



PILOT STUDY

VERBAL WORKING MEMORY ASSESSMENT IN RUSSIAN-BRAZILIAN PORTUGUESE BILINGUALS

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ABSTRACT

In Brazil, the learning of a second language (L2) by speakers of Brazilian Portuguese as a first language (L1) has been extensively explored, but studies on language processing and language interaction among bilinguals are quite recent. The late bilingualism of the first-generation immigrants has been studied mainly from the perspective of their difficulties in learning Brazilian Portuguese. Brazil has numerous communities of heritage speakers of many languages such as Japanese, German, Italian, Polish, Ukrainian, and Russian. However, the number of studies that focus on the bilingual speech of heritage speakers in Brazil is quite limited. The aim of the current study is to assess the working memory in Russian-Brazilian Portuguese bilinguals as a function of the tested language and language dominance profiles. For this purpose, 49 first-generation Russophone immigrants and 28 elderly Russian heritage speakers, all residing in Brazil, were tested in Russian and Portuguese using a Month-Ordering task. We found that

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the working memory scores of the first-generation Russophone immigrants were not statistically different between both languages, but the median working memory score of the elderly Russian heritage speakers in Russian was 1.5-fold lower than in Portuguese. As next steps, we plan to verify the relation between the working memory capacity and narrative production abilities of the elderly Russian heritage-Brazilian Portuguese bilinguals in their heritage and societal languages.

RESUMO

No Brasil, o campo de aprendizagem de L2 por falantes de português brasileiro como L1 é amplamente explorado, mas os estudos sobre o processamento de linguagem e a interação entre as línguas em bilíngues são bastante recentes. O bilinguismo tardio dos imigrantes de primeira geração é estudado principalmente com foco nas dificuldades de aprendizagem do português brasileiro. O Brasil tem inúmeras comunidades de falantes de herança de várias línguas, como japonês, alemão, italiano, polonês, ucraniano e russo. No entanto, no Brasil, o número de estudos que enfocam a fala de falantes de herança é bastante restrito. O objetivo do presente trabalho é avaliar a capacidade de memória de trabalho em indivíduos bilíngues em russo e português brasileiro e verificar se ela varia em função do idioma testado e do perfil de dominância linguística. Para esse fim, 49 imigrantes russófonos de primeira geração e 28 falantes de russo de herança idosos, todos residentes no Brasil, foram testados em russo e português, por meio da tarefa de organização da ordem de meses. Apontamos que os *scores* de avaliação de memória de trabalho dos imigrantes russófonos de primeira geração não diferem estatisticamente entre as duas línguas, mas que os *scores* de memória de trabalho dos falantes de russo de herança idosos em russo se mostraram 1,5 menores do que em português. Nas próximas etapas, pretendemos verificar a relação entre a capacidade de memória de trabalho e o desempenho na produção narrativa dos falantes de russo de herança idosos, bilíngues em português, nas duas línguas.

KEYWORDS

Bilingualism; working memory; Brazilian Portuguese as L2; heritage Russian; Russophones.

PALAVRAS-CHAVE

Bilinguismo; memória de trabalho; português brasileiro como L2; russo como língua de herança; russófonos.

INTRODUCTION

There are different definitions of bilingualism. Here we follow the definition of bilingualism as the use of two or more languages (or dialects) in everyday life (GROSJEAN; LI, 2013). This definition does not presuppose “native-like” proficiency: the languages can be acquired simultaneously or sequentially, language skills (speaking, listening, reading, and writing) can be unbalanced, the proficiency level and the size of vocabulary in each language may vary in different contexts.

The bilingual profiles of the speakers depend on the language dominance that includes the use of languages across the lifespan, language attitudes, and proficiency as one of its components (BIRDSONG, 2006; BEDORE et al., 2012). This is especially important to discuss in the context of migrant generations. The first-generation immigrants who came to a new country as adults maintain their first language as dominant for the rest of their lives; the next generations acquire the societal language within the primary education system and are considered to be heritage speakers of the language spoken by their parents (ALBA et al., 2002; BAHRICK et al., 1994; CONNAUGHTON-CREAN; Ó DUIBHIR, 2017; PORTES; HAO, 1998; SEVINÇ, 2016).

Heritage speakers represent a special category of bilinguals who were exposed to their first language (L1) at home in the childhood, but later acquired the societal language that became dominant (D’ALESSANDRO; NATVIG; PUTNAM, 2021; CUMMINS, 2005; POLINSKY; KAGAN, 2007). The interference of the societal language on their pronunciation in the heritage language is often not notable, and they have a special phonetic advantage in re-learning the heritage language (AU et al., 2008; AU; ROMO, 1997). At the same time, their vocabulary in L1 is rather limited, and their usage of grammar structures in L1 is generally influenced by transfer from their dominant societal language. Thus, the bilingual heritage speakers represent a very special category of bilinguals to be studied in relation to language processing (D’ALESSANDRO; NATVIG; PUTNAM, 2021; BOLGER; ZAPATA, 2011). The research on heritage speakers can address such issues as the developmental trajectories of heritage grammars across the lifespan as well as the potential universal features and generalizable tendencies of human language (D’ALESSANDRO; NATVIG; PUTNAM, 2021). The studies of elderly individuals who represent the final generation of proficient speakers of a moribund heritage language are of special interest: this unique language material is lost in their next generation.

