Leonardo Pavanatto

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SUMMARY

My expertise area is Virtual and Augmented Reality within the scope of 3D User Interfaces. Research interests include how to use augmented reality to improve productivity on real-world tasks, such as working with virtual monitors, cross-device interaction, and the creation of content through immersive technologies. My expected Ph.D. graduation is May 2024.

EDUCATION

Virginia Polytechnic Institute and State University (Virginia Tech), Blacksburg, Virginia, USA

- Ph.D. in Computer Science — Aug 2019 – May 2024 (Expected)
  - Dissertation: "Design and Evaluation of Virtual Displays to Enable the Future of Work from Anywhere"
  - Advisor: Doug A. Bowman
  - Committee: Chris North, Yalong Yang, Wallace Lages, Richard Stoakley
  - Overall GPA: 3.94/4

Pontifical Catholic University of Rio Grande do Sul (PUCRS), Porto Alegre, Rio Grande do Sul, BRA

- M.Sc. in Computer Science — - Mar 2019
  - Thesis: "3D Modeling of Large Structures in Augmented Reality"
  - Advisors: Marcio S. Pinho, Doug A. Bowman
  - Committee: Milene S. Silveira, Bruce H. Thomas
  - Overall GPA: 9.3/10
- B.Eng. in Computer Engineering — - Dec 2016
  - Thesis: "Evaluating the Efficiency of an Ego-exocentric Technique for Cooperative Manipulation in Virtual Environments"
  - Study Abroad: Illinois Institute of Technology, GPA: 3.87/4.0
  - Overall GPA: 8.8/10

RESEARCH EXPERIENCE

Lawrence Livermore National Laboratory, Livermore, California

- Research Intern at Computing/Data Science Institute — Summer 2023
  - **Advanced Manufacturing Inspection:** Designed novel interaction techniques for immersive systems that provide efficient navigation and inspection of digital twins of fabricated parts for validation and defect detection.

Microsoft Research, Redmond, Washington

- Research Intern at EPIC Group — Summer 2022
  - **Cross-Device Interaction:** Designed novel interaction paradigms for transferring UI elements across devices with heterogeneous capabilities, such as handheld devices, laptops, and head-worn displays.
- Research Intern at Interactive Media Group — Summer 2021
  - **VR Monitors:** Conducted formal, summative, user studies to understand the effects of replacing physical monitors with VR virtual monitors; presented findings at internal seminars and through a paper.

3D Interaction Group, Virginia Tech

- Student and Graduate Research Assistant — Aug 2019 – Current
  - **Virtual Displays Research:** Designed novel approaches for extending or replacing physical monitors with virtual ones with the objective to enhance user experience and productivity; results were published at IEEE VR and ISMAR (more in preparation or under review).
  - **Digital Twins in Manufacturing:** Designed approaches for inspecting digital twins as a way of expediting and cutting cost of validating manufactured parts; conducted user studies to gain knowledge on issues such as precision alignment of meshes.

Consultant, Porto Alegre, Brazil

- UX Designer and Developer — Mar 2019 – Aug 2019
  - **Containers:** Developed a virtual environment for inspection and management of cargo containers on a dock. Contracts with PUCRS (university), and Wolves Entertainment (Brazil games/VR company).

Duke immersive Virtual Environment, Duke University

- Visiting Research Scholar — Summer 2015
  - **Collaborative Hybrid Interaction:** Designed a technique for using asymmetric viewpoints in cooperative object manipulation in VR, using Unity 3D (C#), Oculus Rift, and network communication; presented solution at IEEE VR.

Virtual Reality Group, Pontifical Catholic University of Rio Grande do Sul (PUCRS)

- Graduate Research Assistant — Mar 2017 – Feb 2019

- **Situated Modeling:** Designed an AR application for situated modeling in architecture, using Unity 3D (C#) and Microsoft HoloLens; results were published at ACM SUI.
- **Mobile AR Game:** Evaluated methods of interaction for an AR game with behavioral animation of virtual characters using mobile devices (iOS and Android).
- **Remote Presentation:** Designed an application to remotely present keynote slides from inside a virtual environment, which was used live at PUCRS Health Tech.

