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### The disembodied self

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# The Disembodied Self – Using an experimental approach to investigate objective markers of dissociation

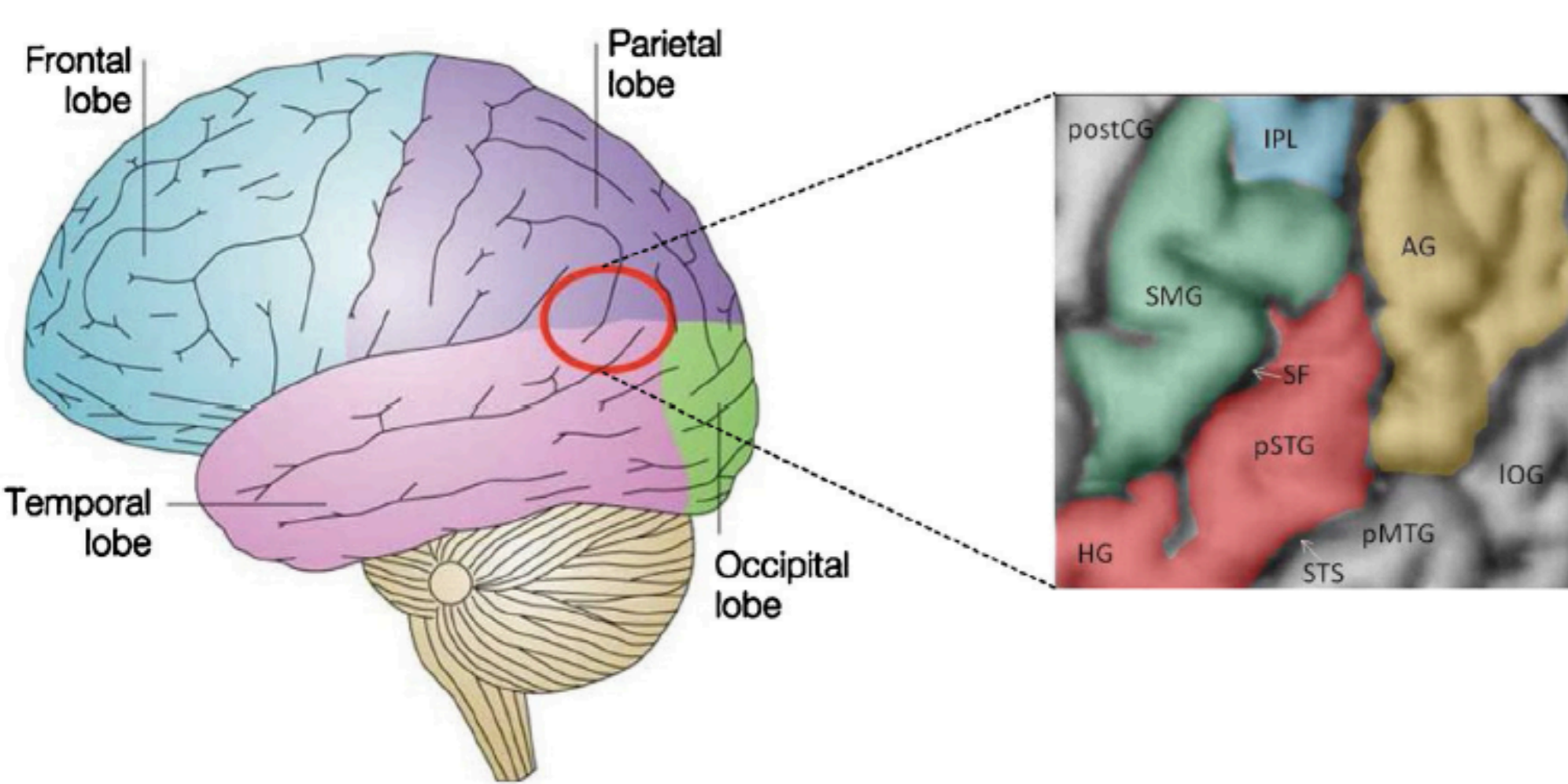
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## Background