In Brazil, the learning of a second language (L2) by speakers of Brazilian Portuguese as L1 has been extensively explored, but studies on language processing and language interaction among bilinguals are quite recent (ZIMMER; FINGER; SCHERER, 2008). The late bilingualism of the first-generation immigrants has been studied mainly from the perspective of their difficulties in learning Brazilian Portuguese (SMIRNOVA HENRIQUES;

BARROS; MADUREIRA, 2020). Brazil has numerous communities of heritage speakers of many languages such as Japanese (ABREU MORATO, 2011; NAWA, 1988); German, including the Hunsrückisch dialect (ALTENHOFEN; MORELLO, 2018; GEWEHR-BORELLA; ZIMMER; ALVES, 2011; KRAMER; MOTA, 2015); Italian, including a north Italian dialect Talian/Venetian (BENINCÁ, 2018; COMIOTTO; MOTA; SOARES, 2020; FAGGION; LUCHESE, 2016); Polish (COSTA; LOREGIAN-PENKAL, 2015; MILESKI, 2017); Ukrainian (COSTA; LOREGIAN-PENKAL, 2015); and Russian (RUSEISHVILI, 2016; VOROBIEFF, 2006). However, the number of studies that focus on the bilingual speech of heritage speakers in Brazil is quite limited (COMIOTTO; MOTA; SOARES, 2020; NAWA, 1988; BORSTEL, 1992).

Our group has recently begun studying the late bilingualism of the first-generation Russophone immigrants in Brazil who arrived from the former Soviet Republics, and characterized special features of their speech in Brazilian Portuguese (SMIRNOVA HENRIQUES et al., 2019; SMIRNOVA HENRIQUES et al., 2020). Our new project aims to characterize the speech of elderly Russian heritage speakers in Brazil who arrived as children in the 1950s or were born in Brazil in Russophone immigrant families that left Russia after the Bolshevik Revolution (SMIRNOVA HENRIQUES et al., 2021). Samples of these bilinguals' speech productions have been collected for the construction of the BraPoRus (Brazilian Portuguese Russian) corpus (SMIRNOVA HENRIQUES et al., 2021). Some additional protocols for the characterization of the language processing by these speakers have been included, for example, the analysis of the narrative abilities in Russian and Portuguese using the MAIN (Multilingual Assessment Instrument for Narratives, GAGARINA et al., 2016) protocol.

Narrative abilities depend on the working memory in both monolingual and bilingual elderly adults (KORMOS; TREBITS, 2011; TSIMPLI et al., 2014; TSIMPLI; PERISTERI; ANDREOU, 2016), hence the necessity to first establish a protocol for the assessment of the working memory capacity. The comparison between the performances on working memory capacity in Russian and Portuguese of the two groups residing in Brazil, the first-generation immigrants, dominant in Russian, and the heritage Russian speakers, dominant in Portuguese, also can bring new insights about the relation between working memory capacity and language dominance.

The aim of the current work is to assess the working memory capacity as a function of the tested language and language dominance profiles in two groups of Russian-Brazilian Portuguese bilinguals residing in Brazil: (i) the first-generation immigrants who acquired Russian as children, in Russian-speaking homeland, and Portuguese as adults (see Section 1.2) and (ii) the Russian heritage speakers who acquired Russian as children, at home in Brazil or other non-Russian-speaking country, but spent most of their time in Brazil and speak Portuguese as the societal language (see Section 1.1). For this purpose, 49 first-generation Russophone immigrants and 28 elderly Russian heritage speakers, all

residing in Brazil, were tested in Russian and Portuguese using a Month-Ordering task (GORAL et al., 2011; KEMPLER et al., 1998). The working memory spans were assessed in each group for both languages. Correlations with age and, whenever possible, time of residence were verified

1. THEORETICAL BACKGROUND

1.1. RUSSOPHONE IMMIGRATION WAVES IN BRAZIL IN THE 20TH CENTURY

Russophone migration to Brazil can be analyzed in four periods (RUSEISHVILI, 2016). The first period, on the turn of the 19th to the 20th century, concerns arrival of the immigrants from the Russian Empire (BYTSENKO, 2006). The Russian German and religious minorities immigrants were farmer families headed for the south and south-east of Brazil as a part of the government campaign for colonization, settlement and *branqueamento* (whitening policies) of the Brazilian population by the European immigrants. At the beginning of the 20th century, the Russian Jews from the south-east region of the Russian Empire were fleeing from pogroms and discrimination. These immigrants settled in the big cities in the Brazilian South-East, mainly in São Paulo (BLAY, 2013).