▪ Undergraduate Research Assistant Apr 2012 – Dec 2016

- **Neurorehabilitation:** Designed gesture-based interaction techniques and mini-games using the Microsoft Kinect that were used by elderly people with mild cognitive impairment in a clinical neurorehabilitation study.
- **Maestro:** Designed an interface for 6 DOF tracking of a conductor's baton during a live orchestral performance; tracking was used in a live mini-game; effort led to enhanced attendance and public engagement.
- **SculptAR:** Developed an application for creating digital sculptures using handheld AR (Android/iOS), combining device tracking and touch screen interaction.

Full list of projects and videos can be seen at my website (leonardopavanatto.com).

PUBLICATIONS

PEER-REVIEWED JOURNAL PAPERS

[1]**Pavanatto, L.**, Lu, F., North, C., Bowman, D. Multi-monitors or Single Canvas? Evaluating Window Management and Layout Strategies in Virtual Displays. *(Under review at IEEE Transactions on Visualization and Computer Graphics)*

[2]Lu, F., **Pavanatto, L.**, Davari, S., Zhang, L., Lisle, L., Bowman, D. "Where did my apps go?" Supporting Scalable and Transition-Aware Access to Everyday Applications in Head-Worn Augmented Reality. *(Under review at IEEE Transactions on Visualization and Computer Graphics)*

[3]**Pavanatto, L.**, Davari, S., Bowman, D., Badea, C., and Stoakley, R. Virtual Monitors vs. Physical Monitors: an Empirical Comparison for Productivity Work. In Frontiers in Virtual Reality. *(Accepted)*

[4]Fabris, E., Sangalli, V., **Pavanatto, L.**, Pinho, M. Immersive telepresence on the operation of unmanned vehicles. International Journal of Advanced Robotic Systems. January 2021. *DOI: 10.1177/1729881420978544*

PEER-REVIEWED CONFERENCE PAPERS

[1]**Pavanatto, L.**, Lu, F., Giovanelli, A., Ramirez, N., Bowman, D. Exploring the Benefits and Challenges of Working with AR Virtual Displays In-The-Wild. *(Under review at ACM CHI 2024)*

[2]Lu, F., **Pavanatto, L.**, Bowman, D. In-the-Wild Experiences with an Interactive Glanceable AR System for Everyday Use. In ACM Symposium on Spatial User Interaction (SUI), 2023, 8 pages. *(Accepted)*

[3]Lisle, L., Davidson, K.,**Pavanatto, L.**, Tahmid, I., North, C., Bowman, D.. Spaces to Think: A Comparison of Small, Large, and Immersive Displays for the Sensemaking Process. In IEEE International Symposium on Mixed and Augmented Reality (ISMAR), 2023, 8 pages. *(Accepted)*

[4]Rodrigues F., Giovannelli A.,**Pavanatto, L.**, Miao, H., de Oliveira, J., Bowman, D.. AMP-IT and WISDOM: Improving 3D Manipulation for High-Precision Tasks in Virtual Reality. In IEEE International Symposium on Mixed and Augmented Reality (ISMAR), 2023, 8 pages. *(Accepted)*

[5]Mantovani, C., **Pavanatto, L.**, Pinho, M.. A Framework for Monitoring Cargo Movement Using Virtual Reality. In 25th Symposium on Virtual and Augmented Reality (SVR), 2023, 5 pages. *(Accepted)*

[6]**Pavanatto, L.**, North, C., Bowman, D., Badea, C., and Stoakley, R. Do we still need physical monitors? An evaluation of the usability of AR virtual monitors for productivity work. In IEEE Virtual Reality and 3D User Interfaces (VR), 2021, 8 pages. *DOI: 10.1109/VR50410.2021.00103*

