# Tiffany Luong

*XR/Perception Research Scientist*

tiffanydluong@gmail.com | https://tiffanyluong.github.io | linkedin.com/in/luong-tiffany | Google Scholar

## Profile

Research scientist specializing in **human perception and interaction in XR**. My work spans **eye tracking** (gaze estimation, pupillometry), **user experience** (cybersickness, mental workload, physiological stress indicators), and **XR hand interaction** (gestures and controller input). I run controlled user studies with physiological sensing (pupillometry, PPG, EDA, respiration), behavioral metrics (motion capture, gaze-tracking), and self-reports to measure user experience, perception, and mental workload. I have also led large-scale field studies, most notably an 837-participant demographic investigation of cybersickness. I also build Unity-based real-time simulation environments and offline pipelines to generate synthetic data and evaluate computer vision models against ground-truth, INS, and humans perception.

## Education

### Ph. D. Computer Science — *Rennes, France*

Université de Rennes 1 — *2018 – 2021*

- **Supervisors:** Anatole Lécuyer (Inria), Guillaume Jégou (b-com), Ferran Argelaguet (Inria), Nicolas Martin (b-com)
- **Jury:** Mark Billinghurst (Uni. of South Australia), Daniel Mestre (CNRS), Catherine Pélachaud (CNRS), Anthony Steed (UCL)
- **Thesis:** *Towards the Exploitation of Mental Workload in Virtual Reality Systems*

### M. Sc. Computer Science — *Laval, France*

Arts et Métiers Paristech — *2016 – 2017*

- Courses in 3D interaction and VR/MR application design and research.
- Industrial projects with Airbus France and Agem Interior Design
- Double-degree, ranked $3^{rd}$

### Engineering Degree — *Paris, France*

Arts et Métiers Paristech — *2014 – 2017*

- Courses and projects on mechanical engineering, object-oriented programs, statistical methods, CAD.

### Classes Préparatoires aux Grandes Écoles — *Nancy, France*

Lycée Henri Poincaré — *2012 – 2014*

- Two-year undergraduate program with mathematics, physics, and engineering courses to prepare for the nationwide competitive exams leading to the French “Grandes Ecoles”.

## Work Experience

### Perceptual — *Boston, USA*

Research Scientist (*Simulation & Perception*) — *2026 – Current*

- Building a **real-time Unity simulation environment** for robotics perception research, including procedural generation of rain, day/night cycles, and environmental variation.
- Contributed to a **GPU-accelerated SLAM pipeline** integrating IMU data; developed Python dataloader interfaces, evaluation pipeline against ground-truth and INS, and managed GCP large data infrastructure for standardized odometry benchmark datasets.
- Implementing real-time rendering scripts (Unity C#, Shaders) to synthesize sensor data and evaluate computer vision models.

### MIT — *Cambridge, USA*

Research scientist (*Department of Brain and Cognitive Sciences*) — *2024 – 2025*

- Designed and built the **VR Observatory for the Quest of Intelligence**: a multi-sensor room (SteamVR, Varjo XR-3, eye-trackers, motion capture) to capture and and study human visual perception.
- Developed a **procedural Unity data generator** for evaluating probabilistic perception models, producing point-light worlds, Spelke-type object representations, and occlusion/depth scenes to probe model failure modes; built adapters and dataloaders compatible with Python OpenCV and JAX on GCP.
- Built rendering pipelines (blur, gaussian noise, Voronoi, rain, object overlay) to systematically test computer vision models under distribution-shifted perceptual conditions and WebGPU examples.
- Collaborated with the Probabilistic Computing and Computational Cognitive Science group on benchmarking probabilistic models against human perceptual thresholds.