The second period lasted from the revolution of 1917 and Russian civil war to the Second World War (RUSEISHVILI, 2016). In 1921, around one thousand stateless refugees, ex-soldiers and military officials of the counter-revolutionary White Army arrived in São Paulo. These people were treated as immigrants and sent to the rural regions for coffee production; however, in a short time, they were emancipated and settled in the big cities, above all, in São Paulo. In the 1920s, the rearrangement of the borders in the Eastern Europe displaced one more immigrant group: Bessarabian peasants. Between 1920 and 1927, around 29,000 immigrants from Bessarabia, registered as “Romanians”, but predominantly Russophones, entered the state of São Paulo (RUSEISHVILI, in press). Along the 1930s, another group of stateless Russophones under the Nansen International Office for Refugees protection was resettled from prewar Europe to Brazil.

Any numerical estimate is hard to obtain, but the Brazilian population census data provide some information. The National Census of 1920 registered 32,299 Polish immigrants and 28,941 immigrants from Russia, these numbers corresponded to 2.1% and 1.8% of the total amount of foreigners in Brazil, respectively (IBGE, 1927). In 1940, there were 47,039 Polish immigrants in Brazil (3.4% of total), 27,001 Russians (2.2%), 15,387 Lithuanians (1.3%), 13,725 Romanians (1.2%), and 12,841 Hungarians (1.1%), among others (IBGE, 1950).

The third period of Russian-speaking immigration began after the end of the Second World War. In virtue of the low accuracy regarding migrant registration by Brazilian

authorities, the exact number of Russophones who entered Brazil over that period is not known. Between 1947 and 1949, the state of São Paulo registered the arrival of 760 Russians, 808 stateless people, 2,963 Polish and 1,080 Ukrainians (RUSEISHVILI, 2018). Furthermore, in the 1950s, Brazil, by rough estimates, accepted up to nine thousand Russophone refugees from China. They had resided in China since the implantation of the Soviet State, but the advance of the Chinese communism forced them to ask for asylum to the other countries. By the reason of the quotas already set by the US government on that moment, the main destinations for these immigrants were the countries of South America and Australia (RUSEISHVILI, 2018).

In Brazil, the Russophone immigrants from China settled in big urban centers, mainly in São Paulo and Rio de Janeiro. They were younger than Russophone people displaced from Europe: among the heads of the families, 45% were between 30 and 39 years old (RUSEISHVILI, 2018). Likewise, there was a great number of children: 44% of total number of Russophones arrived from China were infants and young people less than 29 years old. In the context of a large amount of the single-parent families headed by women, the matter of the childcare was extremely serious. To help them, the oriental order catholic authorities founded two Russian boarding schools: in 1954, São Vladimir Institute (school for boys) in Itu, the hinterland of the state of São Paulo (transferred to Santos in 1958); and in 1958, Santa Olga Institute (school for girls) in Resende, the hinterland of Rio de Janeiro state (HIGA, 2015; VOROBIEFF, 2006). In the 1960s, both institutes moved to the Ipiranga district in São Paulo city. Both schools taught theology, Russian culture and language. All other classes were attended in Brazilian schools. In this way, the children were living in the bilingual environment, having daily contact both with the Portuguese and Russian languages. In the 1970s, when the children of this generation had grown, both schools were closed. By rough estimate based on the IBGE 1950 census (IBGE, 1956), one thousand and half these immigrants could be still alive.

Nowadays, the Chinese Russophone emigrants, their children, and descendants from previous Russophone immigrant waves that live in Brazil and preserve their Russian speech present a great interest for heritage language research. Their next generations rarely maintain proficiency in Russian, and this Brazilian variety of the heritage Russian can be considered moribund.

1.2. RUSSOPHONE IMMIGRATION IN BRAZIL IN THE 21ST CENTURY

The fourth period of the Russophone immigration began with the dissolution of the Soviet Union. The collapse of the Soviet Union in 1991 induced a new wave of emigration both from Russia and other former Soviet Republics (ALESHKOVSKI; GREBENYUK; VOROBYEVA, 2018). According to the *Rosstat* (Russian Federal State Statistics Service) data, approximately 4.3 million people left the Russian Federation during 1993–2016, most

of them in the early 1990s (VOROBYEVA; ALESHKOVSKI; GREBENYUK, 2018). In the following years, the number of emigrants gradually decreased until 2009; since 2010, the number of emigrants has been once again steadily increasing. These numbers could be underestimated 3-4-fold due to the gaps in the migration registration system (VOROBYEVA; ALESHKOVSKI; GREBENYUK, 2018). The International Organization for Migration (IOM) World Migration Report (2018, p. 19, p. 68) shows that the Russian Federation had the third largest population of its citizens living abroad in the world after India and Mexico, at over 10 million emigrants in 2015. Among the reasons for the emigration are poor prospects for the improvements of material welfare, social status, personal stability, and economic security (VOROBYEVA; ALESHKOVSKI; GREBENYUK, 2018). The Russian citizens search for employment in foreign scientific centers and universities, turn into entrepreneurs, use hosting programs for ethnic migrants, and even apply for asylum. In addition, marriages in host countries have become an important emigration reason since 2001.