- Individuals with childhood trauma report elevated levels of **dissociation**, e.g. depersonalization symptoms<sup>1</sup>.
- Lack of objective markers of (somatoform) dissociation, e.g. **out-of-body experiences (OBEs)**; Picture 2).
- Reduced sense of self and diminished body awareness could relate to brain deficits in integrative capacity.
- The **temporoparietal junction (TPJ)** (Picture 1), a critical hub for multisensory integration, is a proposed key region for establishing a coherent sense of (bodily) self<sup>2,3</sup>.
- Lesion and **perturbation studies** indicate that stimulation of the TPJ affects own-body perceptions<sup>4,5</sup> and decreases depersonalization symptoms<sup>6</sup>.
- **Connectivity** between right TPJ and right (posterior) insula depicted the strongest activity associated with changes in self-location and first-person perspective<sup>7</sup>.

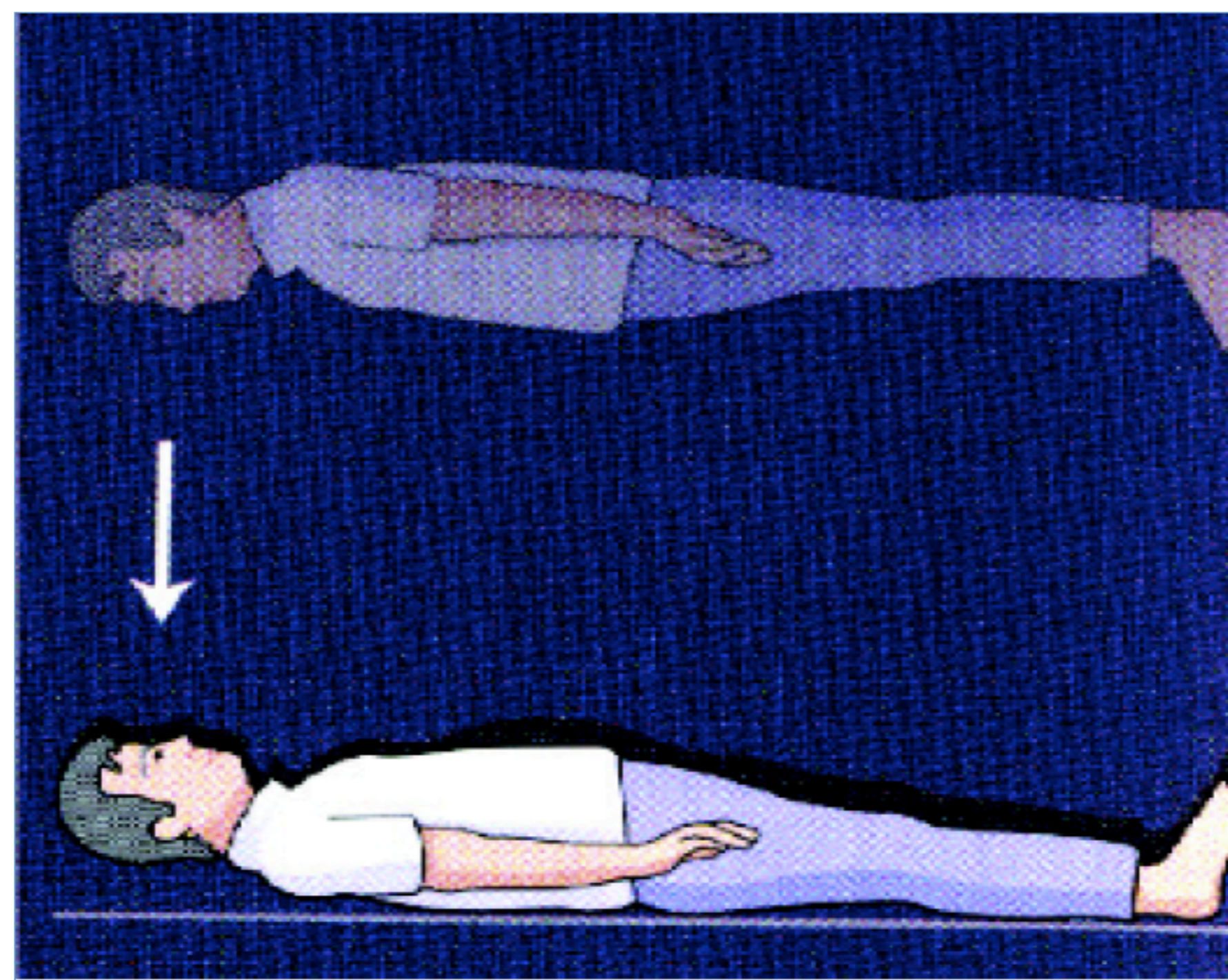


Picture 1. The temporoparietal junction.<sup>4</sup>

## Research Question

How does a temporary perturbation of the right temporoparietal junction (rTPJ) affect

- 1) Dissociative experiences in individuals with (and without) a history of childhood trauma
- 2) Experimentally-induced OBEs<sup>8</sup>?
- 3) The brain network subserving body awareness?



Picture 2. Out-of-Body Experience<sup>3</sup>

## Methods

**Study Design:** Sham-controlled, randomized, pre-post TMS study

**Study Population:** Total  $N = 52$  right-handed, female, young adults\*

**Trauma Group:**  $N = 26$  subjects with former childhood trauma

**Control Group:**  $N = 26$  subjects without former childhood trauma

\*Exclusion Criteria

- 1) Neurological disorder, e.g. epilepsy
- 2) Psychiatric disorder
- 3) Presence of metallic devices
- 4) Psychotropic medication intake for the last 6 months
- 5) Claustrophobia
- 6) Alcohol or drug abuse
- 7) Tinnitus