### ETH Zürich — *Zürich, Switzerland*

Postdoctoral researcher (*Department of Computer Science*) — *2021 – 2023*

- Led a controlled study comparing **hand/gesture tracking vs. controller input** across 6 conditions (IEEE TVCG 2023), with implications for VR input choice.
- Conducted an **837-participant cybersickness study** characterizing demographic and behavioral predictors of cybersickness in VR (IEEE ISMAR 2022).
- Ran physiological UX studies measuring fear, frustration, and insight in VR (IEEE TVCG 2022) using synchronized EDA, PPG, eye-tracking, and respiration sensors.

**Inria Rennes** *Rennes, France*

Intern (*MimeTIC and hybrid teams*) *2017*

- Developed low-cost full-body avatar control for immersive VR using sparse sensors (Unity3D, mecanim, motion graphs, FinalIK, VICON).

# Publications and Patents

### Journal articles

[J1] *Controllers or Bare Hands? A Controlled Evaluation of Input Techniques on Interaction Performance and Exertion in Virtual Reality*
**T. Luong**, Y. Cheng, M. Moebus, A. Fender, and C. Holz
*IEEE TVCG 2023*, Sydney, Australia.
https://doi.org/10.1109/TVCG.2023.3320211

[J2] *Characterizing Physiological Responses to Fear, Frustration, and Insight in Virtual Reality*
**T. Luong**, and C. Holz
*IEEE TVCG 2022*, Singapore, Singapore.
https://doi.org/10.1109/TVCG.2022.3203113

[J3] *A Survey on Affective and Cognitive VR*
**T. Luong**, A. Lécuyer, N. Martin, and F. Argelaguet
*IEEE TVCG 2021*.
https://doi.org/10.1109/TVCG.2021.3110459

[J4] *Experiencing Herd Immunity in VR Increases COVID-19 Vaccination Intention: Evidence From a Large-Scale Field Intervention Study*
A. Plechatá, C. Vandeweerdt, M. Atchapero, **T. Luong**, C. Holz, C. Betsch, B. Dietermann, Y. Schultka, R. Böhm, and G. Makransky
*Computers in Human Behavior 2022*.
https://doi.org/10.1016/j.chb.2022.107533

[J5] *Virtual Reality Reduces COVID-19 Vaccine Hesitancy in the Wild: A Randomized Trial*
C. Vandeweerdt, **T. Luong**, M. Atchapero, A. Mottelson, C. Holz, G. Makransky, and R. Böhm
*Scientific Reports 2022*.
https://doi.org/10.1038/s41598-022-08120-4

[J6] *A Self-Administered Virtual Reality Intervention Increases COVID-19 Vaccination Intention*
A. Mottelson, C. Vandeweerdt, M. Atchapero, **T. Luong**, C. Holz, R. Böhm, and G. Makransky
*Vaccine 2021*.
https://doi.org/10.1016/j.vaccine.2021.10.004

### Conference papers

[C1] *HistoLab VR: A User Elicitation Study Exploring the Potential of Virtual Reality Game-based Learning for Hazard Awareness*
RT. Hänni, **T. Luong**, J. Chatain, F. Mangold, H. Dressel, and C. Holz
*ACM VRST 2024*, Trier, Germany.
https://doi.org/10.1145/3641825.3687723

[C2] *Detecting Users' Emotional States during Passive Social Media Use*
C. Gebhardt, A. Brombach, **T. Luong**, O. Hilliges, and C. Holz
*ACM IMWUT 2024*, Melbourne, Australia.
https://doi.org/10.1145/3659606

[C3] *ViGather: Inclusive Virtual Conferencing with a Joint Experience Across Traditional Screen Devices and Mixed Reality Headsets*
H. Qiu, P. Streli, **T. Luong**, C. Gebhardt, and C. Holz
*ACM MobileHCI 2023*, Athens, Greece.
https://doi.org/10.1145/3604279

[C4] *InfinitePaint: Painting in Virtual Reality with Passive Haptics Using Wet Brushes and a Physical Proxy Canvas*
A. Fender, T. Roberts, **T. Luong**, and C. Holz
*ACM CHI 2023*, Hamburg, Germany.
https://doi.org/10.1145/3544548.3580927