In the last 20 years, 7031 Russian citizens were registered by the Brazilian Federal Police in the national register of foreigners authorized to reside in Brazil, as well as 4261 Ukrainians, 548 Kazakhstani and 265 Belarusians (SISMIGRA, Banco Interativo, 2020; SMIRNOVA HENRIQUES; RUSEISHVILI, 2020). Russophones from the former Soviet Republics, not registered as Russians, also represent an important part of the Russian-speaking community. The annual report on the inclusion of immigrants in the Brazilian labor market shows Russians among 15 nationalities who get the greatest number of work permits (QUINTINO; TONHATI, 2017). To study the late bilingualism of such first-generation immigrants, we have recently created a database that contains audio and video recordings of speech samples in Russian and Portuguese produced by 40 speakers of Russian as L1 who reside in São Paulo (SMIRNOVA HENRIQUES et al., 2020).

Many of the Russophone immigrants marry Brazilians and give rise to a next immigration generation who are heritage speakers. The major cities of Brazil, São Paulo, and Rio de Janeiro, have Russian Saturday schools/kindergartens for bilingual children. “Clube Eslovo” (São Paulo) and “Escolinha Russa” (Rio de Janeiro) reported that they had up to 20 children in the best moments of their projects. In São Paulo, the most numerous age group in 2019 was 4–5-year-old children; in Rio de Janeiro, in 2018, 1-4 year-old.

1.3. BILINGUALISM AND LANGUAGE DOMINANCE

Language dominance is a central theme in bilingual studies, and it can be easily conflated with language proficiency (BIRDSONG, 2006). However, proficiency in terms of bilingual language skills, such as grammar usage or vocabulary size, is often considered in relation to monolingual language use expectations (BEDORE et al., 2012), while dominance derives from a bilingual nature, coexistence of two languages in one

mind (GROSJEAN, 1998). Language dominance is multidimensional in nature, and proficiency is only one of its components (BIRDSONG, 2006; BEDORE et al., 2012). There is no common way to determine language dominance in bilinguals. Self-report instruments which rely on subjective information are predominant in this area. Some examples include the Language Experience and Proficiency Questionnaire (LEAP-Q) (MARIAN; BLUMENFELD; KAUSHANSKAYA, 2007), the Bilingual Dominance Scale (BDS) (DUNN; FOX TREE, 2009), and the Bilingual Language Profile (BLP) (BIRDSONG; GERTKEN; AMENGUAL, 2021). There are also objective tests, for example, measures of lexical richness through standardized diversity scores (TREFFERS-DALLER, 2011) or a combination of sentence repetition tasks, translation tasks, and evaluation of foreign accent degree (FLEGE; MACKAY; PISKE, 2002).

As a theoretical background for different strategies for lexical measures, Faria (1996) described the interdependence relations between language and cognition that co-exist in the form of verbal language, perception, attention, and memory. These interdependences become evident in tip-of-tongue states, lexical access difficulties, interference of L2 lexical items in L1 language production, lack of awareness about meaning differences, and in cases when one lexical item activates other semantic domains.

The evaluation of language dominance through foreign accent ratings is based on results of phonetic experimental research that point out bilinguals develop links across the languages they speak (PISKE; MACKAY; FLEGE, 2001). This is the case of cross-language assimilations of L2 sounds to L1 sounds and the fact that “bilinguals strive to maintain contrast between L1 and L2 phonetic categories, which exist in a common phonological space” (FLEGE, 1995, p. 239). Simonet (2019), analyzing the phonetic behavior of proficient Catalan-Spanish bilinguals, found that non-dominance in one of the languages induced the lack of sound categorization, and results in more processing time and longer speech acoustic inputs to categorize the speech sound contrasts.

The evaluation of language dominance in heritage speakers should consider that this type of bilinguals uses the two languages in different situations, for different purposes and with a different intensity across the lifespan (MONTRUL, 2015). This results in varied fluency and proficiency levels in distinct language skills (listening, speaking, reading, and writing). The speech productions of heritage speakers differ not only based on their linguistic input in the first years of life but also on the patterns of language usage as adults.

1.4. VERBAL WORKING MEMORY IN BILINGUALS

All speaking processes – from intention to internal speech production – perform as part of the mental processes ruled by the working memory (FORTKAMP, 1999), which is responsible for the temporary maintenance and ongoing manipulation of verbal

information (BADDELEY, 1986). The working memory is a part of the domain-general executive function network (BIALYSTOK, 2009; CONWAY et al., 2005). The relations between the verbal working memory and language acquisition, comprehension, and production have been extensively studied (ACHESON; MACDONALD, 2009; FORTKAMP, 1999; MASCARELLO, 2012; WEISSHEIMER; MOTA, 2009).

The majority of the publications devoted to the assessment of the working memory in bilinguals compare monolinguals and bilingual groups (BIALYSTOK, 2009; LEHTONEN et al., 2018; LUKASIK et al., 2018). Some studies also compared the working memory capacity between two languages of a bilingual (ARDILA et al., 2000; GUTIÉRREZ-CLELLEN; CALDERÓN; WEISMER, 2004; HUMMEL, 2002; OSAKA; OSAKA, 1992; OSAKA; OSAKA; GRONER, 1993; XUE et al., 2004). Many theoreticians claim that bilinguals have one conceptual and two separate lexical stores for each language (BOT et al., 1995; GROSJEAN, 1982; PARADIS, 1985; POULISSE, 1993). Thus, the working memory capacity in the two languages of a bilingual can vary. The performance can be affected by the nature of the task, speaker's language preference and proficiency (GUTIÉRREZ-CLELLEN; CALDERÓN; WEISMER, 2004).