## Questionnaires

**Childhood Trauma.** Childhood Trauma Questionnaire (CTQ; Bernstein & Fink, 1998)

**State Dissociation.** Dissociation Tension Scale – Short (DSS-4; Stiglmayr et al., 2009)

**Trait Dissociation.** Dissociative Experiences Scale (DES-II; Carlson & Putnam, 2000)

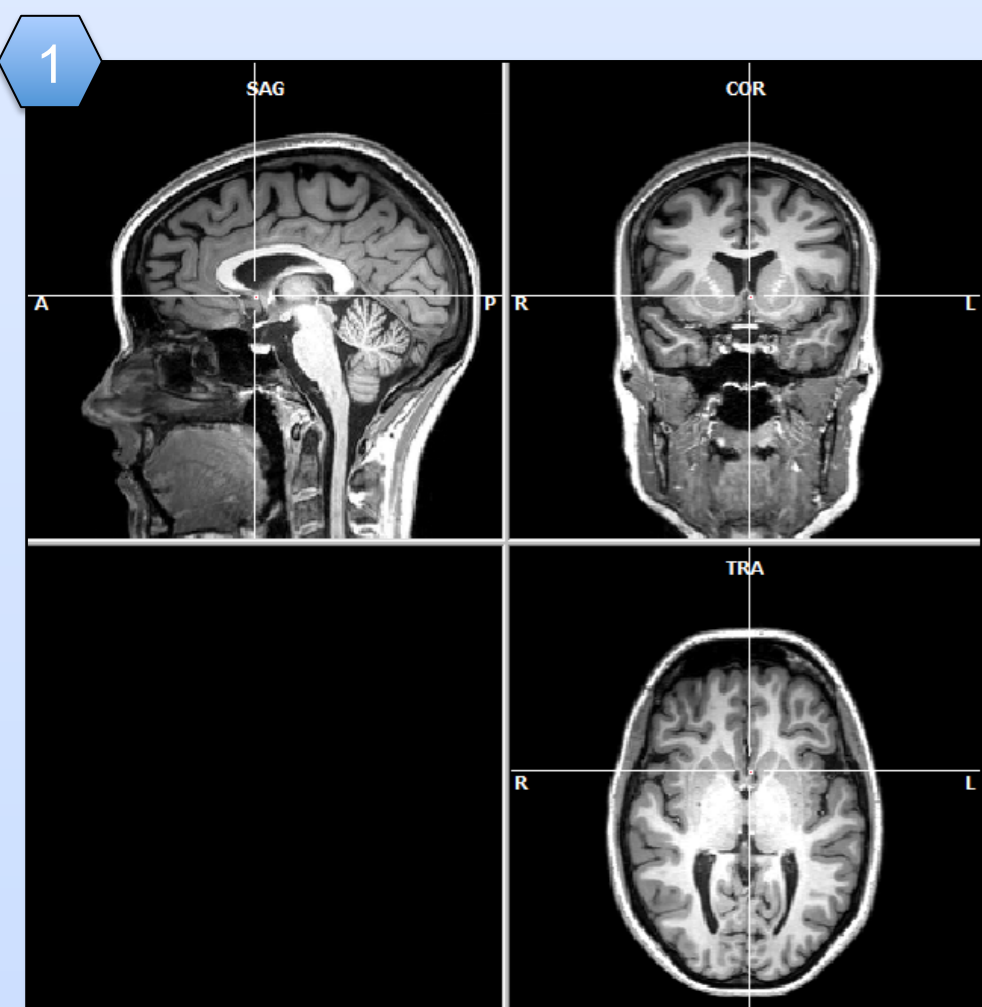
**Depersonalization.** Cambridge Depersonalization Scale (CDS; Sierra & Berrios, 2000)

