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REALITY MONITORING IN A BILINGUAL SELF-OTHER PARADIGM

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Abstract. Reality monitoring (RM) is a metamnemonic process that requires individuals to distinguish between externally and internally derived memories. Yet, cross-linguistic RM remains understudied. We investigated whether the monitoring of self- and other-generated information differs depending on the language in which the information is encoded. We found that self-generated information and information in speaker's second language was remembered better than other-generated information in the first language. Also, errors slightly differed between participants with intermediate and advanced levels of second language proficiency. Our findings suggest that processing information in the second language might require more cognitive effort, allowing for better subsequent monitoring.

Keywords: metamemory, memory errors, source monitoring, reality monitoring, bilingualism

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Introduction

Source monitoring (SM) is a post-retrieval process required for identifying the origin of information or its source (Johnson et al., 1993). According to the source monitoring framework (SMF), memories possess quantitative characteristics which, when assessed, help to determine the origin of the information. The range of these characteristics is unbounded and includes, among others, perceptual and spatiotemporal details, information about cognitive processes, affective states, public and non-public properties of the source, etc. Based on the properties of the source, three SM subtypes are distinguished. External SM (ESM) is implemented when information is perceived from the environment, such as when it is heard or seen. Internal SM (ISM) is implemented when information originated within oneself, as in thoughts or actions. Reality monitoring (RM) is a mixed type of monitoring, implemented to discriminate between internally and externally generated information (Raye, Johnson, 1980). The line between RM and ISM is obscure. Currently, RM is considered to encompass those situations that contrast perceived versus imagined information as well as situations involving action that

is self-performed versus other performed. While it seems that both types of situations rely on a sense of agency as the key characteristic that allows for such discriminations, further research is required to clarify whether they indeed rely on the same mechanisms.

In general, SM is considered to be more sensitive to manipulations of information characteristics than old versus new recognition. Different studies point out the differences in bilingual information processing and resulting memory (Aydin, Ceci, 2013; Fausey et al., 2010), as well as the differences between SM subtypes (Leynes et al., 2005; Mondino et al., 2016). However, cross-linguistic SM, let alone its subtypes, remains understudied. To our knowledge, none of the studies investigated the relationship between internal/external features of the source and the language in bilingual speakers. In this study, we investigated how well Russian-English bilinguals can process and recall the modality (self-generated or other-generated) of information presented in their first or second language. We expected that overall accuracy would be better for the second language (English) and self-generated information, as the processing of this information would result in more characteristics, allowing for better recognition during a test.

Method

We recruited 112 highly proficient unbalanced bilingual speakers of Russian and English, with English being their second language (98 females; mean age = 22.4, *SD* = 4.6 years; mean level of English proficiency = 20 out of 25 points, *SD* = 2.5). For all of them Russian was their native language, and they started acquiring English later in life. We used a 2 (language: first, second) × 2 (modality: self-generated, other-generated) within-subject design. First, participants read aloud (self-generated condition) or listened to (other-generated condition) a total of 20 words presented on a screen in their first or second language. Then they completed a combined RM (modality) and SM (language) task. They had to indicate whether the word was previously "read in English", "heard in English", "read in Russian", "heard in Russian", or "new" for the words that had not been presented in the encoding part of the experiment. The words were retrieved from Hoffman and colleagues (Hoffman et al., 2011) and the Database of Russian Verbs and Nouns (Akinina et al., 2015), matched in frequency and counterbalanced across 4 conditions.

Results

We analyzed the proportions of correct and incorrect answers. A 2 *modality* (said, heard) × 2 *language* (Russian, English) repeated measures ANOVA with the proportion of correct responses (Table 1) showed a main effect of *language* but not of *modality* ($F(1, 111) = 136.918$, $p < .001$, $\eta_p^2 = .552$; $F(1, 111) = 3.387$, $p = .068$, $\eta_p^2 = .030$, respectively). Accuracy was higher for English ($M = .72$, $SD = .05$) than for Russian words ($M = .44$, $SD = .44$), however, there was no significant difference between accuracy for the said ($M = .56$, $SD = .28$) and heard ($M = .60$, $SD = .11$) modalities. The interaction between *modality* and *language* was significant ($F(1, 111) = 32.999$, $p < .001$, $\eta_p^2 = .229$). There was higher proportion of correct re-

sponses for the heard than for the said modality when words were presented in Russian ($t(111) = 5.356$, $p < .001$, $d = 0.506$); for words presented in English, the direction of the results was opposite: correct responses for the said modality were higher than for the heard modality ($t(111) = 2.630$, $p = .010$, $d = 0.249$).

