# Johann Wentzel

HCI Researcher and Technical Prototyper • Virtual and Augmented Reality • Accessibility
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## Overview

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 developing machine learning models that can resolve inaccessible body motions in VR for people with physical disabilities, exploring how machine learning models of gaze-tracking can aid diagnosis of eye movement conditions, and how users can interact with AI for VR and 3D environment design.

## Education

**PhD, Computer Science (Human-Computer Interaction)** – University of Waterloo *Graduating Fall 2024*
**Master of Mathematics, Computer Science** – University of Waterloo (thesis) *2018 – 2020*
**Bachelor of Science, Computer Science** – University of Calgary (thesis) *2011 – 2017*
- First Class Honours (research publication + high GPA)

**Bachelor of Commerce, Business Technology Management** – University of Calgary *2011 – 2017*
- Highest graduating GPA in program.

## Experience

**Expressive Input & Interaction Lab, University of Waterloo** **Waterloo, ON**
*Graduate Researcher and Teaching Assistant* *Sept 2018 – Present*
- Authored and presented multiple qualitative and quantitative research papers (e.g. 1, 2, 3) in human-computer interaction.
- Developed experiments and technical prototypes using Unity, SteamVR, GPT-4, TensorFlow, OpenXR, and MediaPipe.
- Established strategic partnerships with local accessibility foundations 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*
- Wrote and published an accessibility paper **[C3]** using qualitative methods to investigate the use of multi-device input configurations by people with mobility limitations. (more info)
- 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]**. (more info)
- Second author of a conference paper **[E1]** implementing generative AI to create intentionally "ugly" designs. (more info)

**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

**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 Archetypes: Raycasting, Direct Input, and Marking Menus.* In IEEE Transactions on Visualization and Computer Graphics 2024. 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

**[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

**[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
*** 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

### 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

**[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

### 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]

## Skills

**Research:** Controlled experiments, user studies, UX research, surveys, interviews, statistical data analysis
**Programming Languages:** C#, Python, R, HTML, CSS, Javascript, C++, Swift, SwiftUI
**Dev tools:** Unity, Xcode, ARKit, RealityKit, Android Studio, Bootstrap, React, NumPy, jQuery, NodeJS, Git, OpenCV
**Design tools:** Figma, Sketch, Balsamiq, Adobe Illustrator, Final Cut Pro

## Awards and Funding

2021-2024 **Alexander Graham Bell Graduate Scholarship (NSERC CGS-D)** (national) - $105,000 over 3 years
Awarded to top PhD students based on academic merit, research potential, and leadership.

2021-2024 **President's Graduate Scholarship** (institutional) - $30,000 over 3 years
Top-up funding awarded by University of Waterloo to winners of the NSERC CGS-D.

2021, 2020 **Ontario Graduate Scholarship, PhD** (provincial, declined for NSERC CGS-D) - $15,000
Awarded to top PhD students based on academic excellence and research potential.

2020 **Best Paper Honourable Mention (top 5% of submitted papers), CHI 2020**
for [C2] "Improving Virtual Reality Ergonomics [...]" with Greg d'Eon and Daniel Vogel.

2020, 2018 **President's Graduate Scholarship** (institutional) - $5,000
Top-up funding awarded by University of Waterloo to winners of provincial scholarships.

2019 **Alexander Graham Bell Graduate Scholarship (NSERC CGS-M)** (national) - $17,500
National scholarship for top Master's students based on academics and research potential.

2019 **Ontario Graduate Scholarship, Master's** (provincial) - $15,000
Provincial scholarship for top Master's students based on academic excellence and research potential.

2019 **David Johnston International Experience Award** (institutional) - $2,500
Awarded to graduate students to support international work and study opportunities.

2018 - 2022 **David R. Cheriton Graduate Scholarship** (institutional) - $20,000 over 2 years, won twice
Awarded to top graduate students based on academic excellence and research potential.

2018 **Domestic Masters Entrance Award** (institutional) - $5,000
Awarded to top incoming Master's students based on academic excellence.

2018 **Alexander Graham Bell Graduate Scholarship (NSERC CGS-M)** (national, declined) - $17,500
Offered from University of Saskatchewan and Calgary, declined as I chose to attend Waterloo.

2017 **Haskayne School of Business Silver Medallion in Business Technology Management**
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

**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

- **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

**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

### 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

### 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.