

# Johann Wentzel

HCI Researcher • Virtual and Augmented Reality • Accessibility

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## Overview

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My work focuses on *designing, implementing, and understanding interaction techniques that facilitate more inclusive computing*. My research process involves qualitative methods and co-design, prototyping new interfaces and interaction techniques, then deploying controlled user studies for empirical findings. My PhD explores improving VR's accessibility for people with motor disabilities by combining more familiar input devices (game controllers, mice, etc.) to supplement or replace VR hand controllers. **I expect to defend my dissertation by the end of 2024.**

Recently, I've been exploring how machine learning models of gaze-tracking can aid diagnosis of eye movement conditions, how users can interact with AI for VR and 3D environment design, and how inferring user context can make remapping 3D motion in VR easier for users as well as developers.

## Education

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### University of Waterloo

Waterloo, ON

*Doctor of Philosophy (PhD) - Computer Science (Human-Computer Interaction)*

*Defending Fall 2024*

- **Thesis:** *Bring-Your-Own Input: Context-Aware Multi-Modal Input for More Accessible VR*
- **Advisor:** Daniel Vogel [[website](#)]

*Master of Mathematics - Computer Science (Human-Computer Interaction)*

*Sept 2018 - Apr 2020*

- Thesis-based program [[T1](#)], resulting in an award-winning publication [[C2](#)].

### University of Calgary

Calgary, AB

*Bachelor of Science - Computer Science, GPA: 96%*

*Sept 2011 - Jun 2017*

- First Class Honours (published paper [[C1](#)] plus GPA above 90%).

*Bachelor of Commerce - Business Technology Management, GPA: 96%*

*Sept 2011 - Jun 2017*

- **Award:** Haskayne School of Business Silver Medallion (highest graduating GPA in program).

## Employment

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### Expressive Input & Interaction Lab, University of Waterloo

Waterloo, ON

*Graduate Researcher and Teaching Assistant*

*Sept 2018 - Present*

- Published and presented multiple qualitative and quantitative research papers in human-computer interaction.
- Led technical projects across several tech stacks including Unity, C++, OpenCV, MediaPipe, Javascript, and Swift.
- Established strategic partnerships with KidsAbility Waterloo to design and implement VR accessibility research.
- Served as a mentor to undergraduate researchers, providing support and guidance in research teams.

### Meta Reality Labs

New York, NY

*Research Scientist Intern, Input Explorations (mentors: Bruno de Araujo, Jota Costa)*

*Sept 2022 - Jan 2023*

- Designed and developed AR/VR interaction techniques utilizing eye tracking and EMG transformer models.
- Developed, organized, and led Unity input experiments to evaluate AR/VR eye tracking input accuracy.
- Analyzed experimental data using statistical tests like ANOVA and t-tests to reveal trends and overall effects.
- Created a dataset of gaze dynamics and eye-tracking accuracy for consumer VR hardware to aid productization.

### Microsoft Research

Redmond, WA (Remote)

*Research Intern, Ability Team (mentors: Martez Mott, Sasa Junuzovic, Edward Cutrell)*

*Jun 2022 - Sept 2022*

- Primary author and developer for a VR accessibility research experiment involving multimodal VR input and 3D input remapping, using WebXR and Javascript.

*Research Intern, Ability Team (mentors: Martez Mott, Sasa Junuzovic, Edward Cutrell)*

*May 2021 - Aug 2021*

- Primary author of an accessibility research publication [[C3](#)] using qualitative methods to investigate the use of multi-device input configurations by people with mobility limitations.
- Coordinated cross-functional collaboration across Xbox and Accessibility teams to develop a qualitative research agenda.

## Autodesk Research

Toronto, ON

*Research Intern, UI Research Group (mentors: Fraser Anderson, Tovi Grossman)*

Jan 2020 - May 2020

- Primary author and sole Unity developer for a research paper on hybrid VR-desktop interfaces, resulting in a patent [P1] and conference publication [C4].
- Second author of a conference publication [E1] implementing generative AI to create intentionally “ugly” designs.