**Vestibular Symptoms.** Vertigo Symptom Scale-Short Form (VSS-SF; Wilhelmssen et al., 2008)

**Sleep Quality.** Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989)

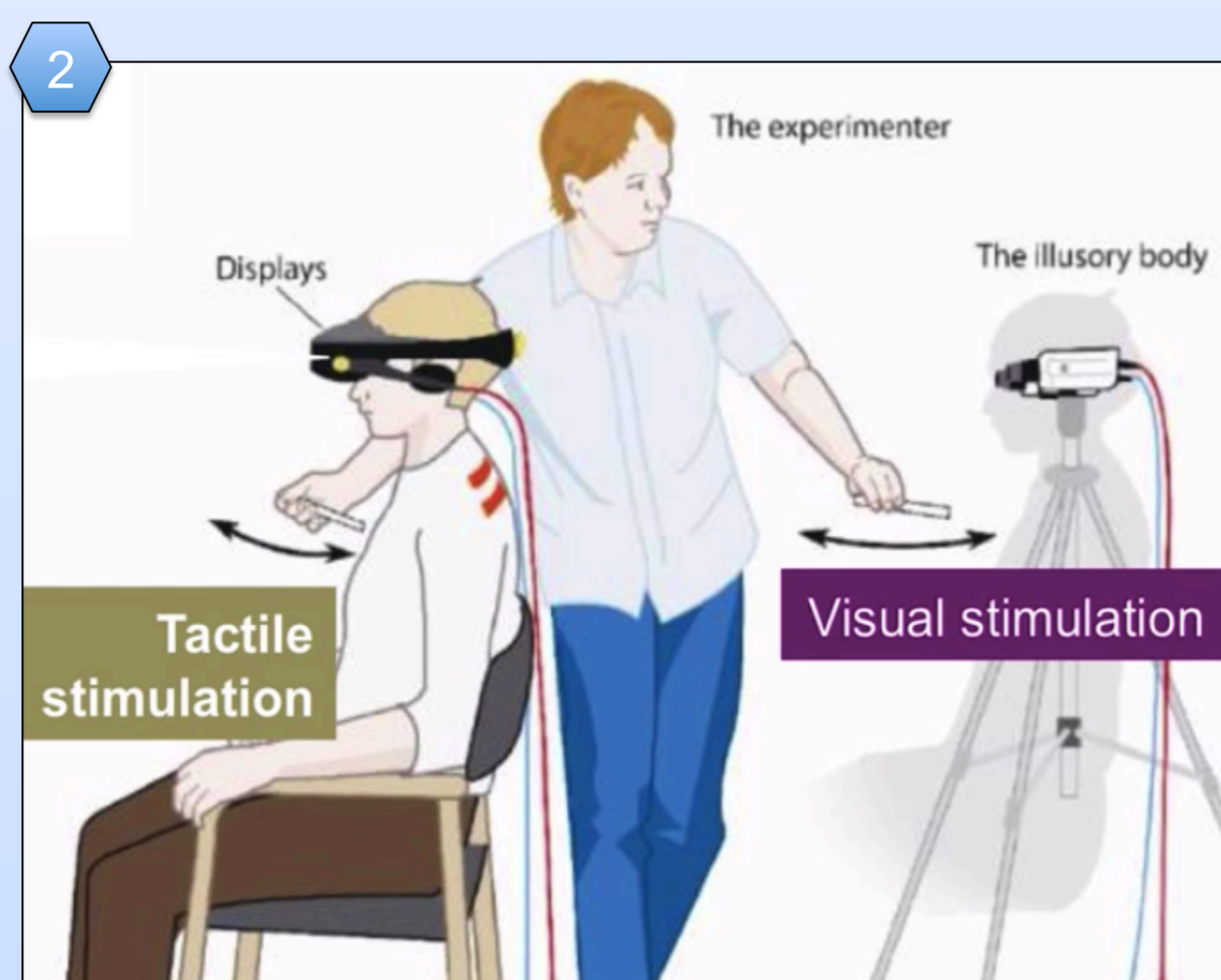


TMS Coil (Figure-8; Cool B65; MagVenture)



