

**WHEN DO MEMORIES GO AWAY?
L1 ATTRITION EFFECT ON
BILINGUAL AUTOBIOGRAPHICAL MEMORY**

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ABSTRACT

Language plays a crucial role in remembering, storing, maintaining, accessing, and sharing of memories. This evidence comes from the disciplines of psychoanalysis (Javier et al., 1993; Schwaneberg, 2010), developmental psychology (Fivush, 2011; Nelson, 2004), and bilingual memory (Larsen et al., 2002; Marian & Neisser, 2000). Some of the most telling examples come from bilingual psychotherapy where therapist switch to the patient's native language in order to access childhood memories (e.g., Aragno & Schlacher, 1996). The loss of language, therefore, may have a detrimental effect on memory storage and recall. Until now, however, this possibility has not been tested. The purpose of the present study is to address this gap by investigating autobiographical memory in speakers undergoing L1 attrition.

The study is grounded in the dual-coding theoretical framework (Paivio, 1971; 2014). According to the dual-coding theory, memories that are encoded with multiple memory traces (audio, visual, etc.) are remembered better and a weakening of a memory trace due to its inactivation might lead to forgetting. Therefore, memories that were encoded in a language that is no longer available might show signs of deterioration.

Twelve non-attriters ages 18-28 ($M=22.08$; $SD=3.73$), 13 moderate attriters ages 18-33 ($M=24.29$; $SD=5.43$), and 10 advanced attriters ages 18-30 ($M=23.1$; $SD=3.7$) shared autobiographical memories with the help of free recall and cued-recall procedures (Marian & Neisser, 2000; Schrauf & Rubin, 2000). The pool of 420 free recall memories were analyzed for amount of detail (Levine et al., 2002) and the set of 1,988 cued recall memories were analyzed for phenomenological properties of vividness, significance, emotionality, and confidence in the event (Schrauf, 2009; Schrauf & Rubin, 2004). The

results revealed that moderate attriters who had vague L1 Russian memories recalled memories with lower confidence rating in comparison to non-attriters, which suggests a negative L1 attrition effect on bilingual autobiographical memory. However, the advanced attriters were able to recall vivid and detailed L1 Russian memories. The aforementioned finding did not support the study's hypothesis that memories might be forgotten if the language of encoding is no longer available. This can be explained by the following observation. Advanced attriters recalled their L1 Russian memories very frequently which insured a preservation of these memories. This rehearsing of L1 memories in their dominant L2 English also caused *re-encoding* of these memories into the dominant language. This was observed qualitatively (participants commenting on how L1 Russian memories were coming to them with L2 English words) and quantitatively (L1 Russian memories were reported to be accompanied by L2 English words).

These findings have several theoretical implications for the discipline of bilingualism. L1 attrition may have a negative effect on bilingual autobiographical memory, at least as far as the phenomenological properties are concerned. However, this negative effect can be reversed by frequent rehearsing of memories that were encoded in an attrited language. Rehearsing may lead to re-encoding of L1 memories into the L2 which suggests that memories may be malleable. This demonstrates flexibility of bilingual mind and how it can adjust to L1 attrition.

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CHAPTER 1 INTRODUCTION

As a Russian-English bilingual, I have experienced firsthand both the pleasures (e.g., extended social networks) and the difficulties (e.g., tip of the tongue effect) associated with speaking two languages. My biggest challenge comes from communicating my “Russian” experiences to my American friends and my “American” experiences to my relatives who live in Russia. There are always untranslatable emotional terms and cultural situations that are difficult to describe. While I try to find words and provide a lengthy explanation to my American friends about the importance of congratulating one another on getting out of a shower (*s legkim parom!*)¹ in Russian culture, the significance of answering “How are you?” honestly and in detail, and the reasoning behind not smiling at everybody, I often fail to translate my emotions, reactions, and attitudes fully. I cannot help but feel that something is missing from my story because I cannot use the Russian language. This troubles me – if I did not have access to my first language any more (due to attrition or amnesia), would I be able to find a way to retell these “missing” nuances in English, or would they forever dissipate with the forgotten language?

The idea that language is somehow connected to autobiographical memory is not new to bilingual memory studies and to the discipline of psychotherapy (Javier, Barroso, & Munoz, 1993; Larsen, Schrauf, Fromhot, & Rubin, 2002). Multiple experiments with bilinguals have demonstrated that first language (L1) words trigger pre-immigration

¹ The expression “s legkim parom” literally translates as “with happy steam” and is commonly said to someone after they just took a hot bath, shower, or came from the banya.

memories. This happens because an L1 language memory trace is attached to these memories. Additionally, if someone experienced trauma in their childhood language, it is beneficial to use the L1 during therapy sessions because accessing traumatic events in the language of the event allows to retrieve more detailed and vivid memories (Schwaneberg, 2010).

So we know that language plays a crucial role in remembering and retrieving autobiographical memories. However, a research gap remains – what happens to these memories when the language is lost or forgotten? Are the memories gone or do they experience some sort of deterioration? According to the dual-coding theory (Paivio, 1971; 2014), memories that are encoded with two codes, are more stable. Since the weakening of one of the memory traces is the main cause of forgetting (Tulving, 1983), it is reasonable to hypothesize that language loss might destabilize these memories.

Language loss or language attrition is a common phenomenon in immigrants and international adoptees who shift to using their second language (L2) (Fogle, 2012) and may have lexical access difficulties, disfluencies, or optionality of grammatical features (Schmid & Jarvis, 2014). There are two main ways in which attrition can be manifested: 1) failure to activate or access a certain language 2) permanent structural erosion (Schmid, 2017). The purpose of this study is to explore the effect of childhood language loss on autobiographical memory in individuals who show signs of both types of attrition.

Thirty-five participants (16 adoptees and 19 immigrants) from Russian-speaking families, who have comparable English mastery but represent a continuum of L1 attrition, participated in a mixed method study where they recalled and describe their L1 Russian and L2 English memories. Phenomenological and amount of detail were analyzed

quantitatively and qualitatively in order to reveal any effects of L1 attrition on autobiographical memory.

This dissertation is structured in the following way. The first three chapters provide an overview of the previous research, including theoretical framework and current research gaps. The fourth chapter describes methodology that was employed in this study which includes information on the research participants, data collection, previous pilot tests, and data analysis. The fifth chapter includes detailed description of the findings. The last chapter discusses the findings by highlighting theoretical implications for the discipline of bilingualism, limitations, and directions for future research.

CHAPTER 2 AUTOBIOGRAPHICAL MEMORY AND LANGUAGE ATTRITION LITERATURE REVIEW

In this chapter I will start by discussing autobiographical memory. I will describe autobiographical memory as a unique type of human memory that develops in childhood, and consider the role of language in storing and sharing memories of self. I will argue that bilingual autobiographical memory may exhibit a divergent pattern from monolingual autobiographical memory. Next, I will discuss language attrition and international adoption, and suggest that this population may experience a greater degree of language attrition which might affect their memories of self. I will conclude the chapter with a summary of the key concepts in this research.

2.1 Autobiographical Memory

When we tell a friend about our first day of school or about our most recent birthday party, these stories are examples of autobiographical memories. These memories form who we are and how we perceive and position ourselves. Autobiographical memory (AM) allows us to remember past events and to form a coherent sense of self by linking together personal experiences across the lifespan (Fivush, 2011). Research shows that AM is a recently evolved distinct type of memory that is only present in humans. In what follows, I will first describe the memory systems, then I will elaborate on how AM fits in this network.

2.1.1 Autobiographical Memory as a Distinct Type of Memory

Research to date consistently differentiates between implicit or procedural (“knowing how”) and explicit or declarative (“knowing what”) knowledge (Rubin & Umanath, 2015; Tulving, 1983, 2002). An example of procedural memory would be remembering how to ride a bike: one does not have to constantly remind oneself how to peddle after the muscle memory is consolidated. At the same time, the explicit or declarative memory requires conscious effort for remembering and recall. For example, one would have to concentrate on memorization of dates for the history test. Explicit memory is further subdivided into semantic memory (remembering facts or words) and episodic memory (remembering details of a specific event) (Squire, 1992; Tulving, 1972; 2002). While AM might rely on semantics (“Ostrich is a flightless bird”) and episodic memory systems (“When I first came to Philadelphia, it was snowing”), it has been argued that AM should be distinguished from all the mentioned above memory types (Williams & Conway, 2009).

The reasoning for such differentiation is based on the fact that animals and birds have elements of episodic memory but do not possess AM (Fivush, 2011). For example, birds like scrub jays hide food and subsequently remember where it was hidden (Baddeley, 2015). Episodic memory enables the birds to record specific details of context such as the main participants, causal connections, and spatiotemporal features which are helpful for survival (Donald, 2012). Researchers hypothesize that general episodic memory emerged in order to accommodate short-term planning, e.g., like remembering where to find edible plants and to avoid danger (Nelson & Fivush, 2004). However, while animals and birds show elements of episodic memory, they do not have the ability to

voluntarily retrieve their memories and have to rely on external cues as memory triggers (Donald, 2012). In this sense, AM is uniquely human.

Another type of evidence that birds and animals do not possess autobiographical memory is the fact that they do not have an awareness of the self experiencing a certain event. Only humans have this *sense of self as experiencer of events* (Tulving, 1993; 2002). This unique sense of self has been termed as *autonoetic consciousness* and can be described as the human capacity of a self-reflective mental state of self-consciousness within different contexts and time frames (Tulving, 2002). It makes possible mental time travel, recollecting, and reliving a memory, the key characteristics of AM.

AM developed relatively recently in relation to episodic memory. It emerged in order to sustain a sense of self, to preserve collective memories, and to accomplish long-term planning and decision-making (Fivush, 2011). Language further allowed for abstract mental representation of memories and for talking about the past (Fivush, 2011; 2014; Nelson, 1993). Language has played a crucial role in the evolution of episodic memory into AM:

Language carried this evolutionary process [emergence of episodic memory] one step further; it enabled people to construct large-scale life narratives into which much longer sequences of specific event-memories could be inserted selectively. Language served as the highest integrative device in this operation. Gathering material from generic event-memory and episodic memory, and placing it in wider context (Donald, 2012, p. 273).

The *self* in the Self-Memory-System refers to a complex set of goals and self-associated image which is collectively referred as the *working self* (Conway, 2005; Conway & Pleydell-Pearce, 2000). The *working self* actively interacts with autobiographical knowledge and controls the process of constructing memories. This can

be seen in the fact that our memories are simply records of our successes and failures (Conway & Pleydell-Pearce, 2000, p. 266). If a certain memory does not fit the self-image or the current goals, it is less likely to be remembered. It is also possible for memories to be modified in order to align with the current motivations of the *working self*. An active selection of what would be remembered and what would be forgotten serves an important function ensuring a stable sense of reality and self.

A remembered event contains the following elements: conscious awareness of self experiencing an event and certain characteristics, i.e., phenomenological properties, such as visual, olfactory, emotional, gustatory, and kinesthetic components (Schrauf & Rubin, 2004; Schrauf, 2003). The phenomenological properties refer to subjective characteristics of a specific memory (Mitchel, 2016). For example, from my experience of trying raw sushi for the first time, I still remember the taste of cold fish (gustatory), my attempts to use chopsticks (kinesthetic), and my surprising enjoyment (emotional). Each memory may have a varied number of components (just the visual detail or more aspects) and different variations (visuals plus emotions or kinesthetic plus olfactory, etc.).

Recently, AM scholars have included a narrative quality of AM into the list of important phenomenological properties (Bartoli & Smorti, 2018; Fivush, 2014; Rubin, 2012; Rubin, 2005; Rubin, Schrauf, & Greenberg, 2003). The narrative quality of AM is highlighted for two apparent reasons: memories are integrated into a narrative of a life story and are subsequently shared with others through a narrative (Bauer, 2012). The integration of personal events is predicated on constructing a personal timeline when one goes beyond remembering the past events but also links all the memories into a coherent life story (Fivush, 2011; 2014). Such complex task of connecting memories requires the

help of a framework for organization and storage, and a narrative structure serves that purpose. As aptly said by Bauer (2012): autobiographical memories “feature all the elements of a good story, including *who* participated in the event, *what* happened, *where* and *when* the event took place, and *why* the sequence of actions unfolded as it did” (2012, p. 206).

What is especially important about AM is that we share memories with others with the help of a narrative and consequently language. Language does not only allow us to share memories, but to also remember events, elicit memories, and rehearse them to avoid forgetting (Pavlenko, 2014). The crucial role of language in AM is rightfully recognized in the developmental psychology (Bartoli & Smorti, 2018; Fivush, 2011; Nelson & Fivush, 2004). Linguistic component as one of the phenomenological properties of AM has been also observed in linguistic experimental studies on memory. For example, in Schrauf and Rubin (2000) participants revealed that 80% of all the retrieved memories came to them “in words” which means they were linguistic in nature. To sum up the theory of AM, established auto-noetic consciousness and access to language are prerequisites for AM development; both of which originate in childhood.

2.1.2 Development of Autobiographical Memory

Memory, in general terms, begins before a child is born since newborns can discriminate between familiar and unfamiliar stories that were read by their mothers during the last trimester of prenatal development (Fivush, 2011). In infancy, children show preference for mother’s voice and face over voices and faces of strangers – a preference that demonstrates elements of remembering (Purhonen, Kilpelainen-Lees, Valkonen-Korhonen, Karhu, & Lehtonen, 2005). Foundational studies in the field of

child psychology show that fourteen month old infants can even remember and repeat simple actions like pressing a black button in order to ring a buzzer after a two month delay (Meltzoff, 1995); at around 21 months of age children can refer to their past experiences with the help of elaboration from their mothers (Hudson, 1990), suggesting that memory in its general sense starts in infancy and gradually evolves throughout the childhood (Bauer, 2015).

2.1.2.1. Childhood Amnesia. While the aforementioned evidence of memory in young children is rather impressive, an interesting phenomenon is that humans are not able to recall any memories before the age of three (Bauer, 2012). This inability to retrieve early childhood memories was named by Sigmund Freud *childhood amnesia* (Freud, 1905/1953). According to Bauer (2012), this phenomenon can be explained by the combination of two factors: poor memory retention and rapid forgetting of childhood memories. Poor memory retention suggests a scarcity of encoded memories, meaning that children encode fewer memories in comparison to adults. Evidence from Rubin (2000) confirms the idea of young children remembering less. The researcher analyzed 11,000 memories produced by children before the age of 10 and concluded that the number of memories in children slowly increases from the age of three to the age of seven where it stabilizes thereafter. The study by Rubin (2000) provides evidence for childhood amnesia as well as the fact that very young children might encode fewer memories.

Another factor in childhood amnesia is rapid forgetting which was demonstrated in Van Abbema and Bauer (2005). The researchers interviewed children at the age of three and then asked the same group of participants to recall what was talked about during the initial session after a three to six year delay. They found that a longer lapsed

time significantly interfered with recall with more than half of the distant events not being recalled at all. Apparently, the rate of forgetting in children is much higher in comparison to adults with children reaching adult-like ability to remember by the age of seven (Bauer, 2012; 2015). However, even after a six year delay, nine year olds managed to retain 34% of memories from the time when they were three (Bauer, 2012; 2015) which suggests that childhood memories are retained to at least some degree.

While poor memory retention and rapid forgetting are evident in young children, they seem to be manifestations of cognitive processes which include developing auto-noetic consciousness, learning language, and acquiring autobiographical narrative framework; all three onset in childhood and are crucial for development of AM (Bauer & Larkina, 2014; Conway, 2005; Fivush, 2011; Nelson & Fivush, 2004; Tulving, 2002). Early signs of auto-noetic consciousness surface as early as 14 months of age when children start recognizing themselves in a mirror and solidify between the fourth and fifth years of life (Vandekerckhove, 2009). It has been shown that the very first memories are encoded after the onset of self-awareness: between 32 and 42 months (Bauer, 2012). However, memories remain scarce in early childhood because children cannot fully rely on language and narrative framework.

2.1.2.2. Emergence of Autobiographical Memory. Language is commonly mastered by the age of six (Fromkin, Rodman, & Hyams, 2018; Levine & McCloskey, 2013) which makes it possible for children to express thoughts, emotions, attitudes, and contextual details of past events. Through sharing, children do not only integrate their experiences but they also contest, negotiate, and validate their version of reality (Fivush, 2011). When talking about the past, the young realize that memory is subjective because it includes

their evaluations and emotions and that it might differ from someone else's sense of reality; "it is only through sharing our stories with others that we come to own our experiences as uniquely ours and true to self" (Fivush, 2011, p. 230).

Additionally, talking about memories allows for rehearsal and, subsequently, better retaining. It was shown that by the age of seven children have a considerably large repertoire of memories about their past (Rubin, 2000). The fact that command of language coincides with increased number of memories in children suggests that language serves as an important tool for remembering. Basically, language enables sharing as well as encoding of memories which both are crucial for AM (Nelson, 2003).

By learning how to embed memories within a narrative, children continue to organize, structure, reproduce, rehearse, and elaborate; thus, allowing to consolidate memories of self in the mind. Children experience a gradual increased complexity in their autobiographical narratives from age seven on and reach adult-like performance by age nine (Bauer, 2012). Together, developed self-awareness, language, and narrative framework ground AM in children.

In short, while episodic memory might develop as early as infancy, the first autobiographical memories usually date to the third year of life. Due to the childhood amnesia adults as well as children are unable to recall events from the first three years. AM emerges during the preschool years with a gradual increase in the number of memories from age three to age seven. The AM continues to mature throughout kindergarten and flourishes by adolescence. AM is predicated on established autoethic consciousness, successful language development, and mastering of the autobiographical

narrative framework which are frequently consolidated by social practices and especially through shared reminiscing.

2.1.2.3. Shared Reminiscing. Shared reminiscing is the practice of child-caregiver talking about happenings of the past (Nelson, 2003; Fivush, 2014). It can involve reminding a child about a trip to the zoo (We went to the zoo today, didn't we?), asking questions about animals or people (Did the zebra have stripes?), and inquiring about emotions or attitudes (Was it fun?). Very first examples of shared reminiscing rely heavily on yes-no questions, body language from the child (nods, smiles, etc.), and on the caregiver's input of information, structure, and elaboration (Langley, Coffman, & Ornstein, 2017). Such simple conversations may start during early childhood and gradually increase in their complexity. This was demonstrated by a classic study by Hudson (1990) who captured conversations between a 21 months old Rachel and her mother for seven continuous months. The researcher found that by the age of 28 months, the child provided more elaboration, engaged in more verbal interactions, and shared more details to the yes-no questions. This positive development was nurtured by the mother who constantly initiated conversations and asked questions (p. 175).

The mother in the classic study by Hudson (1990) is a good example of a *high elaborative* parent. High elaborative parents engage in rich discussions of past events by frequently asking questions, providing details, and by responding to the child. On the other hand, *low elaborative* parents engage in short if any conversations about the past where they provide very little information and elaboration. These differences in the shared reminiscing seem to represent preferred styles of talking and valuing the past and do not stem from the personality qualities of the caregiver (Reese & Farrant, 2003).

The development of AM in children is predicated on the quality of the shared reminiscing as it carries out several important roles in AM emergence and maintenance (Fivush, 2011; Fivush & Nelson, 2004; McDonnell, Valentino, Comas, Nuttall, 2015; Nelson, 2003; Valerio, Nuttall, Comas, McDonnell, Piper, Thomas, & Funuele, 2014). Firstly, it allows the child to make sense of the world around them. Secondly, it helps them to remember their experiences because of the demand on recall in response to the questions. Thirdly, shared reminiscing provides rehearsing opportunities. Lastly, it organizes memories into a narrative which allows for consolidation of memories and better retainment (Fivush, 2014).

It has been shown that children of high elaborative parents can recall more detailed accounts of their past events (Bergen & Salmon, 2010). Reese & Newcombe (2007) set up an experimental study where they included a control group of caregivers and a research group that involved mothers who were trained on how to be high elaborate parents. The results revealed that the children of the mothers who went through the training provided more detailed accounts of the past events.

However, the positive effect of shared reminiscing on AM does not come from mere talking by the caregiver; it has to be a collaborate enterprise between a parent and a child. Tessler and Nelson (1994) analyzed conversations between mothers and their children that happened during the trip to museum and consequent recall of the event. The scholars revealed that only what was talked about by both, mother and child, had a better remembering outcome. Joint encoding is crucial for shared reminiscing and AM. Children as young as three years of age actively engage in a two-way reminiscing and by the age of five they are fully comfortable at initiating it (Reese & Farrant, 2003).

In summary, the practice of child-caregivers talking about happenings of the past plays a crucial role in child's socialization and AM development. Through shared reminiscing children learn a cultural practice of sharing memories in a context-appropriate format. It also allows them to organize, encode, and consolidate memories for future recalls. A connection between the quality of joint reminiscing and children's retention of information shows significance of such talk. Therefore, language serves as important medium for remembering.

2.1.3 Role of Language in Autobiographical Memory

I have already alluded to the importance of language in AM in the beginning of the current chapter. In the process of evolution, language provided a basis for emergence of AM as a distinct type of memory in humans because it allowed them to encode complex sequenced events and rehearse them through talking (Donald, 2012). This can be seen in children: the appearance of language in toddlers serves as a building block in development of AM (Fivush, 2011; 2014; Nelson, 1993). Therefore, linguistic abilities makes encoding, rehearsal, and sharing of memories possible.

For example, Wang and Ross (2005) found that American children tend to access earlier (M=40.96 months) memories in comparison to Asian children (M=48.03). This phenomenon can be explained by the fact that talking about past events allows for systematic rehearsing of those memories, as well as it focuses attention on details and provides elaboration. Additionally, a more individualistic self-narrative style allows children to reflect on their individual qualities and establish a unique sense of self which nourishes self-awareness (Wang, 2006). Both, the unique sense of self and self-awareness, are prerequisites for AM development and might influence an earlier onset of

AM in English-speaking American children. On the basis of these findings they argued that language fosters consolidation of earlier memories.

Wang et al. (2000) observed mother-child talk by American and Chinese parents and found that American mothers tend to speak in a highly elaborative and child-centered manner, while Chinese caregivers tend to employ a low-elaborative style with elements of concern for moral rules and social expectations. These differences in shared reminiscing yield systematic differences in how American and Chinese children remember their past and even present themselves - American children provide more details about events where they focus on their achievements and accomplishments. In contrast, Chinese children tend to mention fewer details about past events and tend to talk about others (Wang, 2004).

While it is not necessary to explain why one needs language in order to rehearse and share memories, the encoding aspect of language needs more elaboration. To claim that language is present at encoding suggests that linguistic elements are processed and stored as components of a certain memory. This was shown in a classic study by Loftus and Palmer (1974). The researchers played videos of car accidents to their participants and asked them: "About how fast were the cars going when they hit / smashed / collided / bumped / or contacted each other?" Depending on the verb used in the question, participants consistently estimated the speeds of the vehicles differently, from assigning the top speeds to the stimuli "smashed" and the lowest speeds to the word "contacted". Additionally, when retested in a week, the participants who were exposed to the verb "smashed", were more likely to agree that they saw broken glass. These results suggest that linguistic labels affect perception as well as memory for certain events.

Language has an effect on memory because it might be stored as an element of that memory and, consequently, represent it in the mind. This can be explained by the fact that when an event is experienced, an individual sees, hears, and experiences sensations of taste and touch, etc. All of these bits of information are processed through the sensory systems (eyes, ears, skin, etc.) and gather in the hippocampus, which is responsible for making sense of our experiences. The hippocampus distributes all the informational pieces (visuals, smells, kinesthetic components, sounds, etc.) to the parts of the brain that are responsible for storing them (Maquire & Mullally, 2013; Markowitsch, Thiel, Reinkemeier, Kessler, Koyuncu, & Heiss, 2000). For example, what we see (visuals) would be transferred to the visual cortex and what we smell would be transferred to the olfactory bulb, and so on. When it is time to remember an event, the hippocampus solicits all of the bits of information from the uni-modal cortical regions of the brain (Rubin & Umanath, 2015).

Language functions as one of the memory traces present at the encoding process due to the fact that human experiences are saturated with language. For example, one's memory from the last birthday party probably includes remembering multiple conversations with friends, family, and maybe even oneself. Language could also become a part of the encoding process because linguistic labels affect perception and, thus, memorization of events (Loftus & Palmer, 1974).

Admittedly, some memories might not have any language present at the time of encoding. If you watched a sunset over the ocean last summer, you might remember the beauty of the nature (visual memory component) and maybe the sound of the waves (the sound component). No language would be present at the time of the event, given if you

enjoyed the sunset alone or in silence. However, once you share that memory with someone, that memory would gain a language memory trace. This happens due to the fact that when a memory is recalled, it becomes malleable and goes through the process of re-coding. A memory, in other words, changes each time we share it. Therefore, once you talk about a memory, it is re-coded with a language memory trace by the pure fact of using language.

The notion that memories are stored with a linguistic memory trace is a central idea in psychotherapy with bilingual speakers. People who experienced childhood trauma in their native language but then learned a second language in adulthood may need to turn to their first language in order to access those earlier memories (Aragno & Schlacher, 1996). The study by Schwaneberg (2010), where Spanish-English bilinguals shared traumatic childhood events in L1 and L2 provides a telling example of this phenomenon. Nineteen participants agreed that sharing an event in the language in which the trauma happened yielded a more emotionally rich recall. One participant admitted that when she was speaking in the L1, the language of the tragic event, she “was seeing it, right there in form of [her] – the accident. It was not like that when [she] was speaking in English” (p. 52).

Additionally, recalls in the language of the event result in more detailed and more vivid memories (Javier, Barroso, & Munoz, 1993). The findings from the aforementioned studies suggest that language is an integrated element of memories and one would need access to that language in order to successfully recall the event (Schrauf, 2000).

To sum up, evidence from developmental psychology and psychotherapy suggests that language plays a crucial role in encoding, remembering, and recall. These findings are of great significance to the study of bilingualism: since language is the key to how we form memories, bilingual AM may rely on multiple languages of encoding and therefore function differently from monolingual AM, as it is discussed in the next chapter.