Table 1. Proportions of Correct Responses for Full Sample

Modality	Language	
	Russian	English
said	.35 (.27)	.75 (.22)
heard	.51 (.27)	.67 (.24)

Note. Standard deviations are in parentheses.

Separate analyses of RM and SM further elaborated these findings. For RM (Fig. 1), new information was identified better than said ($t(111) = 11.468$, $p < .001$, $d = 1.084$) or heard ($t(111) = 8.728$, $p < .001$, $d = 0.825$), and the proportion of correct attributions for said items was the lowest among the three categories ($t(111) = 2.740$, $p = .020$, $d = 0.259$). Reality monitoring errors were investigated with Student's t-tests for incorrect modality attributions (said-to-heard, said-to-new, heard-to-said, heard-to-new, new-to-said, new-to-heard). For both said and new words, misattributions to heard words were significantly higher than to the respective alternatives (said-to-new: ($t(111) = 5.619$, $p < .001$, $d = 0.531$; new-to-said: $t(111) = 9.879$, $p < .001$, $d = 0.934$). For heard words, however, misattributions were higher in favor of new words rather than said ones ($t(111) = 5.857$, $p < .001$, $d = 0.553$).

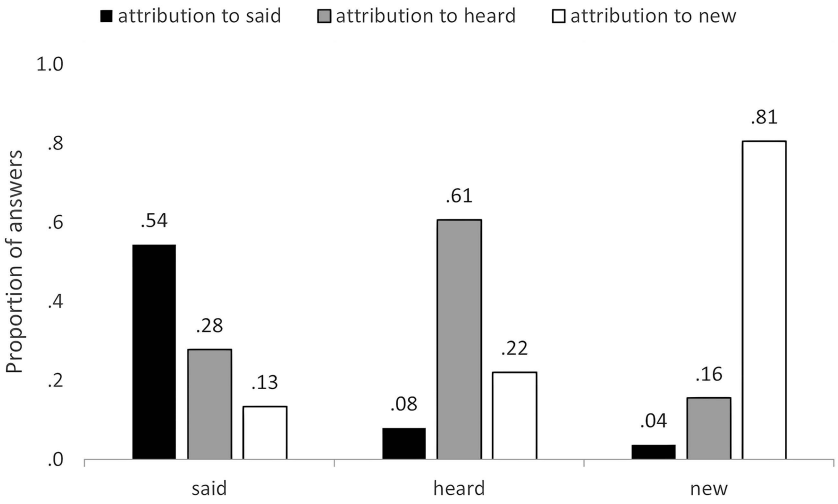

Figure 1. Proportion of correct and incorrect answers for reality (modality) monitoring

For SM (Fig. 2), the accuracy for information in the first language was the lowest among the options ($t(111) = 11.931$, $p < .001$, $d = 1.127$). Source monitoring errors were investigated with Student's *t*-tests for incorrect language attributions (Russian-to-English, Russian-to-new, English-to-Russian, English-to-new, new-to-Russian, new-to-English). For both Russian (words presented in Russian language) and new words (words not presented during encoding), incorrect attributions to English were lower than to the alternative options (Russian-to-new: $t(111) = 5.978$, $p < .001$, $d = 0.565$; new-to-Russian: $t(111) = 3.434$, $p < .001$, $d = 0.324$). However, for English words (words presented in English language), there was no significant difference in misattributions to Russian or new words ($t(111) = .878$, $p = .382$, $d = 0.083$).

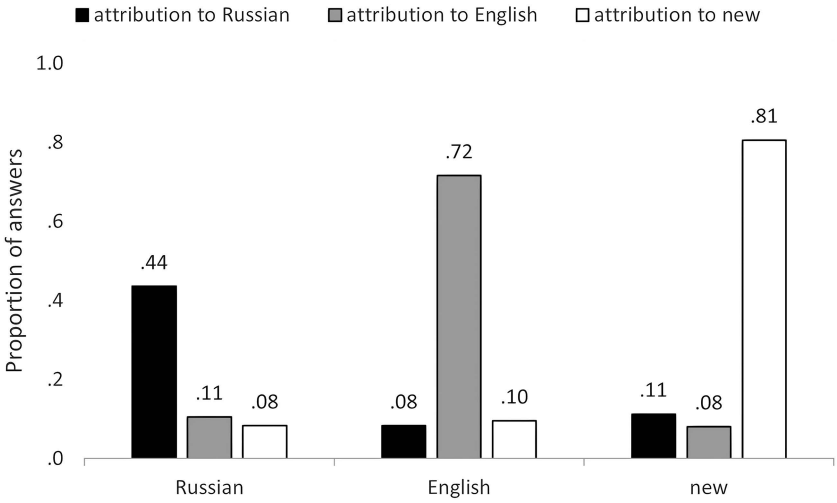

Figure 2. Proportion of correct and incorrect answers for source (language) monitoring