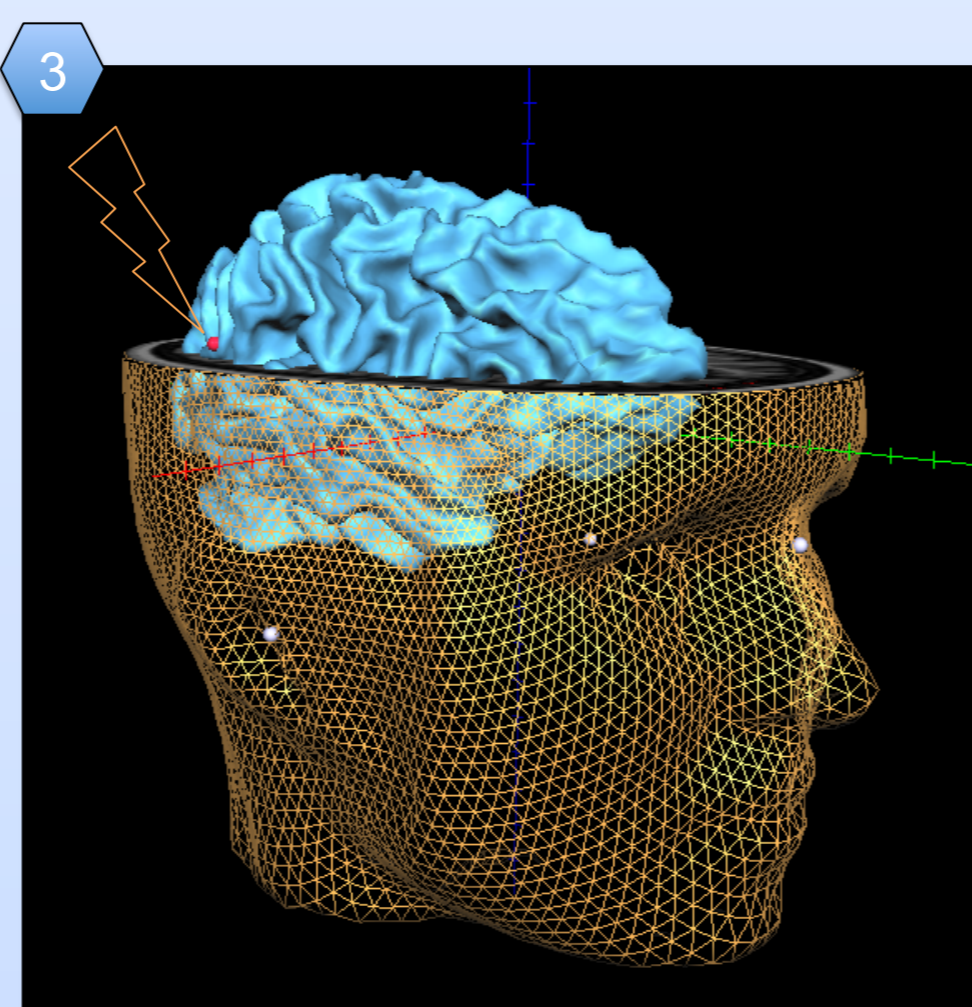
**Brain network PRE-TMS**

- Anatomical scan
- Resting-state fMRI
- Functional connectivity analyses (CONN