2.2 Bilingual Autobiographical Memory

The term *bilingual autobiographical memory* commonly refers to the autobiographical memory of individuals who speak more than one language (Schrauf & Rubin, 1998; Schroeder & Marian, 2014). Individuals who speak multiple languages might encode memories in their L1 or L2 depending on the language spoken around them at the time of the event; bi- and multilinguals may also share their memories in either L1 or L2 disregarding the language of encoding. For example, if an event happened to me during my childhood when only the Russian language was spoken by me and around me, I can talk about that event either in Russian or English because I am proficient in both. Ideally, I would prefer to use my L1 Russian when talking about my childhood events because the match between language of encoding and language of retrieval facilitates successful recall. My cultural background, a collectivistic small town in Siberia, would also affect what I chose to remember and what I never encoded. This happens because cultures place importance on certain elements and those elements are more likely to be highlighted and emphasized which leads to selective remembering (Wang, 2013). In what follows, I provide an overview of studies on bilingual autobiographical memory in a

chronological order by highlighting the main findings and the role of language and culture on memory of self in bilingual speakers.

The first empirical study of bilingual autobiographical memory (BAM) was conducted by Bugelski (1977) with 22 Spanish-English bilinguals who were on average 55 years of age. The participants had a Spanish-speaking childhood but switched to English later in life with none of the participants reporting to use L1 Spanish in the last 10 years. They were given 20 words in English and 20 words in Spanish and asked to “report on their first thoughts” associated with each word. Then the subjects were prompted to locate the time period in their lives to which the “thoughts” seemed to relate. The study revealed that the 70% of “thoughts” triggered by the English stimuli were from the later, adult life period. Such findings were later reinterpreted as evidence of the *language of encoding effect*, whereby bilinguals prompted by words in language X are more likely to retrieve memories in that language (Pavlenko, 2014).

To elicit memories, Bugelski (1977) relied on the cued recall procedure; when word-prompts are played to participants one at a time, the subjects are asked to recall a memory associated with a cue. Customarily, bilinguals are presented with translation equivalents in their L1 and L2, preferably on different test days. This design allows to keep the language conditions separate and to investigate whether bilinguals would recall memories that happened in an L1 environment when prompted by the L1 cues, and memories from their L2 environment when prompted by the L2.

Although Bugelski (1977) discovered differentiated sampling of memory according to language, he asked for “thoughts” which may include associations but not autobiographical memories per se (Schrauf & Rubin, 1998). A dissertation study by

Otoya (1987) focused exclusively on bilingual autobiographical memory recall. The researcher asked 40 English-Spanish bilinguals to share events from their childhood (before eight years of age) and adolescence (after fourteen years of age), as well as to recall memories with the help of 10 cues.

During the free recall the participants talked about the events of the past and rated them on a scale from 1 – “not clear at all” to 5 – “extremely clear”. The analysis revealed that childhood memories that were shared in Spanish were consistently clearer than the childhood memories that were recalled in English. The memories from the earlier part of their lives were also differed in content in comparison to the later memories: more trauma and family-oriented events were reported in the Spanish memories.

The cued recall in Otoya (1987) showed that memories elicited by the Spanish word-prompts were from a significantly earlier time frame than memories evoked by the English equivalents which means that childhood memories might be tagged with the Spanish language. The researcher demonstrated the language of encoding effect in Spanish-English bilinguals which suggests that language of the event might become a prominent memory trace stored with that memory.

Schrauf and Rubin (1998) further investigated preferential sampling according to language in bilinguals with a larger inventory of cues. Twelve Spanish-English bilinguals shared autobiographical memories in reference to a total of 100 cues. The authors hypothesized that memories triggered by the Spanish cues would come from the earlier period of life and memories elicited by the English word-prompts would come from a later period. However, this assumption was not proven to be true as the average age for Spanish memories was 29.69 and for the English memories 46.52 which did not reach

statistical significance. A possible explanation for the lack of the age effect between the English and Spanish memories might be the fact that the participants in the study had used both languages in the second part of their life which means that Spanish memories might have been retrieved from the pre and post-immigration periods.

In order to eliminate the age effect variable, Marian and Neisser (2000) focused on the language used during the original event and its match or mismatch with the language of retrieval. They asked 20 Russian-English bilinguals to elicit memories with the help of 16 word prompts and to recall which language was spoken at the time of the event. The memories were categorized into Russian memories (when the Russian language was spoken at the time of the event), English memories (when English was spoken at the time of the event), and mixed (when both languages were present at encoding). The study showed that Russian cues were more likely to trigger Russian memories and the English cues were more likely to trigger English memories. In addition, English memories were retrieved faster when the cues were presented in English.

To further investigate the effects of the match between the language of encoding and the language of retrieval in BAM recall, Marian and Neisser (2000) ran a second experiment with another cohort of 24 Russian-English bilinguals. This time they focused on the ambient language as a factor underlying language-dependent memory recall, instead of the word-prompt effect (p. 365). The Russian cues were incorporated into the English test day and the English cues were interviewed into the Russian interview in order to disentangle the effect of the word prompts and the ambient language factor. As a

result, participants recalled more Russian memories when interviewed in Russian regardless of the word prompts.

Both experiments by Marian and Neisser (2000) demonstrated the importance of match between the language of encoding and language of recall for enhanced retrieval. This was also the first study that expanded the BAM research to other language than Spanish. Together, the findings of these studies have been interpreted as evidence of the *language of congruity effect*, whereby the match between the language of encoding and retrieval leads to a more detailed, rich, and vivid output (Pavlenko, 2014).

After the significant role of language in BAM was demonstrated by Bugelski (1977), Otoya (1987), Schrauf and Rubin (1998), and Marian and Neisser (2000), Schrauf and Rubin (2000) sought out to investigate the interplay between linguistic (internal language of retrieval, hearing voices, and linguistic intensity) and non-linguistic (visual component, emotionality, and previous rehearsals) elements in BAM. The researchers elicited memories with the help of 50 cues and asked their participants to share whether 1) the memory came to them in Spanish, English, or both languages, 2) they saw any images 3) experienced a sense of relieving 4) could hear voices 5) thought and talked about a memory in the past and 6) the intensity of experienced emotions. The collected phenomenological properties allowed the researchers to demonstrated that 80% of all the memories were linguistic in nature and that hearing voices was correlated with a strong sense of reliving. The study by Schrauf and Rubin (2000) furthered our understanding of the role of language in memory and introduced phenomenological properties as an important variable in the study of BAM.

Similarly to Schrauf and Rubin (2000), Larsen, Schrauf, Fromholt, and Rubin (2002) focused on the internal language for memory retrieval in bilinguals. Although the authors did not include any other variables in the study, they were able to recruit Polish immigrants in Denmark who did not anticipate their move and therefore did not speak any Danish in the first part of their lives. This “clean” break in linguistic environment is ideal for research on memory and language since it allows to test whether the home country memories were encoded in the L1 (p. 48). An additional strength of the study was in the two participant subsets: 10 Polish-Danish bilinguals immigrated at the age of 24 and 10 Polish-Danish bilinguals moved to Denmark at the age of 34 which means that the two groups varied in the onset of exposure to the second language. The collected memories showed a distinctive pattern: the Polish memories in the early bilinguals declined significantly at the age of 24 which is right around their initial contact with Danish. In contrast, the Polish memories in the later migrants waned after their exposure to Danish which was at the 34 year mark.

Larsen et al. (2002) interpreted their findings as evidence for two memory stores in BAM: home country memories might be encoded in the L1, while post-immigration memories might be encoded in the L2 or both. Recruiting bilinguals who relied solely on their native language for at least a part of their lives allowed the researchers to argue for two separate linguistic codes for pre-immigration and post-immigration life periods.

Wang, Leichtman, and Davies (2000), Wang (2004), and Matsumoto and Stanny (2006) felt that experimental examination of BAM should be expanded to non-Indo-European languages (p. 380). Matsumoto and Stanny (2006) recruited 18 Japanese-English bilinguals. The subjects elicited memories with the help of 40 Japanese and

English word-prompts. The memories were coded for the age of event, emotionality, and language of encoding. The results for Japanese-English bilinguals were in accordance with the findings in studies with Spanish-English and Russian-English bilinguals - Japanese cues triggered more Japanese memories and English word prompts elicited more English memories. Thus, in support of the language congruity idea, access to AM was optimal when there was a match between the language of the cue and the language of the event (p. 387).

An interplay between culture and language in bilingual and bicultural individuals has been examined by Marian and Kaushanskaya (2004), Marian and Kaushanskaya (2007), and Wang, Shao, and Li (2010). The first study focused on autobiographical memories of bilingual and bicultural speakers of Russian and English. The participants provided memories of self in their L1 and L2. These memories were coded for the number of personal pronouns, proportion of group pronouns, and main agent of the narrative; the findings revealed that when events were shared in English, they were more likely to be self-oriented. The researchers explained that the Russian language might be associated with a collectivistic culture and provide a different framing for memories; thus, the bilingual self could be mediated by the language spoken at the time of the retrieval (p. 197). Wang et al. (2010) discovered a similar effect of culture and language on bilingual autobiographical memory in Chinese-English speaking children. The bilinguals provided more detailed and self-focused descriptions of events when interviewed in the English language. Marian and Kaushanskaya (2006) interviewed Mandarin-English speakers asking them to name a statue of someone standing with a raised arm while looking into the distance. The study revealed that participants were

more likely to name a statue of Mao when interviewed in Chinese and to name a statue of Liberty when interviewed in English which suggests a language-dependent memory effect.

Although, a crucial role of language in BAM has been established, very few studies looked into a relationship between language proficiency and memory of self. Up to date, to the best of my knowledge, there are only two studies that have considered language proficiency (Mortensen, Berntsen, & Ocke-Schwen, 2014; Esposito & Baker-Ward, 2016). Mortensen et al. (2014) worked with Danish-English bilinguals who were asked to report their L2 proficiency with a help of a questionnaire. The researchers examined the language of the encoding effect with high and low imageability cues. Their findings revealed that language of encoding effect was higher for low imageability words which means that abstract words might be stored and retrieved from a language-specific store in a human mind (p. 152). Unfortunately, the L2 proficiency measure was not considered as a variable in this study; it was collected in order to ensure an adequate level of L2 English proficiency because the participants resided in Denmark.

Another study that collected an L2 proficiency measure and used it as a variable was conducted by Esposito and Baker-Ward (2016). The researchers examined the relationship between L2 proficiency and language of the encoding effect in what they called “less proficient” and “more proficient” Spanish-English bilinguals. The L2 measure was collected with a help of a language background questionnaire and one question: “When conversing with another individual who knows both Spanish and English equally well, what percentage of the time would you choose to speak English?” The data, collected with a help of a cued recall technique, revealed that less proficient

Spanish-English bilinguals retrieved earlier memories to the Spanish cues, while more proficient bilinguals recalled closely dated memories to the Spanish and English cues. The researchers concluded that higher L2 proficiency means that bilinguals might have one conceptual store for their memories. However, the study has a major limitation. The researchers did not collect information on the language of the event, assuming that all post-immigration memories would be encoded in English. No information on the L1 proficiency was collected in this study.

To sum up, the BAM studies to date show that language and culture might dictate how events are encoded and retrieved (Wang, 2013). More specifically, memories are highly context-dependent which means that any relevant language(s) or cultural aspects of an event become a permanent part of that memory (Schroder & Marian, 2014). Subsequently, these elements or contextual factors can serve as retrieval cues. As far as the methodology for BAM inquiry, most studies rely on cued-recall procedure for memory elicitation (Larsen et al., 2002; Marian & Neisser, 2000; Marian & Kaushanskaya, 2004; Matsumoto & Stanny, 2006) with three studies employing a free recall (Javier, et al., 1993; Schrauf & Rubin, 2001; Wang, 2004). When a memory is recalled, the following pieces of information might be collected: age of event (Larsen et al., 2002; Marian and Neisser, 2000; Matsumoto and Stanny, 2006; Schrauf and Rubin, 1998), time of response to a cue (Marian and Neisser, 2000; Matsumoto and Stanny, 2006; Schrauf and Rubin, 1998; Schrauf and Rubin, 2000), and phenomenological properties such as significance, vividness, emotionality (Schrauf & Rubin, 2004; Schrauf & Rubin, 2000). The results suggest a language of encoding effect (Larsen et al., 2002; Marian & Neisser, 2000; Matsumoto & Stanny, 2006; Schrauf & Rubin, 2004; Schrauf &

Rubin, 2000; Schrauf & Rubin, 1998), for the language congruity effect (Javier, et al., 1993; Marian & Kaushanskaya, 2004; Schrauf & Rubin, 1998; Schwanberg, 2010), and for the later reminiscing bump in immigrant bilinguals (Schrauf & Rubin, 1998). A major limitation of this work is the absence of proficiency measures. Even Esposito and Baker-Ward (2016) and Mortensen et al. (2014) who did collect information on L2 proficiency, relied on self-reports. Moreover, none of the BAM studies have considered a relationship between L1 proficiency or L1 attrition and memory of self.

2.3 First Language Attrition

First language attrition (FLA) can be defined as reduction or weakening of language that has been mastered earlier (Schmid, 2011); it can manifest itself in lexical access difficulties, disfluency, and optionality in grammatical features (Schmid & Jarvis, 2014). FLA involves non-pathological language loss and should be differentiated from aphasia and intergenerational language shift – FLA is a phenomenon of gradual change in language proficiency in healthy individuals within one generation (Yagmur, 2004; Schmid, 2011). In what follows, I will outline the key factors shaping FLA and then discuss research methods in the study of FLA.

2.3.1 Factors that Affect First Language Attrition

While the current studies of FLA do not provide a conclusive picture, Schmid (2016; 2011; 2004a) strongly suggests that among the main factors affecting L1 attrition are the following: amount of L1 use, length of residence in the L2 country, education level, attitudes, motivation, and age of arrival to an L2 speaking country. In what follows, I will review each factor in detail.

The *L1 use or L1 contact* might seem like a logical predictor for L1 maintenance – the more one uses the L1, the less likely he or she is to experience decrease in L1 proficiency. However, investigations into how limited L1 use might influence L1 attrition offer contradicting evidence. For example, de Bot, Gommans, and Rossing (1991) showed that amount of language use facilitated L1 maintenance in Dutch-French bilinguals. At the same time, Jaspaert and Kroon (1989) failed to demonstrate a correlation between amount of L1 use and language loss in Turkish and Italian immigrants residing in the Netherlands and Flanders. In other words, limited exposure to Italian and Turkish did not lead to extreme L1 attrition. Similarly, Schmid (2004) found that lack of language use is not a strong predictor for language attrition. Isurin (2007; 2013) further demonstrated that L1 usage in an L2 dominant environment is not sufficient for L1 maintenance.

The only type of L1 usage that seems to prevent L1 attrition is using L1 in a professional setting (Schmid & Dusseldorp, 2010; Steinkrauss, Lahmann, & Schmid, 2017). This can be explained by the fact that while code-switching might be acceptable in everyday language usage, it might be inappropriate in a professional setting which facilitates a higher degree of practice and more inhibition of L2 (Schmid, 2007, Yilmaz & Schmid, 2018). Outside of using the L1 for professional purposes, more frequent usage of L1 does not fully safeguard from L1 attrition. It seems that other factors or combination of factors might be responsible for L1 attrition (Schmid, 2011; Yilmaz & Schmid, 2018).

Length of residence in L2 country also does not seem to be detrimental to L1 maintenance. Multiple studies have shown very little effect of length of residence on L1 attrition (Isurin, 2013; Schmid, 2004; 2016). For example, de Bot and Clyne (1994)

worked with Dutch immigrants in a longitudinal format, with the first and second interviews 16 years apart. The researchers discovered a negligible amount of language loss in those 16 years. Another longitudinal study by Hutz (2004) similarly demonstrated that language might stay remarkably stable over a span of 57 years. According to the current understanding of the first language attrition process, it is possible to maintain a language over an extremely long period of time if the language was somehow maintained in the first years of immigration (Schmid, 2002).

A potential explanation of why the amount of L1 use or length of residence in a L2 country do not predict L1 attrition involves the influence of other extralinguistic factors, such as the *level of education* (Isurin, 2013; Schmid, 2011). For instance, while the mentioned earlier study by Jaspaert and Kroon (1989) did not show any connections between L1 use and attrition, it did reveal the importance of education for successfully performing certain language tasks. Similarly, Waas (1996) demonstrated that education level positively affected L1 verbal fluency in speakers of L1 German. This noticeable influence of education on L1 maintenance was explained by a possible connection between literacy and resistance to attrition (Schmid, 2004). An ability to read and write might allow more L1 exposure. It also might facilitate consolidation of language in the brain (p. 20).

Another extralinguistic factor that might interfere with L1 maintenance involves *attitudes and motivations*. Schmid (2002) convincingly demonstrated that German Jews, who left Germany prior to World War II, formed negative attitude toward the German language because of their experiences of persecution. As a result, they resisted using the language and experienced attrition. This distancing from L1 was detrimental to their L1

maintenance. However, the study by Schmid is the only study that offers compelling evidence for the importance of attitudes and motivations. Yagmur (2004), Waas (1996), and Cherciov (2012) all failed to establish that “attitude is a guarantee against language attrition” (Cherciov, 2012, p. 730).

Another problematic factor is the *age of arrival*. Bylund (2009) and Schmid (2004; 2011) have highlighted the importance of the age factor. The current claim is that the linguistic system can be significantly eroded if the attrition process sets in before puberty because the language acquisition has not been completed (2004, p. 9). This claim is based on two pieces of evidence. One is that children might experience drastic attrition and even complete forgetting of their L1 (Isurin, 2000; Nicoladis & Grabois, 2002; Ventureyra & Pallier, 2004). Another piece of evidence is that once established, linguistic system seems to be resistant to attrition; this stabilization supposedly happens around puberty. In fact, Schmid (2002) even claimed that “no study researching attrition among speakers who were above the age of twelve [...] has found anything remotely drastic [in comparison to early arrivals]” (p. 92).

However, both findings are problematic. First of all, studies that claim complete L1 loss rely on very young children. For example, Nicoladis and Grabois (2002) studied a 17 month-old Chinese adoptee. If the age of arrival of the subject is noticeably low, it means that the language has not been yet fully acquired. By definition, if something has not been acquired, it cannot be lost. Therefore, the 17 month-old subject in Nicoladis and Grabois (2002) who clearly had not mastered Chinese before coming to the U.S. is not an example of attrition, but rather is an example of incomplete acquisition (see in the next subsection of this chapter).

Second of all, age has not been shown as a significant L1 attrition factor in both pre-puberty and post-puberty immigrants. While De Leew, Tusha, and Schmid (2018) were able to demonstrate that even individuals who learned an L2 as adults can experience L1 phonological attrition, Schmid herself (2002) did not find the age of immigration to be a significant predictor for L1 maintenance in the study of adult German refugees. In other words, individuals who were younger at the time of immigration did not experience greater levels of attrition. Similarly, Kaltsa, Tsimpli, and Rothman (2015) showed that while simultaneous and sequential Greek-Swedish bilinguals differed from the monolingual controls, the earlier arrivals did not experience more L1 attrition. A recent study by Steinkrauss, Lahmann, and Schmid (2017) also examined the role of age on L1 attrition in participants with 7 – 17 age of arrival. The researchers confirmed that age of arrival had little effect on L1 attrition. Isurin (2002) and Montrul (2013) demonstrated that the same age of arrival (9 years old) could lead to drastic attrition in one case and to L1 maintenance in the latter which means that other factors or a cluster of factors must be affecting L1 attrition.

Studies by Flores (2010) and Putnam & Sanchez (2013) have also called into question the age factor by highlighting the importance of L1 activation for the L1 maintenance in early arrivals. Chamorro, Sorace, and Sturt (2016) focused on the role of L1 activation in Spanish-English attriters. The researchers demonstrated that certain syntactical structures may be activated after re-exposure to the L1 suggesting that attrition might manifest itself due to the lack of activation.

This idea of activation has gained popularity in L1 attrition research due to the fact that certain linguistic features seem to be particularly resistant to attrition even after a

lengthy period of L2 exposure (Chamorro, Sorace, & Sturt, 2016). Also, some individuals seem to be resistant to L1 attrition even if they do not use their L1 and have spent a reasonably long time in an L2 speaking environment (Yilmaz & Schmid, 2018). The idea of L1 attrition as a result of the lack of activation is juxtaposed to the idea of attrition as a result of erosion (Schmid, 2017). It is assumed that after certain linguistic features are mastered, they remain intact and can resurface given the right amount of activation. However, this is a new approach that so far has not been researched or explained in much detail (Chamorro et al., 2016a; Yilmaz & Schmid, 2018).

2.3.1.1. Incomplete acquisition. Incomplete acquisition is observed when the lack of language proficiency is not the result of L1 weakening or attrition, but is rather caused by having no mastery of certain L1 linguistic features before experiencing contact with the L2 (Montrul, 2008). For example, if an international adoptee did not have full knowledge of L1 syntax when arriving to the U.S., their lack of L1 proficiency would be caused by incomplete acquisition. Attrition refers to the process of L1 knowledge reduction; by definition, an individual cannot lose something that was not originally there.

One way to establish the difference between L1 attrition and incomplete acquisition is to set some sort of benchmark for L1 acquisition. For example, if a case system in Russian is mastered by the age of six and the age of immigration is seven, then weaknesses in case marking may be linked to the weakening of previously acquired L1 knowledge. On the other hand, if the irregular plural forms in Egyptian Arabic are only mastered by the age of 12 (Clark, 2001) and the age of arrival is seven, then any difficulties producing these in speech should be viewed as a result of incomplete acquisition.

Since the current paper examines attrition of Russian as an L1, I will outline some important developmental benchmarks for the Russian language in Table 1 (Ceytlin, 2000; 2006; Polinsky, 2007; Schwatz et al., 2014; Schwartz & Minkov, 2014; Tomas et al., 2017).

Table 1. Ages of Mastery for the Russian Language as an L1

Study	Investigated Feature(s)	Age of Acquisition
Polinsky (2007)	Syllabification	6
Schwartz et al. (2014)	Noun-adjective gender agreement	4-5
Tomas et al. (2017)	Morphonological alternations from Nominative to Genitive case	7
Ceytlin (2000)	All the case markers	6-7
Ceytlin (2006)	Declension three of the case system	6-7
Schwartz and Minkov (2014)	Noun system Genitive case	3 3

As can be seen from the Table 1, although there is a continuum for acquisition of Russian as an L1, a child would have a mastery of the main grammatical elements by the age of six. Therefore, I would argue that any child arriving from a Russian-speaking country after the age of seven should not be viewed as an incomplete attriter.

To sum up, the L1 attrition research does not provide a conclusive picture regarding which factors could be detrimental to the L1 maintenance. Rather, it appears that L1 attrition is caused by a cluster of factors. Another explanation for the inconsistency of findings might stem from participant sampling, data analysis, and

relying on divergent FLA methodologies (Schmid, 2011). The next subsection provides a brief overview of the current methods used to study first language attrition.

2.3.2 Methods of Studying First Language Attrition

There are four main ways of assessing L1 attrition: self-assessment or *can-do*-scales; formal language tasks including grammaticality judgement tests and picture-naming; native speaker perception ratings; and analyzing spoken data for errors and dysfluencies (Isurin, 2013; Schmid, 2011; 2004; Yagmur, 2004). Since it is common to use multiple measures in a single study, in what follows I will review each method in more detail with its advantages and limitations.

The self-assessment or *can-do-scales* consist of various statements pertaining to the participant's language proficiency. Usually, the participant rates his or her proficiency on a scale from "I cannot do it at all" to "I can do it with no difficulty at all". Despite the fact that the self-reported nature of the task has been criticized (Yagmur, 2004), *can-do-scales* have been used successfully because they correlate with formal language assessments (Schmid, 2004; 2014). For example, Schmid (2014) demonstrated that results from a *can-do-scale* task correlate with results from a cloze language test.

Formal language tasks might include grammaticality judgment tests, *c-tests*, cloze tests, translation tasks, lexical or picture naming tasks (Chamorro et al., 2016; Hyltenstam et al., 2009; Isurin, 2013; Montrul, 2013; Schmid & Dusseldorp, 2010). Although popular, all of these assessments have been criticized due to multiple limitations and lack of authenticity. For instance, the translation task does not provide an accurate picture of attrition because the task itself requires certain skills and training; even balanced bilinguals might have difficulties translating between their languages

(Yahmur, 2004). Similarly, Schmid (2004) argued that verbal fluency tests, picture naming, and grammaticality judgment tests are not as effective because they yield a significantly larger number of errors than found in free discourse (p. 26).

Analysis of *elicited spoken data* addresses the issues of inauthenticity of the formal assessments (Flores, 2010; Montrul, 2013; Schmid, 2002; Schmid & Dusseldorp, 2010; Steinkrauss et al., 2017). To collect spoken data, researchers have used spoken interviews or retelling of a story tasks such as using a picture-based book by Mercer Mayer “Frog, Where Are You?” (1969). Picture books have been utilized in the study of L1, L2 development, as well as L1 attrition and have been proven to be appropriate for various linguistic analyses (Berman & Slobin, 1994; Bulte, Housen, Pierrard, & Van Daele, 2008; Pavlenko, 2010; Yahmur, 2004, p. 148).

Elicited narratives are usually transcribed, coded, and analyzed for errors and overall proficiency (Schmid, 2004; Schmid & Dusseldorp, 2010; Steinkrauss et al., 2017). The error analysis consists of defining errors and locating them in the narratives. This approach has many challenges and limitations due to possible rater bias, overreliance on prescriptive grammar, and dialectal differences. It also could be difficult to spot errors when attriters might be “disguising their diminished competence through avoidance strategies” (Schmid, 2004, p. 252). Therefore, researchers favor analyses of overall proficiency. The analysis of overall proficiency usually includes investigation of various linguistic aspects such as lexicon, morphology, and syntax in the narratives. More specifically, a researcher might look into linguistic diversity, mastery of certain case or gender markers, or word order. The main difference between analyses of errors and proficiency is that the latter focuses on obligatory elements such as gender marking in

German (Schmid, 2002). The analysis of proficiency provides a more holistic picture of L1 attrition because it highlights what is retained and not what was lost (p. 239).