We also found that these patterns remain persistent between participants with intermediate and advanced levels of second language proficiency. However, there were also some notable differences in SM misattributions (Figure 3). Specifically, for new information, only intermediate bilingual speakers favored the first over the second language as the erroneous options ($t(55) = 3.190$, $p = .002$, $d = 0.426$), whereas advanced bilingual speakers did not distinguish between them ($t(55) = 1.234$, $p = .223$, $d = 0.165$).

Discussion and Conclusions

Our findings suggest that processing information in a speaker's second language might require more cognitive effort allowing for better monitoring which is reflected in a lower proportion of correct identifications of first language words. Moreover, the level of bilingual proficiency might affect this process as shown by

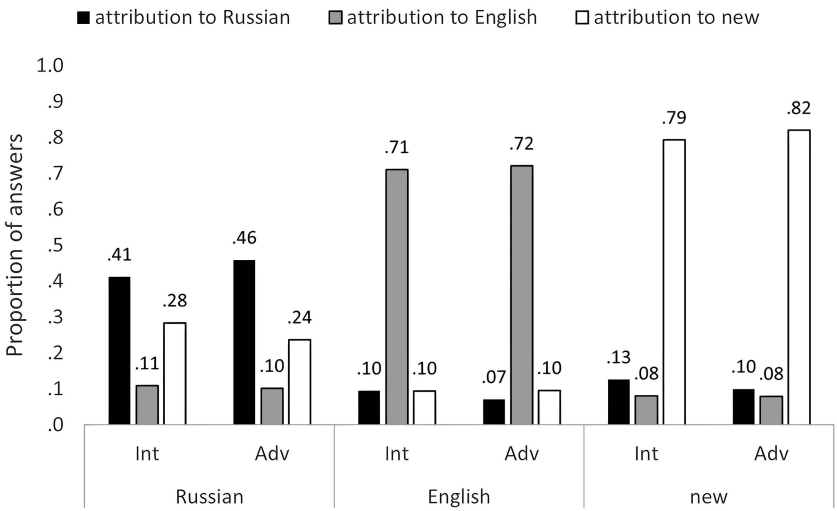

Figure 3. Proportion of correct and incorrect answers for source (language) monitoring for participants with Intermediate (56 participants, 48 females; mean age = 22.1, *SD* = 4.5 years; mean proficiency = 18 out of 25 points, *SD* = 1.3) and Advanced (56 participants, 50 females mean age = 22.87, *SD* = 4.8 years; mean proficiency = 23 out of 25 points, *SD* = 1.5) levels of English proficiency

the differences in misattributions, particularly with new words. Memory errors, such as source misattributions or reality distortions, can have serious implications for people's lives. To compensate for such situations in healthy and clinical populations, a general understanding of the mechanisms underlying mnemonic processes needs further investigation. With the increase of bilingual populations all over the world, it is also important to investigate the possible effects of various language(s) on these processes. Being the first bilingual RM paradigm, this study, therefore, provides theoretical and practical insights on the influence of a language on memory errors and information processing in bilingual speakers, and it serves as the basis for further research of these phenomena.

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МОНИТОРИНГ РЕАЛЬНОСТИ В ДВУЯЗЫЧНОЙ ПАРАДИГМЕ «Я — ДРУГОЙ»

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Аннотация. Мониторинг реальности — это метамнемонический процесс, при котором люди различают воспоминания, полученные из внешних и внутренних источников. Кросс-лингвистический мониторинг реальности остается недостаточно изученным. В этом исследовании мы изучали, различается ли мониторинг информации, сгенерированной самостоятельно или другим человеком, в зависимости от языка, на котором информация была изучена. Мы обнаружили, что самостоятельно сгенерированная информация и информация на втором языке запоминалась лучше, чем информация, сгенерированная другими людьми, и информация на родном языке, и что ошибки участников немного отличались между участниками со средним и продвинутым уровнями владения вторым языком. Наши результаты показывают, что обработка информации на втором языке может потребовать больше когнитивных усилий, что позволит улучшить ее последующий мониторинг.

Ключевые слова: метапамять, ошибки памяти, мониторинг источника, мониторинг реальности, билингвизм

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