Comparison of mu responses as indices of self-performance in clinically-applied body movements executed with and without guided attention

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Background

Executing body movements require intention and sense of agency. Body control involves agentic changes in attention, agency, and intention. Mu frequency appears to decrease in amplitude during both action execution and action observation (Fox, Bakermans-Kranenburg, Yoo, Bowman, Cannon, Vanderwert, Ferrari, and Ijzendoorn, 2016). The psychophysiological basis for clinically applied body movements in *Dohsa-hou*, or the body movement method, as actions executed and monitored through guided attention remains unclear.

Figure 1. Simple model for the proposed mechanism

Dohsa-hou

Dohsa-hou was originally developed psychotherapy for cerebral palsy patients in Japan and demonstrated ways in which body movements are involved in promoting awareness of bodily states. The theory of Dohsa-hou is framed along a general process of intention, effort, and the realization of an intended body movement that leads to a subjective experience of motor resonance. A distinction about the self rather than another as the agent of control and movement performance change is proposed in Dohsa-hou, and empirical support from clinical case studies in Japan has indicated its psychotherapeutic utility for clients with conditions such as autism and schizophrenia.

Figure 2. The psychological process in Dohsa-hou.

Purpose

This study compares two groups instructed to perform body movements while manipulating the presence of guided attention in their instruction (Dohsa-hou). We measured electroencephalographic (EEG) mu power responses used in mirror neuron research to compare degrees of self-oriented behavioral intention in action execution between an experimental group of participants conducting Dohsa tasks with guided attention and an active control group performing the same but unsupervised movement tasks.

Method

18 undergraduate students participated. They were divided into 2 groups

- 1) Dohsa-hou group: self-performance with guided attention (Dohsa-hou).
- 2) Active control group: self-performance without guided attention (Active Control).

Indices: EEG power data (Nihon Kohden, EEG-1100) , Self-reported questionnaires (ESSS).

Group 1: Dohsa-hou group (n=9)

With guided attention to the body in movement execution

Group 2: Active Control group (n=9)

Without guided attention

Figure 3. Experimental Procedure

Findings

1. Correlational Analysis

Results for the 18 individuals showed correlations between especially the Cz Eyes Open Day 3 Post-test mu suppression index and Ownership ($r = 0.53$), indicating that self-reported body ownership was indeed related to mu response indices.

Figure 4. Experimental Schedule

2. Mu responses between the Dohsa-hou and Active Control Group

To investigate differences in mu responses between the Dohsa-hou group (n=9) and active control group (n=9), the difference value between Day 3 pre-/post-test and Baseline (Day 1 pre-test) were analyzed with student's *t*-tests.

There was a significant difference (Eyes Open) between the Dohsa-hou and Active Control group for attention to self-performance at the Cz and C4 locations.

There was no significant difference in the mu responses for the Eyes Closed condition.

Table 1. Independent Samples T-Test (Eyes Open)

	t	df	p	Cohen's d
C4_EO Day 3 Pre - BL	-2.694	16.000	0.016	-1.270
C4_EO Day 3 Post - BL	-2.777	16.000	0.013	-1.309
Cz_EO Day 3 Pre - BL	-2.094	16.000	0.052	-0.987
C4_EO Day 3 Pre - BL	-2.694	16.000	0.008	-1.270
C4_EO Day 3 Post - BL	-2.777	16.000	0.007	-1.309
Cz_EO Day 3 Pre - BL	-2.094	16.000	0.026	-0.987
Cz_EO Day 3 Post - BL	-1.845	16.000	0.042	-0.870

Note. Student's *t*-test.

Note. For all tests, the alternative hypothesis specifies that group 1(Dohsa) is less than group 2 (Active Control).

Discussion

In the Dohsa-hou group, the C4 and Cz difference value (Day 3 minus baseline) is significantly lower than the active control group. This decrease is known as desynchronization via lower mu responses (e.g., Fox, Bakermans-Kranenburg, Yoo, Bowman, Cannon, Vanderwert, Ferrari, and Ijzendoorn, 2016). Desynchronization associated with self-performance occurred in the Dohsa-hou-based guided attention group. These findings are preliminary, however, this observation from an experimental setting with resting state power ratios was shown to be related to attention to the self among those in the group who participated in guided attention to movement from Dohsa-hou.