Another way to strengthen the analysis of L1 attrition is by utilizing a control group (Jaspaert, Kroon, & Hout, 1986; Schmid, 2004; Yagmur, 2004). Usually, a control group would consist of monolingual speakers who still reside in their L1 speaking environment. The experimental and control group are also usually closely matched on all the variables except the factor that is directly related to the language attrition (Jaspaert et al., 1986). Having a static comparison group allows the researcher to compare and contrast L1 proficiency in L1 attriters and L1 speakers (Yagmur, 2004).

Although the control group design has been widely used in L1 attrition studies and has been a staple of quality FLA research (Schmid, 2004), this approach is not without problems. First of all, the issue of *language change* makes it problematic to find an identical speech community (Isurin, 2013). For instance, if the study participants immigrated 20 years ago, then comparing their L1 to the modern L1 speakers in their native country may not be acceptable because the language would have change. Unless the researcher can find some sort of recorded data from 20 years ago, then any comparison between L1 attriters who have resided in their L2 environment and L1 speakers who had remained in their L1 country would not be satisfactory.

Secondly, L1 attriters usually have command (with various levels of proficiency) of at least two languages, i.e., they are in fact bilingual. Grosjean (1989; 1997) has argued that a bilingual is not two monolinguals in one with a call to “no longer examining one of the bilingual’s languages without examining the other” (p. 13). Therefore, taking L1 data

from attriters and comparing it to the L1 data of monolingual population with a complete neglect of the attriters' bilingual status seems problematic. For instance, it is a well-known fact that bilinguals might have smaller vocabulary in their perspective languages in comparison to monolingual speakers (Bialystok, 2008). However, this fact is disregarded in L1 attrition research. For example, Schmid (2002) compared lexicon of German-English bilinguals to monolingual German speakers. Not surprisingly, she discovered a considerable amount of "loss" in the German lexicon of her German-English bilinguals. This loss was interpreted as attrition of the lexical domain. However, it is not clear whether the bilingual status of the participants might have contributed to this finding.

Another task that has been used to measure attrition is the native speaker perception test used to establish whether an attriter sounds native-like (Cherciov, 2012; Montrul, 2013). However, language change, language variation, and monolingual status of the rater might make this task inappropriate for assessing L1 attrition (Wodniecka et al. 2010).

To sum up, the L1 attrition researchers have relied on various types of methodologies in order to assess amount of L1 attrition and factors of L1 attrition including self-assessment or can-do-scales, formal language tasks, native speaker perception ratings, language background questionnaires, and analysis of spoken data. The individual limitations of perspective paradigms make triangulation of quantitative and qualitative method highly preferable in the study of L1 attrition (Isurin, 2013).

2.4 International Adoption in the United States

One population that may exhibit L1 attrition are international adoptees. In the United States, adopted children are quickly immersed in an English-dominant environment and rapidly lose their native language (Fogle, 2012; Isurin, 2000). In fact, for these children L1 preservation is often seen as an obstacle to socialization leading to abrupt L1 loss (Fogle, 2012). According to the Bureau of Consular Affairs, U.S. Department of State, there had been 267,098 intercountry adoptions from 1999 to 2016. The age at the time of adoption is rising, meaning that more and more school-age children come into the U.S. An older age of adoption suggests that the native language as well as the autobiographical memory had already started to develop before their arrival (Fivush, 2011). If L1 maintenance is necessary for access to early memories, what happens to those childhood recollections after L1 attrition sets in?

The terms *international*, *intercountry*, or *transnational adoption* are frequently used interchangeably and present a subtype of adoption where parents 1) adopt a child from a country other than their own through permanent legal means; and 2) bring that child to their country of residence to live with them permanently (U.S. Department of State, 2016). The international adoption process involves finding an agency, choosing a country of adoption, navigating the legal system, applying for an orphan visa through the U.S. Citizenship and Immigration Services (USCIS), and going through the judicial proceedings in a foreign country. Despite the daunting multistep legal process, international adoption is rather popular in the United States with one out of five children being an international adoptee (Tessler, Tuan, & Lee Shiao, 2011). In 2010, 42% of all

international adoptees found new homes in the U.S. which made it the largest receiving country in the world (Pew Research Center, 2017; Selman, 2012).

The origins of international adoption in the United States can be traced back to the cultivation of the idea of helping poor and distressed which was introduced by circulated images of children in need during the Depression era; the images of hungry children taught the public to feel responsible for the unfortunate (Briggs, 2012). “Americans first learned how to feel about foreign children from photos of sad eyed, often hungry or homeless kids. Before there was transnational adoption, there were photographs of children in need” (p. 132). According to Briggs (2012), pictures of starving children were widely used after the First World War to dramatize the rising Fascism and Communism in Europe and were partially responsible for a popular movement that demanded for the U.S. to become involved in the foreign affairs. The onset of the Cold War invited further intervention overseas and created a need and desire to help children who were orphaned and impoverished (p. 130). The adopted Displaced Persons Act of 1948 and the Refugee Relief Act of 1953 made it possible for Americans to adopt children, mostly war orphans from Korea, Japan, and China (Tessler et al., 2011).

In her book “To Save the Children of Korea: The Cold War Origins of International Adoption”, Arissa Oh (2015) tells a story of how the Korean War left behind 1,500 babies between American soldiers and Korean women along with 100,000 orphaned children. This did not pass unnoticed by the American Christian missionaries who were outraged with the levels of childhood poverty and homelessness. The very first American couple of Henry and Bertha Hold who adopted eight Korean children in 1955 marked the beginning of the Korean international adoption in the U.S. According to the

estimates of the Asian Nation Organization., there are currently between 110,000 – 150,000 Korean adoptees residing in the country with ages ranging from infancy to the 50s which comprises 10% of the present day Korean-American population (Korean Adoption Services Report, 2018; Lee, 2003).

Latin America became a popular source of international adoption in the 1980s after the U.S. engaged with the war on drugs, free trade, and antiterrorism in the region (Briggs, 2012). Presence of the United States in Latin America allowed for the local agencies to create connections and place orphaned children with American adoptive parents. The largest sending countries were Colombia, Peru, Guatemala, Chile, and Paraguay. Colombia and Guatemala remained in the top seven countries from 1990s till 2004 with Colombia still ranked fifth in 2010 (Selman, 2012).

After the fall of the Soviet Union in 1991, Russia became another popular source of international adoptions for Americans. The social and economic instability in the region lead to an increase in childhood poverty and homelessness. It is estimated that in the 1990s there were as many as 600,000 orphans in the Russian Federation (McKinney, 2009). While those numbers went down as the country became more stable, the number of children living in orphanages still remains high at estimated 330,000 (Mazzarino, 2014). In the last two decades Russia had been in the top three sending countries with 46,111 adoptions between the years of 1999 and 2014² with 30% of children being adopted after the age of three (Selman, 2012; U.S. Department of State, 2016). Later age of adoption suggests Russian adoptees would have a certain mastery of L1 and emerging

² Intercountry adoptions from Russian declined after a domestic law prohibiting foreign adoptions was passed by the Russian Federation Parliament in 2012 (Pew Research Center, 2017).

childhood memories. This means that at the time of their arrival to the United States, they should have an ability to talk about themselves and their past in the native language before they transition to an L2, English.

The only other country that surpasses Russia as a source of international adoptees is China with 76,026 cases between the years of 1999 and 2015. However, most Chinese adoptees are adopted at younger ages, more specifically, 87% of Chinese adoptees arrive to the U.S. before they turn three years of age. Also, parents who adopt children from China are more likely to keep up with the child's language and culture because Chinese children do not look like their adoptive parents (Fogle, 2012). This is not the case with the international adoptees who arrive from Russia since they look more like their Anglo-Saxon parents. This puts Russian adoptees in a greater risk for cultural assimilation and language attrition. Sometimes, the attrition might be complete within two years after arrival (Isurin, 2000).

Although adoptions from the Russian Federation had ceased after a ban on foreign adoption came into effect in 2012 (Baitel, 2015), there are thousands of Russian adoptees currently living in the United States. Moreover, the ban does not mean the end of adoption of Russian-speaking children – in the past few years Ukraine has emerged as a new source country for Ukrainian and Russian-speaking adoptees (Selman, 2012; Traster, 2014). The country has an age limitation: a child has to be at least five years old in order to qualify for an international adoption (Traster, 2014). Other countries such as Poland and Belarus also promote adoption for older children (Selman, 2012) which means that those adoptees will become vulnerable to a rapid L1 attrition after their arrival to the United States.

2.4.1 L1 Attrition and L2 Development in International Adoptees

An almost complete and abrupt L1 loss in the population of international adoptees has been well documented by linguistic and fMRI studies (Fogle, 2012). In one such study, Ventureyra et al. (2004) asked Korean adoptees in France to discriminate between common Korean voiceless consonants. The adoptee group did not perform better than monolingual French controls even after a brief re-exposure to L1 Korean. Similarly, Pallier et al. (2003) discovered that Korean adoptees could not distinguish Korean sentences from other languages; also, the fMRI scans did not reveal any differences in brain activation patterns between Korean adoptees and monolingual French controls which was interpreted as complete L1 loss by the authors.

This L1 loss is usually accompanied by L2 acquisition which leads to a complete replacement of L1 with an L2. The dominant language replacement has not been shown to benefit successful L2 acquisition. In fact, L1 attriters might perform worse on L2 language tasks in comparison to monolingual and bilingual speakers (Hyltenstam, Bylund, Abrahamsson, & Park, 2009; Norrman & Bylund, 2016). This finding can be explained by the fact that L1 maintenance can be beneficial for L2 acquisition, while drastic L1 attrition might hinder native-like L2 attainment.

Several studies demonstrated that internationally adopted children might fail to catch up to their monolingual peers in language development (Eigsti et al., 2011; Hough & Kaczmarek, 2011). Hough and Kaczmarek (2011) analyzed language development in 44 internationally adopted children ages 5-11 with the help of standardized language tests and showed that at least third of the tested sample were below the norm. The researchers interpreted their findings by the trauma of being institutionalized. However, only the

readings scores correlated with the amount of time spent at an orphanage with spoken language, listening, pragmatics, semantics, and syntax not connected to the variable of institutionalization. Eigsti et al. (2011) also discovered a language delay in internationally adopted children where the time spent at an orphanage did correlate with the language development issues.

However, there is a wealth of studies demonstrating that internationally adopted children do catch up with their monolingual peers if given enough time (Glenn, 2014; Krakow & Roberts, 2003; Rakhilin et al., 2015). For instance, Glenn (2014) followed 56 adopted children for three years and tested their receptive and expressive L2 knowledge. He discovered that children who were adopted at the ages of 1-2 “caught up” faster than children who were adopted at the ages of 3-4. However, even the older adoptees showed no language delays after three years of residency in the United States.

While the conflicting findings might be explained by the differences in method used and small sample sizes, it is important to point out that there is a high level of variability when it comes to L2 development in international adoptees that could be affected by multiple factors such as orphanage conditions, country of origin, etc.

The finding regarding complete L1 loss in international adoptees has also been challenged by several recent studies where the adoptees were subject to a considerable amount of re-exposure to their L1. Oh et al. (2010) demonstrated that Korean adoptees were better at identifying some L1 morphemes in comparison to the control group after a two-week Korean language course. Similarly, Choi et al. (2017) demonstrated that Korean adoptees were better at discriminating voiced and voiceless Korean L1

consonants after 13 training sessions over 12 days in comparison to the control group. The aforementioned studies argued that early exposure to an L1 can be beneficial in relearning that language. These studies also suggest that remnants of L1 might remain in the brain, at least as far as Korean phonetics is concerned.

Isurin and Seidel (2015) documented a case of an adoptee remembering traces of her L1 after an extensive exposure to L2. TJ, a test subject was adopted at the age of three and reported complete loss of her L1. She did not have a productive L1 knowledge; she could recognize several words but failed to provide their meaning. The researchers used a series of tasks that included word recognition, picture-word matching, and word recall. Two sets of words were used: old words that most children would be familiar with before the age of 3 and new words that the participant would not have been exposed to. The subject performed significantly better on relearning of the old words. The authors interpreted their findings within a savings paradigm theory suggesting that residual memory for the learned language could provide a savings effect during subsequent relearning of that language.

2.4.2 Autobiographical Memories of International Adoptees

To the best of the author's knowledge, there are no experimental studies focusing on the role of language in autobiographical memory of international adoptees. However, at least two aspects should be acknowledged when investigating memory of self in this population. To begin with, the language development of international adoptees is unique because separation from biological parents and life in an orphanage may be traumatic experiences, and in the context of international adoption these experiences may be linked to the L1, similarly to the experience of persecution among German Jews in Schmid's

study. The trauma may also affect their recall because memory for traumatic events may differ qualitatively from non-traumatic events (Brewin, 2007). For instance, a meta-analysis of all the articles on traumatic autobiographical events from two large databases PsycINFO and MEDLINE by Barry et al. (2018) revealed that traumatized individuals show compromised memory specificity, i.e., recall fewer details compared to individuals without exposure to trauma.

Individuals with posttraumatic stress disorder (PTSD) and depression also remember trauma differently in comparison to healthy population. Ashbaugh et al. (2017) examined an effect of PTSD on phenomenological characteristics of autobiographical memories in a sample of 696 participants. The authors demonstrated that individuals with PTSD retrieved more negative memories that had higher sensory detail and were more vivid. Similarly, Rubin, Dennis, and Beckham (2011) reported that people with PTSD recall more emotionally intense memories. At the same time, depression might cause impaired recollection (Ashbaugh et al., 2017; Ramponi et al., 2004) and bias toward negative events with better memory for negative events (Burt, Zembar, & Niederehe, 1995).

While there seems to be a consensus that traumatic events might be remembered differently from non-traumatic events (Ashbaught et al., 2017; Barry et al., 2018; Rubin et al., 2011; Ono et al., 2016; Williams & Moulds, 2007), it is important to point out that traumatic memories differ from non-traumatic memories only in clinical populations. In other words, only individuals who have been diagnosed with PTSD or depression exhibit different patterns of remembering, especially when it comes down to the negative events.

At the same time, healthy populations do not demonstrate any differences in how they remember negative, neutral, or positive events (Brewin, 2007).

2.5 Summary of the Literature Review

Autobiographical memory is a uniquely human phenomenon that is deeply rooted in language. It emerges around the age of three and is fostered by the development of language which allows for the encoding, storing, and sharing of these memories. Bilingual speakers might encode their memories in multiple languages depending on the language of the event which means that their memories might be stored with either an L1 or L2 language memory code. For bilinguals, if an L1 code becomes inaccessible, as it happens during language attrition, the memory that was stored with that code might deteriorate or be forgotten. The most common method to investigate bilingual autobiographical memory is the cued recall technique which will be implemented in this study.

One population that may experience abrupt L1 attrition in the United States is international adoptees. Their L1 maintenance is commonly unsupported and they are fully immersed in L2 speaking environment. Based on the review of the literature, the most useful and informative methods for investigating attrition is a combination of self reports and analysis of authentic L1 speech, and these will be utilized in this research. Since autobiographical memories for traumatic events might be less specific and qualitatively different from non-traumatic events, I will focus on retrieving memories of common foods, games, and toys and avoid collecting memories of negative events.

CHAPTER 3 THEORETICAL FRAMEWORK

3.1 Dual Coding Theory

The theoretical framework of the present study is the dual coding theory (DCT) developed by Canadian psychologist Alan Paivio between 1971 and 2014. The theory is based on an assumption that human cognition rests on two separate systems, one is rooted in the processing of verbal information or language, and another - in the processing of information concerning nonverbal objects (Paivio, 1990). In the context of episodic memory, Paivio and his associates (Clark & Paivio, 1987; Clark & Paivio, 1991; Paivio, 1990) showed that memory trace that encode verbal and non-verbal information are more resilient to forgetting: “dually-coded items will be remembered better than unitary coded items” (Paivio, 1990, p. 5). Memories that are encoded with a single code, e.g., only verbal, might become susceptible to deterioration and erode over time.

This theory was originally developed by Paivio (1971/1979) based on a series of experiments on remembering and forgetting where he presented pictorial stimuli with no verbal component and pictorial stimuli with a verbal component to the participants. His findings revealed that the verbal memory trace was crucial for successful retrieval, especially in sequential tasks. Paivio (1979) concluded that “two codes summate in their facilitative effect on information retrieval” (p. 238). If there is only one memory trace present at the time of the encoding, then the storage and retrieval is weakened.

Initially, the dual coding theory was applied to learning and memory in general – if new information is presented with two modes of representation, e.g., and audio and an image, that new information would be remembered better (Clark & Paivio, 1990; 1987). Paivio and Desrochers (1980) extended the dual coding theory to second language (L2)

acquisition suggesting that L2 vocabulary learning can benefit from the usage of pictorial representations. Since then, the application of DCT to L2 learning has been tested by multiple researchers in a variety of areas, including awareness of lexical errors (Lee, 2017), L2 vocabulary learning (Sadoski, 2005), acquisition of literacy (Paivio & Sadoski, 2011), and memory for L2 idioms (Pritchett, Vaid, & Tosun, 2016). All the studies confirmed that presenting information through several modes of representation enhanced L2 learning.

Paivio and Lambert (1981) extended the dual coding theory to bilingual memory. The researchers presented French-English bilinguals with words under three conditions: repetition of a word in L1 or L2, translation of a word into L1 or L2, and presentation of a word with an image. The memory test revealed that the participants did not remember the items they repeated regardless of the language they were in. However, they remembered the translated items pretty well. Although the memory for the words accompanied by the pictures was the best, the authors argued that having an extra code, the translated word, enhanced the memory for those items. The explanation involved L1 and L2 processing systems (Paivio, 1990); if both are engaged, the storage and recall are more consistent and successful. Thus, bilingual speakers might have a memory advantage when utilizing both languages. This finding was replicated with French-English bilinguals (Vaid, 1988) and Japanese-English bilinguals (Taura, 1998).

More recently Paivio and associates (Jared, Pei Yun Poh, & Paivio, 2013) tested the prediction that in addition to two separate verbal processing systems, some bilinguals have two separate non-verbal processing systems. Forty Chinese-English bilinguals who were raised in China and studied in Canada engaged in a picture naming task of

culturally-biased and culturally unbiased images in their L1 and L2. The results revealed that the naming latency was significantly shorter for the culturally-biased pictures if the language and culture matched. In other words, participants named the objects faster if those objects were representative of Chinese culture and the naming was done in the Chinese language. It is important to point out that this finding is not due to a higher fluency in Chinese because the pictures representing Western/Canadian culture were also named faster when the naming was performed in the English language.

These findings led the researchers to argue that verbal labels might be attached to a culture-specific conceptual storage and that “concepts are not the same for translation-equivalent words in two languages” (p. 393). Thus, this study supports the bilingual DCT suggesting that bilinguals might have to separate conceptual representations for their L1 and L2.

Summing up, the dual coding theory has successfully explained and demonstrated how a multimodal memory trace enhances learning, remembering, and recalling of new information in monolingual and bilingual speakers. The reason why this theory was chosen is because in case of L1 attrition the language memory code might deteriorate which could compromise the memory. This theory has never been applied to bilingual autobiographical memory in individuals whose verbal memory traces might have deteriorated due to the language loss. The following subsection elaborates on this gap in research literature.

3.2 Gaps in the Current Research

Currently there is a wealth of evidence suggesting a connection between language and personal memories: we rely on language to remember, store, and share the stories about our past (Fivush, 2014; Shwaneberg, 2010; Wang, 2004). The way we talk about events with others, i.e., shared reminiscing, dictates what would be remembered and what would be forgotten. This process of memory consolidation starts in early childhood where language as a medium plays a significant role in establishment of autobiographical memory (Fivush, 2011).

In individuals who speak more than one language, memories might be differentiated based on the language(s) spoken at the time of the event, i.e., bilinguals might have a set of L1 memories for events that happened in their native language and a set of L2 memories that were experienced in their second language (Pavlenko, 2014). This has been shown by the language of encoding effect: L1 cues are more likely to trigger L1 memories and L2 prompts to elicit L2 memories. In essence, words in the L1 might become a prominent part of a memory that happened in the L1 speaking environment (Schrauf, 2009).

If a memory is permanently tagged with a linguistic memory trace, it would be stored as a part of that memory and could serve as a cue for retrieval. For example, if I hear *варенье* (varen'e) "homemade jam" in Russian, it triggers a very vivid memory of me picking cherries in my grandma's garden, covering berries with pounds of sugar, watching my grandma boil berries in a huge aluminum tub, and inhaling amazing aroma of the cooked fruit. This multidimensional memory with visuals (burgundy colored cherries, etc.), kinesthetic sensations (popping the pits out of mushy cherries), and

olfactory elements (smell of the boiling jam) is elicited through the word *варенье*. Just hearing it triggers many other related memory components creating a complete mental image of that experience. Interestingly, the word itself seems to bring it all together – seeing sugar or cherries somehow does not have the same effect – only when I hear *варенье*, I get to re-experience this warm childhood memory.

Conversely, an English translation equivalent “jam” reminds me of selecting prepackaged jams at the grocery store, reading the sugar content label, and standing in the check-out line. While the memory triggered by the English word might be also multidimensional, it lacks vividness and emotionality, and it definitely does not bridge into recalling my childhood memory. It seems crucial for me to hear that exact L1 word in order to retrieve that specific memory.

If the presence of the L1 enables access to childhood memories, it is important to establish whether loss of native language might inhibit recall, weaken remembering, and offset forgetting. When a language is spoken during childhood but then lost due to attrition, those childhood memories cannot be rehearsed in the language in which the events happened. This can facilitate forgetting (Tulving, 1983).

Additionally, since the L1 words are not recognizable anymore, they cannot serve as retrieval hints which can interfere with recall (Baddeley, Eysenck, & Anderson, 2009). Lastly, memories might deteriorate due to the loss of a crucial memory trace that anchored a memory in the mind. While L1 attriters might still have access to the visual memory traces, the L1 verbal traces might have been weakened, deteriorated, or not recognizable. Would attriters remember events that were encoded with verbal and non-verbal memory traces after the verbal trace has deteriorated? The goal of this study,

therefore, is to investigate the effect of language attrition on autobiographical bilingual memory.

3.3 Research Questions

The purpose of the present study is to address the following research questions:

- 1). Does first language (L1) attrition affect bilingual autobiographical memory?
- 2) If so, what aspects of recall will be particularly affected in speakers with L1 attrition?

To answer these questions, I will examine the following aspects of recall, operationalized as dependent variables: vividness, emotionality, phenomenological components (olfactory, linguistics, kinesthetic, visual, and audio), personal significance, frequency of recall, age of the first memory, and confidence in the event. I will also consider the effect of an intervening variable – language of the interview. An independent variable will be a level of L1 attrition.

CHAPTER 4 METHODOLOGY

4.1 Participants

A total of 35 participants took part in the study. There were 12 males and 23 females ages 18 – 33 ($M=23.3$; $SD=4.4$) with the age of arrival between 5 and 15 years ($M=9.2$; $SD=2.6$) and length of residence in the U.S. between 5 and 21 years ($M=14$; $SD=4.6$). The participants were recruited by advertisements on college campuses across the United States and through social media such as Facebook. In order to reach the population of international adoptees who were most likely to be attriters, the researcher gained access to closed adoptee groups. These Facebook groups included Families for Russian and Ukrainian Adoption (FRUA), Russian Adoption Bloggers, Adoptive Family Care, Russian Connections, and Russian Adoptees. Advertisements about the study were posted on a weekly basis until the necessary participant quota was reached. Each participant received a \$50 e-gift card for their time.

All of the participants came from Russian-speaking families from former republics of the U.S.S.R. (i.e., Russian Federation, Ukraine, Belarus, and Georgia). All spoke Russian during their childhood (self-reported). Sixteen of the participants were international adoptees and 19 were immigrants. Participants who spoke other than Russian language during their childhood were disqualified. For example, there were several participants who reported using Russian and Ukrainian or Russian and Georgian in their childhood. Several participants have studied foreign languages, such as Spanish, German, Chinese, and French in high school or college; however, all of them reported a low level of proficiency in those languages, which means that it was unlikely to affect the outcomes of the study. All the participants had some college education and were

proficient English language users. However, they had various levels of L1 proficiency. For instance, some participants could not hold a conversation with the researcher in L1 Russian, while others could speak L1 Russian but with some difficulties, such as frequent pauses and search for words. There were also participants who did not have any difficulties in communicating in their L1.

4.1.1 Assessment of L1 Attrition

L1 attrition implies loss or deterioration of certain language structures that had been previously acquired. Ideally, for research purposes, one should follow an attriter for a period of time and assess his or her language proficiency by measuring what exactly has been lost. This is called a longitudinal approach. However, this design is challenging for several reasons and, as discussed earlier, is not common in L1 attrition research. That is why I measured L1 proficiency at a certain point of time in the life of my participants. Comparing their L1 proficiency across participants allowed me to analyze who had a higher and who had a lower degree of L1 mastery. A higher degree of L1 mastery suggested that the L1 remained intact and that there were little signs of L1 attrition. A lower L1 proficiency suggested L1 attrition. In other words, if one participant had difficulties marking cases in Russian, he or she was considered an attriter, because another participant with a similar age of arrival and length of residence employed the case system in a grammatical manner. L1 attrition was assessed based on a triangulation of the following components: 1) self-reported L1 and L2 usage; 2) can-do-scales; 3) L1 and L2 proficiency as measured by narratives which included analyses of lexical diversity, fluency, and syntactic complexity.

4.1.1.1. Self-Assessment and L1 Usage. Attriters may not have as many opportunities for using their L1 which, in turn, may lead to attrition (Bot et al., 1991). Therefore, self-reported L1 and L2 usage data was collected. When participants were recruited for the study, they were directed to an on-line survey where they rated their L1 and L2 usage on a 1 to 4 scale from “never” to “frequently”.