Xue et al. (2004) showed that unbalanced Chinese-English bilinguals with lower proficiency in L2 performed better in semantic and phonological tasks in their L1. Ardila et al. (2000) found that early Spanish-English bilinguals, highly proficient in both languages, also performed better in the verbal memory subtests in L1. Grundy and Timmer (2017) concluded, through a meta-analysis, that bilinguals perform the working memory tasks better in their dominant language. Vejnović, Milin and Zdravković (2010) showed that the working memory in L2 of Serbian-English bilinguals, evaluated through a complex-span task, depends on the proficiency level and age of acquisition; performance in the L2 is not affected by these factors. However, in other studies, the results obtained for the two languages of highly proficient speakers were strongly correlated (Japanese-English bilinguals, OSAKA; OSAKA, 1992; German-French bilinguals, OSAKA; OSAKA; GRONER, 1993; French-English bilinguals, HUMMEL, 2002; Spanish-English bilinguals, GUTIÉRREZ-CLELLEN; CALDERÓN; WEISMER, 2004). Several recent meta-analyses do not find any positive effect of bilingualism on the working memory capacity; these inconsistent results are explained by the publication bias between positive and negative results (LEHTONEN et al., 2018; LUKASIK et al., 2018).

Measures of working memory are important in the experiments with assessment of narratives in bilinguals because the working memory capacity influences performance in the picture description tasks (KORMOS; TREBITS, 2011; TSIMPLI et al., 2014; TSIMPLI; PERISTERI; ANDREOU, 2016). The studies of aphasic and non-aphasic language impairments suggest a relationship between the working memory capacity and discourse

production aspects, such as macrolinguistic narrative components (CAHANA-AMITAY; JENKINS, 2018; YOUSE; COELHO, 2005).

In Latin America, working memory studies related to language are quite recent but encompass a wide range of questions as language acquisition, metapragmatic awareness, bilingualism, phonological and syntactical aspects (CRESPO ALLENDE; ALVARADO BARRA, 2010; FINARDI; SILVEIRA, 2011; GINDRI; KESKE-SOARES; MOTA, 2007; KRAMER; MOTA, 2015; TESSMAN BANDEIRA, 2008). Topics such as L2 acquisition and production (fluency, accuracy, and complexity), and teaching strategy development, are prioritized (FINARDI, 2008; FONTANINI et al., 2005; GUARÁ-TAVARES, 2013; MATIELO; OLIVEIRA; BARETTA, 2018; MOTA, 2003; PREBIANCA; FINARDI; WEISSHEIMER, 2014; ORTIZ-PREUSS, 2019). Only few studies considered the working memory measurements in the immigrant populations (KRAMER; MOTA, 2015).

There are many ways to measure the working memory capacity which involve different kinds of stimuli (words, numbers, phrases, etc.) and operations executed over them (recalling the elements in established order, producing grammatical phrases, etc.) (JUST; CARPENTER, 1992). The working memory capacity involves the same fundamental processes as language production, that is, the storage and processing of ongoing information. While the storage component is responsible for memorizing the stimuli, the processing component orders them (FORTKAMP, 1999). One of the most reliable and valid measures of the working memory capacity is a span task (CONWAY et al., 2005).

In the present study, we apply the Month-Ordering task because it allows us to avoid the influence of the vocabulary size in unbalanced bilinguals. This task requires using very common vocabulary (names of months) which is well known even by heritage speakers. This task was proposed by Kempler et al. (1998) for English-speaking Alzheimer's disease patients and later extended by Goral et al. (2011) to monolingual elderly English-speaking adults. A recent modification of this task was applied to the Portuguese speakers in Portugal, and the results proved that this method is internally consistent and temporally stable (BUEKENHOUT; LEITÃO; GOMES, 2018). Its scores predict the efficiency of language comprehension processes, and this task is considered suitable even for patients with significant cognitive impairments and/or individuals with very low educational attainment.

2. METHODS

2.1. PARTICIPANTS

The sample included 77 participants divided in two groups: the first-generation Russophone immigrants that have lived in Brazil for at least two years, and elderly Russian heritage speakers who have lived in Brazil for the most part of their life or even their whole life. The study was approved by the Ethics Committee of Pontifícia Universidade Católica de São Paulo (CAAE 09079219.9.0000.5482).

The group of the first-generation Russophone immigrants included 49 participants, speakers of Russian as L1, who self-identified as proficient in Portuguese. All of them acquired Portuguese as adults and are considered to be late L1 Russian - L2 Brazilian Portuguese bilinguals. As in many other studies that characterize the speech of different migrant generations (ALBA et al., 2002; BHRICK et al., 1994; CONNAUGHTON-CREAN; Ó DUBHIR, 2017; PORTES; HAO, 1998; SEVINÇ, 2016), we consider that first-generation immigrants are dominant in their L1, Russian. Five participants also spoke Ukrainian.

