‘07 in Atlanta, Georgia, USA	2007
Dean’s Honour List Capilano University	1995-1997
Nan McLean Goodwin Award Capilano University	1996

Service

External Conference Charing

General Co-Chair	2023
<i>IEEE ISMAR 2023</i>	
<i>International Symposium on Mixed and Augmented Reality</i>	
Workshops and Tutorials Co-Chair	2022
<i>ACM ISS 2022</i>	
<i>Interactive Surfaces and Spaces Conference</i>	
Program Chair	2022
<i>OZCHI 2022</i>	
<i>Australian Conference on Human-Computer Interaction</i>	
Publicity Co-Chair	2022
<i>IEEE VR 2022</i>	
<i>Conference on Virtual Reality and 3D Interfaces</i>	
Demos and Interactivity Co-Chair	2021
<i>ACM MobileHCI 2021</i>	
<i>Conference on Human-Computer Interaction with Mobile Devices and Services</i>	
General Chair	2021
<i>CHI Down Under 2020</i>	
<i>Local virtual event for researchers in Australia and New Zealand in lieu of CHI '20</i>	

External Conference Program Committees

<i>ACM CHI Conference on Human Factors in Computing Systems</i>	2023
<i>IEEE VR Conference on Virtual Reality and 3D Interfaces</i>	2023
<i>GI Graphics Interface</i>	2023
<i>ACM SUI Symposium on Spatial User Interaction</i>	2022
<i>IEEE VR Conference on Virtual Reality and 3D Interfaces (Journal Track)</i>	2022
<i>GI Graphics Interface</i>	2022
<i>ACM CHI Conference on Human Factors in Computing Systems</i>	2021
<i>IEEE ISMAR International Symposium on Mixed and Augmented Reality</i>	2021
<i>IEEE VR Conference on Virtual Reality and 3D Interfaces (Journal Track)</i>	2021
<i>GI Graphics Interface</i>	2021
<i>ISVC International Symposium on Visual Computing</i>	2021
<i>ACM CHI Conference on Human Factors in Computing Systems</i>	2020
<i>IEEE VR Conference on Virtual Reality and 3D Interfaces (Conference Track)</i>	2020
<i>GI Graphics Interface</i>	2020
<i>ACM MUM International Conference on Mobile and Ubiquitous Multimedia</i>	2020
<i>ACM AH Augmented Human International Conference</i>	2020
<i>ISVC International Symposium on Visual Computing</i>	2020
<i>ACM CHI Conference on Human Factors in Computing Systems</i>	2019
<i>IEEE VR Conference on Virtual Reality and 3D Interfaces (Conference Track)</i>	2019

<i>ACM VRST Symposium on Virtual Reality Software and Technology</i>	2019
<i>IEEE AIVR International Conference on Artificial Intelligence and Virtual Reality</i>	2019
<i>GI Graphics Interface</i>	2019
<i>ACM AH Augmented Human International Conference</i>	2019
<i>ISVC International Symposium on Visual Computing</i>	2019
<i>OZCHI Australian Conference on Human-Computer Interaction</i>	2019
<i>ACIS Australasian Conference on Information Systems</i>	2019
<i>ACM CHI Conference on Human Factors in Computing Systems (Late Breaking Work)</i>	2018
<i>IEEE AIVR International Conference on Artificial Intelligence and Virtual Reality</i>	2018
<i>IEEE VR Conference on Virtual Reality and 3D Interfaces (Conference Track)</i>	2018
<i>ACM MUM International Conference on Mobile and Ubiquitous Multimedia</i>	2018
<i>ISVC International Symposium on Visual Computing</i>	2018
<i>ACM VRST Symposium on Virtual Reality Software and Technology</i>	2019
<i>IEEE BDVA International Symposium on Big Data Visual Analytics</i>	2017
<i>ACM SUI Symposium on Spatial User Interaction</i>	2017
<i>ACM MobileHCI Conference on Human-Computer Interaction with Mobile Devices and Services</i>	2016
<i>ACM SUI Symposium on Spatial User Interaction</i>	2016

