

How creativity training modulates electrophysiological responses to novel metaphors



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BACKGROUND

Creativity training has been previously shown to improve performance in a number of divergent thinking tasks (cf., Fink et al., 2006). Little is known, however, if creativity training may facilitate novel metaphor comprehension, an index of creativity in language. Prior electrophysiological (EEG) studies demonstrated that comprehending novel metaphors may be more effortful than literal language, but less effortful than nonsense language (e.g., Rataj et al., 2017; Rutter et al., 2012). Could this effect change as a function of training?

Using a pretest-posttest design (with intermediate training) we investigated whether two different creativity training procedures may differentially modulate electrophysiological (EEG) responses to novel metaphor comprehension. Participants were randomly assigned to undergo either (1) TRIZ training, a systematic creativity method that guides the concept generation process using solution patterns derived from problems similar to the ones at hand (Ogot and Okudan, 2007), or (2) sketching training, emphasizing sketching techniques during ideation. At pretest and posttest, participants read literal, anomalous, and novel metaphorical sentences and made judgments about their meaning while undergoing EEG recording (cf., Rutter et al., 2012). The impact of both training procedures on sentence comprehension was measured by means of analyzing mean amplitude of the N400 and P600 Event-Related Potentials (ERPs).

METHOD

Participants: 34 engineers (13 ♀, 21 ♂; $M_{age} = 19.4$) | right-handed | English monolinguals

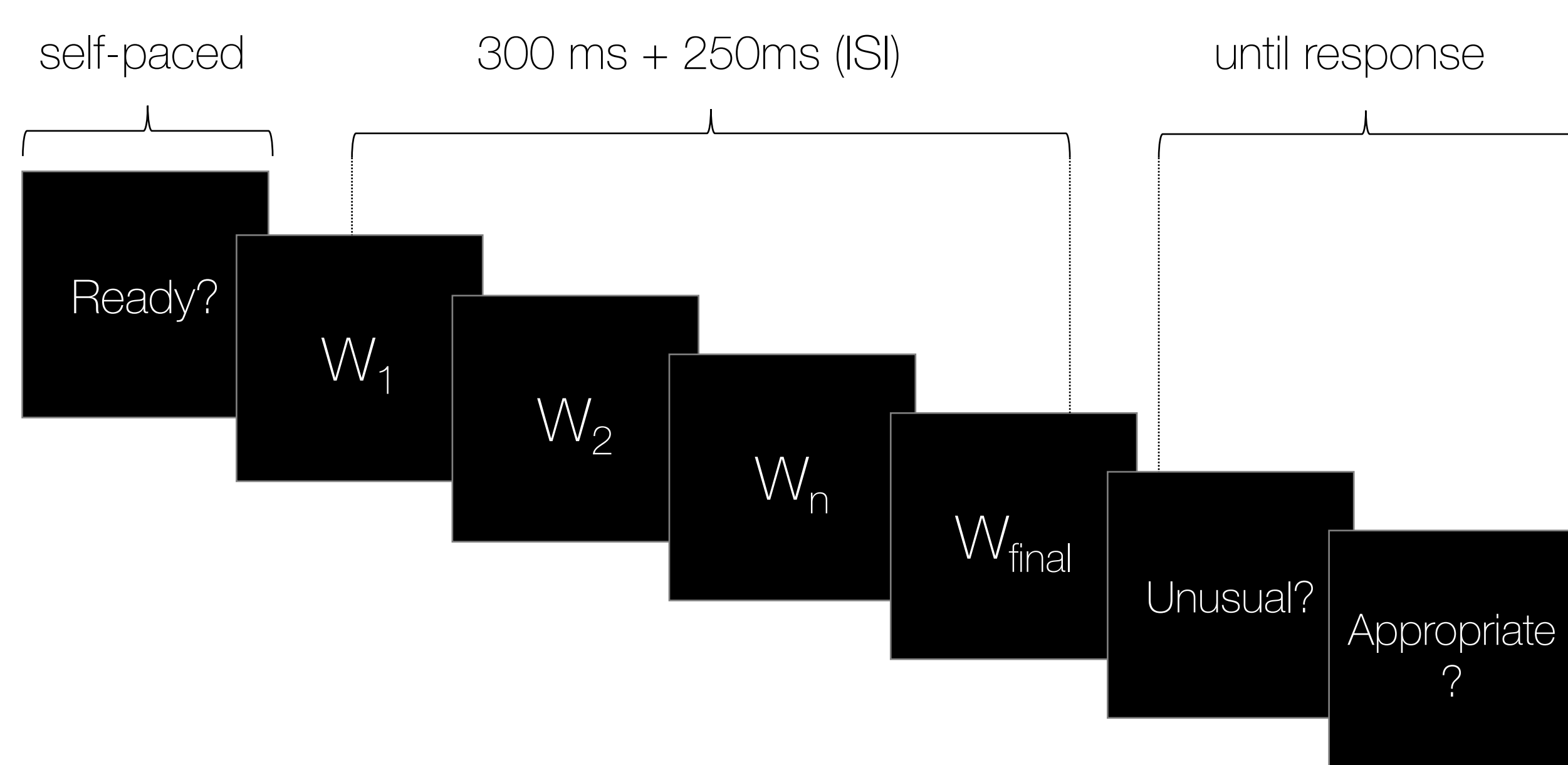
Stimuli: 228 English sentences referring to engineering, differing in verb only.