After the completion of the experiment, all the participants filled out can-do-scales for the L1 and L2 language skills. These types of self-assessment or can-do-scales have been widely used by L1 attrition researchers due to the ease of implementation and their reliability (Schmid, 2011). The can-do-scales have been shown to correlate with formal language tasks such as cloze tests (Schmid, 2014). For the present study participants filled out can-do-scales where they rated their language abilities from 1 “I cannot do it at all” to 5 “I can do it with no difficulty at all” for 24 statements containing language tasks. (see Appendix A).

4.1.1.2. Narrative Elicitation. In order to elicit naturally occurring speech, I asked participants to narrate a picture book. Two picture books “Frog, Where Are you?” and “Frog Goes to Dinner” (Mayer, 1969) were used interchangeably between the two test days (see more information about the two test days in the Research Design subsection).

4.1.1.3. Coding and Analysis of Narratives. Two minute excerpts were extracted from the narratives. As suggested by Polat and Kim (2014), the starting point for each excerpt was when participants were on a second page of a story book because speakers tend to speak naturally once they feel comfortable with a task. Previous studies on fluency differed in the length of a speech sample, ranging from 20 seconds to 60 seconds (Baker-Smemoe, Dewey, Bown, & Martinsen, 2014). The two minute excerpts were chosen as a unit of

analysis instead of a traditional one minute excerpt because the lexical diversity test required a minimum of 100 words per narrative (DeBoer, 2014). Since some of the L1 attriters did not produce 100 words per one minute, I decided to extend each speech samples to two minutes. The length was adjusted plus/minus 10% in order to include complete sentences (Spoelman & Verspoor, 2010). After these passages were transcribed, they were analyzed for lexical diversity, syntactic complexity, and fluency.

4.1.1.4. Lexical diversity. Lexical diversity is a measure of vocabulary richness and refers to the number of unique words used by a speaker (Ellis & Barkhuizen, 2005). Since attriters might repeat the same high-frequency words (Hutz, 2004), it is important to analyze the vocabulary used beyond a simple lemma count. The *D* measure for lexical diversity has been shown to be effective in estimating lexical diversity (Jarvis, 2002; McKee, Malvern, Richards, 2000). This measure is calculated based on random words from the whole text which makes it less sensitive to text length and topic shifts (Jarvis, 2002; McKee et al., 2000). The *D score* refers to the proportion of unique or unrepeated words per 100 words.

The following procedure was implemented for the lexical diversity analysis. First, excerpts that are exactly 100 words were taken from each participant's narrative. Dysfluencies, pauses, and repetitions were manually deleted. Then, the excerpts were lemmatized with the help of FREELING 4.0 software. The lemmatization refers to converting all inflected words into their original grammatical form. For example, the verb "works" is derived from the verb "to work". The lemmatization was an important step because inflected words such as "worked" and "works" would be otherwise counted as different lemmas/words which would create a false impression of higher lexical diversity.

Utilizing computer software for lemmatization helped avoid human error. After the excerpts were lemmatized, they were run through the CLAN software for the lexical diversity analysis. This was done by inserting each excerpt into CLAN and entering a command to analyze vocabulary. The CLAN program provided a *D* score for each participant's excerpt. A higher *D* score indicated a higher lexical diversity and lack of L1 attrition. Conversely, a low *D* score pointed to a lower lexical diversity and L1 attrition.

4.1.1.5. Fluency. Fluency refers to the ease or difficulty of producing speech (Ellis & Barkhuizen, 2005). It reflects how fast a speaker can access language knowledge, meaning that slower and effortful speech may occur when a speaker struggles to access a certain word, formulate a grammatical sentence, and produce appropriate pronunciation (Housen & Kuiken, 2009). Fluency is usually measured by speed fluency (how quickly a speaker can produce speech) and breakdown fluency (frequency of pauses) (Hepford, 2017). Since L1 attriters' may exhibit issues accessing words and producing appropriate language structures in a timely manner, I assessed fluency based on two measures of 1) frequency of filled pauses (e.g., *hmm*, *umm*, etc.) and silent pauses; and 2) speech rate (Schmid, 2011).

The frequency of filled pauses was calculated in the following way. First, a two minute excerpt from each participant's narrative was transcribed and coded for silent pauses (.) and filled pauses (&). A silent pause constituted a pause in speech that lasted more than four seconds (Tavakoli & Foster, 2011). Then, the total number of pauses per excerpt was calculated by "search" (Ctrl+F) command. Lastly, the number of words was divided by the total number of pauses. This number yielded an average rate of pauses or

how frequently a speaker paused in his or her speech. For example, if an excerpt had 315 words and 21 pauses, it meant that that participant paused every 15 words.

The speech rate was calculated based on the number of words a participant produced within two minutes (Baker-Smemoe et al., 2014). In order to assess the rate of speech, the transcribed two minute excerpts were trimmed for silent and filled pauses by manually removing them. Then, each excerpt was placed into a separate WORD document. The “word count” command revealed the number of words per excerpt.

4.1.1.6 Syntactic complexity. Syntactic complexity refers to the speaker’s ability to produce complex structures in his or her speech instead of relying on simple structures (Ellis & Barkhuizen, 2005). This stems from the assumption that proficient speakers may incorporate detailed descriptions that include prepositional phrases, subordinate clauses, adjectives, and adverbs (Norris & Ortega, 2009). Therefore, the measure of *elaboration* is especially useful when analyzing syntactic complexity because it is a global measure that allows researcher to investigate whether the speaker uses complex or simple syntactical structures (Norris & Ortega, 2009). The measure of elaboration is calculated based on words per AS-unit. The AS-unit was proposed as a unit for the free speech analysis by Ellis and Barkhuizen (2005) because oral narratives may contain sentence fragments and incomplete sentences. An AS-unit contains an independent clause or a subclausal unit together with any subordinate clauses. Subclausal units might include fragmented sentences that can be elaborated into complete sentences or answers to questions. For example, the following sentence incorporates all three structures: “Of course not (subclausal unit), I am not going to the flower show (independent clause) because I am allergic to flowers (subordinate clause).”

Elaboration was analyzed in the following way. The transcribed two minute excerpts were pruned for silent and filled pauses and divided into AS-units. Then, the total number of words was divided by the number of AS-units in the transcript. The yielded number presented an average number of words per AS-unit. In order to avoid researcher bias, a second coder confirmed AS-unit analysis in 10% of the data. The 10% mark was used as a common inter-reliability standard in applied linguistics (Foster & Tavakoli, 2009). If the researcher and the second coder disagreed, they discussed the differences until an agreement was reached (Larsen-Freeman, 2006).

4.1.1.7 Recognition of L1 Stimuli. The ability to recognize L1 stimuli was also included in the analysis of L1 attrition. This supplementary measure was incorporated after several participants (n=10) could not provide an L1 narrative. These participants stated that they did not have productive knowledge of Russian. Their lack of Russian proficiency was manifested when the researcher attempted to speak Russian to them. Several participants did not respond to the researcher's greeting. They either would say "I do not speak Russian" or would not respond at all and continue speaking in English. There were some who attempted to use Russian, but could not keep up with a conversation once it went beyond formulaic greetings. Here is one example from the beginning of the interview:

Participant: Hello!

Researcher: Привет! Как дела? / Privet! Kak dela? / [Hello! How are you?]

Participant: Очень хорошо, спасибо! / Ochen' khorosho, spasibo / [Good, thank you.]

Researcher: Замечательно! Есть ли у тебя какие-то вопросы перед тем как мы начнем? / Zamechatel'no. Est' li u yeb'a kakieto voprosy pered tem kak my nachnem? / [Excellent. Do you have any questions before we get started?]

Participant: Oh, that was really fast. Can you repeat that?

Researcher: Sure, есть ли у тебя вопросы, вопросы есть какие-нибудь перед тем как мы начнем? / Est' li u teb'a voprosy, voprosy est' kakienibud' pered tem

kak my nachnem? / [Do you have any questions, questions, do you have any questions before we get started?]

Participant: Ok, I did not catch that at all (laughing with embarrassment).

Researcher: That's ok, I was just asking if you had any questions before we get started.

Participant: Oh, ok.

Because of their inability to produce spoken Russian, they were unable to produce L1 narratives of the frog stories. However, the researcher always tried to elicit speech even if a participant did not engage in an informal conversation in the beginning of the interview.

Here is an example of one of those attempts:

Researcher: Could you please tell me what is going on in each picture in Russian.

Хорошо? / Khorosho / [Okey?]

Participant: In Russian?

Researcher: Yes

Participant: Wait, what? Are you serious?

Researcher: Let's give it a try. Just do your best.

Participant: Should have I studied for it?

Researcher: Not at all.

Participant: I do not even know how to say frog (pause) oh my gosh, I don't know (long pause, sighs with frustration) &amm (pause) Ia ne zna'u (I do not know).

This participant stated that she did not even remember how to say the word “frog” in Russian. She did produce a formulaic “Я не знаю” / Ia ne zna'u / [I do not know]. However, she could not retell the frog story. That was the point when we would switch back to the English language. These samples are representative of the participants' inability to produce Russian. Can-do-scales of these participants confirmed their lack of Russian proficiency. During the experiment, these participants also were unable to recognize L1 experimental stimuli that consisted of 10 high-frequency words in Russian:

спокойной ночи малыши / spokoinoi nochi malyshy / [good night, baby]

пирожки / pirozhki / [pirogi]

неволяшка / nevolashka / [roly-poly doll]

перемена в школе / peremena v shkole / [recess]

тихий час / tikhi chas / [nap time]

компьютерные игры / komp'uternye igry / [computer games]

любимая игрушка / l'ubimaia igrushka / [favorite toy]
горка / gorka / [slide]
играть в догонялки / igrat' v dogonalki / [playing tag]

Because of this, I used the rate of L1 experimental stimuli recognition as a secondary measure of L1 proficiency in order to show that some participants were not able to recognize high-frequency Russian words. If a participant recognized a word, he or she would get one point. The maximum score would be 10 points if someone recognized all of the words (see the Results chapter detailing how these scores were used in the analysis).

4.2 Research Design

The current study investigated the connection between L1 attrition and autobiographical memory. More specifically, I looked into any negative effects of L1 attrition on memory of the self. The study featured a mixed-method design where I analyzed memories quantitatively and qualitatively. Each participant participated in two research sessions: one session was in Russian and the other was in English. The two research sessions were one week apart. This is the format of each session:

Greeting, signing of consent form ~ 1-3 min
Task 1: Narrative Elicitation ~ 5-10 min
Task 2: Free recall ~ 5-15 min
Task 3: Cued recall ~ 30 – 40 min
Task 4: First memory elicitation ~ 1-2 min
Debriefing ~ 1-5 min

The narrative elicitation task was included on both test days in order to 1) collect L1 and L2 speech samples and 2) to activate the desired language. It was also done for the purposes of symmetry. All four tasks took on average about an hour. Before the first session each participant filled out an on-line language questionnaire where he or she

shared their usage of Russian and English on a scale from 1 (never) to 4 (frequently), as well as how proficient they perceived themselves to be. After the last session each participant filled out can-do-scales. Both pre- and post-interview questionnaires were done on-line via the Survey Monkey tool.

The original plan entailed face-to-face interviews with the participants (n=9). However, when it became apparent that participants who met research criteria could not be recruited locally, a national search was initiated. All the materials were converted to a Skype platform. When interviewed on-line, the researcher shared her screen and projected experimental stimuli to the participant's computer. The participants were instructed to be at their desk computer or a laptop alone in a noise-free environment. All the sessions were recorded with a Skype recording software. There did not seem to be any differences between face-to-face and on-line research conditions. In both conditions, participants were one-one-one with an interviewer in front of a power point on a computer screen.

4.2.1 Free Recall Task and Coding

The free recall was a part of the qualitative approach to investigating bilingual autobiographical memory in this study. The participants were invited to share their memories. During the free recall a participant was asked to recall three events from their life in a Russian-speaking country and three events from their post-immigration period with the following prompt:

“I will ask you to tell me about an event from your life in a Russian-speaking country and United States. You can choose any events you wish. The event must be one you were personally involved in, and you must have a recollection of being personally involved in. Do not pick events that you heard about from others. They must be events from a specific time and place. For example, playing basketball in

school would not be sufficient. However, an event involving a specific basketball game would be good. I want you to provide as much detail as you can about the event. Our interest is not so much in which events you choose, but rather how you describe them. So do not feel pressured to pick any particular event. I want you to know that I will be asking you to give some details for these events later, so be sure to only choose events that you feel comfortable discussing in detail.”

The prompt was adopted from Levine, Svoboda, Hay, Winocur and Moscovitch (2002).

Participants were presented with a list of life events in order to assist with memory retrieval (see Appendix B), but they were not limited to the events on the list. They were encouraged to share events that they felt comfortable talking about.

The free recall task was incorporated into the study for two reasons. The first reason was to encourage the participants to recall events from both the pre-immigration and post-immigration parts of their lives. The second reason for including a free recall task was to allow the participants to talk about their lives in a more authentic way outside of the cued-recall experiment. These memories were not dated by the participants, meaning that they were not asked to provide their age when that memory happened. The participants also were not asked to describe the memories in terms of any phenomenological properties, such as vividness or personal significance.

The elicited events were transcribed and coded for amount of detail. The researcher adopted an autobiographical memory interview protocol from the discipline of psychology. Levine et al. (2002) demonstrated a successful implementation of the autobiographical memory interview protocol in the study of quality of autobiographical memory. The protocol incorporated the following elements:

Event – description of what happened.

Time – mentioning of the season, year, month, etc.

Place - mentioning of the location, city, street, etc.

Actors – description of any other individuals present.³

Perceptual – auditory, olfactory, tactile, taste, visual, kinesthetic descriptors.

Thought/emotion – emotional state, thoughts, implications, reactions of others.

The following rating schema was used:

0 points - no mentioning of information pertaining to the specific category;⁴

1 points – a category is simply mentioned with no description;

2 points – a category (e.g., place) is mentioned and described.

Additionally, each event was marked for its emotional valence (negative and non-negative) and presence or absence of direct speech. The coding was done by the main researcher and six additional coders. The main researcher coded all the memories (n=144). Then, the 144 memories were divided among six second coders, who each analyzed 24 memories each. After additional coders completed the coding, the main researcher compared their analysis with hers. If there were any discrepancies in the ratings, the main researcher and the additional coder discussed each score until an agreement was reached. Additionally, a third researcher coded 10% of the data (n=14) in order to reveal any inconsistencies or discrepancies. Although the inter-coder reliability of this coding process was not measured statistically, very few disagreements between the coders emerged, and this three step coding analysis seemed to yield a consistent and reliable analysis.

4.2.2 Cued Recall Task and Coding

As discussed in Chapter 2, the cued recall technique has been widely used in the study of bilingual autobiographical memory. Usually a cue is played, and a participant is

³ The category of “actors” will be highlighted as a separate category for the purpose of this research. Levine et al. (2002) combined “other people” or actors in the “event” category.

⁴ The rating schema was also adopted from Levine et al. (2002).

asked to recall the first event that comes to his or her mind. The present study expands on this common approach by 1) incorporating visual cues to prompt the participant's recollection of autobiographical memories and by 2) utilizing culture-specific and culture-neutral cues. The culture-specific cues include images of artifacts that belong to a certain culture. For example, *matryoshka* represents a Russian culture-specific artifact. The incorporation of culture-specific cues was necessary as L1 attriters might not have recognized L1 verbal cues. By employing culture-specific images, the researcher could test memories for common Russian foods and toys in L1 attriters. For example, if an L1 attriter does not recognize an image of *kasha*, a very common Russian breakfast food, it would suggest memory deterioration. The addition of visual cues is based on the fact that previous research relied solely on verbal cues which might lead to a larger number of memories that "come in words" (Pavlenko, 2014).

4.2.2.1 Experimental stimuli. The present study features a diverse set of experimental stimuli. The stimuli differed by their presentation and content. There were three ways of presentation: 1) "audio only" format when a cue is presented aurally (n=10), 2) "visual only" when a picture is shown (n=10), 3) "audio and visual" when a visual component is accompanied by an audio (n=10). There were also three types of stimuli based on their content: 1) American-culture specific (n=15), Russian-culture specific (n=15), and non-culture specific (n=15). The reasoning for including audio only, visual only, and audio and visual presentation formats stemmed from the necessity to expand the previous methodologies that exclusively focused on audio cues. Pavlenko (2014) argued that overreliance on audio only cues yields mostly linguistic memories; thus, an incorporation of pictorial cues is crucial when eliciting memories. The incorporation of visual cues was

also necessary because of L1 attriters' inability to recognize L1 words/cues. The content of the cues and their presentation were carefully counter-balanced, meaning that if there was a Russian culture-specific cue represented in an audio only format, then there was an American culture-specific cue represented in an audio only format as well, etc. (see Table 2 and 3).

Table 2. *Experimental Stimuli for the English Test Day*

Culture specific, N=15	Audio only, N=10	Image only, N=10	Audio and Image, N=10
<i>Cartoons</i>	Rugrats	Cookie monster	Bugs Bunny
<i>Foods</i>	Twizzlers	Animal cracker	Mac n Cheese
<i>Toys</i>	Hot wheels	Lego's	Beanie babies
<i>School and Home</i>	Recess	School bus	Safety scissors
	Footsie pajamas	Play-Doh	Jack-o'-Lantern
Non-culture specific, N=15	Audio only	Image only	Audio and Image
<i>Games and Toys</i>	Computer games	Ball	Tricycle
	Doll	Rubik's Cube	Teddy bear
	Favorite toy	Coloring pencils	Jump rope
<i>Outdoors and Activities</i>	Slide	Sand box	Sled
	Playing tag	Baby chair	Swing

Table 3. *Experimental Stimuli for the Russian Test Day*

Culture specific, N=15	Audio only, N=10	Image only, N=10	Audio and Image, N=10
<i>Cartoons</i>	Спокойной Ночи Малыши Spokoinoi nochi malyshy (Good night, baby TV show)	Карлсон Carlson (Cartoon character)	Винни Пух Vinni Pukh (Winnie the Pooh)
<i>Foods</i>	Пирожки Pirozhki (Little pies)	Мороженое Morozhenoe (Soviet style Ice cream)	Каша Kasha (Cereal)
<i>Toys</i>	Неволяшка Nevolashka (Roly-poly doll)	Игра нупогоди Igra nu pogodi (Russian game boy)	Змейка Zmeika (Snake-like puzzle)
<i>School and Home</i>	Перемена в школе Peremena v shkole (Recess)	Школьная форма Shkol'naia forma (Soviet school uniform)	Пропись Propis' (Russian copy book)
	Тихий час Tikhi chas (Nap time)	Пластилин Plastilin (Russian Play-Doh)	Новогодние игрушки Novogodnie igrushki (Christmas tree decorations)
Non-culture specific, N=15	Audio only	Image only	Audio and Image
<i>Games and Toys</i>	Компьютерные игры Komp'uternie igry (computer games)	Мяч Miach (Ball)	Трехколесный велосипед Trehkolesnyi velosiped (Tricycle)
	Кукла Kukla (Doll)	Кубик Рубик Kubik Rubik (Rubik's Cube)	Плюшевый мишка Plushevyi mishka (Teddy bear)
	Любимая игрушка L'ubimaia igrushka (Favorite toy)	Карандаши Karandashy (Coloring pencils)	Скакалка Skakalka (Jump rope)
<i>Outdoors and Activities</i>	Горка Gorka (Slide)	Песочница Pesochnitsa (Sand box)	Санки Sanki (Sled)
	Играть в догонялки Igrat' v dogonalki (Playing tag)	Стульчик Stul'chik (Baby chair)	Качели Kacheli (Swing)

Since there were three ways of representing cues and three types of content that cues could have, a total of 60 cues that incorporated six experimental conditions were presented to each participant, 30 during the Russian test day and 30 during the English test day:

- 1) Culture-specific audio only (n=5)
- 2) Culture-specific image only, (n=5)
- 3) Culture-specific audio + image (n=5)
- 4) Non-culture specific audio only (n=5)
- 5) Non-culture specific image only (n=5)
- 6) Non-culture specific audio + image (n=5)

The order of the test days, Russian first or English first, was counter-balanced across participants with participants randomly assigned to either test condition. The order of the experimental conditions (n=6) was assigned according to the balanced Latin Square counterbalanced measure design (Alferes, 2012). The following schema was designed specifically to avoid biased results due to the effects of the order (see Table 4). The cues within each experimental condition were also randomized.

Table 4. *Assignment of Experimental Conditions*

Participant #	Experimental Condition
Participant <u>1</u> , <u>8</u> , <u>15</u>	123456
Participant 2, <u>9</u> ,16	126354
Participant <u>3</u> ,10, <u>17</u>	231465
Participant 4, <u>11</u> ,18	342516
Participant <u>5</u> ,12, <u>19</u>	453621
Participant 6, <u>13</u> ,20	564132
Participant <u>7</u> ,14,(<u>21</u>)	615243

Note. Every second participant was assigned to the Russian testing condition. The underlined participants represent the “English day first” testing condition.

The images had a white or light background and were positioned in the center of a PowerPoint slide and were of the same size. All the images were accessed through a Google image search that allowed noncommercial reuse (see Appendix D for the full list of images used in the experiment). The audio components were recorded by two female native speakers of English and Russian.

4.2.2.2 Collecting Phenomenological Properties of the Elicited Memories. When a participant recalled a memory, a short note about the memory was taken by the researcher. After all the 30 memories were recalled, the participant was asked to go back and rate the phenomenological properties of each memory on a Likert scale from 1 to 5.

The following phenomenological properties were collected: vividness, emotionality,

previous recalls to others, previous recalls to self, ease of recall, significance of the event, and confidence that the event actually happened. Additionally, language(s) of the event, memory traces (smells, kinesthetic, visual, audio, words, etc.), type of emotion (negative, neutral, and positive), and age of the event were collected (see Appendix D for the full questionnaires in English and Russian). All translated materials were translated and then back-translated by two Russian-English bilinguals.

4.2.2.3 Previous Pilots. Three separate pilot tests took place in order to assess the cues' capability to elicit autobiographical memories and to test the overall methodology. The first pilot included eight Russian-English bilinguals ages 18-26 ($M=21.9$; $SD=2.9$) who had comparable L1 and L2 proficiency. The participants were asked to recall memories with the help of a cued-recall procedure that included culture-specific and non-culture specific cues ($n=70$). They also shared and dated their very first memory. This pilot led to editing of the language background questionnaire, to removing certain cues due to their misinterpretation or poor quality, and to expanding of the memory questionnaire.

The second pilot included two L1 attriters, one male (19) and one (18) female who emigrated from the Russian Federation at the ages of seven. Students at Temple University, they had a native-like mastery of the L2 English but reported a low proficiency in L1 Russian. Their self-reported low L1 proficiency was confirmed by a narrative elicitation task during which both participants demonstrated dysfluencies and issues with producing L1 grammar. The participants were asked to recall memories with the help of a cued recall; a total of 70 cues were used. This pilot test led to incorporating a narrative elicitation task in order to accurately assess L1 proficiency. More specifically, I decided to collect L1 and L2 narratives in order to analyze participants' L1 and L2

proficiency. Also, a qualitative task of free recall where participants could share their memories in a free format was added. This was done in order to collect authentic stories of the self outside of the cued-recall experiment.

The third pilot included a finalized design of a free recall task, cued-recall task, and a first memory elicitation task. It was piloted with one international adoptee Alina (nickname) age 23 who was adopted from the Russian Federation at the age of eight. The participant had a native-like command of English, but demonstrated an inability to produce Russian speech. Alina shared two free recall memories and 44 memories with the help of a cued-recall procedure. The findings demonstrated that Alina's L1 memories were less vivid, and she also was not confident that these memories actually happened. This pilot was the inspiration for the studying the L1 attrition effect on bilingual autobiographical memory in a larger group of attriters.

Before the three pilot tests, the experimental stimuli were carefully selected based on previous research (Marian & Neisser, 2000; Schrauf & Rubin, 1998) and a specially designed Survey Monkey questionnaire. Thirty-seven native English speakers who grew up in the United States ages 18-30 and 36 native Russian speakers who grew up in Russian-speaking countries ages 19-32 were asked a series of open-ended questions about games, foods, activities, traditions, movies, cartoons, etc. that reminded them the most of their childhood. Their answers were tallied and analyzed. Only toys, events, foods, etc. that were mentioned by at least 10% ($n=3$) were included in the pilots and the final study.

4.2.3 Eliciting the First Memory

After the cued recall was completed, each participant was asked to recall and date the very first memory. The first memory was elicited twice, during the Russian and English test days, for consistency purposes. A short debriefing concluded each session where participants were invited to ask questions about the study. Each session usually lasted about 55-75 minutes.

5.2.4 Description of Data Collection and Analysis

The recruitment of participants was done via social media and flyers that were posted on the campuses of Temple University, University of Pennsylvania, and Drexel University. When a participant contacted the researcher, he or she would be directed to a Survey Monkey language background questionnaire where they would state any languages spoken during the childhood and their perceived L1 proficiency. This brief questionnaire was used in order to determine participants' eligibility. For example, if a participant spoke three or more languages and /or utilized other languages than Russian during their childhood, that participant was excluded. That was done in order to ensure that only L1 Russian and L2 English memories are collected for the analysis. There were two experimental sessions: one was performed in L1 Russian and another was performed in L2 English. The sessions were one week apart.

Each participant was interviewed individually either at a lab or via Skype platform. When a participant came in or logged in, he or she was greeted in the language of the testing day (L1 Russian and L2 English). After the required consent form was signed or a verbal consent was given, the participant was asked to complete the first task.

The first task was a speech elicitation with the help of picture books (see Research Design chapter). The participant was asked to retell a story. The researcher would flip through the pages until the whole story was narrated. The participants were given an unlimited amount of time to complete each page. The researcher would only flip to the next page if a participant indicated that he or she was done.