## Future Reality Lab, New York University

New York, NY

*Visiting Scholar (mentor: Ken Perlin)*

Sept 2019 - Dec 2019

- Designed and implemented a co-located multi-user AR audio solution for an industry client.
- Solo developer for a multiplayer iOS project using ARKit and Swift, on iPhone and iPad.

## Deloitte

Calgary, AB

*iOS/Web/AR Developer (Business Technology Analyst)*

Aug 2017 - Aug 2018

- Created an iOS app for navigation and SAP Cloud interaction, implementing OCR functions and a custom keyboard UI.
- Designed and demonstrated an AR eCommerce demo for industry clients using Unity, Vuforia, and Node.js.

## Freelance Developer (iOS, Android, Web)

Calgary, AB

- Web design and development consultant for startups and businesses.

May 2014 - Aug 2016

- Individually designed, developed, and published Android and iOS apps for local firms.

## Critical Mass

Calgary, AB

*User Experience Design Intern*

May 2016 – Aug 2016

- Created interactive design prototypes for user testing, using code-based animation tools.
- Designed and annotated user flows and wireframes for pre-production websites and software.

## University of Calgary

Calgary, AB

*Undergraduate Researcher*

Sept 2014 - Sept 2015

- Developed an augmented reality interface between Google Glass, Kinect, and a Baxter humanoid robot.
- Published study findings as first author [C1], winning a Calgary Undergraduate Research Award.

## SMART Technologies

Calgary, AB

*User Experience Design Intern*

May 2014 - Aug 2014

- Designed and delivered full-process mockups for web products, including concepts, sketches, videos, and prototypes.

## Research

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**Note about venues:** CHI (ACM Conference on Human Factors in Computing Systems) is recognized as a very top tier HCI conference (ranked #1 on Google Scholar). The average acceptance rate for CHI is 23%.

## Full Paper Publications

- [J1] **Johann Wentzel**, Matthew Lakier, Jeremy Hartmann, Falah Shazib, Géry Casiez, Daniel Vogel. 2024. *A Comparison of Virtual Reality Menu Techniques: Raycasting, Direct Input, and Marking Menus*. To appear in IEEE TVCG 2024. [doi.org/10.1109/TVCG.2024.3420236](https://doi.org/10.1109/TVCG.2024.3420236)
- [C4] **Johann Wentzel**, Fraser Anderson, George Fitzmaurice, Tovi Grossman, Daniel Vogel. 2024. *SwitchSpace: Understanding Context-Aware Peeking Between VR and Desktop Interfaces*. In Proceedings of the CHI Conference on Human Factors in Computing Systems (CHI '24). [doi.org/10.1145/3613904.3642358](https://doi.org/10.1145/3613904.3642358)
- [C3] **Johann Wentzel**, Sasa Junuzovic, James Devine, John Porter, Martez Mott. 2022. *Understanding How People with Limited Mobility Use Multi-Modal Input*. In Proceedings of the CHI Conference on Human Factors in Computing Systems (CHI '22). [doi.org/10.1145/3491102.3517458](https://doi.org/10.1145/3491102.3517458)
- [C2] **Johann Wentzel**, Greg d'Eon, Daniel Vogel. 2020. *Improving Virtual Reality Ergonomics through Reach-Bounded Non-Linear Input Amplification*. In Proceedings of the CHI Conference on Human Factors in Computing Systems (CHI '20). [doi.org/10.1145/3313831.3376687](https://doi.org/10.1145/3313831.3376687)  
\* **Best Paper Honourable Mention (top 5% of submitted papers)**

- [C1] **Johann Wentzel**, Daniel Rea, James Young, Ehud Sharlin. 2015. *Shared Presence and Collaboration Using a Co-Located Humanoid Robot*. In Proceedings of the 3rd International Conference on Human-Agent Interaction (HAI '15). [doi.org/10.1145/2814940.2814995](https://doi.org/10.1145/2814940.2814995)