- all sentences were normed in 2 pre-experimental norming studies.
- ERPs were time-locked to the onset of the verb & the onset of the last word.

76	literal	The wind <i>moved</i> the <u>turbine</u> .
76	metaphorical	The wind <i>tickled</i> the <u>turbine</u> .
76	anomalous	The wind <i>ate</i> the <u>turbine</u> .

Task: Rapid Serial Visual Presentation (RSVP)

Following sentence presentation, participants judged if the meaning of the sentence was 1) unusual (original) and 2) appropriate (sensical).



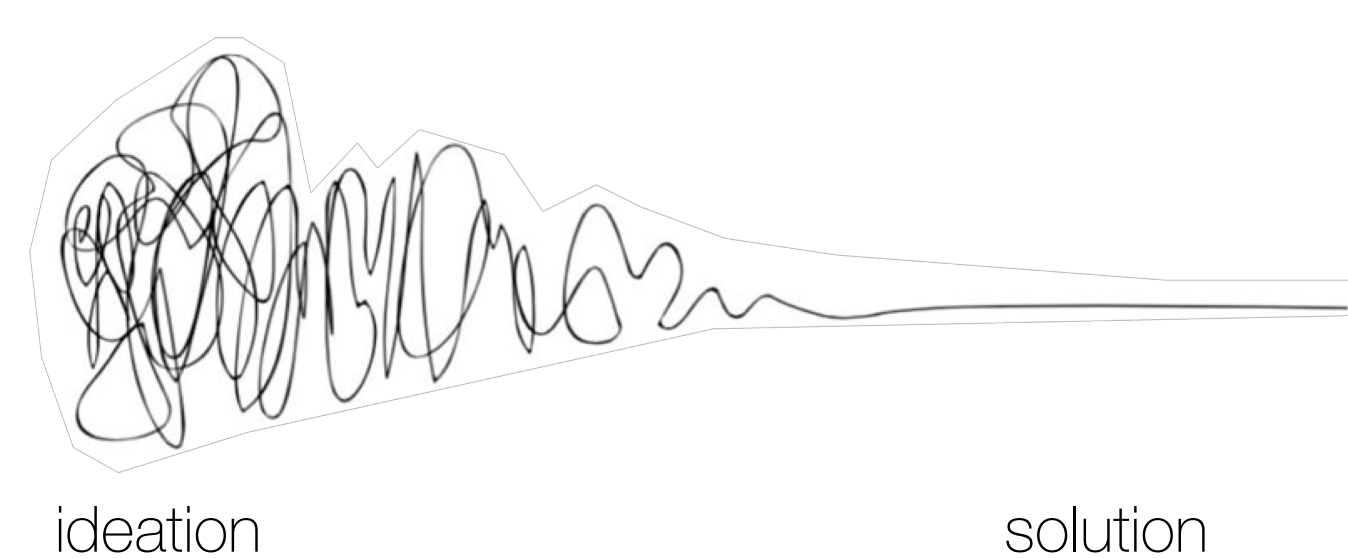
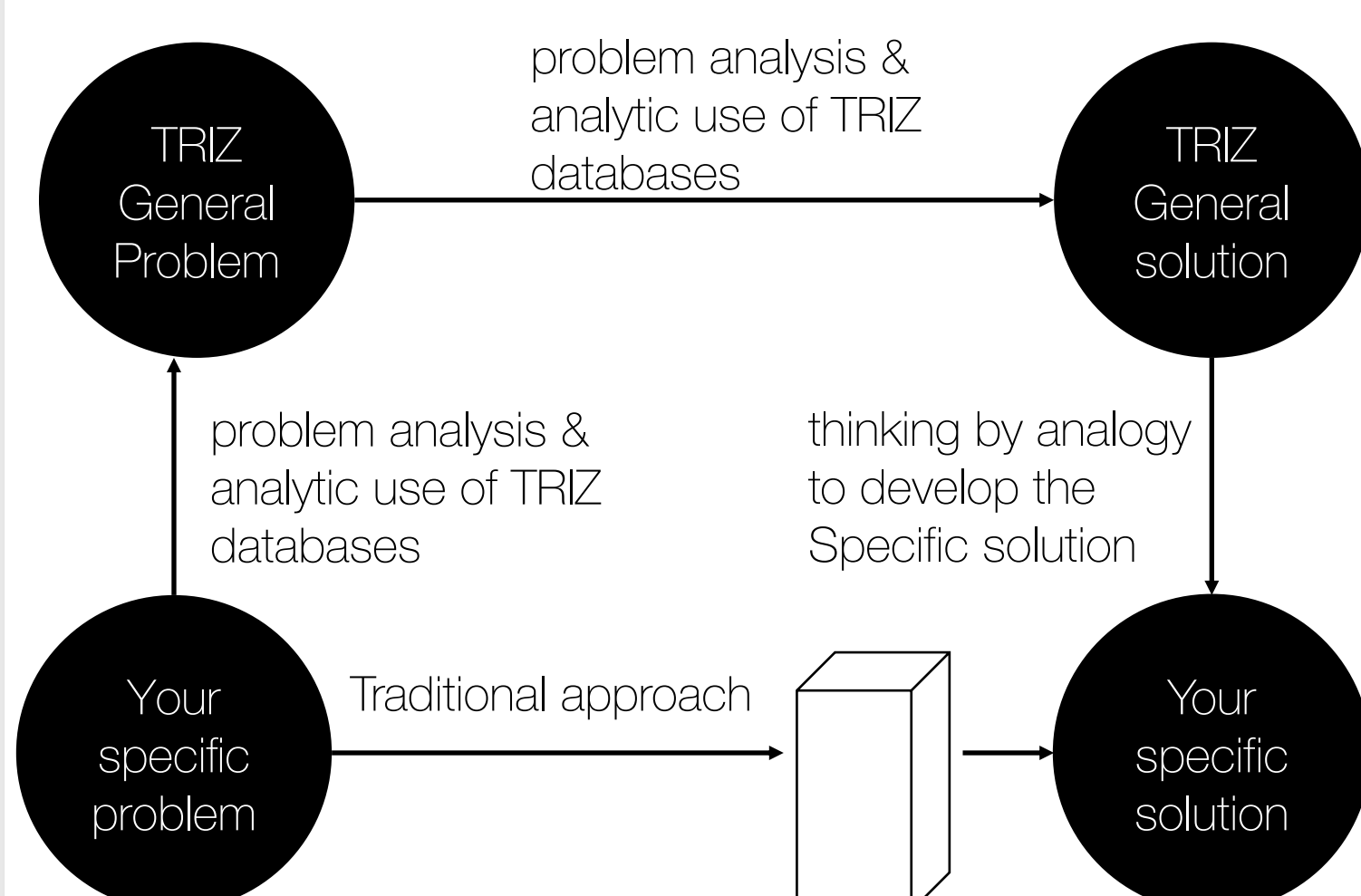
TRAINING PROCEDURES

—TRIZ training—

- TRIZ: The theory of inventive problem solving
- Genrich Altshuller (1946): Innovative thinking is more of a *systematic than intuitive* process
- problem solving strategies based on Altshuller's analysis of over 200,000 patents

