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Activating the Right Hemisphere Through Left-Hand Muscle Contraction Improves Novel Metaphor Comprehension

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Introduction

The neurotypical brain is characterized by left hemisphere lateralization for most language processing. However, the right hemisphere plays a crucial part when it is required to bring together seemingly unrelated concepts into meaningful expressions (Beeman, 2005; see Figure 1), such as in the case of novel metaphors (unfamiliar figurative expressions). The aim of our study was to test whether it is possible to enhance novel metaphor comprehension through an easy, efficient, and non-invasive method – intentional contraction of the left hand's muscles, to activate the motor and sensory areas in the contralateral hemisphere.

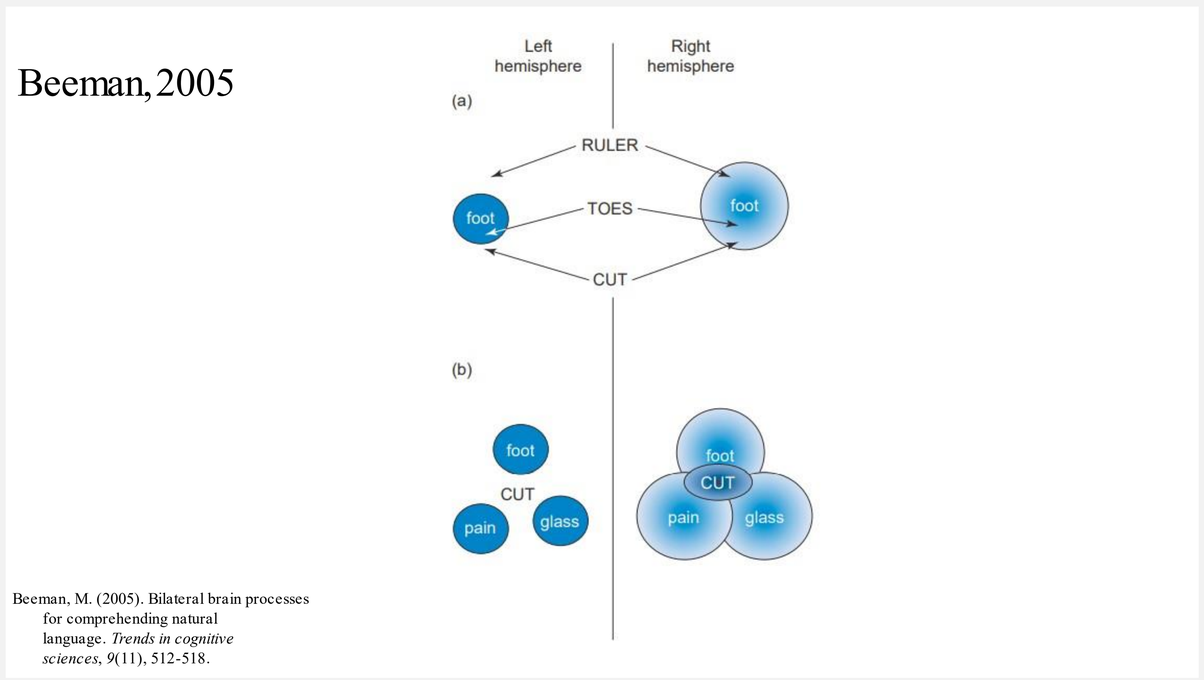

Figure 1. Beeman's theory of fine and coarse semantic coding

Objectives and Method

The balance between the hemispheres (i.e., the involvement of each hemisphere) in language processing is not stable. It has been shown that the performance of each hemisphere could, in fact, be intentionally activated, suppressed, or manipulated, resulting in changes to their balance (Bassel and Schiff, 2001; Harmon-Jones, 2006; Pobric et al., 2008; Goldstein et al., 2010; Schiff and Lamon, 1994; Schiff et al., 1998). It has been suggested that an intentional muscle contraction of the hand activates the motor and sensory areas of the contralateral hemisphere and that this activation spreads to other brain areas that are crucial for language processing (Goldstein et al., 2010). Thus, the main objective of the current studies was to test whether boosting the right hemisphere through left-hand muscle contraction may improve novel metaphor comprehension among adults and adolescents.

Study 1

118 neurotypical participants were presented with 240 Hebrew word pairs forming four types of semantic relations: literal – LIT (e.g. soft blanket), conventional metaphor – CM (e.g. juicy gossip), novel metaphor (taken from poetry) – NM (e.g. wilting hope) or unrelated – UR (e.g. picturesque concern; see Figure 2 for an illustration). Participants were randomly assigned to the control (no contractions), left-hand, or right-hand contraction conditions. In the contraction conditions participants squeezed a 7-cm-diameter rubber ball for four minutes (see Figure 3).