The second task was a free recall. This is when participants were asked to share three events from their life in a Russian-speaking country and three events in their life in the U.S. The participants were instructed to provide as much detail as possible and to focus on events that happened to them. They were given unlimited time to complete this task. The researcher would only move to the next task after a participant indicated that he or she was done.

The third task was a cued recall. During this task, an experimental stimuli would be played or displayed one at a time on a computer screen. If a participant was interviewed via Skype, the researcher would share her screen and project the experiment stimuli in a similar manner to the face-to-face condition. After each experimental stimuli was played or displayed, a participant would be asked to share the very first memory that came to them. The researcher would make a brief note about each memory, such as “first birthday present”, etc. After the participant recalled memories to all the experimental stimuli (n=30), he or she was asked to go back and to rate each memory for the phenomenological properties of vividness, significance, emotionality, and confidence in the event. He or she was also asked to date the memory, state the language of the event, and label a type of emotion that accompanied that memory (see Appendix D).

The fourth and last task was the first memory elicitation. A participant was asked to share and date their very first memory. This task was repeated during the second session for the consistency purposes.

After the end of both test days, L1 Russian and L2 English, a participant would be directed to Survey Monkey in order to complete can-do-scales. The can-do-scales were used in assessing the extent of L1 attrition (see Language Profiles section).

5.2.4.1 Analyses Performed. Although the main focus of the project was examining the L1 attrition effect on bilingual autobiographical memory, I carried out a more comprehensive analysis of the whole data set in order to provide a more complete picture of the data. Thus, some of the analyses and results are secondary to the main research questions. Here is a list of these *secondary analyses* performed and their rationale. The first one was comparing a proportion of negative memories recalled by the three groups of participants. The rationale for this analysis was to insure that the proportion of the negative events is similar for each group since traumatic events may be qualitatively different (see “Literature Review” chapter). The second secondary analysis was analyzing phenomenological properties of memories that were encoded in L2 English. This analysis was carried out in order to make sure that L2 English memories recalled by all three groups of L1 attriters had similar qualities. All three groups of participants had comparable L2 English proficiency. Since I was making an argument that L1 attrition had a negative effect on autobiographical memory, then L2 English memories should not have shown any differences (see “Results” chapter).

The third secondary analysis involved investigating self-cueing memory retrieval strategies. The rationale behind this analysis was the fact that during the sessions

participants seemed to help themselves by repeating experimental stimuli. That repetition was not mechanical and served as a strategy for memory retrieval. Although this is something that was not addressed by the project's research questions and emerged on its own, I decided to briefly talk about it in the dissertation. The reason why I chose to mention is because I observed a negative L1 attrition effect on memory retrieval process: advanced attriters could not repeat the experimental stimuli and it seemed to hinder their recall of L1 Russian memories.

I will now discuss the main analyses that were performed. Since the main focus of this dissertation was investigating the connection between L1 attrition and autobiographical memory, I focused on pre-immigration memories that were encoded in L1 Russian, on phenomenological properties that were encoded in L1 Russian, and on memories that came with L1 Russian words in the three groups of participant who had different degrees of L1 attrition (Table 5).

One-way ANOVA with Tukey post hoc analyses were chosen to investigate any differences in phenomenological properties and amount of detail in the three groups of participants. The phenomenological properties (vividness, emotionality, significance, and confidence in the event) and amount of detail were dependent variables. These variables were continuous which meet the required assumptions for one-way ANOVA (Larson-Hall, 2010). When there were multiple comparisons, a Bonferroni adjustments was made. This was done in the following way: a p value of 0.05 was divided by the number of dependent variables which yielded a new p value. This new p value determined whether a result would be considered statistically significant (Larson-Hall, 2010)

Table 5 List of Main Analyses Performed

Task and Rationale	What is Measured	Analyses Performed
<i>Free Recall</i>		
To investigate an effect of match/mismatch of language of encoding and language of recall in three groups of participants.	Amount of detail of pre-immigration memories between three groups of participants.	One-Way ANOVA with a Tukey post hoc test.
<i>Cued Recall</i>		
To investigate any differences in phenomenological properties of memories that came with L1 words to participants from three groups.	Phenomenological properties of memories that came with L1 words.	One-Way ANOVAs with Tukey post hoc and with Bonferroni adjustments for multiple comparisons.
To investigate any differences in phenomenological properties of memories that were encoded in L1 in three groups of participants.	Phenomenological properties of L1 Russian memories.	One-Way ANOVAs with Tukey post hoc and with Bonferroni adjustments for multiple comparisons.
<i>Eliciting First Memory</i>		
To investigate any age differences between first memories that were provided during the L1 Russian and L2 English test days.	Age of first memory that was provided during L1 Russian test day and age of first memory provided during L2 English test day.	T-test
To investigate any age differences of first memories. provided by three groups of participants	Age of first memory provided during L1 Russian test day by all three groups of participants.	One-Way ANOVA with Tukey post hoc.

To sum up, participants participated in two research sessions: one in L1 Russian and one in L2 English. Each session involved four tasks: narrative elicitation, free memory recall, memory recall with the help of cued recall, and first memory elicitation. The memories were analyzed qualitatively and quantitatively according to the previous research and previous pilot tests. In what follows, I will provide an overview of the results.

CHAPTER 5 RESULTS

This chapter starts with a section “Language Profiles of Participants” where I describe how all the participants were divided into three groups based on their level of L1 proficiency. Then, the results of the three experimental tasks will be presented in the following format: 1) results for each group of participants; 2) a detailed between group comparison of the three groups. The chapter will conclude with a summary where I will address the following research questions:

- 1). Does language attrition affect bilingual autobiographical memory?
- 2) If so, what aspects of recall will be particularly affected in speakers with L1 attrition?

5.1 Language Profiles of Participants

Since L1 attrition is an independent variable in this study, it is anticipated that there will be a relationship between language loss and memory of the self, it was important to carry out a detailed analysis of L1 attrition in the participant sample. Thus, the participants’ L1 attrition was assessed using the following components: 1) can-do-scales; 2) language usage; 3) lexical diversity; 4) fluency; 5) syntactic complexity; 6) L1 stimuli recognition. The can-do-scales and the language usage were self-rated. The lexical diversity was based on the proportion of unique vocabulary words produced per 100 words. Fluency was measured by the frequencies of pauses and overall speech rate.

The syntactic complexity analysis was based on the average number of words per AS-unit.⁵

The L2 English mastery was assessed with the help of the same six components mentioned above; this was done in order to ensure that all the participants had a comparable L2 English proficiency. The analysis of L2 English revealed that the participants produced between 150 – 332 words per 2 minutes (M=235; SD=52), had a rate of pauses between 8 and 37 words (M=14; SD=6), spoke between 7 – 13 words per AS-unit (M=10; SD=1.6), rated their proficiency between 3.62 – 5 (M=4.9; SD=0.25), recognized between 9 – 10 L2 stimuli (M=9.9; SD=0.2), used English frequently (M=3.9; SD=0.2), and provided lexically diverse narratives scored between 19 - 42 (M=27; SD=6). As seen in Figure 1 and Figure 2, there was only a very small degree of variation in the L2 language mastery. That was expected as everyone has their individual style of speech: for example some individuals paused more frequently than others. Nevertheless, despite this variation, the standard variation values were relatively small which suggests that all 35 participants had a comparable L2 proficiency.

⁵ AS-unit refers to a syntactical unit that contains an independent clause together with any subordinate clauses.

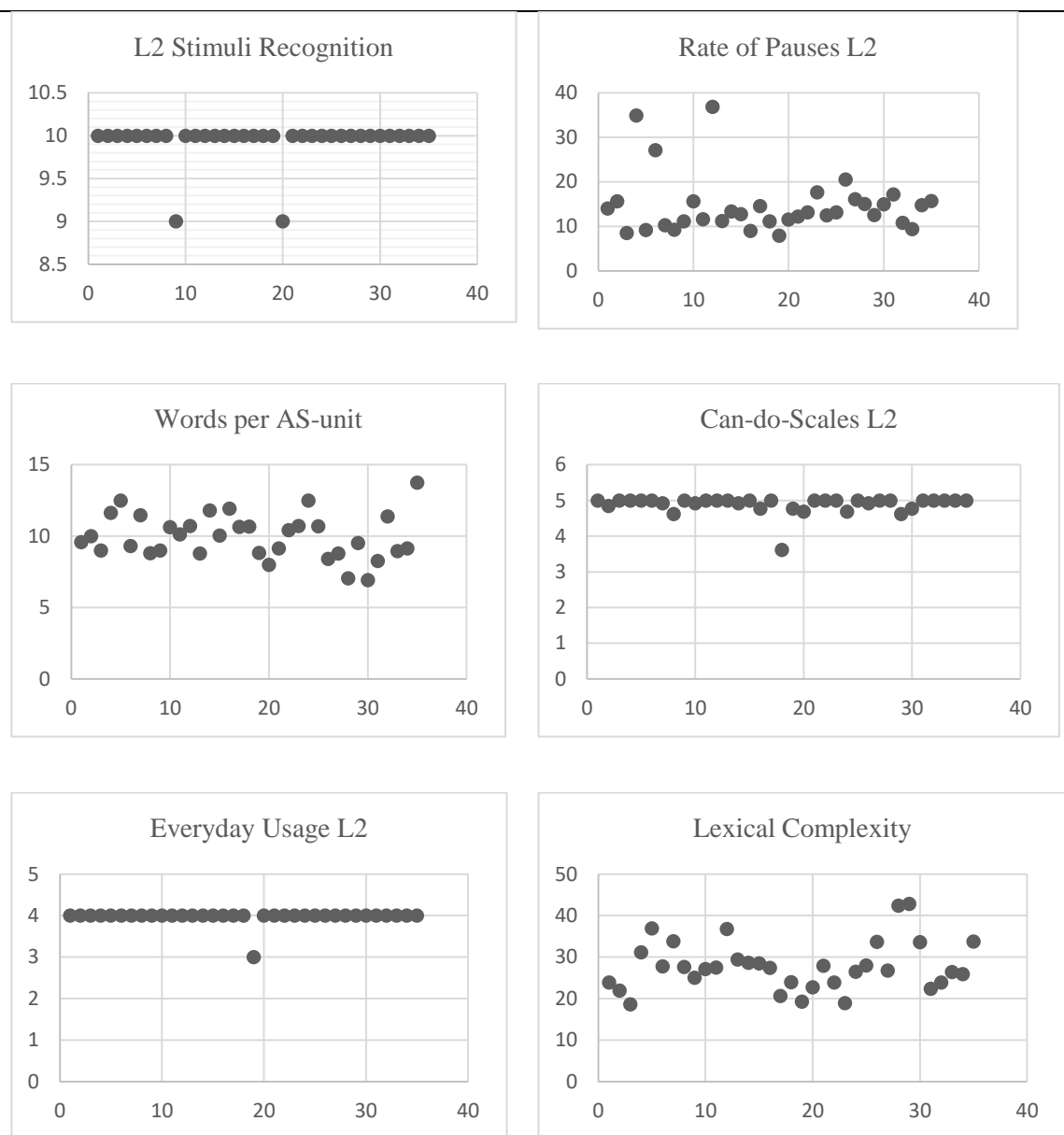


Figure 1. Raw data for L2 English including everyday usage, can-do-scales, lexical complexity, words per AS-unit, rate of pauses, and stimuli recognition

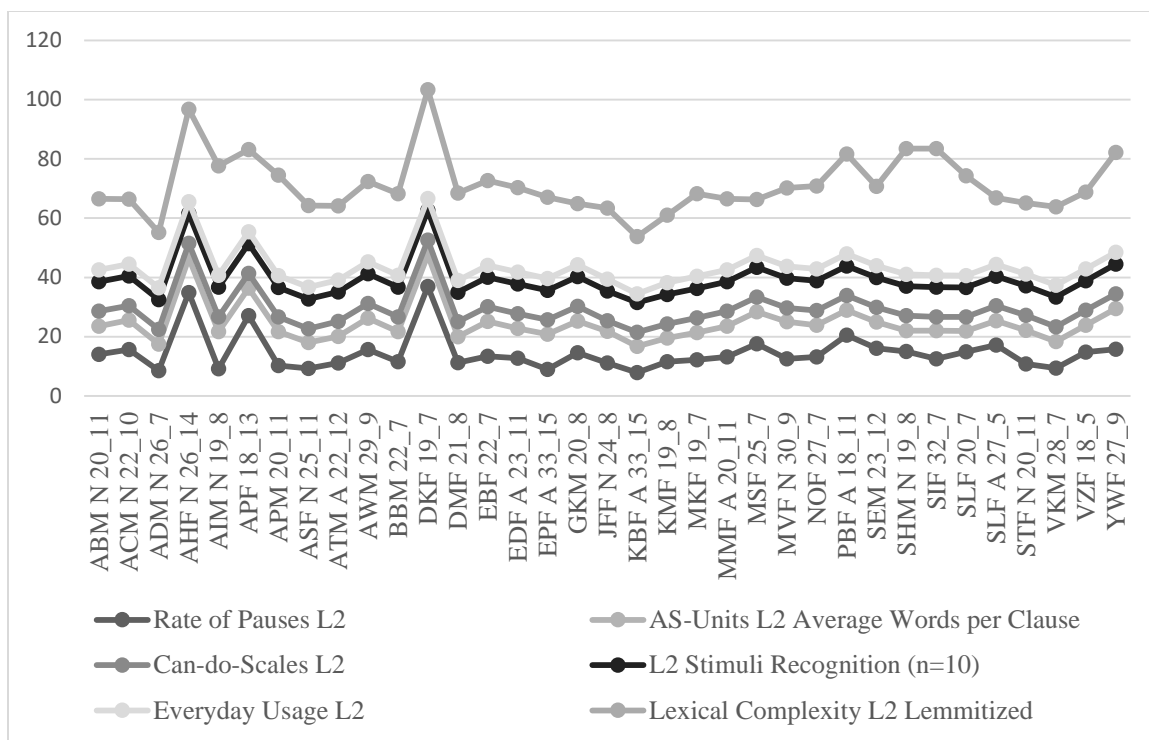


Figure 2. Visualization of L2 measures including everyday usage, can-do-scales, lexical complexity, words per AS-unit, rate of pauses, and stimuli recognition

The analysis of L1 Russian shows that the participants varied significantly in their L1 proficiency. This can be seen from this data visualization (see Figure 3).

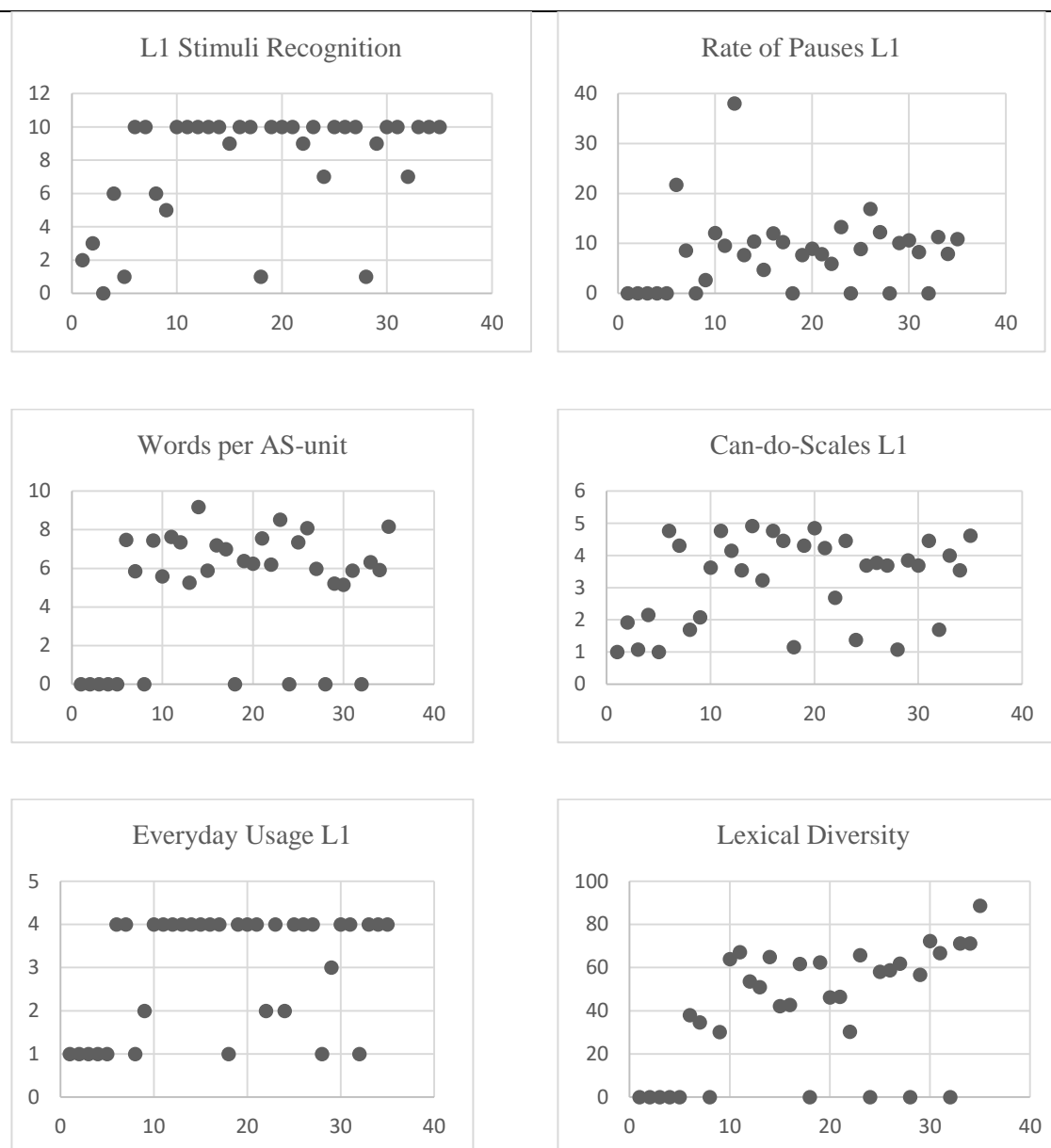


Figure 3. Raw data for L1 Russian measures including everyday usage, can-do-scales, lexical complexity, words per AS-unit, rate of pauses, and stimuli recognition

The participants differed in the number of words produced per two minutes (0 – 239, $M=112.77$; $SD=81$), rate of pauses (0 - 38; $M=8$; $SD=7.6$), words per AS-unit (0 – 9.2; $M=4.8$; $SD=3.2$); can-do-scales (1 – 4.92; $M=3.3$; $SD=1.3$); recognition of L1 stimuli (0 – 10; $M=7.9$; $SD=3.3$); use of L1 Russian (1 – 4; $M=3$; $SD=1.3$), lexical diversity (0 –

88.65; $M=40$; $SD=28$). The uneven distribution of data can be seen in large standard deviation values and scattering of data points.

However, despite a high degree of variability in the data, a clear pattern emerges. When examining everyday usage distribution, it is noticeable that there are two clusters of data points around the scores of “1” and “4” with the rest of participants being somewhere in between. It means that some participants use L1 Russian frequently, others use it very rarely or never, and several use it sometimes.

The same pattern can be observed with lexical diversity, stimuli recognition, words per AS-unit, rate of pauses, and can-do-scales. For example, if we run a distribution of the can-do-scale variable, we get a range of scores from 1 to 4.95 (see Table 5). Within these scores, there are participants in the bottom 25 percentile, in the top 25 percentile, and there are participants whose scores are in the middle.

Table 6. *Distribution of Can-do-Scale Scores*

Score	Frequency	Percent	Cumulative Percent
1.00	2	5.7	5.7
1.08	2	5.7	11.4
1.15	1	2.9	14.3
1.38	1	2.9	17.1
1.69	2	5.7	22.9
1.92	1	2.9	25.7
2.08	1	2.9	28.6
2.15	1	2.9	31.4
2.69	1	2.9	34.3
3.23	1	2.9	37.1
3.54	2	5.7	42.9
3.62	1	2.9	45.7
3.69	3	8.6	54.3
3.77	1	2.9	57.1
3.85	1	2.9	60.0
4.00	1	2.9	62.9
4.15	1	2.9	65.7
4.23	1	2.9	68.6
4.31	2	5.7	74.3
4.46	3	8.6	82.9
4.62	1	2.9	85.7
4.77	3	8.6	94.3
4.85	1	2.9	97.1
4.92	1	2.9	100.0
Total	35	100.0	

Bottom 25% performers

Top 25% performers

The above example with the can-do-scales demonstrates how the researcher visualized a distribution for all the L1 mastery skills of 1) fluency; 2) syntactic complexity; 3) can-do-scales; 4) L1 usage; 5) stimuli recognition; and 6) lexical diversity. If a score was in the bottom 25 percentile, it was assigned “1”, if a score was in the top 25 percentile, it was

assigned “3”; the values in between were assigned “2”. As a result, each participant had a score for each measure (see Table 6).

Table 7. Scores for L1 Measures Including Everyday Usage, Can-Do-Scales, Lexical Complexity, Words per AS-unit, Fluency, and Stimuli Recognition

Participant	Can-do-Scales	Everyday Usage	Stimuli Recognition	Lexical Complexity	Fluency	Syntactic complexity
ABM N 20_11	1	1	1	1	1	1
ACM N 22_10	1	1	1	1	1	1
ADM N 26_7	1	1	1	1	1	1
AHF N 26_14	2	1	1	1	1	1
AIM N 19_8	1	1	1	1	1	1
APF 18_13	3	3	3	2	3	3
APM 20_11	2	3	3	2	2	2
ASF N 25_11	1	1	1	1	1	1
ATM A 22_12	2	2	1	2	2	3
AWM 29_9	2	3	3	3	2	2
BBM 22_7	3	3	3	3	3	3
DKF 19_7	2	3	3	2	3	3
DMF 21_8	2	3	3	2	2	2
EBF 22_7	3	3	3	3	2	3
EDF A 23_11	2	3	3	2	2	2
EPF A 33_15	3	3	3	2	2	2
GKM 20_8	3	3	3	2	3	2
JFF N 24_8	1	1	1	1	1	1
KBF A 33_15	2	3	3	2	2	2
SLF A 27_5	2	3	3	2	2	2
KMF 19_8	3	3	3	2	2	2
MKF 19_7	2	3	3	2	3	3
MMF A 20_11	2	2	3	2	2	2
MSF 25_7	3	3	3	3	3	3
MVF N 30_9	1	2	2	1	1	1
NOF 27_7	2	3	3	2	3	3
PBF A 18_11	2	3	3	2	3	3
SEM 23_12	2	3	3	2	3	2
SHM N 19_8	1	1	1	1	1	1
SIF 32_7	2	2	3	2	2	2
SLF 20_7	2	3	3	3	3	2
SLF A 27_5	3	3	3	3	2	2
STF N 20_11	1	1	2	1	1	1
VKM 28_7	3	3	3	3	2	2
VZF 18_5	2	3	3	3	2	2
YWF 27_9	3	3	3	3	3	3

As seen in Table 6, several participants had exactly the same scores on all the L1 proficiency measures. At the same time, some participants varied in their scores across the variables. For example, APF 18_13 received “3” for all the measures except for lexical diversity, where she got “2”. In order to arrive at a single score that would indicate each participant’s L1 proficiency, all six were averaged. Figure 4 demonstrates the final outcome.

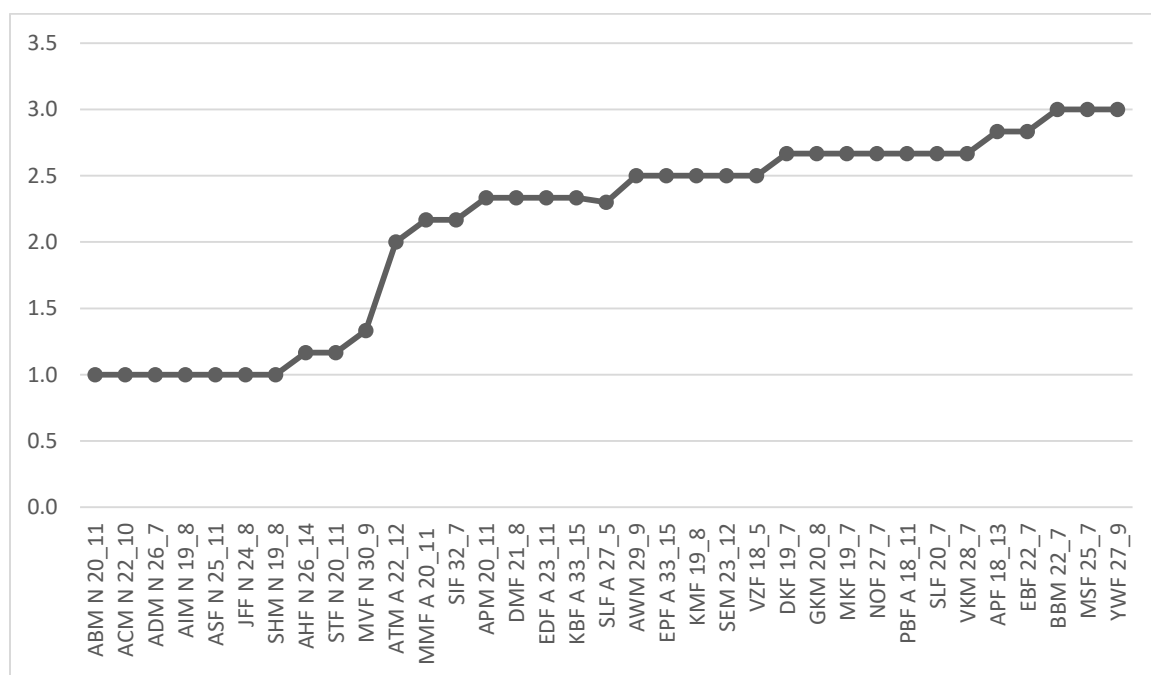


Figure 4. Average L1 proficiency scores

As seen from Figure 4, all participants are on a continuum of L1 Russian mastery, which suggests that there is a group of language users at the bottom of that spectrum, a group at the top of that continuum, and a group of participants in between. After we run a distribution of their scores and divide all the participants into bottom 25% and top 25%

performers, we get three groups: non-atriters (n=12), moderate L1 attriters (n=13), and advanced L1 attriters (n=10) (Table 7 and Figure 5).

