Reflex-like spatial updating of rotations can be adapted without any sensory conflict

**Introduction**

Spatial updating as a reflex-like process

In this study, we investigated the adaptation of reflex-like spatial updating.

**Goal:** Adapting spatial updating without any sensory conflict

**Methods**

3 Phases: Pre-test, Adaptation phase, post-test

**Experimental phases:**
- 3 phases: pre-test, adaptation phase, and post-test
- Spatial updating was quantified using behavioral measurements of the new post-rotation orientations (rapid pointing to invisible landmarks in a previously learned scene)

**Stimuli:**
- Visual/vestibular = 2

**Conclusions**

A cognitive conflict can recalibrate spatial updating and hence the interpretation of vestibularly perceived self-motions

Does that hold for other reflexes like the VOR, too?

**References**


**Outlook:**
Future experiments will investigate whether the adaptation of behavioral measures (spatial updating) also affects physiological measures (that is, reflexive phenomena). The vestibulo-ocular reflex (VOR) serves here as a prototypical testbed.

**Results**

Gain factor increased from 1.17 to almost 2

Conclusions:
- Vestibularly-driven reflex-like spatial updating can be adapted without any concurrent sensory conflict, just by a pure cognitive conflict. That is, the cognitive discrepancy between the vestibularly updated reference frame (which served for the pointing) and the subsequently received static visual feedback were able to recalibrate the interpretation of self-motion.

**Apparatus and material**

- **Fig. 1:** Experimental design
- **Fig. 2:** Participant sitting on the motion platform and facing the curved projection screens. The physical field of view (FOV) is 86°x64° and matches the simulated FOV.
- **Fig. 3:** Position-tracking pointer in the default position (aperture) and pointing position.
- **Fig. 4:** Schematic experimental setup showing the 6 degrees of freedom motion platform and the projection screen.
- **Fig. 5:** The model was created by wrapping a 360° round shot photograph of the Tübingen market place presented on a curved projection screen (86°x64° FOV, see Fig. 2-8). All participants were familiar to the scene and trained on the pointing task. For vestibular stimulation, participants were seated on a 6 DOF motion platform.
- **Fig. 6:** 360° round shot view of the Tübingen market place, displaying the landmarks "Lauermarktplatz", "Brucke", "Kronenplatz", "Michelstein", and "Pfalzwacht", indicated by little red dots.
- **Fig. 7:** 360° view of the market place illustrating its irregular geometry. The viewpoint is indicated by the red cross.
- **Fig. 8:** 360° round shot of the Tübingen market place.

**Fig. 9:** Mean spatial updating performance. Note the gain factor of almost 2 in the post-test phase. The "optima" are different from those of the pre-test because the participants were presented with an additional optic flow stimulus with and without concurrent physical rotations, respectively (Riecke et al., 2003 & Riecke, 2003). Response time and configuration error were comparable between the two studies. Boxes and whiskers denote one standard error of the mean and standard deviation, respectively.