External Conference Paper Reviewing

<i>ACM CHI Conference on Human Factors in Computing Systems</i>
<i>ACM C&C Conference on Creativity & Cognition</i>
<i>ACM CSCW Conference on Computer-Supported Cooperative Work and Social Computing</i>
<i>ACM DIS Conference on Designing Interactive Systems</i>
<i>ACM HAI Conference on Human-Agent Interaction</i>
<i>ACM IUI Conference on Intelligent User Interfaces</i>
<i>ACM ISS Conference on Interactive Surfaces and Spaces</i>
<i>ACM TEI International Conference on Tangible, Embedded and Embodied Interaction</i>
<i>ACM MobileHCI Conference on Human-Computer Interaction with Mobile Devices and Services</i>
<i>ACM SUI Symposium on Spatial User Interaction</i>
<i>ACM TOCHI Transactions on Computer-Human Interaction</i>
<i>ACM UIST Symposium on User Interface Software and Technology</i>
<i>GI Graphics Interface</i>
<i>IEEE VIS Visualization Conference</i>
<i>IEEE ISMAR Symposium on Mixed and Augmented Reality</i>

External Journal Paper Reviewing

<i>ACM Transactions on Computer-Human Interaction</i>
<i>ACM Transactions on Interactive Intelligent Systems</i>

IEEE Transactions on Visualization and Computer Graphics

IEEE Computer Graphics and Applications

IEEE Transactions on Haptics

Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies

Sage Publications Information Visualization Journal

Taylor & Francis International Journal of Human-Computer Interaction

Elsevier International Journal of Human-Computer Studies

CSIRO Journal of Southern Hemisphere Earth Systems Science

External Grant Reviewing

<i>French National Research Agency (ANR)</i>	2022
<i>Australian Research Council (ARC)</i>	2022
<i>National Sciences and Engineering Research Council of Canada (NSERC)</i>	2018, 2022

University Service

Director, Bachelor of Information Technology Faculty of Information Technology, Monash University, Melbourne, Australia	July 2021-
Deputy Director, Bachelor of Information Technology Faculty of Information Technology, Monash University, Melbourne, Australia	2021
Director of Engagement Department of Human-Centred Computing, Monash University, Melbourne, Australia	2020-2021
Communications Coordinator Department of Human-Centred Computing, Monash University, Melbourne, Australia	2018-2020
Instructor Search Committee, Graduate Student Representative Department of Computer Science, University of Manitoba, Winnipeg, Canada	2016
Departmental Council, Graduate Student Representative Department of Computer Science, University of Manitoba, Winnipeg, Canada	2014-2015
Awards Committee, Graduate Student Representative Department of Computer Science, University of Manitoba, Winnipeg, Canada	2013-2014

Talks and Presentations

Presentations at International Conferences

CHI '21 – Online (co-presented) “Grand Challenges in Immersive Analytics”	2021
IEEE VIS '20 – Online “Uplift: A Tangible and Immersive Tabletop System for Casual Collaborative Analytics”	2020