### Extended Abstract Publications

- [E3] **Johann Wentzel**. 2023. *Bring-Your-Own Input: Context-Aware Multi-Modal Input for More Accessible Virtual Reality*. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems Extended Abstracts (CHI '23 Doctoral Consortium). [doi.org/10.1145/3544549.3577056](https://doi.org/10.1145/3544549.3577056)
- [E2] **Johann Wentzel**, Lesley Istead. 2022. *Volumetric and User-Centric Rendering Techniques for Lens Flare and Film Grain in Virtual Reality Environments*. In the 2022 European Conference on Visual Media Production Extended Abstracts (CVMP '22). [PDF]
- [E1] Josh Urban Davis, **Johann Wentzel**. 2021. *Font Your Friends and Loved Ones: On the Utility of Ugly Interfaces*. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems Extended Abstracts (CHI '21). [doi.org/10.1145/3411763.3450371](https://doi.org/10.1145/3411763.3450371)

### Workshop Papers

- [W2] Alessandra Luz, **Johann Wentzel**. 2024. *More Than Input: Using the Gaze-Psychology Link for More Accessible AR*. In the CHI 2024 workshop "Designing Inclusive Future Augmented Realities". [PDF]
- [W1] **Johann Wentzel**, Daekun Kim, Jeremy Hartmann. 2021. *Same Space, Different Place: Designing for Differing Physical Spaces in Social Virtual Reality*. In the CHI 2021 workshop "Social VR: A New Medium for Communication and Collaboration". [More info | PDF]

### Patents

- [P1] **Johann Wentzel**, Fraser Anderson, Tovi Grossman, George Fitzmaurice. *Transitions between states in a hybrid virtual reality desktop computing environment*. 2022. [Google Patents]

### Theses and Dissertations

- [T1] **Johann Wentzel**. 2020. *Reach-Bounded, Non-Linear Input Amplification for More Comfortable Virtual Reality*. Master's thesis, UWSpace. [Link]

## Awards and Funding

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|-------------|---|
| 2021-2024   | <b>Alexander Graham Bell Graduate Scholarship (NSERC CGS-D)</b> (national) - \$105,000 over 3 years<br>Awarded to top PhD students based on academic merit, research potential, and leadership. |
| 2021-2024   | <b>President's Graduate Scholarship</b> (institutional) - \$30,000 over 3 years<br>Top-up funding awarded by University of Waterloo to winners of the NSERC CGS-D.                              |
| 2021, 2020  | <b>Ontario Graduate Scholarship, PhD</b> (provincial, declined for NSERC CGS-D) - \$15,000<br>Awarded to top PhD students based on academic excellence and research potential.                  |
| 2020        | <b>Best Paper Honourable Mention (top 5% of submitted papers), CHI 2020</b><br>for [C2] "Improving Virtual Reality Ergonomics [...]" with Greg d'Eon and Daniel Vogel.                          |
| 2020, 2018  | <b>President's Graduate Scholarship</b> (institutional) - \$5,000<br>Top-up funding awarded by University of Waterloo to winners of provincial scholarships.                                    |
| 2019        | <b>Alexander Graham Bell Graduate Scholarship (NSERC CGS-M)</b> (national) - \$17,500<br>National scholarship for top Master's students based on academics and research potential.              |
| 2019        | <b>Ontario Graduate Scholarship, Master's</b> (provincial) - \$15,000<br>Provincial scholarship for top Master's students based on academic excellence and research potential.                  |
| 2019        | <b>David Johnston International Experience Award</b> (institutional) - \$2,500<br>Awarded to graduate students to support international work and study opportunities.                           |
| 2018 - 2022 | <b>David R. Cheriton Graduate Scholarship</b> (institutional) - \$20,000 over 2 years, won twice<br>Awarded to top graduate students based on academic excellence and research potential.       |
| 2018        | <b>Domestic Masters Entrance Award</b> (institutional) - \$5,000<br>Awarded to top incoming Master's students based on academic excellence.   |
| 2018        | <b>Alexander Graham Bell Graduate Scholarship (NSERC CGS-M)</b> (national, declined) - \$17,500<br>Offered from University of Saskatchewan and Calgary, declined as I chose to attend Waterloo. |
| 2017        | <b>Haskayne School of Business Silver Medallion in Business Technology Management</b><br>Awarded to the Business Technology Management student with the highest graduating GPA.                 |