[7]**Pavanatto, L.**, Bowman, D., and Pinho, M. Evaluating the Impact of Point Marking Precision on Situated Modeling Performance. In Proceedings of ACM Symposium on Spatial User Interaction (SUI), 2019, 5 pages. *DOI: 10.1145/3357251.3357586*

[8] Stahl, B., **Pavanatto, L.**, Sangalli, V., Klein, P., Copstein, R. and Pinho, M. DirectFlow: A Robust Method for Ocular Torsion Measurement. In IEEE 43rd Annual Computer Software and Applications Conference (COMPSAC), 2019, 6 pages. *DOI: 10.1109/COMPSAC.2019.00052*

[9] **Pavanatto, L.**, Kopper, R. and Pinho, M. EGO-EXO: A Cooperative Manipulation Technique with Automatic Viewpoint Control. In 20th Symposium on Virtual and Augmented Reality (SVR), 2018, 6 pages. *DOI: 10.1109/SVR.2018.00023*

[10] **Pavanatto, L.**, Musse, S., Pinho, M. and Boussu, J. Evaluation of Selection Techniques on a Mobile Augmented Reality Game. In 17th Brazilian Symposium on Computer Games and Digital Entertainment (SBGames), 2018, 10 pages. *DOI: 10.1109/SBGAMES.2018.00024*

[11] Copstein, R., Abichequer, V., Andrade, M., Machado, L., Rodrigues, E., **Pavanatto, L.** and Pinho, M. Image Processing Strategies for Automatic Detection of Common Gastroenterological Diseases. In IEEE 42nd Annual Computer Software and Applications Conference (COMPSAC), 2018, 6 pages. *DOI: 10.1109/COMPSAC.2018.00090*

OTHER PUBLICATIONS (POSTERS, WORKSHOP PAPERS, DEMO PAPERS)

[1] Lisle L., Lu F., Davari S., Tahmid I., Giovannelli A., Ilo C., **Pavanatto, L.**, Zhang L., Schlueter L., and Bowman D. Clean the Ocean: An Immersive VR Experience Proposing New Modifications to Go-Go and WiM Techniques. In IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW), 2021, 2 pages. *DOI: 10.1109/VRW55335.2022.00311*

[2] **Pavanatto, L.** Designing Augmented Reality Virtual Displays for Productivity Work. In IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct), 2021, 2 pages. *DOI: 0.1109/ISMAR-Adjunct54149.2021.00107*

[3] **Pavanatto, L.**, Lu, F., Davari, S., Harris, E., Folino, A., Imamov, S., Chekuri, S., Blustein, L., Lages, W. and Bowman, D. Get the job! An immersive simulation of sensory overload. In IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW), 2020, 2 pages. *DOI: 10.1109/VRW50115.2020.00106*

[4] Sangalli, V., Oliveira, T., **Pavanatto, L.** and Pinho, M.S. SculptAR: An augmented reality interaction system. In IEEE Symposium on 3D User Interfaces (3DUI), 2017, 2 pages. *DOI: 10.1109/3DUI.2017.7893371*

[5] **Pavanatto, L.**, Pinho, M. and Kopper, R. Design and preliminary evaluation of an EGO-exocentric technique for cooperative manipulation. In IEEE Symposium on 3D User Interfaces (3DUI), 2017, 2 pages. *DOI: 10.1109/3DUI.2017.7893342*

[6] **Pavanatto, L.**, Oliveira, T., Sangalli, V., Pinho, M. and Kopper, R. Collaborative hybrid virtual environment. In IEEE Symposium on 3D User Interfaces (3DUI), 2016, 2 pages. *DOI: 10.1109/3DUI.2016.7460081*

[7] Bogoni, T, **Pavanatto, L.**, Sangalli, V., Pinho, M. Dental Simulator for Endodontic Access Cavity Preparation. Demo at IEEE Virtual Reality (VR), 2016, 2 pages. Available at *website*