In the group of the first-generation Russophone immigrants, ten participants were men and 39 women. The mean age of the participants was 38.5 years ($SD = 8.9$), range 24 to 58 years; the mean time of residence in Brazil was 9 years ($SD = 5.9$), range 2 to 30 years. Thirty-nine participants resided in São Paulo, four in other cities of the state of São Paulo, three in Rio de Janeiro, one in Brasília, one in Curitiba, and one in Salvador. At least 43 participants, 88% of the sample, had a college degree. The most mentioned occupations were instructors of Russian (14 participants), administrators, economists, or financial specialists (11), university professors of Mathematics or Physics (5), and housewives (4). Twenty participants were selected from our database of 40 Russophone immigrants living in São Paulo (Smirnova Henriques et al., 2020), the others were recruited through personal contact.

The group of elderly heritage Russian speakers consisted of 28 participants older than 58 years who acquired Portuguese as children or young men/women. Since they spent most of their life in Brazil, most of them should be dominant in Portuguese. Later analysis of the Bilingual Language Profile (BIRDSONG; GERTKEN; AMENGUAL, 2021) in this group showed that 80% of 23 participants that answered the questionnaire were in fact dominant in Portuguese (unpublished). Some of the speakers reported usage of other languages in their everyday life, but only three participants informed that they spoke other languages on a weekly basis. The frequency of their third language usage was self-evaluated by these participants as no more than 20% of the general speaking time.

In the group of elderly heritage Russian speakers, 11 participants were men and 17 women. The mean age of the participants was 75.8 years ($SD = 7.8$), range 59 to 98 years. In this group, 23 participants resided in São Paulo, two in other cities in the state of São Paulo and three in Rio de Janeiro. Thirteen were born in China; nine, in Brazil; three, in Europe; three, in Russia or Belarus. For 19 participants who were not born in Brazil the

mean age at arrival was 10.3 years ($SD = 5.7$), range 1 to 24 years. Only one participant arrived in Brazil at the age older than 17 years, she was born in Paris. At least 18 participants, 64% of the sample, had a college degree. All elderly Russian heritage speakers were from the database of the BraPoRus, a corpus of oral speech samples of Russian heritage-Brazilian Portuguese bilinguals (SMIRNOVA HENRIQUES et al., 2021).

2.2. VERBAL WORKING MEMORY MEASURE

For verbal working memory measure, the Month-Ordering task (KEMPLER et al., 1998; GORAL et al., 2011) was translated into Russian and Portuguese. In this task, participants listen to an increasingly long set (from 2 to 7) of months, presented out of calendar order, and are asked to recall the months back in the order they appear in the calendar. The sets of months in English are presented in Table 1. At each span level, there were four sequences; testing was stopped when two items at a span level were recalled incorrectly. The number of months in the last block which contained more than two correct sequences was considered the working memory span of participant. The tasks were administered in both languages (Russian and Portuguese) in the order established by assessor, speaker of Russian as L1 and Portuguese as L2. In the group of the first-generation Russophone immigrants, 27 participants first took the test in Russian and 22 in Portuguese. In the group of elderly Russian heritage speakers, 14 participants first took the test in Russian and 14 in Portuguese.

Span level	Stimuli
2	- May, March - November, September - April, June - July, October
3	- May, February, March - December, August, April - March, July, May - June, November, September
4	- May, April, January, July - October, March, September, June - December, April, September, October - September, May, February, August
5	- January, June, March, May, April - March, August, February, May, November - June, March, May, April, August - January, February, August, May, December
6	- February, August, January, April, September, July - March, August, October, May, January, April - September, January, October, August, February, June - April, September, July, June, August, May
7	- March, July, April, January, December, August, June - July, May, November, February, December, October, April - April, July, June, September, November, March, December - June, February, May, January, March, October, August

Table 1. Stimuli used in the Month-Ordering task for working memory measure (KEMPLER et al., 1998; GORAL et al., 2011). In the current test, the task was translated into Russian and Portuguese.

Due to the sanitary restrictions to prevent the spread of COVID-19, the participants were tested by phone; the call was scheduled by the research assistant prior to testing. At the beginning of the test session, the participant was asked about the quality of the sound to check if it was adequate for conducting the test. Then, the assistant introduced the participant to the task, collected the personal data (age, time, and place of residence in Brazil, profession) and conducted the Month-Ordering task. The beginning of each language block was announced in the language of the task. The answers were compared with the correct answers from the protocol and recorded immediately in the spreadsheet. Each test lasted around 7-15 min.

2.3. STATISTICAL PROCEDURES

The median, mean values and standard deviations (*SD*) for the scores were calculated in Excel. The normality of the distributions was verified through the Kolmogorov-Smirnov (K-S) Test of Normality, available online (STANGROOM, 2021). The correlations were verified through the Spearman's Rho correlation calculator (STANGROOM, 2021). The comparisons between two languages of the same sample, containing paired data, were performed using Wilcoxon signed-ranks test; the comparisons between two samples were performed using Mann-Whitney test (STANGROOM, 2021).

