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## SPATIAL CATEGORIZATION OF WORDS IN L1 AND L2

Research article

**Marchenko O.P.<sup>1,\*</sup>, Guryanov N.S.<sup>2</sup>**

<sup>1</sup>ORCID : 0000-0002-5716-6744;

<sup>2</sup>ORCID : 0000-0002-7668-7561;

<sup>1</sup>Moscow State Psychological and Pedagogical University, Moscow, Russian Federation

<sup>2</sup>University of Applied Sciences, Augsburg, Germany

\* Corresponding author ([olga.p.marchenko@yandex.ru](mailto:olga.p.marchenko@yandex.ru))

### Abstract

If the connection of the native language with motor experience has been shown in numerous studies, then the question of whether a foreign language is embodied remains unresolved. The aim of the study was to explore the relationship between the semantics of verbs and human motor experience when using native and foreign languages. One hundred twenty-four native Russian speakers (36 men, 88 women) aged 18 to 47 ( $M = 21$ ,  $SD = 4,7$ ) took part in the study. The task was to evaluate the verbs presented in the center of the screen as causing the desire to approach or withdraw. When using a native language and when using a foreign language, the categorization process proceeds in different ways, depending on whether the meaning of a word is consistent with movement in space or not. Despite the fact that a smaller quantity of significant effects was observed when using a foreign language, it is not possible to say that a foreign language is disembodied.

**Keywords:** embodied cognition, verbs, categorization, L1, L2.

## ПРОСТРАНСТВЕННАЯ КАТЕГОРИЗАЦИЯ СЛОВ РОДНОГО И ИНОСТРАННОГО ЯЗЫКА

Научная статья

**Марченко О.П.<sup>1,\*</sup>, Гурьянов Н.С.<sup>2</sup>**

<sup>1</sup>ORCID : 0000-0002-5716-6744;

<sup>2</sup>ORCID : 0000-0002-7668-7561;

<sup>1</sup>Московский государственный психолого-педагогический университет, Москва, Российская Федерация

<sup>2</sup>Университет прикладных наук, Аугсбург, Германия

\* Корреспондирующий автор ([olga.p.marchenko@yandex.ru](mailto:olga.p.marchenko@yandex.ru))

### Аннотация

Если связь родного языка с двигательным опытом показана в многочисленных исследованиях, то вопрос о воплощении иностранного языка остается нерешенным. Целью исследования было изучение связи между семантикой глаголов и двигательным опытом человека при использовании родного и иностранного языков. В исследовании приняли участие 124 носителя русского языка (36 мужчин, 88 женщин) в возрасте от 18 до 47 лет ( $M = 21$ ,  $SD = 4,7$ ). Задача состояла в том, чтобы оценить глаголы, представленные в центре экрана, как связанные с желанием приблизиться или отдалиться. Как при использовании родного языка, так и при использовании иностранного языка процесс категоризации протекает по-разному, в зависимости от того, соответствует ли значение слова совершаемому движению или нет. Несмотря на то, что при использовании иностранного языка наблюдалось меньше значимых эффектов, нельзя сказать, что иностранный язык не связан с телесным опытом.

**Ключевые слова:** воплощенное познание, глаголы, категоризация, родной язык, иностранный язык.

### Introduction

Understanding a word involves activation of the action representation associated with the word [4], [6], [9]. This process could be reflected in the accuracy and time of the categorization. The connection between the semantics of language and the body experience of a person has been widely studied within the framework of the concept of embodied cognition.

If the connection of the native language with motor experience has been shown in numerous studies, the question whether a foreign language is embodied remains unresolved [8].

The aim of the study was to explore the relationship between the semantics of verbs and human motor experience when using native (L1) and foreign (L2) languages.

The embodiment of a language is usually studied through the analysis of response speed. For example, emotional words have been shown to be classified more slowly if the movement is incongruent (arm extension is used to respond to positive words, while arm flexion is used to respond to negative words) [3], [7]. However, even similar response times may be due to different trajectories of movements, as well as different dynamics of the action. Therefore, in this study, we decided to find out how the hand moves in the interval preceding the pressing of the answer key.

To solve this kind of problem, the technique of recording the movement of a computer mouse is well suited, which has established itself as a valid tool for studying the micro-dynamics of the categorization process [5]. It can be assumed that if the domain of approach or avoidance is actualized, the readiness for the corresponding movement is also activated. This will be registered in the interval preceding pressing the answer key, even if the direction of movement (supposed by the approach or avoidance behavior) does not match the one specified by the instruction. This will be evidenced by the parameters of the

trajectory of the movement of the hand preceding the pressing of the answer key and the speed of categorization. Based on the fact that the understanding of a concept must be inextricably accompanied by the actualization of the individual's experience associated with this concept, signs of a connection between categorization and motor experience should appear not only when using the native language but also with a foreign language.