[C5] *Demographic and Behavioral Correlates of Cybersickness: A Large Lab-in-the-Field Study of 837 Participants*
**T. Luong**, A. Plechatá, M. Möbus, M. Atchapero, R. Böhm, G. Makransky, and C. Holz
*IEEE ISMAR 2022*, Singapore, Singapore.
https://doi.org/10.1016/j.chb.2022.107533

[C6] *ComforTable User Interfaces: Surfaces Reduce Input Error, Time, and Exertion for Tabletop and Mid-air User Interfaces*
Y. Cheng, **T. Luong**, A. Fender, P. Streli, C. Holz
*IEEE ISMAR 2022*, Singapore, Singapore.
https://doi.org/10.1109/ISMAR55827.2022.00029

[C7] *Towards Real-Time Recognition of Users' Mental Workload Using Integrated Physiological Sensors Into a VR HMD*
**T. Luong***, N. Martin*, A. Raison, F. Argelaguet, J.-M. Diverrez, and A. Lécuyer
*IEEE ISMAR 2020*, Recife, Brazil.
https://doi.org/10.1109/ISMAR50242.2020.00068

[C8] *Introducing Mental Workload Assessment for the Design of Virtual Reality Training Scenarios*
**T. Luong**, F. Argelaguet, N. Martin, and A. Lecuyer
*IEEE VR 2020*, Atlanta, USA.
https://doi.org/10.1109/VR46266.2020.00089

[C9] *Studying the Mental Effort in Virtual Versus Real Environments*
**T. Luong**, N. Martin, F. Argelaguet, and A. Lecuyer
*IEEE VR 2019*, Osaka, Japan.
https://doi.org/10.1109/VR.2019.8798029

### Other publications

[O1] *3Dexterity: Finding Your Place in a 3-Armed World*
A. Audinot*, D. Dewez*, G. Fouché*, R. Fribourg*, T. Howard*, F. Lécuyer*, **T. Luong***, V. Mercado*, A. Reuzeau*, T. Rinnert*, G. Vailland*, and F. Argelaguet
*IEEE VR 2020*, Atlanta, USA.
https://doi.org/10.1109/VRW50115.2020.00112

[O2] *Pyramid Escape: Design of Novel Passive Haptics Interactions for an Immersive and Modular Scenario*
H. Brument*, R. Fribourg*, G. Gallagher*, T. Howard*, F. Lécuyer*, **T. Luong***, V. Mercado*, E. Peillard*, X. de Tinguy*, and M. Marchal
*IEEE VR 2019*, Osaka, Japan.
https://doi.org/10.1109/VR.2019.8797848

[O3] *Toward Intuitive 3D User Interfaces for Climbing, Flying and Stacking*
A. Bernardin*, G. Cortes*, R. Fribourg*, **T. Luong***, F. Nouviale*, and H. Si-Mohammed*
*IEEE VR 2018*, Reutlingen, Germany.
https://doi.org/10.1109/VR.2018.8446047

### Patent

[P1] *INPI Patent no FR2000704*
**T. Luong**, F. Argelaguet, N. Martin, and A. Lécuyer
*Issued Jan. 24, 2020 — Real-time mental workload estimation from physiological signals integrated into a VR head-mounted display*.

## Scientific Papers Reviewing

IEEE VR,ISMAR, TVCG, ACM CHI, UIST, IMWUT, SIGGRAPH, TAC, ISS, Presence, IJHCI

## Awards and Grants

2021 **Best Ph. D. Student Award**, *b-com* — *Rennes, France*

2020 **International Mobility Grant**, 3200 €, *MathSTIC* — *Rennes, France*
For 4 months at the University College of London in the Virtual Environments and Computer Graphics group (canceled due to COVID-19)

2020 **3DUI Contest**, Honorable Mention, *IEEE VR* — *Atlanta, US*
Development of a VR application on the theme “Embodiment for the Difference”