[8] Oliveira, G., **Pavanatto, L.**, Sangalli, V., Pinho, M. A Software Architecture for Distributed AR Applications. Demo at IEEE Virtual Reality (VR), 2016, 2 pages. Available at *website*

[9] Lykawka, C., Oliveira, T., **Pavanatto, L.**, Sangalli, V., Siqueira, E., Campos, M, Pinho, M. Belt-Based Haptic Device for Representing Scene Depth Information. Demo at Virtual Reality (VR), 2016, 2 pages. Available at *website*

AWARDS & SCHOLARSHIPS

- 1st Place at IEEE VR 3DUI Contest (out of 17 teams) — Mar 2022
  A storytelling experience about cleaning the ocean of plastic while using novel 3D interaction techniques.
- Academic Excellence fellowship recipient from CAPES/PROEX (Top 5%) — 2017 – 2018
  Full-tuition fellowship with stipend due to high performance at graduate program.
- Featured Student from the Brazilian Computer Society (SBC) (Highest GPA) — Jan 2017
  Recognition awarded due to achieving the highest GPA of graduating class.
- Brazil Scientific Mobility Program scholarship recipient from CAPES — 2014 – 2015

Full-tuition scholarship with stipend for an exchange program to the United States of America.

RESEARCH FUNDING

AUTHORED

- HCC: Small: Enabling the future of work through flexible virtual displays. **Leonardo Pavanatto**, Feiyu Lu, Doug A. Bowman, and Chris North. Submitted to the National Science Foundation (NSF). Proposed duration 36 months, requested amount $600,000. [Rejected]

TEACHING EXPERIENCE

TEACHING ASSISTANT

- CS3754, Cloud Software Engineering (Fall 2022)
- CS5764, Information Visualization (Spring 2022)
- CS5704, Software Engineering (Fall 2021)
- CS5754, Virtual Environments (Spring 2021)
- CS3724, Introduction to Human-Computer Interaction (Fall 2019)

MENTORING & ADVISING

INDIVIDUAL PROJECT MENTORING

- Nikki Ramirez (2022-2023): collaborated on a user study about using virtual displays in the wild.
- Luke Schlueter (2021-2022): collaborated on designing and conceiving an AR user study about virtual displays.
- Guilherme Arturi Maurer (2019): collaborated on the user studies about menus in VR.
- Lucas Cardoso (2019): provided an introduction to 3DUI design through mentoring and tutorials.
- Daniele Paz (2019): provided an introduction to 3DUI design through mentoring and tutorials.
- Vinicius Da Silva Branco (2017): provided guidance on a scientific initiation project about AR frameworks.

GROUP PROJECT MENTORING

- HCI Capstone group (2021): provided semester-long guidance for one group on the design of virtual displays, with weekly meetings and discussions.
- Virtual Environments class - multiple groups (2021): provided semester-long guidance for seven groups in this graduate-level class, with weekly meetings and discussions.

PROFESSIONAL AFFILIATIONS & ACTIVITIES

IEEE Computer Society

- Student Member — 2019 – Present

Association for Computing Machinery

- Student Member — 2019 – Present

Brazilian Computer Society

- Student Member — 2018 – Present

CAMPUS ACTIVITIES

Center for Human-Computer Interaction, Virginia Tech

- Student Member — 2019 – Present
- Student Council Member — 2022 – 2023

SKILLS

Expertise areas: Research, Augmented Reality, Virtual Reality, 3D User Interfaces, Human-Computer Interaction, User Studies

Main Tools & Technologies: C#, Unity Engine, Python, Swift, SwiftUI, Git, Latex, C, C++, OpenGL, OpenCV, Windows APIs

LANGUAGES

- Portguese: Native language.
- English: Bilingual Proficiency.
- Spanish: Intermediate (reading, listening, speaking, writing).
- French: basic (reading, listening, speaking, writing).

[*CV compiled on 2023-10-11*]