- 2016 **University of Calgary Undergraduate Merit Award** (institutional) - \$800  
Awarded to top continuing undergraduate students.
- 2015 **Program for Undergraduate Research Experience Award** (institutional) - \$6,000  
Merit-based research funding for undergraduate students in the UCalgary Honours program.
- 2014 **Alistair H. Ross Memorial Scholarship** (institutional) - \$3,750  
Awarded to top continuing undergraduate students based on GPA.
- 2011 **President's Admission Scholarship** (institutional) - \$2,500  
Awarded to top incoming undergraduate students based on academic excellence.
- 2011-2017 **Dean's List, University of Calgary**  
Maintained a GPA above 3.6/4.0 while enrolled full-time in undergraduate studies.

## Supervision

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**Daekun Kim**, University of Waterloo undergraduate, Sept 2020 - Sept 2022

- "Exploring the effects of depth perception in virtual reality"

**Falah Shazib**, University of Waterloo undergraduate, Jan 2021 - Apr 2021

- "Exploring the effects of hierarchy within 3D marking menus in virtual reality"

## Invited Talks

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- **Accessibility Strategies for using Extended Reality in Teaching.** Educause 2023, Chicago, IL, USA
- **Incorporating Emerging Technologies into Higher Education with Care: Accessibility Strategies for Virtual Reality and Augmented Reality.** UWaterloo Teaching and Learning Conference 2023. Waterloo, ON, Canada.
- **Breaking Into XR Research.** UWaterloo VR Club, Waterloo, ON, Canada
- **Robotics in Manufacturing / Working Alongside Baxter.** ACAMP Seminar Series - Unmanned Vehicles, Robotics, and Intelligent Systems Seminar. Calgary, AB, Canada.
- **Shared Presence and Collaboration with a Co-Located Humanoid Robot.** University of Calgary Undergraduate Research Symposium. Calgary, AB, Canada.

## Press

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**School of Computer Science News**, 2023. *PhD candidate Johann Wentzel makes VR more accessible.* [\[Link\]](#)

**University of Waterloo News**, interview, 2023. *Waterloo doctoral candidate focuses on ways to make virtual reality more accessible.* [\[Link\]](#)

**Government Technology**, interview, 2022. *What Is the Metaverse's Future in K-12 and Higher Ed?* [\[Link\]](#)

## Service and Volunteering

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### Teaching

*Instructional Apprentice, University of Waterloo*

- Leading computer labs as a lab instructor for undergraduate computer science courses.

### Academic Service

- **Program Committee:** ISS 2024, GI 2022
- **Session Chair:** Waterloo CHI 2020 (online CHI event in response to COVID-19)
- **Student Volunteer:** UIST 2021, CHI 2021, UIST 2019
- **Reviewer:** CHI, UIST, CHI PLAY, MobileHCI, ISS, IJHCS, etc. (all over several years)

## Side Projects

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### HCIKit: An HCI Experiment Automation Framework

- A Unity framework for dynamically generating and counterbalancing HCI user studies.
- Allows for easy automation, replication, logging, and analysis of user study data.

### Self-Configured Home Server

- A fully self-assembled home server for VPN, file hosting, smart home services, and multiplayer games.

## Skills

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**Programming Languages:** C#, Python, R, Swift, HTML, CSS, Javascript, C++

**Dev tools:** Unity, Xcode, ARKit, RealityKit, Android Studio, Bootstrap, React, NumPy, jQuery, NodeJS, Git.

**Design tools:** Figma, Sketch, Balsamiq, Adobe Illustrator, Final Cut Pro

**Hobbies:** Home servers, game development for VR, AR, iOS. Classically trained in piano, clarinet, voice.