toolbox, SPM12; ROIs: TPJ, insula, pSTG, S1, mPFC,...)



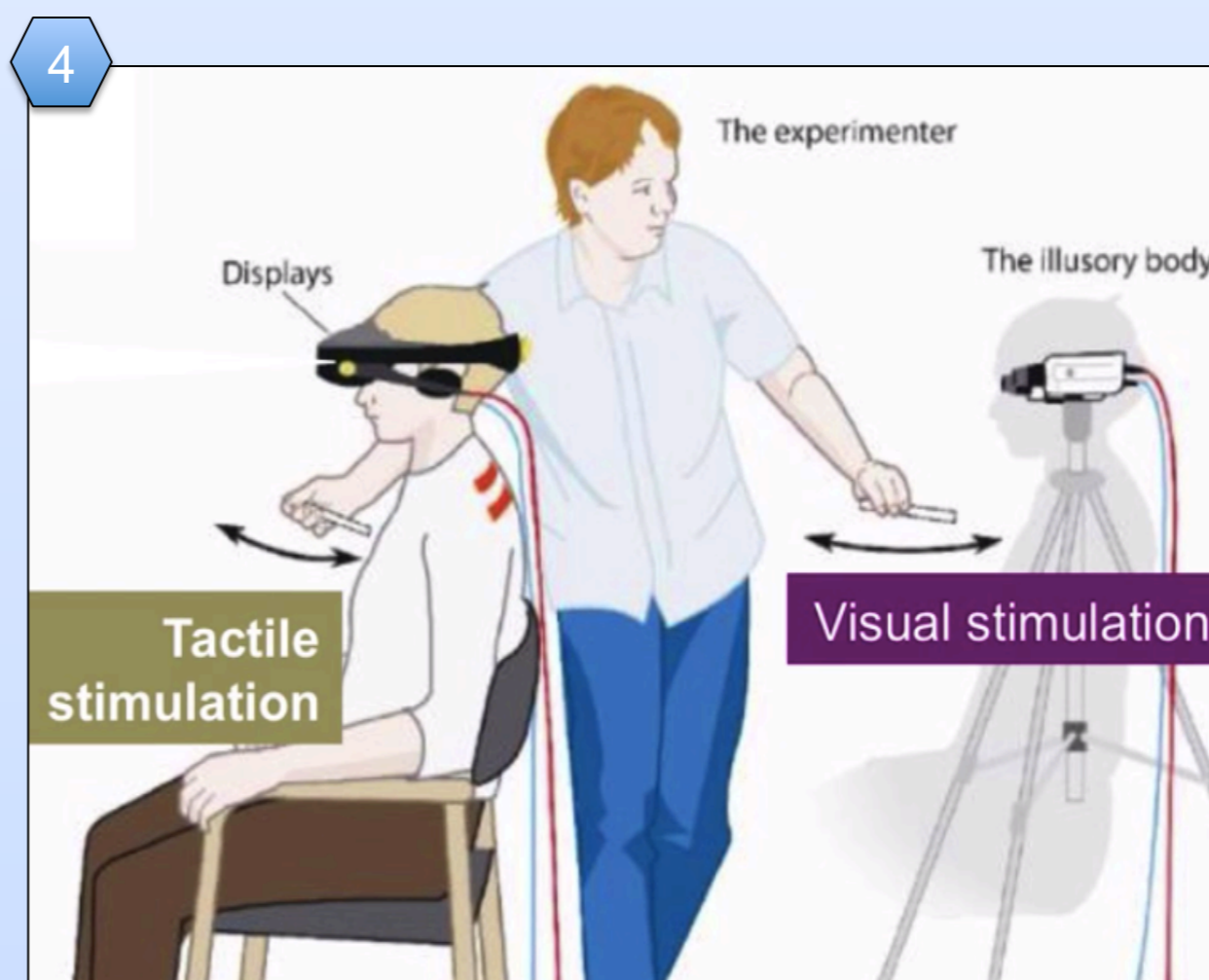
**Out-of-Body Illusion Paradigm<sup>8</sup> PRE-TMS**