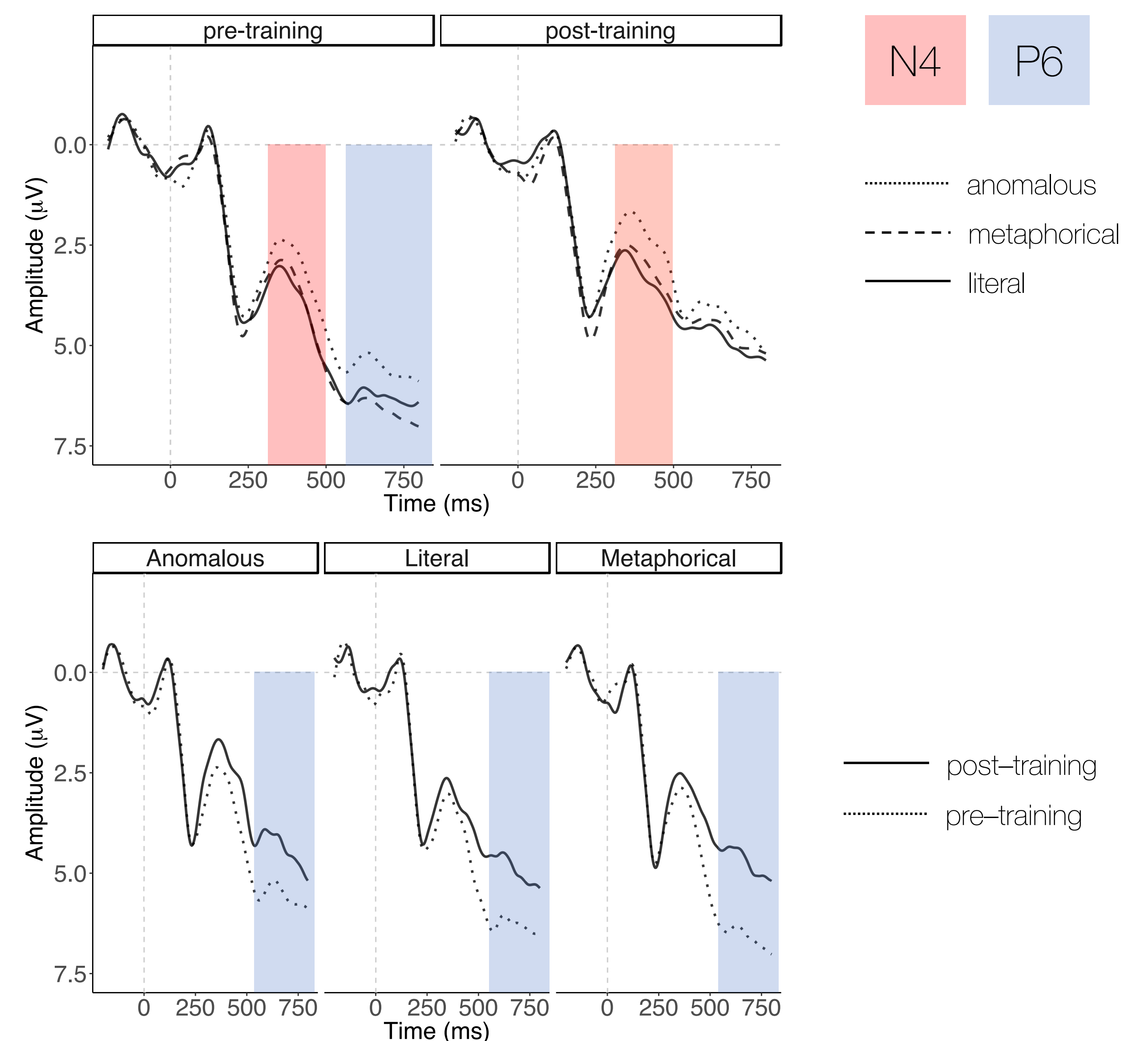
—Sketching training—

- helps to communicate concepts and develop an idea before the engineer starts the formal process of product specification
- shown to decrease cognitive work load during a design process by externalizing thoughts and information