3. RESULTS

In this section, we describe the assessment of the working memory capacity through the Month-Ordering task in the first-generation immigrants, late Russian-Portuguese bilinguals, and elderly Russian heritage speakers who speak Portuguese as the societal language for most part of their life.

In the group of the 49 late Russian-Portuguese bilinguals, the median Month-Ordering spans for Russian and Portuguese were 5 and 4, respectively (Table 2).

	Month-Ordering span			
	Russian-Portuguese late bilinguals		Elderly Russian heritage-Portuguese bilinguals	
	Russian	Portuguese	Russian	Portuguese
Mean	4.5	4.4	3.9	4.8
<i>SD</i>	1.2	1	1.5	1.5
Median	5	4	3	4.5

Table 2. Working memory capacity (Month-Ordering span) in Russian and Portuguese languages in 49 late Russian-Portuguese bilinguals and 28 elderly Russian heritage-Portuguese bilinguals as measured through Month-Ordering task.

For the late Russian-Portuguese bilinguals, the distributions of Month-Ordering spans for both languages were not normal (Figure 1A). There was no statistical difference in the working memory scores between the languages. Sixteen participants showed numerically higher working memory scores in Russian, 12 in Portuguese and 21 had the same scores in both languages.

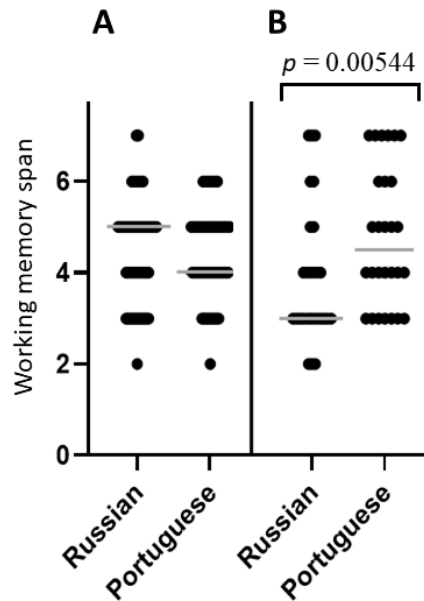


Figure 1. Working memory capacity (Month-Ordering span) in Russian and Portuguese languages in 49 late Russian-Portuguese bilinguals (A) and 28 elderly Russian heritage-Portuguese bilinguals (B) as measured through Month-Ordering task. Grey horizontal lines show the median values for each language in each group.

For the late Russian-Portuguese bilinguals, the Month-Ordering spans obtained in Russian and in Portuguese were correlated (Table 3). There were no correlations between the working memory capacity and the age of the participants, time of their residence in Brazil, or order of the language presentation in the task (Table 3).

	Spearman's correlation coefficient	
	Month-Ordering span, Russian	Month-Ordering span, Portuguese
Age	$r = -0.0187$ $p = 0.89852$	$r = -0.01706$ $p = 0.90736$
Time of residence in Brazil	$r = 0.13336$ $p = 0.36097$	$r = 0.2418$ $p = 0.09416$
Order of language presentation in the task	$r = 0.01206$ $p = 0.93446$	$r = 0.01364$ $p = 0.9259$
Correlation between the working memory spans in Russian and Portuguese	$r = 0.64263$ $p = 0$	

Table 3. Verification of the variables related to the working memory capacity in Russian and Portuguese for 49 late Russian-Portuguese bilinguals.

In the group of 28 elderly Russian heritage-Portuguese bilinguals, the median Month-Ordering spans for Russian and Portuguese were 3 and 4.5, respectively (Table 2, Figure 1B). The distribution of the scores was normal in Portuguese, but not in Russian. The median working memory score in Russian was 1.5-fold lower than in Portuguese (Wilcoxon signed-ranks test, $p = 0.00544$). Four participants showed numerically higher working memory scores in Russian, 15 in Portuguese and 9 had the same scores in both languages. The Month-Ordering spans obtained in Russian and in Portuguese were correlated (Table 4). There were no correlations between the working memory capacity and the age of participants or order of the language presentation in the task (Table 4).

	Spearman's correlation coefficient	
	Month-Ordering span, Russian	Month-Ordering span, Portuguese
Age	$r = -0.34034$ $p = 0.07638$	$r = -0.04145$ $p = 0.83413$
Order of language presentation in the task	$r = 0.06491$ $p = 0.7428$	$r = 0$ $p = 1$
Correlation between the working memory spans in Russian and Portuguese	$r = 0.50293$ $p = 0.00638$	

Table 4. Verification of the variables related to the working memory capacity for 28 elderly Russian heritage-Portuguese bilinguals.

In the comparison between the groups of 49 late Russian-Portuguese bilinguals and 28 elderly Russian heritage-Portuguese bilinguals, the Month-Ordering spans in Portuguese were not different, but in Russian, the elderly Russian heritage-Portuguese bilinguals had 1.7-fold lower scores than the not-elderly late Russian-Portuguese bilinguals (Mann-Whitney test, $z\text{-score} = 2.1708$, $p = 0.03$).