- VR goggles connected to camera filming subject
- Synchronous tapping → OBE



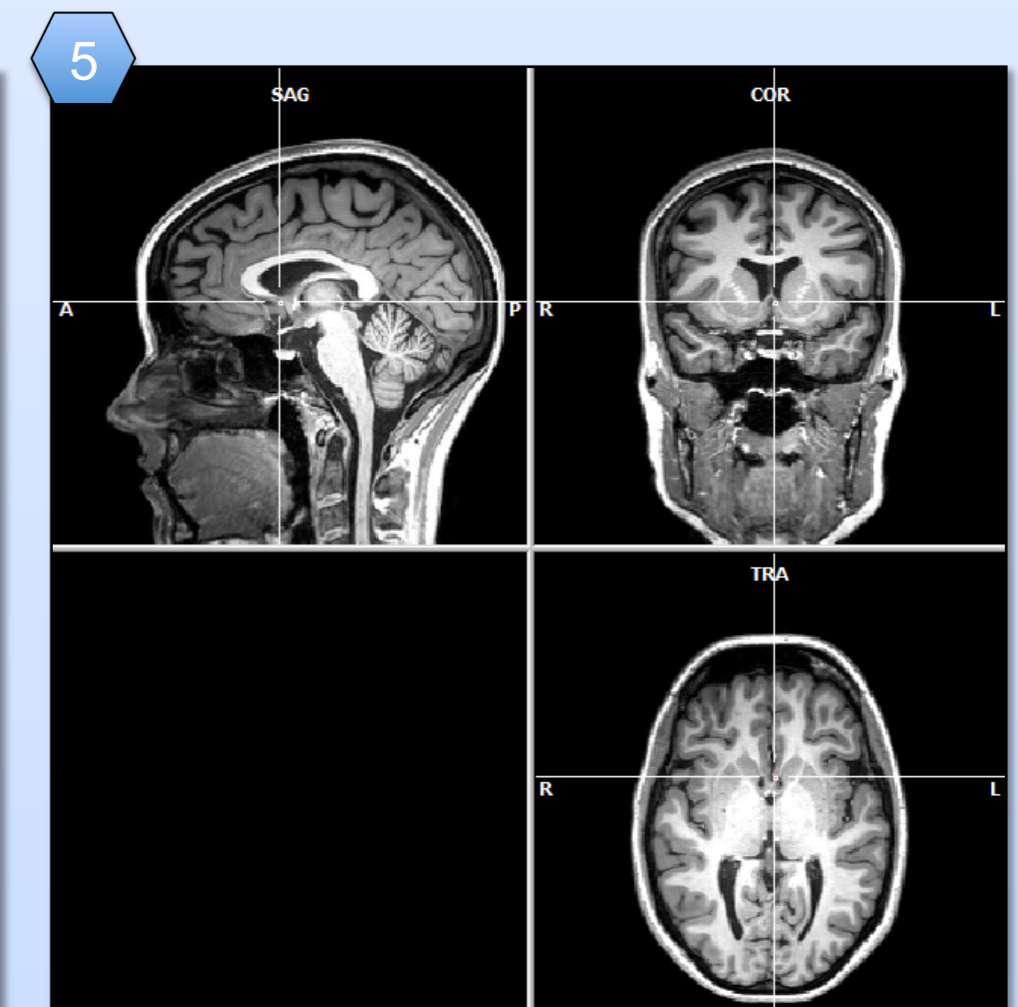
**Transcranial Magnetic Stimulation (TMS)**