### Research methods and principles

One hundred twenty-four native Russian speakers (36 men, 88 women) aged 18 to 47 ( $M = 21$ ,  $SD = 4,7$ ) took part in the study.

The task was to evaluate the verbs presented in the center of the screen as causing the desire to approach or withdraw. Ten verbs related to moving away from oneself and 10 verbs related to moving towards oneself were used (in Russian and English). Verbs were matched by frequency [1], [2] and length in Russian and English. Participants were instructed to click on the withdrawal button at the top of the screen (moving their hand away from their body) or the approach button at the bottom of the screen (by moving the hand towards the body) in the congruent condition. The position of the keys was opposite in the incongruent condition. In the incongruent condition, verbs denoting movement towards oneself had to be evaluated by movement from oneself, and the verbs denoting movement away from oneself, by a movement towards oneself. To collect hand movement, software was used that allows tracking the trajectory of the mouse movement and register the speed indicators of this movement. X-, Y-coordinates of a computer mouse were recorded as it moves to the response key on the screen. The variables were: the length of the trajectory and the reaction time (RT). On the screen, a frame marked the working field in which the participants of the study were supposed to work. The working field for recording mouse movement was 1200x750 Px. At the beginning of each trial, the mouse cursor was in the center of the screen. To collect data on the hand movement, a program was used to track a computer mouse. According to the instructions, the participants in the study, upon presentation of the word, immediately, without hesitation, had to start moving the mouse to the answer key, indicating their attitude to the given word (to approach / or withdraw). After pressing the answer key with the mouse, the transition to the next test automatically occurred. RM ANOVA was used for analyses with movement and congruency as intra-subject factors (table 1).

Table 1 - The design of the experiment

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	Approach verb	Withdrawal verb
Toward the body	Congruent condition	Incongruent condition
Away from the body	Incongruent condition	Congruent condition

### Main results

The analyses of RT revealed significant effects of congruency and direction of the movement and for native language ( $F(1, 123) = 55,956$ ,  $p < 0,001$ ;  $F(1,123) = 7,215$ ,  $p < 0,01$ ). RT was shorter in a congruent condition in comparison to an incongruent one (fig. 1). In addition, RT was shorter when the hand moved away from the body in comparison to the RT when the hand moved toward the body.

There was a significant effect of congruency ( $F(1,123) = 36,428$ ,  $p < 0,001$ ) for foreign language as well. At the same time, the effect of movement was insignificant for foreign language ( $F(1,123) = 0,108$ ,  $p = 0,743$ ).

