

RESTORATIVE EXPLAINED

PRISMATIC ADAPTATION



Prismatic adaptation is a **non-invasive neuromodulation technique**. It has long been used in the rehabilitation of visuo-spatial attention impairments, most notably hemispatial **neglect** - a common cognitive problem after **stroke**. In recent years, prismatic adaptation attracted clinicians' interest thanks to its potential in the rehabilitation of higher cognitive functions such as **memory, attention, and language**, and of their **executive control** components (e.g., planning, response inhibition, set-shifting, working memory maintenance and manipulation, updating, and performance monitoring). Let's see why!

How does prismatic adaptation work?

Prismatic adaptation is a visuomotor procedure in which goal-directed pointing movement is performed while wearing prism lenses - therefore the name **MindLenses** for our rehabilitation device! - that laterally shift the visual field.

AN ENDOGENOUS MODULATION TECHNIQUE, ACHIEVING A CORTICAL PRIMING EFFECT:

PRISMATIC ADAPTATION STIMULATES THE BRAIN, WITHOUT TOUCHING IT

This action induces rapid sensorimotor recalibration and a robust after-effect, producing **endogenous** neuromodulation: a network-specific **modulation of cortical excitability and connectivity** - documented with fMRI, TMS and EEG - within cerebello-parietal-motor and fronto-temporal circuits.

Why non-invasive?




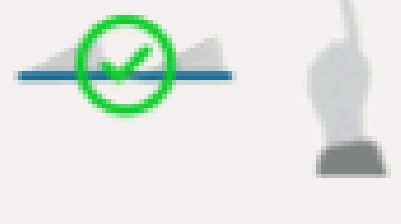
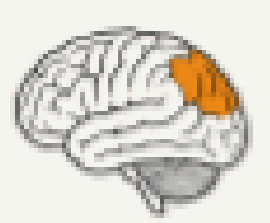
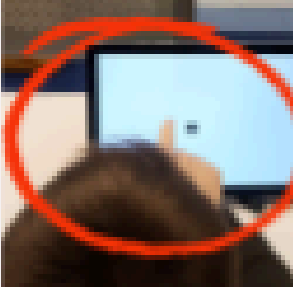



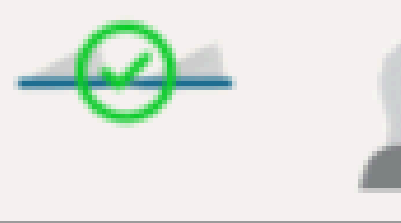



Unlike exogenous neuromodulation methods that deliver **external** physical stimuli to the brain, prismatic adaptation achieves comparable network-level modulation **endogenously**, via controlled alteration of visual input and goal-directed motor behavior. In other words, the **modulation arises from sensorimotor recalibration** rather than from an external electromagnetic source

What's the clinical use of prismatic adaptation?

Prismatic adaptation shifts the visual field to the right or left, allowing clinicians to modulate neural processing in a **single hemisphere at the time**. This produces a short-lived tuning of networks involved in perception, attention, and motor control. In practice, prismatic adaptation serves as a **cortical primer**: a preparatory step that "sets the stage" for the next phase of rehabilitation, such as **serious games** or other behavioral training targeted to specific cognitive functions.



PRISMATIC ADAPTAION IN PRACTICE During prismatic adaptation, the patients performs a visuo-motor task while wearing prismatic lenses. The lenses can shift the visual field either RIGHT (selective stimulation of RIGHT hemisphere) or LEFT (selective stimulation of LEFT hemisphere).

Phase	What the patient is doing	What the brain does	External observation
Pre-exposure	Touches the target that appears in different positions on the screen 	Learning the Target-Pointing Movement	Correct pointing action 
Exposure I: Direct effect	Makes errors and points in the direction of the deviation induced by the lenses Deviation direction: flatter lens bit  	Posterior parietal cortex (the "error sensor") detects that the finger does not reach the target on the screen — e.g., it lands too far to the left. 	Clear pointing error 
Exposure II: Adaptation / Recalibration	Corrects the error and successfully hits the target 	The cerebellum assesses the magnitude of the error and determines that, to correct it, the next movement should aim slightly more to the right. 	The error rapidly decreases 
Re-alignment	Continues to hit the target accurately 	The cerebellum performs a kind of "rewriting" process, remapping the relationship between where the patient is looking and where their arm feels to be.	The error almost disappears, and pointing movements become accurate and consistent
(From pointings nr. 20-25 onwards)	Correction becomes automatic; the patient hits the target "without thinking" 	Thanks to the primary motor cortex (M1), which "stores" the new map so it remains in memory, the patient can follow the updated mapping without further effort. The recalibration has succeeded. 	Pointing remains accurate and consistent, without effort
Post-exposure After-effect	Makes errors by pointing in the opposite direction of the deviation 	→ LEARNING COMPLETE	Observable after-effect of adaptation 