4. DISCUSSION AND FUTURE DIRECTIONS

In the current work, we assessed the working memory capacity, in Russian and in Portuguese, in two groups of participants: (i) the first-generation immigrants who acquired Russian as children in Russian-speaking homeland and Portuguese as adults, predicted to be dominant in Russian, and (ii) the Russian heritage speakers who acquired Russian as children but have spent most of their time in Brazil, speak Portuguese as the societal language and, in most cases, consider themselves to be dominant in Portuguese. While the working memory scores of the first-generation Russophone immigrants were not different between the languages, the median score of the elderly Russian heritage speakers in Russian was 1.5-fold lower than in Portuguese (Figure 1). In the comparison between the two groups, their working memory capacity measured in Portuguese was the

same, while in Russian the elderly Russian heritage-Portuguese bilinguals got 1.7-fold lower scores than the first-generation immigrants. In both groups, no correlations were found between the working memory capacity and the age of participants or the language presentation order in the task. The time of residence in Brazil of the first-generation Russophone immigrants also did not affect the scores.

In previous studies, the Month-Ordering task was used only with monolinguals (BUEKENHOUT; LEITÃO; GOMES, 2018; GORAL et al., 2011; KEMPLER et al., 1998); in the monolingual conditions, it was established that its scores predict the efficiency of language comprehension processes (BUEKENHOUT; LEITÃO; GOMES, 2018). However, even though the performance of unbalanced bilinguals in the Month-Ordering task should not be influenced by the vocabulary size, it can be influenced by the vocabulary processing speed. We hypothesize that the fact that the first-generation immigrants have the same working memory capacity in both languages can be explained by the regular use of both languages in everyday life. The Russian heritage speakers, even though they know the month names well, rarely use them in Russian, and this could affect the processing of this vocabulary category.

In the studies of Kramer and Mota (2015), younger bilingual Brazilian Portuguese-Hunsrückisch speakers showed better working memory scores in Portuguese than elderly bilinguals in the measurement of Alpha span task. We have seen this effect only for the less used language (Russian) of the Russian heritage speakers, but not for Portuguese, even considering that the groups of the first generation Russophone immigrants and Russian heritage speakers had a big difference in terms of age (mean ages of 38.5 and 75.8 years, respectively). However, the results obtained by Kramer and Mota (2015) could be influenced by the different education levels in their samples: the elderly Brazilian population has a lower education level, and it is difficult to match the samples by this criterion. In their experiments, the elderly bilinguals had only 5.3 years of formal education. The mismatch in socioeconomic status and education is well known as an important factor that biases the working memory measurements (LEHTONEN et al., 2018; LUKASIK et al., 2018). In our experiments, the elderly Russophone immigrants that have grown in Brazil had more opportunities, and at least 64% of them had a college degree.

One factor that we did not consider in this study is a potential influence of third languages spoken by participants. In fact, some first-generation Russophone immigrants also spoke Ukrainian, and a few Russian heritage speakers reported some weekly use of their third languages. Probably, many of the participants studied English or other languages at school or university. However, in the 21st century, the time of globalization, travels, internet, and an easy access to learning, it is very difficult to find real “monolinguals” or “bilinguals” or describe in a comprehensive way a multilingual profile of the speakers. In the current study, we use the term “bilinguals” to emphasize that the

research is focused on Russian and Brazilian Portuguese that are the main languages used by the participants in their everyday life.

In fact, 23 out of the 28 Russian heritage speakers filled out the self-evaluation questionnaire of the Bilingual Language Profile protocol during the data collection for the BraPoRus corpus, and their language dominance profiles have been defined: 18 were dominant in Portuguese, one was balanced bilingual, and four were dominant in Russian (unpublished). However, the first-generation immigrants did not perform this task yet, thus, these data can not be compared, and the relation between the self-evaluated language dominance and working memory will be evaluated in a next step.

The data on the working memory capacity in Russian and Portuguese of the elderly Russian heritage-Brazilian Portuguese bilinguals are meant to provide a base to verify the relation between the working memory capacity and narrative production abilities of the heritage speakers in their heritage and societal languages. The narrative abilities of bilinguals will be assessed using the MAIN protocol (GAGARINA et al., 2016) that already exists in Russian and Brazilian Portuguese versions. To the best of our knowledge, until now, the Russian heritage-Brazilian Portuguese early bilinguals from old immigration waves to Brazil have been studied only in the sociological and historical aspects (RUSEISHVILI, 2016; VOROBIEFF, 2006), and their linguistic profile remains unknown.

Considering that the main reason of the present study was to provide a basis for the future analysis of narrative abilities, we have not performed any comparison of the working memory scores with monolinguals. However, we plan to make these comparisons in our future work, carefully matching the samples by education level. The age-related losses in the executive function are expected to be attenuated by bilingualism (BIALYSTOK et al., 2004; BIALYSTOK; CRAIK; FREEDMAN, 2007), but this has never been verified using the Month-Ordering task.

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