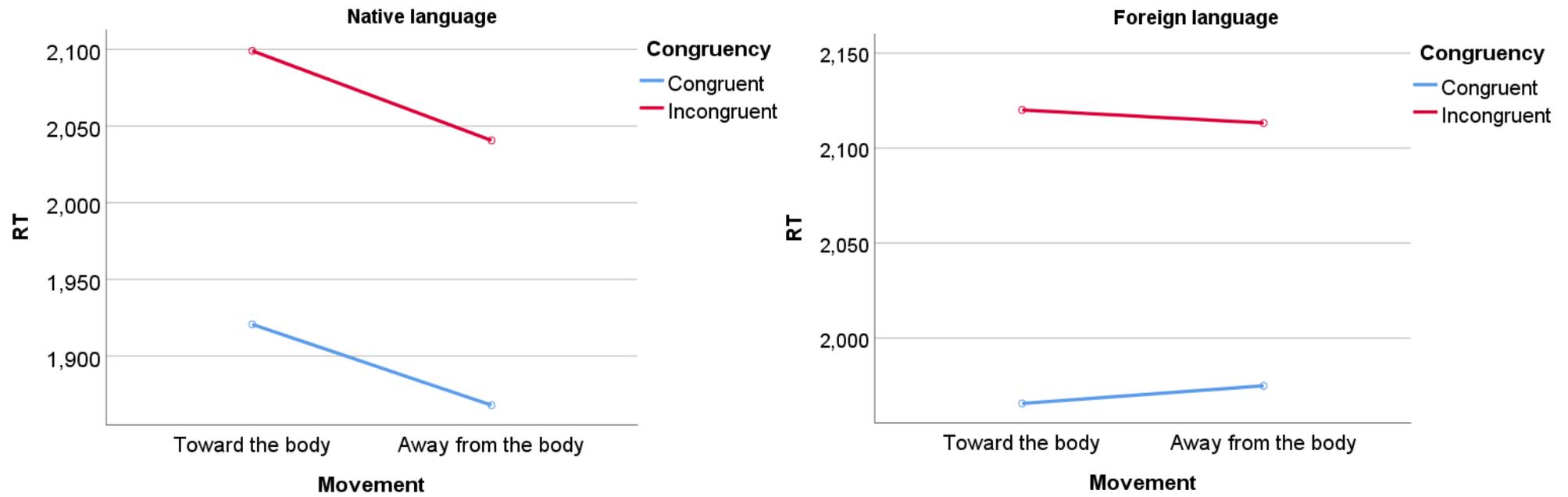


Figure 1 - RT for verbs in native and foreign language  
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Analyses of the trajectory length showed that there were significant effects of congruency for native language ( $F(1,123) = 71,501, p < 0,001$ ). The length of the trajectory was shorter when the movement was congruent to the meaning of the word. There was significant interaction between movement and congruency effects ( $F(1,123) = 4,303, p < 0,05$ ). The length of the trajectory was shorter when the hand moved toward the body in comparison to the movement away of the body for congruent condition ( $T(123) = -2.726, p < 0,01$ ). There were no significant differences for incongruent condition ( $T(123) = 0,621, p < 0,536$ ; fig. 2).

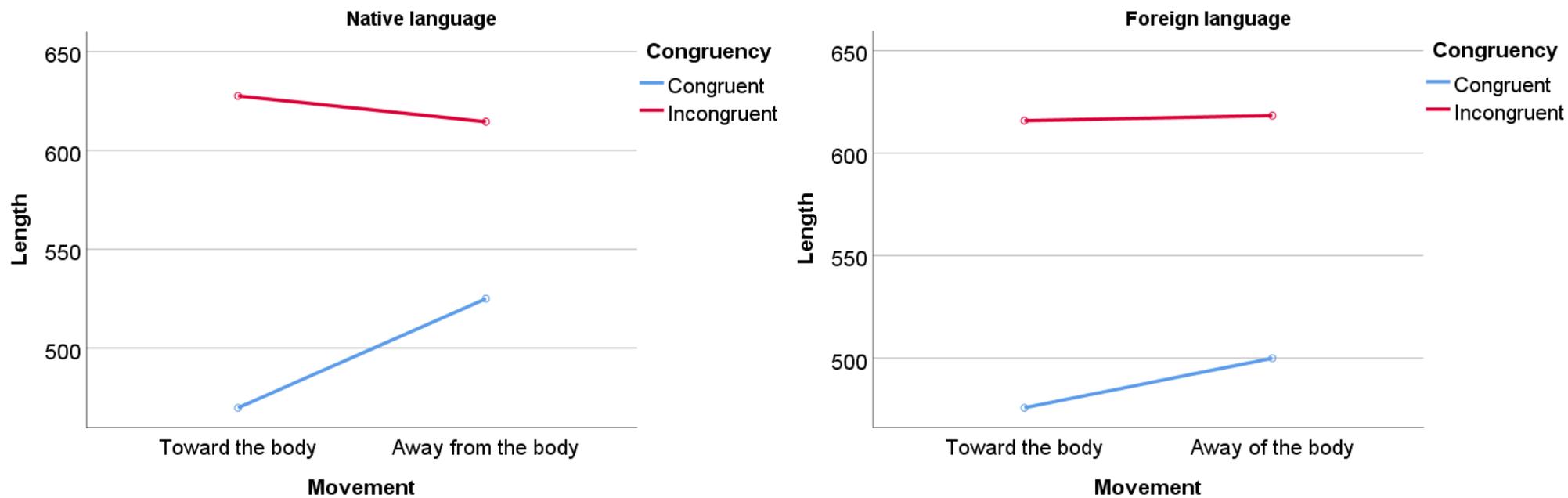


Figure 2 - Length of the trajectory of movement when using the native and foreign language  
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There was a significant effect of congruency for foreign language ( $F(1, 123) = 68,861, p < 0,001$ ). The length of the trajectory was shorter when the movement was congruent to the meaning of the word. Other effects were not significant.

### Discussion

The hand moved slower in an incongruent condition in comparison to a congruent one. In the incongruent condition, hand moved less directly to the answer key or at the first moment, hand moved to the congruent direction (that is, towards oneself in response to words associated with approach movement, and away from oneself in response to words associated with withdrawal movement), after which it turned in the direction specified by the instruction. That is why the length of the trajectory was longer in incongruent condition. Despite the smaller quantity of significant effects for a foreign language, it is not possible to say that a foreign language is disembodied. Congruency effect was significant for both native and foreign languages. This result is consistent with other data. For example, in other study verbs in native language elicited stronger sensorimotor brain activation than in foreign language which suggest stronger embodiment effects in L1 than in L2 [10]. The understanding of the verb is accompanied by the actualization of ideas about the corresponding actions in space, even if foreign language is being used.

### Conclusion

The process of extracting the meaning of a word involves the activation of the representation of the corresponding actions, the readiness for which can be observed both when using the native and foreign languages.

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Карапетова И.Н., Пятигорский государственный университет, Пятигорск, Российская Федерация  
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### Conflict of Interest

None declared.

### Review

Karapetova I.N., Pyatigorsk State University, Pyatigorsk, Russian Federation  
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