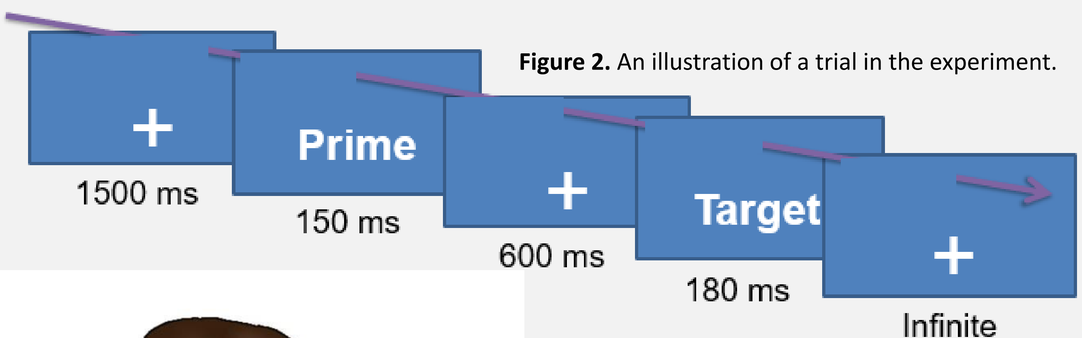

Figure 2. An illustration of a trial in the experiment.

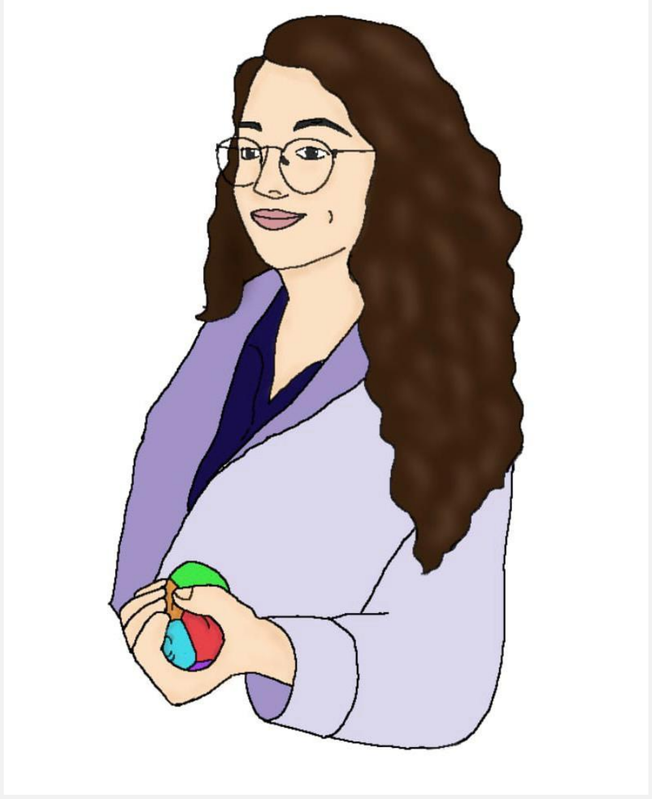

Figure 3. Illustrated by Tina Shammas

Results

For AC, the interaction between hand and expression-type was found significant (see Figure 4). the follow-up analysis revealed that a significant main effect for NM indicating that participants in the left-hand contraction condition were more accurate responding to NM than participants in the right-hand or control conditions. No difference between right-hand and control was found.

Similarly, an interaction between hand condition and expression type was found for RT (see Figure 4). The follow-up analysis revealed that the differences between hand conditions were significant. Within all hand conditions, responses to LIT were faster than to CM, NM and UR and responses to CM were faster than to NM and UR, but NM and UR did not differ.