SIGGRAPH Asia '19 – Brisbane, Australia (co-presented) Course: Immersive Analytics	2019
IEEE VIS '16 – Baltimore, MD, USA “Spatial Analytic Interfaces: Spatial User Interfaces for In-Situ Visual Analytics”	2016
SUI '16 – Tokyo, Japan “Combining Ring Input with Hand Tracking for Precise, Natural Interaction with Spatial Analytic Interfaces”	2016
UIST '15 – Charlotte, NC, USA “Candid Interaction: Revealing Hidden Mobile and Wearable Computing Activities”	2015
SUI '15 – Los Angeles, USA “Spatial Constancy of Surface-Embedded Layouts across Multiple Environments”	2015
SUI '14 – Honolulu, USA “Ethereal Planes: A Design Framework for 2D Information Spaces in 3D Mixed Reality Environments”	2014
VISSOFT '14 – Victoria, Canada “ChronoTwigger: A Visual Analytics Tool for Understanding Source and Test Co-Evolution”	2014
DIS '14 Workshop – Vancouver, Canada “Personal Command and Control: A Spatial Interface for Head-Worn Displays as a Platform for Everyday Visual Analytics”	2014
CHI '14 – Toronto, Canada “The Personal Cockpit: A Spatial Interface for Effective Task Switching on Head-Worn Displays”	2014
MobileHCI '12 Doctoral Symposium – San Francisco, USA “Collaborative Interfaces in Ethereal Space”	2012
MobileHCI '11 – Stockholm, Sweden “Characterizing user performance with assisted direct off-screen pointing”	2011
CHI '11 Workshop – Vancouver, Canada “Visually augmented interfaces for improving awareness in mobile collaboration”	2011

Invited Talks

Singapore Management University – Singapore “Using Space around Us for Sensemaking”	2022
Victoria University – Wellington, New Zealand “Using Space around Us for Sensemaking”	2022
HIT Lab NZ / Tangata Hangarau, University of Canterbury – Christchurch, New Zealand “Using Space around Us for Sensemaking”	2022
Geospatial Research Institute / Toi Hangarau Seminar Series, – Christchurch, New Zealand “Using Space around Us for Sensemaking”	2022
Creative Robotics Lab, University of New South Wales – Sydney, Australia “Using Space around Us for Data Exploration”	2022

SydCHI ACM SIGCHI Local Chapter – University of New South Wales – Sydney, Australia “Using Space around Us for Data Exploration”	2022
International Conference on Vocational Education and Technology (iConVET) – Universitas Pendidikan Ganesha, Bali Keynote “Using Space around Us for Immersive Analytics”	2021
Australian Researchers in Interactive Virtual Environments (ARIVE) Network 2021 Lecutre Series – University of Canterbury, New Zealand Panel Discussion	2021
Australian Researchers in Interactive Virtual Environments (ARIVE) Network 2021 Lecutre Series – University of Canterbury, New Zealand “Using Space around Us for Immersive Analytics”	2021
Waterloo University – Kitchener-Waterloo, Canada “On the Productivity Limits of Immersive Interfaces”	2020
University of Manitoba – Winnipeg, Canada “On the Productivity Limits of Immersive Interfaces”	2020
University of Calgary – Calgary, Canada “On the Productivity Limits of Immersive Interfaces”	2020
Shonan Seminar on Immersive Analytics and Trail Sets Data Analysis Seminar attendance by invitation only	2019
Google Project Soli Team – Mountainview, California, USA “Mixed-scale gesture interaction”	2018
Monash University – Melbourne, Australia “Spatial Analytic Interfaces”	2016
University of Saskatchewan – Saskatoon, Canada “Spatial Analytic Interfaces”	2016
Dagstuhl Seminar on Immersive Analytics Seminar attendance by invitation only	2016
Concordia University – Montreal, Canada “Blending Information Interfaces into our Physical and Social Environments”	2016
HCI Lab, University of Waterloo – Waterloo, Canada “Blending Information Interfaces into our Physical and Social Environments”	2016
University of Manitoba, Department of Computer Science Seminar “Blending Information Interfaces into our Physical and Social Environments”	2015
iLab, University of Calgary – Calgary, Canada “Spatial User Interfaces for Mobile Collaboration”	2012
NOKIA University Relations Forum– Vancouver, Canada “Novel User Interfaces for Assisting Collaborative Search Tasks on Mobile Devices”	2010
Human-Computer Interaction Class Lecture, University of Manitoba “The Personal Cockpit: A Spatial Interface for Effective Task Switching on Head-Worn Displays”	2014