It is important to point out that the first two groups consist of bilingual speakers, i.e., they speak two languages, L1 Russian and L2 English, with the second group demonstrating some signs of L1 attrition. That last group does not have productive L1 knowledge (cannot produce L1 words or L1 sentences) or even receptive L1 knowledge (cannot recognize high frequency L1 words). This last group might be described as monolingual speakers because they only speak English. Thus, this study has two groups of bilingual speakers. In order to differentiate between the three groups, I will label the first group *non-atriters* because they had a high level of L2 and L1 mastery as it was demonstrated in their ability to participate in an experiment in both, their L1 and L2. They also reported using L1 Russian and L2 English frequently and produced L1 and L2 narratives that had comparable syntactic complexity, lexical diversity, and fluency. The second group that also consists of bilingual speakers but shows signs of L1 attrition will be labeled *moderate L1 attriters*. The last group will be labeled *advanced attriters*.

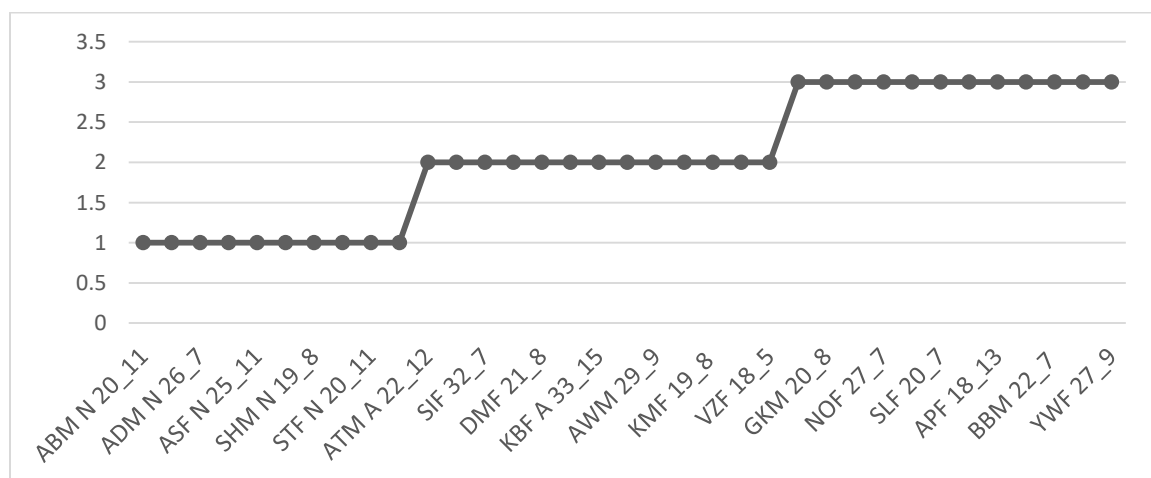


Figure 5. Non-atriters, moderate L1 attriters, and advanced L1 attriters

Table 8. *L1 Scores of Non-Attriters, Moderate L1 Attriters, and Advanced L1 Attriters*

Non-Attriters N=12	L1 Score/ Adoptee Status	Moderate L1 Attriters N=13	L1 Score/ Adoptee Status	Advanced L1 Attriters N=10	L1 Score/ Adoptee Status
DKF 19_7	3/N	ATM A 22_12	2/A	ABM N 20_11	1/A
GKM 20_8	3/N	MMF A 20_11	2/A	ACM N 22_10	1/A
MKF 19_7	3/N	SIF 32_7	2/N	ADM N 26_7	1/A
NOF 27_7	3/N	APM 20_11	2/N	AIM N 19_8	1/A
PBF A 18_11	3/A	DMF 21_8	2/N	ASF N 25_11	1/A
SLF 20_7	3/N	EDF A 23_11	2/A	JFF N 24_8	1/A
VKM 28_7	3/N	KBF A 33_15	2/A	SHM N 19_8	1/A
APF 18_13	3/N	AWM 29_9	2/N	AHF N 26_14	1/A
EBF 22_7	3/N	EPF A 33_15	2/A	STF N 20_11	1/A
BBM 22_7	3/N	KMF 19_8	2/N	MVF N 30_9	1/N
MSF 25_7	3/N	SEM 23_12	2/N		
YWF 27_9	3/N	VZF 18_5	2/N		
		SLF A 27_5	2/A		

Note. “A” stands for adoptee, “N” stands for non-adoptee.

To sum up, the triangulation of the data from analyses of fluency, syntactic complexity, can-do-scales, L1 usage, stimuli recognition, and lexical diversity shows that all 35 participants have comparable L2 English mastery but different levels of L1 mastery. This variation in L1 attrition resulted in dividing participants into three groups: non-attriters, moderate L1 attriters, and advanced L1 attriters. The non-attriters comprised 12 participants ages 18-28 (M=22.08; SD=3.73); moderate attriters included 13 participants ages 18-33 (M=24.29; SD=5.43); and advanced attriters had 10 participants ages 18-30 (M=23.1; SD=3.7).

5.1.1 Factors that Affect L1 Attrition

Although this research project is not concerned with factors of L1 attrition, it is important to consider predictors of attrition in our participant sample, more specifically: why some bilinguals were able to preserve their L1 and why others were not. As we can

see from the Pearson correlation results (Table 8), age of arrival did not correlate with the self-reported measures of can-do-scales ($r=-0.9$, $n=35$, $p=0.5$) or amount of L1 usage ($r=-1.7$, $n=35$, $p=0.3$). The age of arrival also did not correlate with words produced per 2 minutes ($r=-0.17$, $n=35$, $p=0.3$), rate of pauses ($r=0.01$, $n=35$, $p=0.5$), total number of As-units ($r=-0.19$, $n=35$, $p=0.2$), As-units produced per clause ($r=-0.1$, $n=35$, $p=0.6$), lexical diversity ($r=-0.3$, $n=35$, $p=0.8$), or recognition of L1 stimuli ($r=-.03$, $n=35$, $p=0.8$). This means that participants with an earlier age of arrival did not experience a greater level of attrition.

Length of residence also did not seem to have an effect on words produced per 2 minutes ($r=0.5$, $n=35$, $p=0.8$), rate of pauses ($r=-0.05$, $n=35$, $p=0.8$), total number of As-units ($r=0.09$, $n=35$, $p=0.6$), As-units produced per clause ($r=0.05$, $n=35$, $p=0.8$), lexical diversity ($r=0.3$, $n=35$, $p=0.9$), or recognition of L1 stimuli ($r=-0.12$, $n=35$, $p=0.5$). This means that a longer residence in the L2 speaking country did not result in a higher level of attrition.

In contrast, self-reported measures of can-do-scales and L1 usage had a strong correlation with words produced per two minutes ($r=0.9$, $n=35$, $p=0.0$; $r=0.9$, $n=35$, $p=0.0$), rate of pauses ($r=0.7$, $n=35$, $p=0.0$; $r=0.7$, $n=35$, $p=0.0$), total number of As-units ($r=0.8$, $n=35$, $p=0.0$; $r=0.9$, $n=35$, $p=0.0$), As-unites produced per clause ($r=0.9$, $n=35$, $p=0.0$; $r=0.9$, $n=35$, $p=0.0$), lexical diversity ($r=0.9$, $n=35$, $p=0.0$; $r=0.9$, $n=35$, $p=0.0$), and L1 stimuli recognition ($r=0.9$, $n=35$, $p=0.0$; $r=0.9$, $n=35$, $p=0.0$). This finding suggests that self-reported measures correlate with the actual language mastery.

As far as the factors of L1 attrition, we cannot answer the question regarding what affected different degrees of L1 attrition in our participant sample based on the variables that we collected. However, when interviewing participants, an interesting pattern emerged. While the age of arrival and length of residence did not seem to affect L1 attrition, it seemed that participants who put in a greater effort into maintaining their L1 had a lower degree of attrition. This was especially evident in the group of international adoptees who had very few opportunities to use their L1 due to a full emersion in an English-speaking environment. Despite this, some international adoptees continued practicing their L1 which helped them preserve their childhood language. Here is one example:

MMF A 20_11: So when I was adopted, I remember it was maybe a year or so before I stopped using Russian. I remember people told me “after you grow up, you are going to lose your accent”. And I was like “I don’t want to lose my accent” so I would listen to Russian music all the time and I would read books all the time. And after I came here, I wrote down about everything I have gone through in Russia (pause) in Russian. Just watch movies in Russian. I was so confident that I was going to lose the language.

Researcher: Did you have any Russian speaking friends? Do you have anyone you can speak Russian to?

MMF A 20_11: No.

MMF A 20_11: Ну я буду слушать песни, смотреть мультики по русскому языку (.). Не хочу забыть этот язык. / Nu ia budu slushat’ pesni, smotret’ mul’tiki po russkomu iazyku. Ne khochu zabyt’ etot uazyk. / [I am going to listen to music, watch cartoons in Russian. I do not want to forget this language.]

This international adoptee stated that she did not have any opportunities to practice her L1. However, somehow she feels that it is important for her to retain Russian, as she has made significant efforts at maintaining the language by writing in her notebook, watching cartoons, and listening to Russian music. This participant did exhibit some signs of L1 attrition and was placed in the moderate L1 attriters group.

Here is another example from an international adoptee who arrived to the United States at the age of five:

SLF 27_5: I did forget a lot. I realized that my Russian was bad, and I was (.) oh my gosh [laughter], I have to do something about it. So I started studying. Why not?

This participant, despite her early age of arrival, was able to produce a narrative in L1 Russian; she also was able to participate in the Russian testing conditions. She did exhibit some signs of attrition in her syntax and lexicon, which is why she was placed in the moderate L1 attriters group. SLF 27_5 recently moved to Russia and married a native Russian speaker. She also created a Facebook page for international adoptees where she helps people to reconnect with their biological families, aids in translating documents, and helps adoptees apply for their Russian citizenship.

There are two more examples that demonstrate how important one's agency is when it comes to retaining an L1. Two siblings ATM A 22_10 and STF A 20_11 who arrived at the ages of 10 and 11 and who were raised together, demonstrated a strikingly different pattern in their L1 attrition levels. ATM A 22_10 was able to produce an L1 narrative and participate in the Russian testing condition. STF A 20_11 could not hold a conversation in Russian and had to rely on her L2 when completing the experimental tasks. Here is my conversation with ATM A 22_10 during the debriefing:

Researcher: I am just so curious at how you were able to preserve Russian. Could you tell me? Could you please tell me a little bit about how (.) you were able to keep up with that?

ATM A 22_10: So for a while, my sister was also adopted, so for a while her and I spoke Russian back and forth so that helped. &Umm, and I think on top of that I also listened to Russian music for a long period of time. Even after her and I stopped speaking Russian, because we switched to English after a while. Our parents did not want us to use Russian [laughs]. But now, honestly, there is nothing really to stop me from practicing. I need to (.) I am starting to forget it.

Here ATM A 22_10 admits that he and his sister were not allowed to use Russian and eventually switched to English. However, he kept listening to Russian music. He also continued reading in Russian. Additionally, ATM A 22_10 took several Russian courses at his university. On the other hand, his sibling, STF A 20_11, although raised in the same environment, for some reason chose not to practice her L1 and eventually experienced a greater degree of attrition.

These four trajectories described above suggest that age of arrival, lack of communicative opportunities, and frequency of use might not have as drastic of an effect on L1 attrition when it comes to maintaining an L1: speaker's agency and desire to preserve a childhood language might play a role in safeguarding against language loss.

5.2 Results of the Experiment

Twelve non-attriters, 13 moderate L1 attriters, and 10 advanced L1 attriters were asked to perform three tasks: free recall, cued recall, and first memory elicitation. The collected set of 420 free recall memories, 1,988 cued recall memories, and 70 first memories were analyzed in order to answer the following research questions:

- 1) Does language attrition affect bilingual autobiographical memory?
- 2) If so, what aspects of recall will be particularly affected in speakers with L1 attrition?

This chapter is organized in the following way. First, I will list the results of the free recall, cued recall, and first memory elicitation for each group of the participants. Then, I will present a between group comparison for the free recall, cued recall, and first memory elicitation. I will conclude the chapter with answers to the research questions.

5.2.1 Non-Attriters: Results of the Cued Recall, Free Recall, and First Memory Elicitation

Twelve non-attriters recalled a total of 144 memories during the free recall and a total of 694 memories during the cued recall part of the interview. They also shared and dated 24 first memories, one during the Russian test day and one during the English test day. I will first present the results of the free recall task. Then, I will describe the analysis of the cued-recall memories. The results of the first memory task will be presented last.

5.2.1.1 Non-Attriters: Free Recall Results. In the free recall task, participants were asked to recall three events from their life in a Russian-speaking country and three events from their life in the United States. These events were recorded, transcribed, and coded for amount of detail. There were two testing days, one in Russian and one in English, one week apart. Each testing day a participant would share three events from their life in a Russian-speaking country and three events that happened to them in the United States. This means that all the shared memories were told under these four conditions: 1) Russian memories told in English, 2) English memories told in English, 3) Russian memories told in Russian, 4) English memories told in Russian. Since the participants did not date the memories and did not provide the language of the event, we assume that all pre-immigration memories were encoded in Russian and that some post-immigration memories were encoded in Russian and some could have been encoded in English.

The average amount of detail for all the free recall memories was 21.52 (SD=4.9). Just to remind the reader, each memory was coded for amount of detail for the following categories: time, place, actors, perceptual, thoughts/emotions. A maximum score could be 10 points for each memory if all the categories (time, place, actors, perceptual, thoughts/emotions) were mentioned and described in detail.

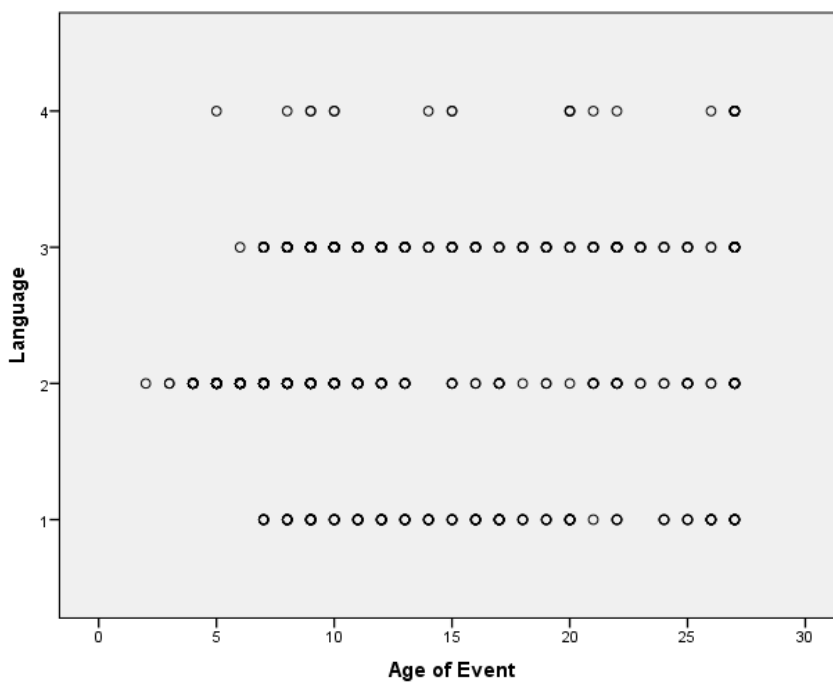
When analyzing free recall memories of non-atrainers, my first goal was to establish whether the distribution of negative events was even among different testing conditions. That was crucial in order to establish the fact that memories shared in different languages and within different testing conditions are comparable to each other. This means that I had one independent variable (condition) and one dependent variable (amount of details). That is why I ran a one-way ANOVA. Out of 144 memories, 102 (70%) were neutral or positive and only 42 (30%) were coded as negative events.⁶ The amount of detail was not affected by the testing condition, i.e., by the language or a mismatch in the language of event and the language of the encoding, [$F(3, 36)=1.93$, $p=0.1$] which means that the non-atrainers provided equal amount of detail for the first ($M=22.25$), second ($M=22.08$), third ($M=22.75$), and fourth ($M=19$) conditions. The number of negative memories was also equally distributed between the four testing conditions with the first condition yielding nine negative memories, second condition = 15, third condition – nine, and fourth condition yielding 14 negative memories: [$F(3, 36)=0.7$, $p=0.5$] with first ($M=0.83$), second ($M=1.25$), third ($M=0.75$), and fourth ($M=1.17$) conditions producing an equal number of negative events. This means that non-atrainers produced balanced narratives of self in all the testing conditions with an equal distribution of negative events.

5.2.1.2 Non-Attrainers: Cued Recall Results. Twelve non-atrainers (ages 18 – 28 with age of arrival between 7 - 13) recalled a total of 694 memories through the means of the cued recall procedure. Based on the language of the event, there were 137 (19.7%) English memories, 339 (48.8%) Russian memories, 195 (28.1%) Mixed memories, and 22 (3.2%)

⁶ All the memories were included in the analysis, the small proportion of negative memories is mentioned here due to the fact that traumatic events might be remembered differently.

memories that were not accompanied by any language. The latter means that no language was spoken by the participant or by anyone around at the time of the event. Although the main focus of this project is to investigate the L1 attrition effect on bilingual autobiographical memory, I will not solely focus on memories that were encoded in L1 but also briefly overview memories that were encoded in L2 and in both languages in order to provide a comprehensive report of the whole data set.

So I could get a better understanding of how frequently non-attriters encoded L1, L2, and mixed memories, I ran a scatter plot of the dates for the L1, L2, and mixed memories (Figure 6).



*Figure 6. Age of event for Russian, English, and mixed memories in non-attriters
1=English, 2=Russian, 3=mixed, 4= “no language” memories*

The scatter plot demonstrates that non-atriters have been encoding Russian memories throughout their lifespan. The English and the mixed memories had been continuously encoded after exposure to the English language which happened after the age of six. This means that non-atriters still encode L1 memories although they do not reside in a Russian-speaking country.

When looking at the overall phenomenological properties of all the memories, non-atriters recalled memories with one phenomenological memory trace (n=452, 65%), while 194 (28%) memories were accompanied by two phenomenological properties, 40 (5.8%) by three, five (0.7%) by four, and only one by five (0.1%). The most common phenomenological property was the visual component with 547 (78.8%) of all the memories triggering a visual image. The kinesthetic sensations (n=163, 23.5%), sounds (n=132, 19%), words (n=57, 8.2%), smells (n=54, 7.8%), and taste (n=32, 4.6%) also accompanied the memories. Overall, only 57 memories out of 693 (8.2%) came in words including 36 memories (5.2%) that came in L1 Russian, 12 (1.7%) that came in L2 English, and seven (1%) that came in both languages. The majority of memories triggered emotions (n=568, 81.8%) with 196 (28.2%) memories assigned “little” emotion, 258 (37.2%) “moderate”, and 114 (15.4%) “strong” emotion. Additionally, the majority of the memories were perceived as positive (n=342, 49.4%), 236 (34%) were assigned a neutral valence, and only 115 (16.6%) were rated as negative.

5.2.1.3 Non-Attriters: Phenomenological Properties of Memories that Came with Words.

Since this project investigated a relationship between language and memory, I analyzed the memories that came with words to non-atriters. It was of interest to investigate whether memories that came with words would differ from memories that were not

accompanied by a linguistic component. Overall, non-atriters recalled 57 memories that came with words. Since I had one categorical variable (words versus no words) and multiple continuous dependent variables (phenomenological properties), I ran a one-way ANOVA with Tukey post hoc tests. In order to avoid Type I error, a Bonferroni adjustment was applied⁷; the results were considered significant if $p < 0.006$. Table 9 summarizes phenomenological properties of memories that came in words. There were no differences in terms of vividness, emotionality, significance, confidence in the event, frequency of recall, and ease of recall.

Table 10. *One-way ANOVA Results for the Phenomenological Properties of the Memories that Came with Words to Non-Attriters*

Phenomenological Properties	No Words (n=637)	Words (n=57)	F Value (1,692)	P Value
Vividness	M=3.19	M=3.33	1.716	.191
Emotion	M=2.50	M=2.75	3.673	.056
Significance	M=2.35	M=2.6	4.574	.033
Confidence	M=3.6	M=3.5	1.630	.202
Type of Emotion	M=2.32	M=2.44	1.362	.244
Recall Others	M=1.79	M=1.95	2.297	.130
Recall Self	M=1.95	M=1.98	.097	.755
Ease of Recall	M=1.38	M=1.28	1.683	.195

Note. No post hoc tests were performed because the results did not reach a statistical significance at $p < 0.006$

The memories that came in words could have been in L1 Russian, in L2 English, or in both languages. Here is a detailed analysis of each subtype. The memories that came

⁷ Bonferroni adjustments were applied to all the analyses that included multiple comparisons.

to participants with words in the Russian language were rated as more significant ($F(1,693) = 7.918, p < 0.006$) (Table 10).

Table 11. *One-way ANOVA Results of the Phenomenological Properties of the Memories that Came with the Russian Words to Non-Attriters*

Phenomenological Properties	Not in Russian (n=658)	Words in Russian (n=36)	F Value (1, 693)	P Value
Vividness	M=3.19	M=3.39	2.083	.149
Emotion	M=2.50	M=2.92	6.428	.011
Significance	M=2.35	M=2.75*	7.918	.005*
Confidence	M=3.59	M=2.75	.818	.366
Type of Emotion	M=2.32	M=2.53	2.734	.099
Recall Others	M=1.79	M=1.97	1.916	.167
Recall Self	M=1.95	M=2.0	.140	.708
Ease of Recall	M=1.38	M=1.25	1.798	.180

Note. The results were considered significant if $p < 0.006$

As far as the English memories, there was no effect of having English words on vividness, emotion, type of emotion, recall, ease of recall, significance, or confidence.

This means that memories that came with English words were comparable to each other in the sample of non-attriters. (Table 11).

Table 12. *One-way ANOVA Results of the Phenomenological Properties of the Memories that Came with English Words to Non-Attriters*

Phenomenological Properties	Not in English (n=682)	Words in English (n=12)	F Value (1, 693)	P Value
Vividness	M=3.20	M=3.25	.050	.822
Emotion	M=2.53	M=2.00	3.498	.062
Significance	M=2.37	M=2.33	.024	.877
Confidence	M=3.59	M=3.50	.263	.608
Type of Emotion	M=2.33	M=2.25	.136	.712
Recall Others	M=1.80	M=1.75	.051	.821
Recall Self	M=1.95	M=1.75	.706	.401
Ease of Recall	M=1.38	M=1.08	3.124	.078

Note. No post hoc tests were performed because the results did not reach a statistical significance at $p < 0.006$

The memories that came with words in both languages demonstrated the similar pattern to the English memories: there was no effect of having words in Russian and in English on any phenomenological properties including significance, ease of recall, or confidence in the event (Table 12).

Table 13. *One-way ANOVA Results for the Phenomenological Properties of the Memories that Came with Words in Both Languages to Non-Attriters*

Phenomenological Properties	No Words in Both (n=687)	Words in Both Languages (n=7)	F Value (1, 692)	P Value
Vividness	M=3.19	M=3.57	1.479	.224
Emotion	M=2.51	M=3.29	4.435	.036
Significance	M=2.37	M=2.71	1.199	.274
Confidence	M=3.58	M=3.71	.352	.553
Type of Emotion	M=2.33	M=2.43	.128	.721
Recall Others	M=1.79	M=2.57	7.197	.007
Recall Self	M=1.94	M=2.43	2.361	.125
Ease of Recall	M=1.38	M=1.29	.172	.679

Note. No post hoc tests were performed because the results did not reach a statistical significance at $p < 0.006$

5.2.1.4 Non-Attriters: Phenomenological Properties of Russian, English, and Mixed

Memories. Before I present the phenomenological properties of the memories encoded in Russian, English, and both languages, I will present the results yielded by each test day.

The English test day, when the overall language of the interview was English, produced a total of 349 memories: 102 (29.2%) English, 117 (33.5%) Russian, 113 (32.4%) Mixed, and 17 (4.9%) “no language” memories. The Russian test day triggered a total of 345 memories: 223 (64.6%) Russian, 82 (23.8%) Mixed, 35 (10.1%) English, and 5 (1.4%) “no language” memories (Figure 7).

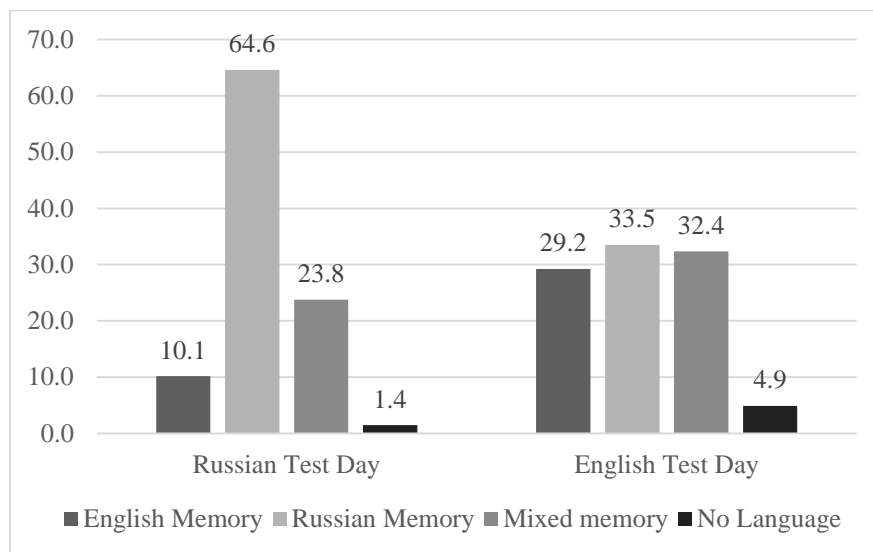


Figure 7. Distribution of the Russian, English, and mixed memories recalled by non-attriters users during the Russian and English test days

The Russian test day had only 10.1% (n=35) cross-over memories⁸. The English test day resulted in 33.5% (n=117) cross-over memories. The Russian test day yielded 82 (23.8%) mixed memories and English day had 113 (32.4%) (Figure 8).