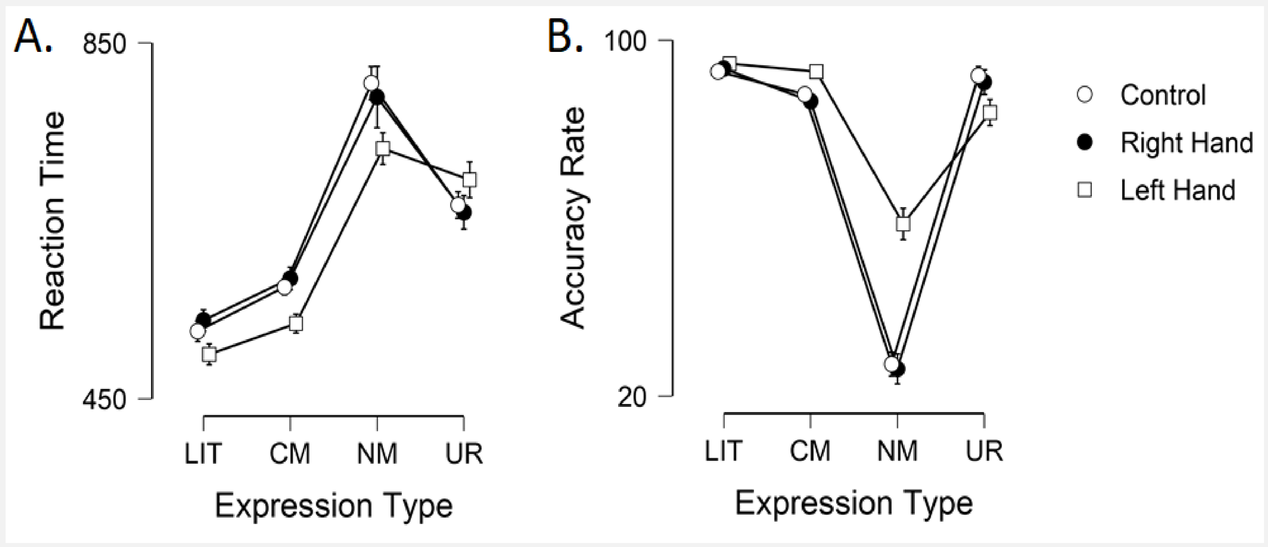

Figure 4. Interaction between hand and expression type for reaction time (A) and accuracy rate (B). LIT – Literal expressions; CM – Conventional metaphors; NM – Novel metaphors; UR – Unrelated expressions. Error bars indicate the standard errors.

Study 2

The results of the study are important because as far as we know, this is the first time, that novel metaphors comprehension was improved by such a simple and an easy technique. Moreover, this finding empirically supports Beaman's theory. Because this proposal offers a very simple and inexpensive method that can be applied anytime and anywhere, we choose to expand our research and investigate whether this method can also aid to improve figurative language processing among adolescents. 22 adolescents already participated in the study and preliminary results can be seen in Figure 5. This study may aid teachers, psychologists, and researchers in the field of education and developmental psychology to help children and adolescents improve and develop their figurative language which as consequence may even improve their social skills.

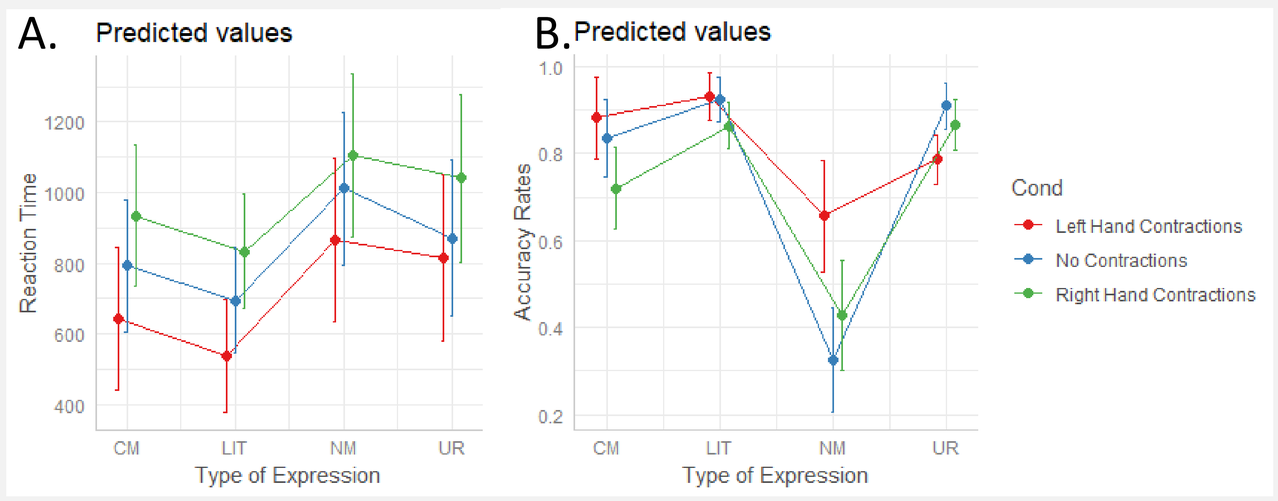

Figure 5. Preliminary results from the adolescents' experiment. Interaction between hand and expression type for reaction time (A) and accuracy rate (B). LIT – Literal expressions; CM – Conventional metaphors; NM – Novel metaphors; UR – Unrelated expressions. Error bars indicate the standard errors.

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