Master's Thesis Short Project and Master's Thesis Project

Developing an XR Platform for Demonstrating Human Perceptual Adaptation and Brain Plasticity

Human perception actively adapts to continuous sensory input, allowing the brain to recalibrate and maintain accurate representations of the world. Optical illusions, phantom sensations, and visuomotor distortions provide unique insights into this adaptability. At the Life Science Learning Centre (UZH and ETH), such effects are currently demonstrated using physical setups.

This Master's short project will evaluate how Virtual Reality (VR) or Augmented Reality (AR) technologies could modernize and extend these neuroscience demonstrations. During this initial phase, you will explore commercially available systems and gain an understanding of the neuroscience behind perceptual illusions and adaptation.

Once a feasible approach is identified, the prototype will be developed into a full implementation as part of a Master's Thesis. This will include designing a behavioral experiment in which the XR solution is tested and evaluated with human volunteers. The overall goal is to enable users to experience visual and proprioceptive illusions interactively using immersive technology, ultimately contributing to educational and research applications in neuroscience and psychology.

Phase 1 — Short Project / Evaluation (approx. 2–3 months)

- Review perceptual and sensorimotor illusions used to study brain plasticity (e.g., visuospatial shift, rubber-hand/phantom-hand effects, body-schema distortions).
- Compare potential XR setups (VR headset vs. AR device), including cost, technical capability, and experimental control.
- Build a small prototype to assess the feasibility of digitally shifting visual feedback during reaching/throwing tasks.

Phase 2 — Master's Thesis (approx. 6 months)

- Design and build an XR experience that induces controlled visuomotor conflict and measures user adaptation.
- Integrate navigation through existing 3D brain reconstructions as an additional educational component.
- Validate the setup with users: quantify error reduction, adaptation effects, and subjective experience.
- Relate the observed effects to known mechanisms of motor learning and body representation.

Work Environment

You will join an interdisciplinary team at the **Institute of Neuroinformatics**, in the lab of Prof. Dr. Benajmin Grewe (Neural Learning and Intelligent Systems) exploring the intersection of:

- **Brain plasticity** — how quickly the nervous system rewires
- **Human perception** — how vision and proprioception construct reality
- **XR development** — Unity/Unreal Engine, motion tracking, real-time interaction

Desired Skills and Interests

- Experience with Unity or Unreal Engine
- Basic understanding of neuroscience concepts
- Data analysis skills
- Creativity in interaction design
- Motivation to work independently

This project will produce a ready-to-use neuroscience demo for teaching and outreach, and may open doors toward future applications in rehabilitation and research.

If you're excited about making people question where their hand actually is — we'd love to hear from you.

Contact:
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