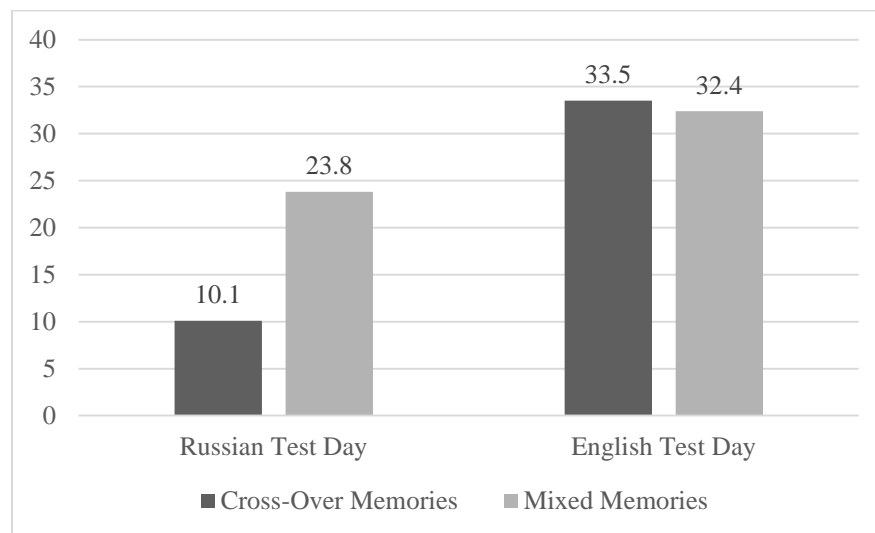


Figure 8. Cross-over and mixed memories recalled by non-attriters

I will now move on to comparing Russian, English, and mixed memories in terms of their phenomenological properties. Although, the main focus of this project is investigating L1 memories, I will briefly overview L2 and mixed memories. I will exclude the “no language” memories due to their extremely small number (3.2%).

L1 Russian, L2 English, and mixed memories “came in words” to the same degree in comparison to each other. These memories also did not differ in their confidence levels. However, L1 Russian memories were more likely to be accompanied by words in Russian, L2 English memories were more likely to trigger words in English,

⁸ A cross-over memory is when a certain language of a cue or the interview triggers a memory that was encoded in another language. For example, if an English cue “tricycle” triggers a Russian memory, that memory would be considered a cross-over one.

and mixed memories were accompanied by words in both languages. Table 13 provides a summary of the one-way ANOVA results for the Russian, English, and mixed memories and their phenomenological properties.

Table 14. *One-way ANOVA and Tukey post hoc Results for the Phenomenological Properties of the Russian, English, and Mixed Memories Recalled by Non-atriters*

Phenomenological Properties F (2,690) Value and P Value	English Memories, (n=137)	Russian Memories, (n=339)	Mixed Memories (n=195)
Vividness F=1.8, p=0.13	M=3.21, SD=0.9	M=3.13, SD=0.8	M=3.3, SD=3.3
Words F= 1.16, p=0.3	M=0.1, SD=0.3	M=0.09, SD=0.2	M=0.7, SD=0.2
Words Russian F=6.4, p=0.00*	M=0.01, SD=0.02	M=0.1*, SD=0.01	M=0.03*, SD=0.01
Words English F=14.0, p=0.00*	M=0.08*, SD=0.2	M=0, SD=0	M=0.01, SD=0.07
Words Both F=4.1, p=0.007*	M=0.01, SD=0.08	M=0, SD=0	M=0.03*, SD=0.1
Emotion F=8.9, p=0.00*	M=2.25*, SD=0.9	M=2.5*, SD=1	M=2.7*, SD=0.9
Type of Emotion F=6.81, p=0.00*	M=2.1*, SD=0.8	M=2.36, SD=0.7	M=2.45, SD=0.7
Recall Others F=9.4, p=0.00*	M=1.66, SD=0.7	M=1.75, SD=0.7	M=2.03*, SD=0.8
Recall Self F=8.2, p=0.00*	M=1.77, SD=0.7	M=1.94, SD=0.9	M=2.15*, SD=0.8
Age of Event F=52.1, p=0.00*	M=15.82, SD=6	M=9.6*, SD=6.1	M=14.44, SD=6.1
Ease of Recall F=25.2, p=0.00*	SD=1.28, SD=0.5	M=1.26, SD=0.6	M=1.7*, SD=0.6
Significance F=8.52, p=0.00*	M=2.1*, SD=0.7	M=2.4, SD=0.8	M=2.5, SD=0.8
Confidence F=0.93, p=0.4	M=3.65, SD=0.6	M=3.55, SD=0.6	M=3.6, SD=0.5

Note. The significantly significant means are marked by “*” at $p < 0.004$

These three groups of memories triggered different amount of emotional response ($F(2,690) = 8.9, p < 0.004$), with mixed memories rated the highest ($M = 2.7$), Russian rated the second ($M = 2.5$), and English memories rated as least emotional ($M = 2.25$). The memories also differed by the type of emotion ($F(2, 690) = 6.81, p < 0.004$) with English memories being more likely rated as “neutral” ($M = 2.1$) in comparison to Russian ($M = 2.36$) and mixed memories ($M = 2.45$). Mixed memories were also more likely to be recalled to others and to self ($F(2, 690) = 9.4, p < 0.004$; $F(2, 690) = 8.2, p < 0.004$). While English memories were perceived least significant ($F(2, 690) = 8.52, p < 0.004$), the mixed memories were the hardest to retrieve ($F(2, 690) = 25.2, p < 0.004$). These findings

suggest that while L1 Russian memories might be perceived to be emotional, mixed memories may stand out in terms of frequency of recall and emotionality.

5.2.1.5 Non-Attriters: Self-Cueing Strategy for Memory Retrieval. When working with non-attriters, an interesting pattern emerged during research sessions. Apparently, participants seemed to rely on a self-cueing strategy in order to retrieve memories. More specifically, they repeated the audio cue or named the image. It was not a mechanical repetition of the experimental stimuli, but it appeared to be a verbal retrieval strategy that participants utilized in order to help themselves remember. Here is an example:

An image with an audio cue of “safety scissors” is presented.

Participant: safety scissors (repeats in whisper) safety scissors hmm. Gosh. I do not use them. I guess it reminds me of my 5th grade art project, making borders with these funky scissors.

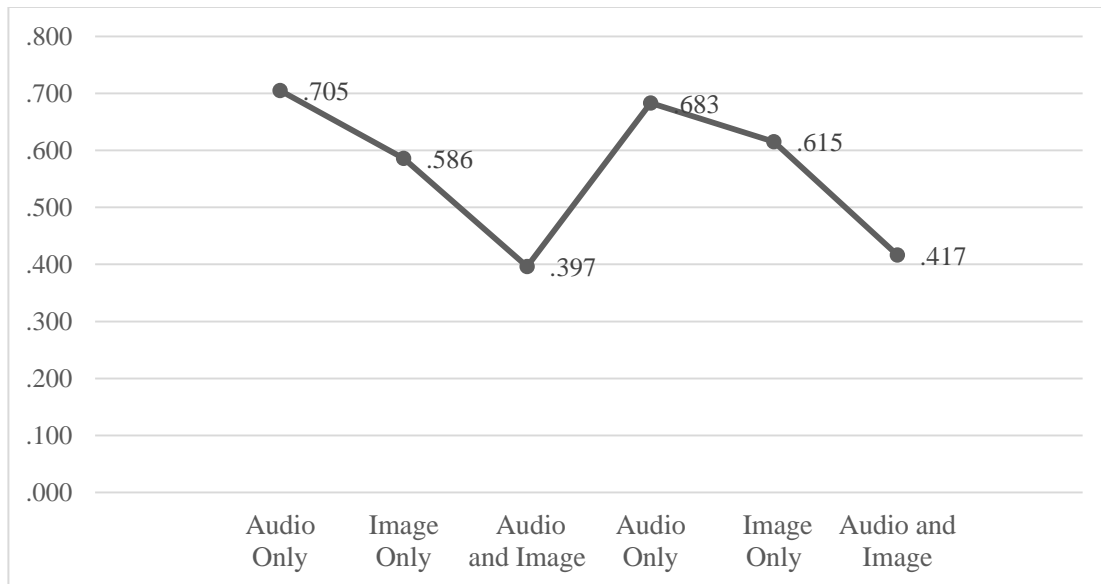
Here the participant repeats the cue “safety scissors” several times and pauses before retrieving the memory. This strategy seemed to facilitate memory retrieval. Although an analysis of possible memory retrieval strategies was not something I was looking for in this research, I wanted to mention it here because it is linguistic in nature (repeating a word) and I was investigating a role of language in bilingual autobiographical memory.

While all the participants relied on this strategy, they used it to a various degree. One participant used it only three times within both test days, while some used it as frequent as 42 times (70%) out of 60 possible. Overall, 392 (56.5%) memories were retrieved with the help of this strategy. The verbal retrieval strategy has been utilized similarly during the Russian ($M=0.54$; $SD=0.49$) and English ($M=0.58$; $SD=0.49$) test days [$F(1, 692)=1.1$, $p=0.3$] meaning that the overall language of the interview did not affect the use of this technique. However, language of the memory had an effect on the self-cueing. According to the one-way ANOVA and Tukey post hoc results, when

retrieving Russian memories ($M=0.49$, $SD=0.5$), the strategy was used the least often in comparison to the English ($M=0.68$, $SD=0.5$) and mixed ($M=0.61$, $SD=0.5$) memories [$F(3, 693)=6.08$, $p=0.0$].

Also, the use of the strategy was affected by the testing condition⁹. In order to analyze whether the six testing conditions had an effect on the use of this strategy, a one-way ANOVA was performed. There was a significant effect of condition on the verbal retrieval at the $p<0.05$ level for the six conditions [$F(5, 692) = 8.58$, $p=0.0$]. The post hoc comparisons using Tukey HSD test indicated that the mean scores for the third ($M=0.4$; $SD=0.05$) and sixth ($M=0.4$; $SD=0.04$) conditions were significantly lower than the mean scores for the first ($M=0.7$; $SD=0.05$), second ($M=0.56$; $SD=0.05$), fourth ($M=0.7$; $SD=0.04$), and fifth ($M=0.6$; $SD=0.04$). In other words, when the cues were represented with an audio and an image component, the participants relied less on a verbal retrieval strategy (see Figure 9).

⁹ The word “condition” here refers to the six types of cues used in the study: culture-specific audio only, culture-specific image only, culture specific audio and image, non-culture specific audio only, non-culture specific image only, non-culture specific audio and image.



Condition	Mean
Culture-Specific Audio Only (#1)	.705
Culture Specific Image Only (#2)	.586
Culture-Specific Audio and Image (#3)	.397
Non-Culture Specific Audio Only (#4)	.683
Non-Culture Specific Image Only (#5)	.615
Non-Culture Specific Audio and Image (#6)	.417

Figure 9. Non-atriters using self-cueing strategy across six testing conditions

Overall, it seemed that non-atriters utilized the strategy less often when the stimuli contained two codes, audio and visual. Having more information present at the time of the retrieval could facilitate the process of accessing memories. Since they relied on the self-cueing strategy more often when the stimuli were presented with just one code, audio or visual, it is possible to that they had to utilize the self-cueing strategy when the environment was not as rich.

5.2.1.6 First Memories of Non-Attriters. Non-atriters also shared and dated 24 first memories. It was anticipated that non-atriters may recall earlier first memories when

interviewed in L1 Russian. It turned out that majority of non-attriters, seven out of 12 (59%), recalled divergent memories on different test days. Also, the memories provided during the Russian test day had a lower average age and a lower maximum age (see Table 14). However, according to a t-test, the difference between the age of memories that were provided during the Russian test day ($M=3.25$, $SD=0.78$) was not significantly lower than the age of memories shared during the English test day ($M=3.54$, $SD=0.95$); $t(11) = -0.8$, $p=0.4$.

Table 15. *Ages of the First Memories Recalled by Non-attriters during the Russian and English Test Days*

Age of the First Event	Russian Test Day	English Test Day
Average Age	3.25	3.54
Standard Deviation	0.78	0.95
Minimum Age	2	2
Maximum Age	4.5	5

Interestingly, the participants also did not seem to remember what first memory they shared with the researcher during the previous research session which occurred just a week before. Here is an example from one of the interviews:

Researcher: Alright, last question for today. What was your very first memory?
 DMF 21_8: Hmm, I remember getting a new couch slash bed and for myself and it was placed in my parents' room and I remember really liking it was brown color and very soft.
 Researcher: Ok, good. Last time you told me a different memory. Do you remember what it was?
 DMF 21_8: Yeah, I do not remember (laughs).
 Researcher: Why do you think something different came to your mind?
 DMF 21_8: I don't know. Could you tell me?
 Researcher: My notes say “как нас родители оставляли с маминым братом на лето” / *kak nas roditeli ostavl'ali s maminyum bratom na leto* / [how our parents would leave us with my uncle for the summer].

DMF 21_8: Oh, ok. That one definitely was before the couch one I don't really know why I thought of the couch one today.

Here is DMF 21_8 recalled a later memory during the English test day about getting a new bed. She also did not remember what she told the researcher during the Russian test day. Although this participant did not provide any explanations regarding why she thought of a different event, many other participants shared their thoughts regarding recalling different first memories. Several participants explained it by the fact that they were using a different language. Here is one example:

YWF 27_9: Я помню свою подружку в садике Алиса как мы пошли на физкультуру. Ей платье мое понравилось. / Ia pomnu svoiu podruzhku v sadike Alisa kak my poshli na fizkul'turu. / [I remember my best friend Alisa in our day care. We went to the gym class. She liked my dress.]

Researcher: Хорошо, спасибо. По-моему в прошлый раз ты мне рассказала что-то другое. Ты помнишь? / Khorosho, spasibo. Po moemu v proshlyi raz ty mne raskazaka chto to drugoe. Ty pomnish? / [Good, thank you. Why do you think last time you shared a different event with me? Do you remember?]

YWF 27_9: Не помню, я помню что этот вопрос вы задавали но я не помню что я сказала. / Ne pomnu, no ia pomnu chto etot vopros vy zadavali no ia ne pomnu chto skazala. / [I do not remember, I only remember that you asked the same question about my first memory, but I do not remember what I said.]

Researcher: Здесь я записала "playing with best friend" / Zdes' ia zapisala "playing with best friend". / [This is what I have in my notes "playing with my best friend."]

YWF 27_9: А! На английском я вспомнила как мы играли во дворе. Мы жили в соседских домах. А тут на русском я вспомнила как мы в садике были. / A! Na angliiskom ia vspomnila kak my igrali vo dvore. My zhyli v sosedskikh domakh. A tut na russkom ia vspomnila kak my v sadike byli. / [Aha! In English I remembered how we played in our back yard. We were neighbors. Today in Russian I remembered how we were at the daycare.]

Researcher: Хорошо, а какое событие было раньше? / Khorosho, a kakoe sobytie ran'she bylo? / [Ok, which event was earlier?]

YWF 27_9: Сегодняшнее потому что мы с ней в садике познакомились. / Segodn'ashnee potomuchto my s nei v sadike poznaomilis'. / [The one I shared today because we met at the daycare.]

In the example above YWF 27_9 shared a different and an earlier memory during her Russian test day. She did not have any recollection regarding what she told the researcher

during the English test day. Her explanation was that she was using a different language: “На английском я вспомнила как мы играли во дворе. А тут на русском я вспомнила как мы в садике были”/ In English I remembered how we played in our back yard. Today in Russian I remembered how we were at the daycare.

To sum up, since non-atriters served as a control group in this study, it was crucial to provide a detailed analysis of their L1, L2, and mixed memories. According to the results of the free recall, cued-recall tasks, as well as the question about the very first memory, non-atriters provided consistent narratives of self. Their Russian and English memories did not differ in the amount of detail (free recall). They also shared a comparable number of Russian, English, and Mixed memories (cued recall). Also, the English memories were more likely to come in with the English words, the Russian memories with words in Russian, and the mixed memories were more likely to be accompanied by the words in both languages.

Additionally, the memories that were accompanied by words were rated as more significant, emotional, and were more likely to be shared with others. The Russian, English, and mixed memories differed in their phenomenological properties with mixed memories standing out in terms of higher emotional valence, more frequent recall to self, and ease of recall. The Russian memories were also very emotional and significant in comparison to the English memories.

The results of the very first memory elicitation task revealed an inconsistency - with participants providing divergent first memories during different testing conditions. The Russian test day triggered earlier first memories in comparison to the English test day; however, that difference was not statistically significant.

5.2.2 Moderate L1 attriters: Results of the Cued Recall, Free Recall, and First Memory Elicitation

Moderate attriters represented a group who retained their L1, but had a lower L1 proficiency in comparison to non-attriters. Thirteen moderate L1 attriters shared a total of 156 memories during the free recall, 740 memories during the cued-recall part of the interview, and 26 first memories (one during the Russian test day and one during the English test day). I will first present the results of the free recall task. Then, I will describe the analysis of the cued-recall memories. The results of the first memories will be presented last.

5.2.2.1 Moderate L1 attriters: Free Recall Results. The free recall task yielded a total of 156 memories. The average amount of detail was 18.31 (SD=4.7). Out of 156 memories, 42 (27%) were coded as negative events. All the memories were shared under four conditions: 1) Russian memories told in English, 2) English memories told in English, 3) Russian memories told in Russian, 4) English memories told in Russian. The number of negative memories was equally distributed between the four testing conditions with the first condition yielding 14 negative memories, second condition – 11, third condition = 9, and fourth condition – 8 negative memories: $[F(3,48)=0.9, p=0.4]$ with first (M=1.08), second (M=0.85), third (M=0.7), and fourth (M=0.6) conditions producing an equal number of negative events

However, as anticipated, the amount of detail was affected by the testing condition $[F(3,48)=6.93, p=0.001]$ with the participants providing more detailed memories in the first (M=19.23) and second (M=22) testing conditions in comparison to the third (M=16.62) and fourth (M=15.38). This means that when moderate L1 attriters

shared their memories in their weaker language, Russian, the memories were less detailed which is expected due to their L1 attrition.

5.2.2.2 Moderate L1 attriters: Cued Recall Results. Now I will provide results of the cued recall. Thirteen moderate L1 attriters ages 18-33 with age of arrival between 5 – 15 shared a total of 740 memories. There were 241 (32.6%) English memories, 346 (46.8%) Russian memories, 147 (19.9%) Mixed memories, and 6 (0.8%) “no language” memories (Figure 10).

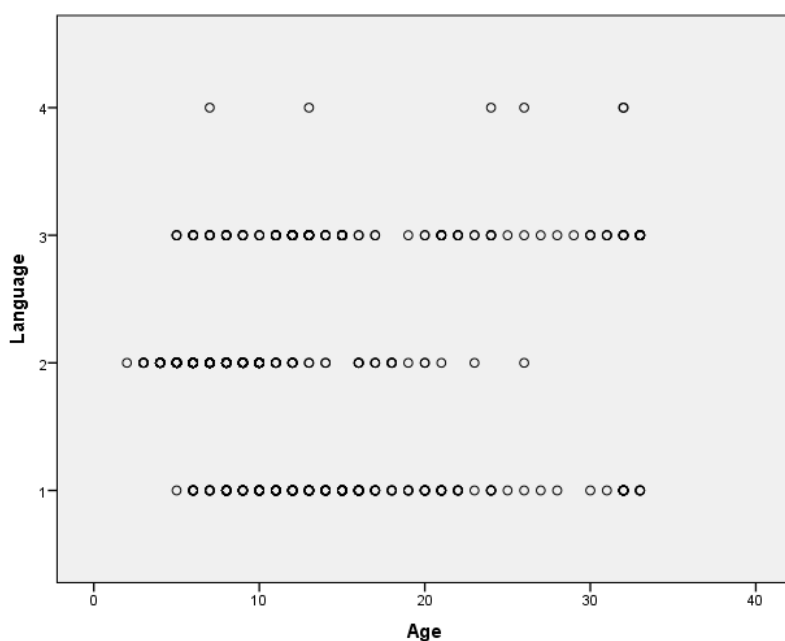


Figure 10. Age of Event for Russian, English, and mixed memories recalled by moderate L1 attriters

1=English, 2=Russian, 3=mixed, 4=“no language” memories

The scatterplot demonstrates that most of the L1 Russian memories of moderate L1 attriters were encoded in the childhood, while the L2 English and mixed memories have been encoded continually throughout the life span after exposure to the English language.

When looking at the overall phenomenological properties of the memories that were recalled by moderate attriters, most of the memories came to them with one

phenomenological property (n=513, 69.3%), while 174 (23.5%) were accompanied by two memory traces, 46 (6.2%) by three, and only seven (0.9%) by four. The most common phenomenological property was the visual component with 579 (78.2%) memories evoking a visual image. The kinesthetic sensations (n=189, 25.5%), sounds (93, 12.6%), words (n=80, 10.8%), smells (n=54, 7.3%), and taste (n=32, 4.3%) also accompanied the memories. Overall, only 80 memories (10.8%) came to the participants in words including 43 memories (5.8%) that came in Russian, 36 memories (4.9%) that came in English, and one memory (0.1%) that came in both languages. The majority of memories (n=606, 81.9%) were accompanied by an emotional component with 250 (33.8%) memories triggering “little” emotions, 235 (31.8%) “moderate”, and 121 (16.4%) strong. Most of the memories were rated as positive (n=402, 54.3%), 262 (35.4%) were perceived as neutral, and 75 (10.1%) were assigned a negative valence.

This means that most memories came to moderate attriters as visuals with a small portion of memories being accompanied by words. This is a similar pattern in comparison to non-attriters. Moderate attriters also mostly recalled positive or neutral memories with a small portion of negative events which is comparable to the memories of non-attriters. This suggests that the memory data set of moderate attriters and non-attriters comparable.

5.2.2.3 Moderate L1 attriters: Phenomenological Properties of Memories that Came with Words. Since the main focus of this project was to investigate the role of language in bilingual autobiographical memory, it was of interest to see whether memories that came in words differed from memories that were not accompanied by a linguistic component. Overall, there were 80 memories that were accompanied by words. These memories that came in words did not differ in terms of vividness, significance, emotionality, frequency

of recall, or confidence in comparison to memories that did not come with words (see Table 15).

Table 16. *One-way ANOVA Results for the Phenomenological Properties of the Memories that came with Words to Moderate L1 attriters*

Phenomenological Properties	No Words (n=660)	With Words (n=80)	F Value (1, 738)	P Value
Vividness	M=3.05	M=2.96	.577	.448
Emotion	M=2.46	M=2.46	.000	.992
Type of Emotion	M=2.45	M=2.44	.010	.921
Recall Others	M=1.60	M=1.62	.106	.744
Recall Self	M=1.73	M=1.89	3.640	.057
Ease of Recall	M=1.53	M=1.36	3.842	.050
Significance	M=2.40	M=2.49	.747	.388
Confidence	M=3.50	M=3.56	.545	.461

Note. No post hoc tests were performed because the results did not reach a statistical significance at $p < 0.006$

This demonstrates a different pattern from non-attriters. For non-attriters, if a memory came in words, it was perceived as more emotional and more significant which was not the case for moderate attriters. In order to investigate this issue further, I compared memories that came with L1 Russian words (n=43), L2 English (n=36), or words in both languages (n=1). Here is a detailed analysis of each subtype. For the memories that came with L1 Russian words, there was no difference in terms of vividness, significance, ease of recall, frequency of recall to others or self, or confidence in the event for the less proficient L1 users (Table 16).

Table 17. *One-way ANOVA Results of the Phenomenological Properties of the Memories that Came with the Russian Words to Moderate L1 attriters*

Phenomenological Properties	No Words in Russian (n=697)	Words in Russian (n=43)	F Value (1, 738)	P Value
Vividness	M=3.04	M=2.91	.901	.343
Emotion	M=2.46	M=2.49	.030	.863
Type of Emotion	M=2.44	M=2.51	.453	.501
Recall Others	M=1.60	M=1.60	.000	.984
Recall Self	M=1.74	M=1.91	2.393	.122
Ease of Recall	M=1.52	M=1.33	3.047	.081
Significance	M=2.41	M=2.53	1.024	.312
Confidence	M=3.51	M=3.53	.060	.806

Note. No post hoc tests were performed because the results did not reach a statistical significance at $p < 0.006$

This is also a different pattern in comparison to non-attriters. For non-attriters, memories that came with L1 Russian words, were more significant and emotional which did not hold true for moderate attriters.

As far as the memories that came with L2 English words, there was a similar pattern observed. For the memories that came in words in the English language there was no effect of memories having English words on vividness, significance, ease of recall, frequency of recall to others or self, or confidence in the event for moderate attriters (Table 17).

Table 18. *One-way ANOVA Results of the Phenomenological Properties of the Memories that Came with the English Words to Moderate L1 attriters*

Phenomenological Properties	No Words in English (n=704)	Words in English (n=36)	F Value (1, 738)	P Value
Vividness	M=3.04	M=3.03	.003	.954
Emotion	M=2.46	M=2.44	.015	.904
Type of Emotion	M=2.45	M=2.39	.259	.611
Recall Others	M=1.60	M=1.64	.118	.731
Recall Self	M=1.74	M=1.86	1.013	.315
Ease of Recall	M=1.52	M=1.39	1.091	.296
Significance	M=2.41	M=2.44	.055	.815
Confidence	M=3.51	M=3.58	.452	.501

Note. No post hoc tests were performed because the results did not reach a statistical significance at $p < 0.006$

5.2.2.4 Moderate L1 attriters: Phenomenological Properties of Russian, English, and Mixed Memories. Now I will provide the results yielded by each test day as well as the phenomenological properties of Russian, English, and mixed memories. The English test day resulted in a total of 377 memories: 190 (50.4%) English, 96 (25.5%) Russian, 88 (23.3%) Mixed, and 3 (0.8%) “no language” memories. The Russian test day triggered a total of 363 memories: 250 (68.9%) Russian, 59 (16.3%) Mixed, 51 (14%) English, and 3 (0.8%) “no language” memories (Figure 11).

