

It's not you, it's me: the impact of visual feedback on motor awareness, agency and body ownership in Anosognosia for Hemiplegia.

Authors

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Overview

- ❖ Differentiating between self and others, and recognising whether an action originated from us, are key to self-consciousness and social interactions.
- ❖ Patients with Anosognosia for Hemiplegia offer unique insight into different aspects of the self (sense of ownership, sense of agency and motor awareness).
- ❖ Manipulating congruency of motor expectations and actual performance deeply altered AHP patients sense of self, thus suggesting that expectations of movement have a crucial role in maintaining the sense of self, with possible repercussions on self-other distinction.

Introduction

- Patients with Anosognosia for Hemiplegia (AHP; i.e. unawareness of hemiplegia) present with altered motor expectations, driven by their **motor intentions** and not updated based on sensory feedback (Fotopoulou et al., 2008).
- Existing research showed that HP (i.e. hemiplegic) patients have a more flexible representation of their paralysed hand (Burin et al., 2015) and that they show a **dominance of visual information** over proprioceptive one when it comes to ownership of their own arm (Martinaud et al., 2017).

Aim:

Determine whether AHP patients' motor expectations may impact the way they perceive their own body beyond the motor domain and according to the congruency between visual feedback and motor expectations.

Hypotheses:

Congruency of visual feedback would influence AHP patients' awareness of movement, sense of agency (i.e. the sense of being in control of one's actions) and ownership (i.e. the sense that our body is our own).

Methods



Figure 1. Experimental set-up.

Participants:

19 AHP and 20 HP (females=20, mean age= 66.64 SD=13.6).

Design:

2 (group: AHP vs HP) x 2 (feedback: congruent vs incongruent) block design (order: counterbalanced).

Procedure:

Patients were asked to perform a movement and were then provided with **visual feedback** via a rubber hand (Fig. 1) that was **either congruent** (i.e. the rubber hand moved) or **incongruent** (i.e. no movement occurred) with their **motor expectations**. (Fig. 2)

Measures:

- **Ownership** ("Is this your left hand?", values: 0, 0.5, 1; "To what extent do you feel this is your hand?", 0-10 ratings), **motor awareness** (values: 0, 0.5, 1) and **agency** (values: 0, 0.5, 1) following attempted movements.

Methods - procedure

Conditions

Baseline
[experimenter points to the rubber hand]



Measures

Ownership:
"Is this your left hand?"
"To what extent do you feel this is your hand (0-10 rating)?"

Congruent Feedback
"Move your left hand when I tap"
[experimenter lifts the rubber hand]



Motor awareness:
"Has the hand moved?"

Agency:
"Did you move it or was it someone else that moved it?"

Incongruent Feedback
"Move your left hand when I tap"
[experimenter does not lift the rubber hand]



Ownership:
"Is this your left hand?"
"To what extent do you feel this is your hand (0-10 rating)?"

Figure 2. Experimental procedure and outcome measures.

Results

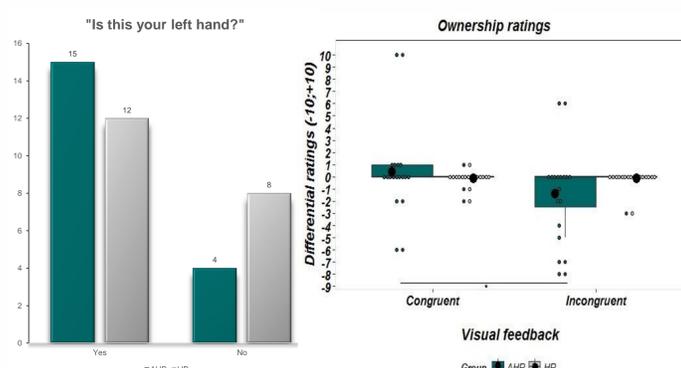


Figure 3. Number of Yes/No responses per group to the question "Is this your left hand?" (at baseline).

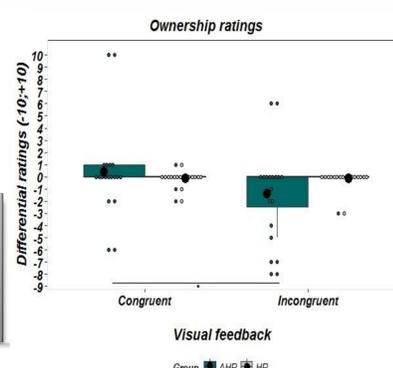


Figure 4. Differential ownership ratings between incongruent and congruent feedback conditions.

Main effects (Mann-Whitney U test):

Group:

↑ **agency** in AHP vs HP ($z = -2.585, p = 0.016$), but no difference in motor awareness or ownership.

Visual feedback:

↑ **agency** ($Z = -3.111, p < 0.01$) following **congruent visual feedback**, but no difference in motor awareness or ownership.

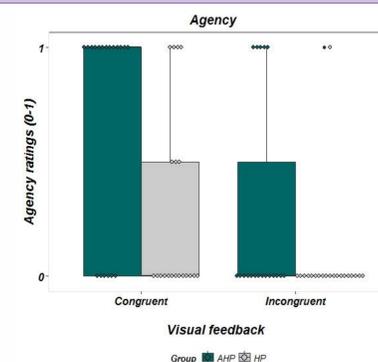


Figure 5. Agency values following congruent and incongruent feedback (1="I moved the hand"; 0.5="Not sure"; 0="Someone else moved it"). Solid line = median

Main effect of agency – direction (Wilcoxon Signed Rank Test, corrected for multiple comparisons with $\alpha = 0.025$):
↑ **agency** in AHP patients ($Z = -2.828, p < 0.01$) following **congruent feedback**, but not in HP patients (Fig 5).

Interactions:

↓ **motor awareness** in AHP patients (i.e. more likely than HP to claim the rubber hand moved) when visual feedback was **incongruent** ($Z = -2.711, p < 0.01$) (Fig. 6).

↓ **ownership** (0-10 ratings) in AHP patients ($Z = -2.591, p = 0.020$) following **incongruent feedback** (Fig. 4).

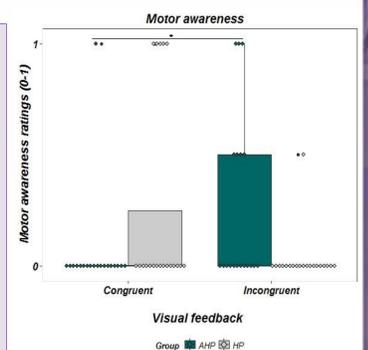


Figure 6. Motor awareness values following congruent and incongruent feedback (1=Wrong; 0.5=Not sure; 0=Correct). Solid line = median, * $p < 0.5$

Discussion

➤ When **visual feedback** is **incongruent** with their expectations of movement, AHP patients experience **decreased motor awareness** and **ownership** of the paralysed limb compared with HP. When feedback is **congruent**, AHP patients show **increased agency** when compared to HP.

➤ **Motor expectations** play a role not only on awareness of motor outputs but also in shaping these patients' experience of their own body (i.e. **ownership**) as well as their sense of being the agents of their own actions (i.e. **agency**).

Conclusion

In Anosognosia for Hemiplegia, patients' expectations of movement deeply affect different aspects of their sense of self, with possible repercussions on self-other distinction.

References

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