- cTBS protocol, 40s, 600 pulses
- Inhibitory effect
- Neuronavigated rTPJ stimulation (Brain Voyager TMS neuronavigation)



**Out-of-Body Illusion Paradigm<sup>8</sup> POST-TMS**

- VR goggles connected to camera filming subject
- Synchronous tapping → OBE



**Brain network POST-TMS**

- Resting-state fMRI
- Functional connectivity analyses (CONN toolbox, SPM12; ROIs: TPJ, insula, pSTG, S1, mPFC,...)

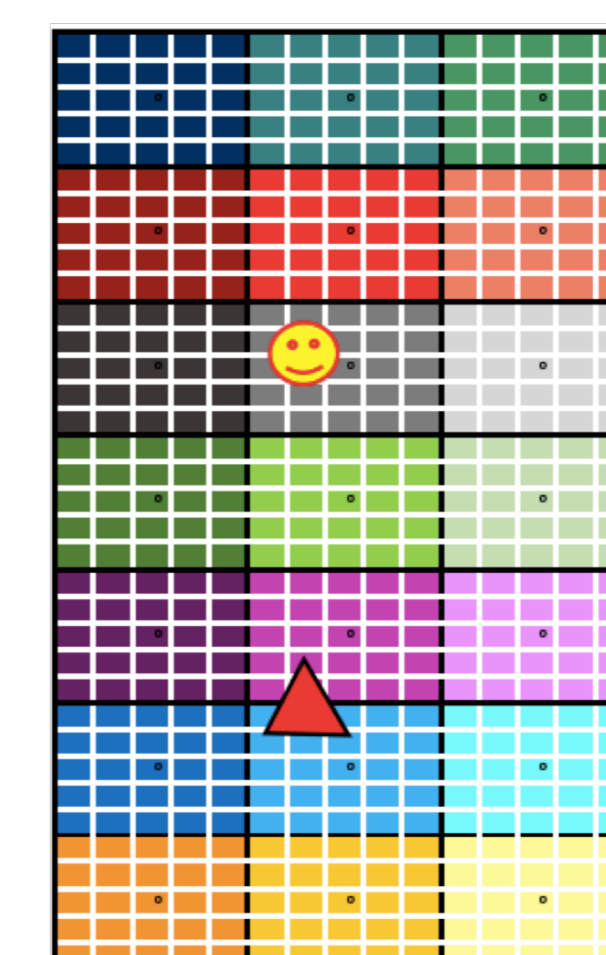
### Infobox 1: Heart rate as objective marker of disembodiment

- Measured with wireless C3 Corrium heart rate (HR) monitor
- Threat-evoked: Fake hammer attack on illusory body
- Before: Increased emotional distress measured via skin conductance response after OBE induction<sup>8</sup>
- Hypothesis: OBE induction leads to increased heart rate (=distress) when illusory body attacked.



### Infobox 2: Spatial map as objective marker of self-localization

- Subjects indicate shift in self-localization on map
- Hypothesis: OBE induction leads to shift in self-localization from original position (smiley) towards camera (red triangle)



## Contact

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