2020 **Nominee for the Best Ph. D. Student Award**, *b-com* — *Rennes, France*

2019 **3DUI Contest**, Tournament Winner, *IEEE VR* — *Osaka, Japan*
Development of an escape room involving passive haptic feedback and “Impossible Spaces” navigation in VR

2018 **3DUI Contest**, Honorable Mention, *IEEE VR* — *Reutlingen, Germany*
Development of 3D user interfaces for 3 given tasks (climbing, flying, tower stacking) in VR

2017 **Hackaton in VR**, First Prize, *Inria Rennes* — *Rennes, France*
Development of a VR application featuring a movie: the maze of Harry Potter and the Goblet of Fire

2017 **Virtual Fantasy Limited Time**, First Prize, *Laval Virtual* — *Laval, France*
Development of a VR application for education: fundamental physics equation in an escape room

## Teaching and Supervision

### Teaching Assistant

*2021 Fall & 2022 Fall* - Human-Computer Interaction, *ETH Zürich*
Course for 82 students (in 2021), undergrad level.
In charge of supervising 5 groups of 4–6 students in HCI projects; introduction to statistical analysis methodology for HCI.

*2022 Spring* - Advanced Topics in Mixed Reality, *ETH Zürich*
Seminar for 24 students, undergrad level.
In charge of supervising 12 students.

### Guest Lecturer

*2022 Fall* - Mixed Reality, *ETH Zürich*
Experimental design and evaluation for MR studies.

### Supervision

*Master's Theses*
A. Brombach, 2023, Effect of Consumed Content on Mobile Devices on Users' Immediate Emotional Response
A. Abollivier, 2020, Baseline procedures for the usage of physiological signals in VR
A. Raison, 2019, Mental Workload study in VR settings

*Bachelor's Theses*
R. Hänni, 2022, Risk awareness in a VR cytology lab
J. Steiner, 2021, Frustration in VR
T. Fischer, 2021, Focus and concentration in VR

## Skills

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| **Coding Languages** | Unity C#, Python, R, Unity Shaders |
| **XR Hardware & Platforms** | SteamVR Tracking, OpenXR; Varjo XR-3, Meta Quest, HTC Vive; Manus Gloves (finger-level hand tracking); OptiTrack, VICON (motion capture); IMU (inertial head & hand motion tracking) |
| **Physiological Sensing** | Eye-tracking (gaze, pupillometry), EDA/GSR, PPG, Respiration, FSR; synchronized multi-modal recording integrated into XR HMDs; signal processing and feature extraction on physiological data |
| **Human Factors** | Cybersickness, mental workload (NASA-TLX, physiological indices), affectiv and cognitive states, large-scale user studies (800+ participants), experimental design, mixed-effects models |
| **Perception Model Evaluation** | Unity synthetic data generation, evaluation of CV/SLAM/probabilistic models against synthetic ground-truth, humans, and INS |
| **Dev Environments** | Git, GCloud, Conda, uv, pixi, SteamVR, OpenXR, Unity XR |
| **3D Modelling** | 3ds Max, Substance Painter, Photoshop |

## Languages

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| **English** | Professional |
| **French** | Native |
| **German** | Intermediate |

## Interests

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| **Music** | Piano (9 years of piano and music theory in conservatoire) |
| **Sport** | Vietnamese martial arts (6 years, teacher and coach), swimming (4 years) |
| **Art** | Sketching, 3D modeling, painting, interest in cinema, video games, and Japanese anime |
| **Transfer** | Introduction to VR for middle school students in 2019 and 2020 |
| **Volunteering** | Journées Sciences et Musique in Rennes in 2018 and 2019, Restos du Cœur in 2014 (food gathering), raising awareness about the Ehlers Danlos syndrome in 2014 |
| **Involvement** | Part of the organization team of numerous events (with over 1k people during engineering school) and member of several school associations (mainly related to sport and art) during engineering school and Ph. D. |