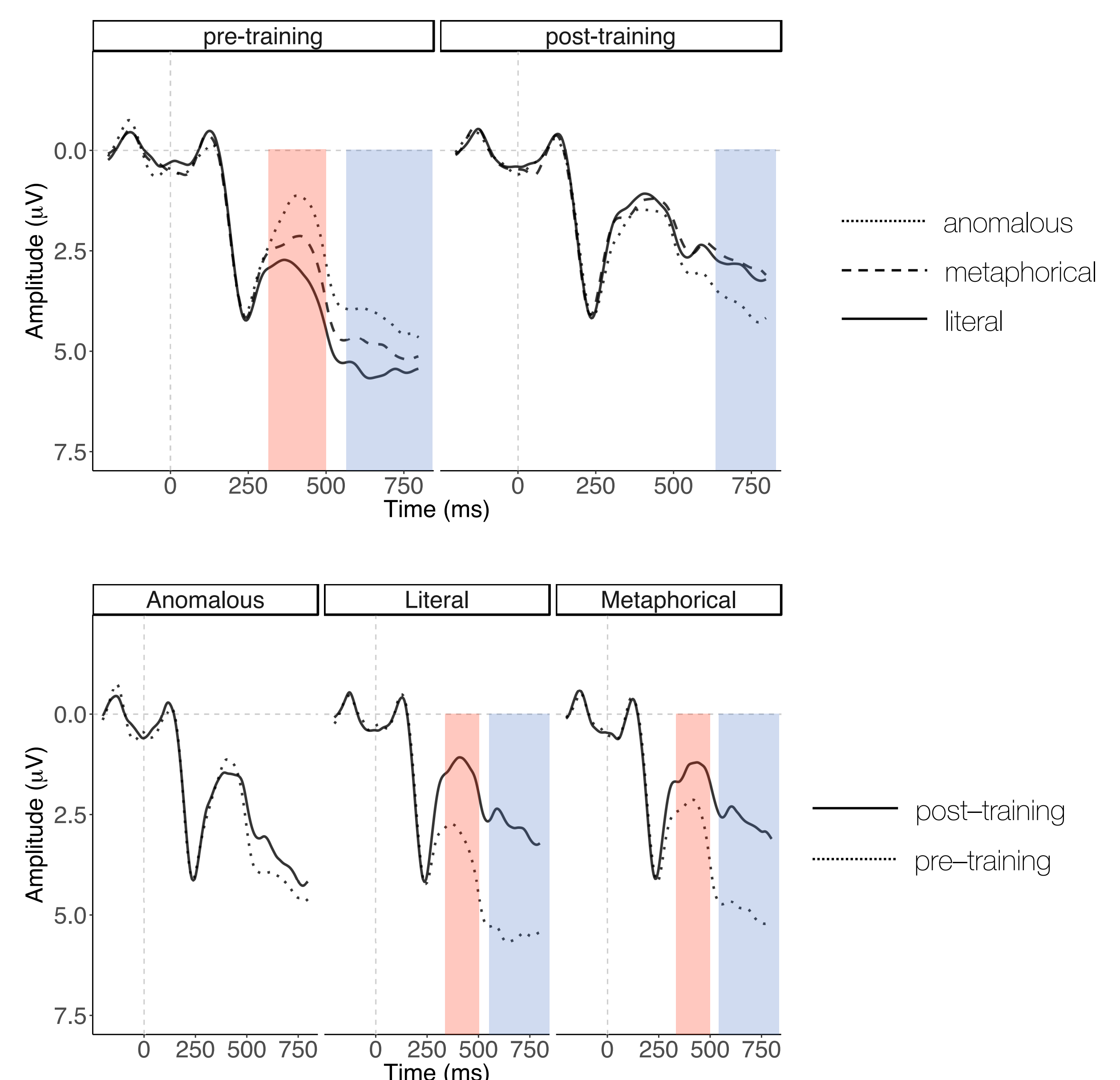


Participants: 17 (3 ♀, 14 ♂; $M_{age} = 19.6$) Participants: 17 (10 ♀, 7 ♂; $M_{age} = 19.2$)

EFFECT OF TRIZ TRAINING



EFFECT OF SKETCHING TRAINING



DISCUSSION

The present study corroborates prior work on novel metaphor processing, with overall increased N400 to anomalous sentences, followed by novel metaphorical, and literal sentences (cf., Rutter et al. 2012; Rataj et al. 2017). The EEG signal amplitude was overall reduced in both post-training sessions, indicating less effortful sentence processing. Critically, we found a differential modulation of the N400 and P600 amplitudes as a factor of type of training. Following the sketching training, participants demonstrated more enhanced N400 amplitudes to novel metaphorical and literal sentences relative to the pre-training session; this N400 effect was not found in the TRIZ training group. By contrast, the P600 amplitudes were more reduced to novel metaphorical and literal sentences following both types of training, with the effect being more robust after the sketching training. This complex pattern of results suggests that although both types of training seemed effective, the sketching training may have led to a greater facilitation of novel metaphor processing, enabling more efficient semantic re-analysis and re-integration of novel metaphors as indexed by significantly reduced P600 amplitudes.

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