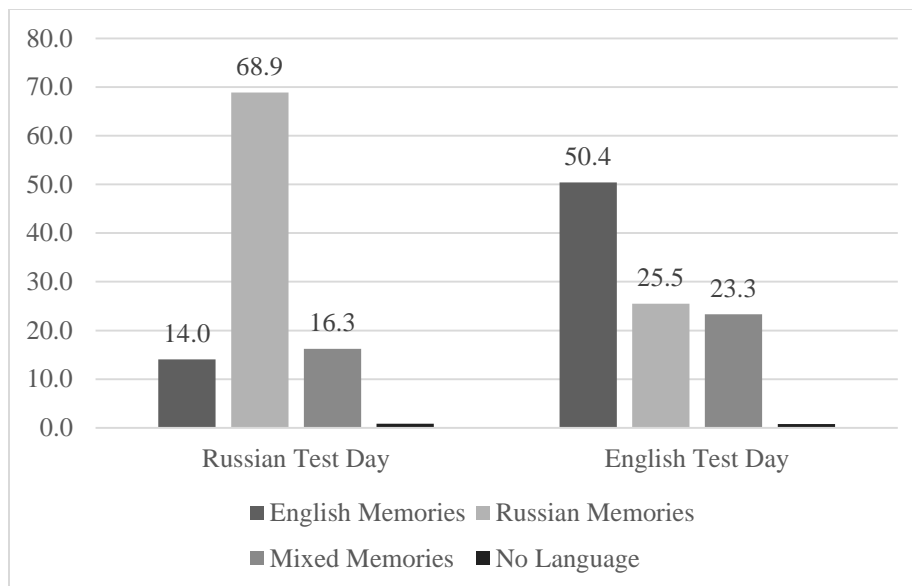


Figure 11. Distribution of the Russian, English, and mixed memories recalled by moderate L1 attriters during the Russian and English test days

The English test day triggered more cross-over memories with 96 (25.5%) Russian memories and 88 (23.3%) mixed memories; the Russian test day yielded 51 (14%) English memories and 59 (16.3%) mixed memories (Figure 12).

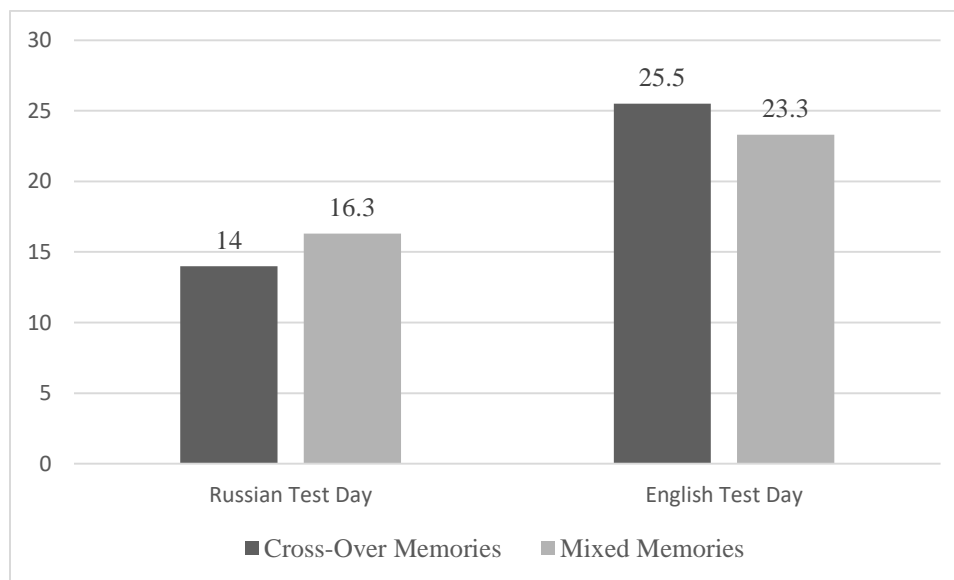


Figure 12. Cross-over and mixed memories recalled by moderate L1 attriters

Now I will describe Russian, English, and mixed memories in terms of their phenomenological properties. The mixed memories stood out for this group of participants in terms of significance, ease of recall, and emotional intensity. More specifically, the mixed memories were more significant, more emotional, but harder to recall. The Russian memories had a significantly lower rate of confidence and vividness. The nineteenth table outlines the phenomenological properties of the Russian, English, and mixed memories that were recalled by the moderate L1 attriters.

Table 19. *One-way ANOVA and Tukey post hoc Results for the Phenomenological Properties of the Russian, English, and Mixed Memories Recalled by Moderate L1 attriters*

Phenomenological Properties	English Memories n=241	Russian Memories n=346	Mixed Memories n=147
Vividness [F(3, 736)=8.4, p=0.00*]	M=3.14, SD=0.9	M=2.9*, SD=1	M=3.27, SD=0.8
Words [F(3, 736)=0.3, p=0.3]	M=0.11, SD=0.3	M=0.11, SD=0.3	M=0.11, SD=0.3
Words in Russ. [F(3, 736)=8.6, p=0.00*]	M=0.0, SD=0.0	M=0.1*, SD=0.3	M=0.05, SD=0.2
Words in Eng. [F(3, 736)=11.2, p=0.00*]	M=0.11*, SD=0.3	M=0.01, SD=0.07	M=0.05, SD=0.2
Words in Both [F(3, 736)=1.35, p=0.3]	M=0.0, SD=0.0	M=0.0, SD=0.0	M=0.01, SD=0.8
Emotion [F(3, 736)=9.4, p=0.00*]	M=2.5, SD=1.0	M=2.3, SD=0.9	M=2.8*, SD=0.9
Type of Emotion [F(3, 736)]=0.36, p=0.8]	M=2.4, SD=0.7	M=2.5, SD=0.7	M=2.4, SD=0.7
Recall to Others [F(3, 736)]=0.1, p=0.3]	M=1.6, SD=0.6	M=1.6, SD=0.6	M=1.7, SD=0.6
Recall to Self [F(3, 736)]=0.7, p=0.5]	M=1.7, SD=0.7	M=1.8, SD=0.7	M=1.8, SD=0.7
Ease of Recall [F(3, 736)]=12.8, p=0.00*]	M=1.4, SD=0.7	M=1.5, SD=0.7	M=1.8*, SD=0.6
Significance [F(3, 736)]=5.6, p=0.001*]	M=2.34, SD=0.8	M=2.39, SD=0.8	M=2.63*, SD=0.8
Confidence [F(3, 736)]=7.5, p=0.00*]	M=3.6, SD=0.5	M=3.4*, SD=0.7	M=3.6, SD=0.6

Note. The results were considered significant if $p < 0.004$

The most important finding that relates to the main research question regarding a negative effect of L1 attrition on bilingual autobiographical memory is the finding about lower vividness and lower confidence rating of L1 Russian memories of moderate attriters. This was a hypothesized result.

Since the Russian memories were significantly less vivid and had a lower level of confidence in comparison to the English and Mixed memories but less recent with an

average age of event at 7.9, two extra analyses were performed. The justification for this extra step was the fact that older memories might fade away with age. For this analysis, the most recent memories that happened within a year were taken out of the data set with the help of the “compute variable” and “if variable” SPSS commands.

The one-way ANOVA and Tukey post hoc tests demonstrated that even if the most recent memories were taken out, the Russian memories ($M=2.87$, $SD=0.9$) were still perceived as less vivid in comparison to the English ($M=3.08$, $SD=0.9$) and mixed memories ($M=3.21$, $SD=0.8$). That difference was statistically significant ($F(2,682)=4.4$, $p<0.004$).

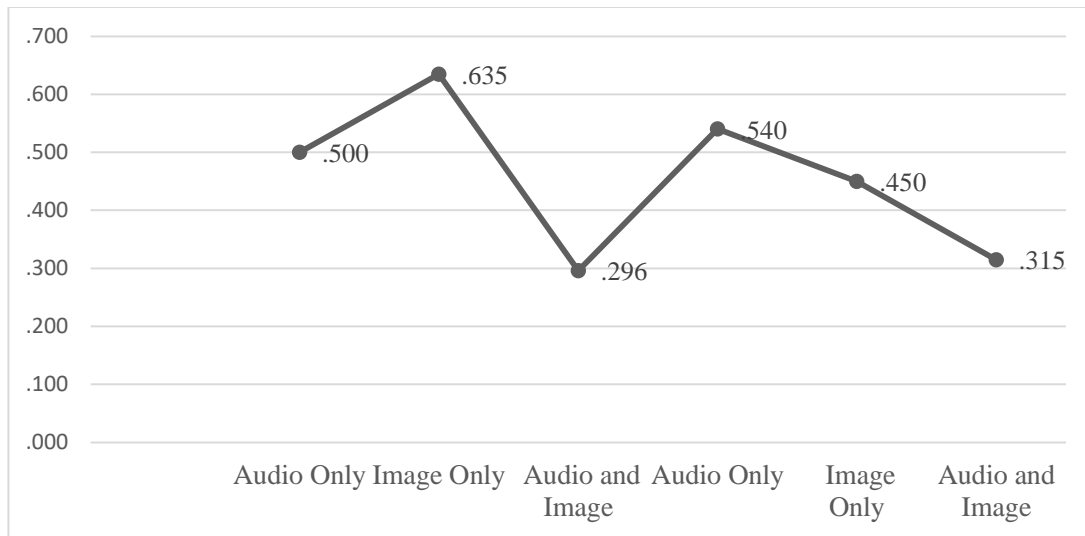
Similarly, the fact that the Russian memories were perceived as less confident was not affected by removing of the most recent memories. One-way ANOVA and Tukey post hoc tests demonstrated that the Russian memories had a significantly lower confidence ratings ($M=3.39$, $SD=0.7$) than the English memories ($M=3.64$, $SD=0.6$); $F(2,682)=6.9$, $p<0.004$. There was no statistically significant difference in confidence ratings between the English ($M=3.64$, $SD=0.6$) and mixed memories ($M=3.5$, $SD=0.6$); there was also no difference between the mixed ($M=3.64$, $SD=0.6$) and Russian memories ($M=3.39$, $SD=0.7$). These results suggest that we are observing a negative L1 attrition effect on phenomenological properties of autobiographical memories.

5.2.2.5 Self-Cueing Strategy for Memory Retrieval. Similarly to non-atriters, moderate L1 attriters relied on the verbal retrieval strategy 321 times (43.4%) out of 740 possible memory retrievals. They translated cues from Russian into English eight times (2.5%). This group utilized the verbal retrieval strategy equally during the Russian ($M=0.45$; $SD=0.04$) and English ($M=0.47$; $SD=0.49$) test days which means that the language of

the interview did not affect the use of the strategy. The language of the memory did not have an effect on the use of the strategy with Russian memories ($M=0.4$; $SD=0.03$), English memories ($M=0.4$; $SD=0.05$), mixed memories ($M=0.5$; $SD=0.04$), and “no language” memories ($M=0.6$; $SD=0.2$) yielding no statistically significant results [$F(3, 737) = 2.0, p=0.11$]. This means that moderate L1 attriters did not differ in how frequently they relied on the verbal retrieval when recalling Russian, English, Mixed, or “no language” memories.

However, there was a significant effect of condition¹⁰ on the usages of the verbal retrieval strategy at the $p<0.05$ level for the six conditions [$F(5, 737) = 4.76, p=0.0$]. The post hoc comparisons using Tukey HSD test indicated that the mean scores for the third ($M=0.3$; $SD=0.05$) and sixth ($M=0.3$; $SD=0.05$) testing conditions were significantly lower than the mean scores for the first ($M=0.5$; $SD=0.05$), second ($M=0.63$; $SD=0.05$), fourth ($M=0.5$; $SD=0.05$), and fifth ($M=0.5$; $SD=0.04$). This means that the cues were represented with an audio and an image component, the participants relied less on a verbal retrieval strategy (see Figure 13).

¹⁰ The word “condition” here refers to the six types of cues used in the study: culture-specific audio only, culture-specific image only, culture specific audio and image, non-culture specific audio only, non-culture specific image only, non-culture specific audio and image.



Condition	Mean
Culture-Specific Audio Only (#1)	.500
Culture Specific Image Only (#2)	.635
Culture-Specific Audio and Image (#3)	.296
Non-Culture Specific Audio Only (#4)	.540
Non-Culture Specific Image Only (#5)	.450
Non-Culture Specific Audio and Image (#6)	.315

Figure 13. Moderate L1 attriters using self-cueing strategy across six testing conditions

5.2.2.6 *First Memories of Moderate L1 attriters.* Now I will present the results of the very first memory recall task. The moderate L1 attriters shared 26 first memory events. The majority of the participants, eight (66%) out of 12, recalled divergent memories during the different test days. The average age of the first memory during the Russian test day was 4.13 (SD=1.42), while the average age during the English test day was 4.04 (SD=1.13). This difference was not statistically significant [$t(11) = -0.2, p=0.9$] (Table 20).

Table 20. *Ages of the First Memories Recalled by Moderate L1 attriters during the Russian and English Test Days*

Age of the First Memories	Russian Test Day	English Test Day
Average Age	4.13	4.04
Standard Deviation	1.42	1.13
Minimum Age	2	2
Maximum Age	7	6

All the participants who recalled a different memory during their second interview did not remember what they shared during the first test day. Some of the participants attempted to explain why they might have recalled a different memory. Those explanations usually included referring to a different state of mind and were not connected to language:

Researcher: Ok, great. So here is the last question for today. What was your very first memory?

EPF A 33_15: I remember playing with my dad on the bed and I would give him a massage and I would draw in his back and we would play a guessing game he would try to guess which letter I am trying to draw.

Researcher: Alright, thanks. So last time you I asked you the same question. Do you remember?

EPF A 33_15: No.

Researcher: Yeah, I asked you about your first memory.

EPF A 33_15: Really?

Researcher: My notes say “переезд с родителями к бабушке с дедушкой” / *pereezd s roditel’ami k babushke s dedushkoi* / moving to grandpa and grandma with my parents.

EPF A 33_15: A! Moving, that's right. That is actually a first memory. Moving from one city to another. I think different things come to mind because recently I was thinking about my dad and it came into my mind today.

Here the participant recalls an earlier memory during the English test day. She explains it by the fact that recently she has been thinking about her father and therefore recalled a memory related to her dad.

To sum up, moderate attriters produced a comparable memory data set to the one of non-attriters: they recalled mostly positive or neutral events that were mainly encoded with visuals. They recalled the same proportion of memories that were accompanied by words. However, several differences emerged in comparison to non-attriters. First of all, their free recall memories were less detailed when shared in Russian. Second of all, their L1 Russian memories were less vivid than English and mixed memories. The Russian memories also had a lower confidence rating. These findings suggest that L1 attrition has a negative effect on bilingual autobiographical memory.

5.2.3 Advanced L1 Attriters: Results of the Cued Recall, Free Recall, and First Memory Elicitation

Ten advanced L1 attriters comprised a group that did not retain their L1. Overall, they shared a total of 120 memories during the free recall, 554 memories during the cued recall part of the interview, and 20 very first memories (each participant shared one during the Russian test day and one during the English test day). I will first present the results of the free recall task. Then, I will describe the analysis of the cued-recall memories. The results of the first memories will be presented last.

5.2.3.1 Advanced L1 attriters: Free Recall Results. Each participant shared three events from their life in a Russian-speaking country and three events from their life in the United States during the Russian and English test days. Total, each participant shared 12 events under four conditions: 1) Russian memories told in English (n=3), 2) English memories told in English (n=3), 3) Russian memories told in Russian (n=3), 4) English memories told in Russian (n=3). The average amount of detail for all the memories for all

the participants provided during the free recall was 17.78 (SD=5). Out of 120 memories, only 44 (37%) were coded as negative. The number of negative memories was also equally distributed between the four testing conditions [$F(3, 48)=0.6, p=0.6$] with first (M=0.9), second (M=1.3), third (M=1.3), and fourth (M=0.9) conditions producing an equal number of negative events.

The amount of detail was not affected by the testing condition with the first condition yielding 10 negative memories, second condition – 13, third condition – 13, and fourth condition – 9 negative memories [$F(3, 48)=0.5, p=0.7$] for the first (M=19.2), second (M=18.2), third (M=16.5), and fourth (M=17.2) conditions yielding the same amount of detail. These patterns were similar to the patterns of moderate attriters and non-attriters.

5.2.3.2 Advanced L1 attriters: Cued Recall Results. Now I will share the cued recall results. The advanced L1 attriters ages 19 – 30 with age of arrival between 7 -14 recalled a total of 554 memories. There were 239 (43.1%) English memories, 192 (34.7%) Russian memories, 122 (22%) of mixed memories, and one (0.2%) “no language” memory (Figure 14).

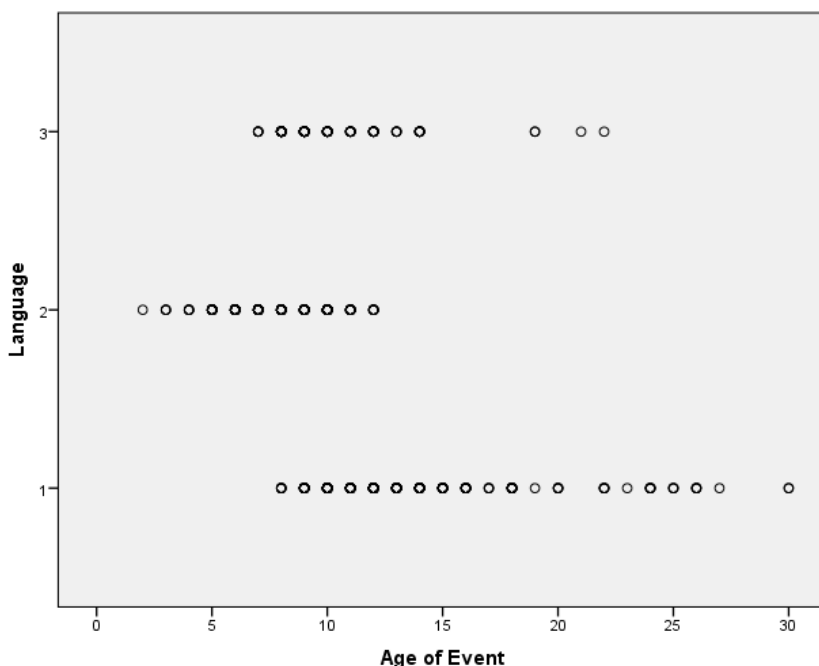


Figure 14. Age of event for Russian, English, and mixed memories recalled by advanced L1 attriters

1=English, 2=Russian, 3=mixed memories

As can be seen in the scatter plot, the Russian memories were only encoded in the childhood with all the L1 Russian memories dated under 15 years of age. The encoding of L2 English and mixed memories started after exposure to the English language with L2 English memories continuing to be encoded and with mixed memories seizing with age.

As far as the overall phenomenological properties, most of the memories came to the advanced L1 attriters with one phenomenological property (346, 62.5%), 152 (27.4%) were accompanied by two, 48 (8.7%) by three, seven (1.3%) by four, and only one (0.2%) by five. The most common phenomenological property was the visual component with 496 (89.9%) memories triggering a visual image. Sounds (113, 20.4%), kinesthetic sensations (89, 16.1%), words (63, 11.4%), smells (39, 7%), and taste (22, 4%) also

accompanied the recalled memories. Only 63 memories (11.4%) came to participants in words with 25 (5.1%) memories that triggered Russian words, 38 (6.9%) English words, and none in both languages. The majority of memories were accompanied by an emotional component (n=502, 90.8%) with 188 (33.9%) memories being assigned “little” emotion, 201 (36.6%) “moderate”, and 113 (20.4%) “strong” emotion. Majority of emotions were positive (n=295, 53.2%), 206 (37.2%) were neutral, and 52 (9.4%) were negative.

This means that advanced attriters recalled memories that were mostly encoded with visuals. A small proportion of the memories came to them with words. Most of the memories were of a positive or neutral nature. All these parameters are similar to the memory data set of moderate attriters and non-attriters which make the memories from three groups comparable to each other.

5.2.3.3 Advanced L1 attriters: Phenomenological Properties of Memories that Came with Words. Overall, 63 memories came to advanced L1 attriters in words. The memories that came with words to this group of participants did not differ in terms of vividness, emotionality, frequency of recall, and confidence of event from memories that were not accompanied by words (Table 21).

Table 21. *One-way ANOVA Results of the Phenomenological Properties of the Memories that Came with Words to Advanced L1 attriters*

Phenomenological Properties	No Words (n=491)	With Words (n=63)	F Value (1,552)	P Value
Vividness	M=3.23	M=3.13	.897	.344
Taste	M=0.04	M=0.02	1.057	.304
Emotion	M=2.69	M=2.56	1.283	.258
Type of Emotion	M=2.46	M=2.27	4.848	.028
Recall Others	M=1.80	M=2.05	5.313	.022
Recall Self	M=1.91	M=2.21	6.425	.012
Ease of Recall	M=1.39	M=1.57	6.498	.011
Significance	M=2.66	M=2.52	1.419	.234
Confidence	M=3.57	M=3.59	.056	.813

Note. No post hoc tests were performed because the results did not reach significance at $p < 0.006$

All the memories that came in words could have been accompanied by words in L1 Russian or in L2 English. The advanced L1 attriters did not recall any memories that came to them in both languages. Here is a detailed analysis of each subtype. The memories that came with Russian words did not differ in terms of vividness, emotionality, frequency of recall, and confidence of event from memories that were not accompanied by Russian words (Table 22).

Table 22. *One-way ANOVA Results of the Phenomenological Properties of the Memories that Came with the Russian Words to Advanced L1 attriters*

Phenomenological Properties	No Words (n=526)	Words in Russian (n=28)	F Value (1,552)	P Value
Vividness	M=3.22	M=3.14	.252	.616
Emotion	M=2.68	M=2.64	.042	.838
Type of Emotion	M=2.45	M=2.36	.486	.486
Recall Others	M=1.83	M=1.93	.447	.504
Recall Self	M=1.94	M=2.18	2.107	.147
Ease of Recall	M=1.40	M=1.64	5.634	.018
Significance	M=2.64	M=2.57	.206	.650
Confidence	M=3.57	M=3.57	.000	.993

Note. No post hoc tests were performed because the results did not reach significance at $p < 0.006$

The memories that came in with the English words did not differ in terms of vividness, emotionality, frequency of recall, and confidence of event from memories that were not accompanied by English words (Table 23).

Table 23. *One-way ANOVA Results of the Phenomenological properties of the Memories that Came with the English Words to Advanced L1 attriters*

Phenomenological Properties	No Words (n=516)	Words in English (n=38)	F Value (1, 552)	P Value
Vividness	M=3.22	M=3.13	.463	.497
Emotion	M=2.69	M=2.45	2.642	.105
Type of Emotion	M=2.46	M=2.21	5.028	.025
Recall Others	M=1.81	M=2.11	4.878	.028
Recall Self	M=1.93	M=2.21	3.790	.052
Ease of Recall	M=1.41	M=1.50	1.130	.288
Significance	M=2.65	M=2.47	1.662	.198
Confidence	M=3.57	M=3.58	.008	.928

Note. No post hoc tests were performed because the results did not reach significance at $p < 0.006$

5.2.3.4 Advanced L1 attriters: Phenomenological Properties of Russian, English, and Mixed Memories. Now I will describe memories that was yielded by each testing day and the phenomenological properties of the Russian, English, and mixed memories. The English test day had a total of 290 memories: 151 (52.1%) English, 52 (17.9%) Russian, and 87 (30%) mixed memories. The Russian test day triggered a total of 264 memories: 141 (53.4% Russian), 88 (33.3%) English, and 35 (13.3%) mixed memories (Figure 15).

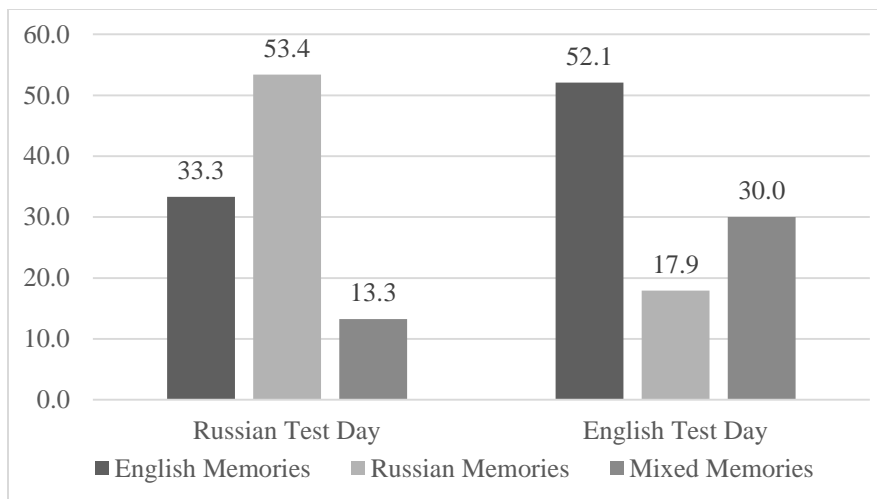


Figure 15. Distribution of the Russian, English, and mixed memories recalled by advanced L1 attriters during the Russian and English test days

The advanced L1 attriters had 33.3% cross-over memories during the Russian test day and 35 (13.3%) of mixed memories. There were 52 (17.9%) cross-over and 87 (30%) mixed memories during the English test day (Figure 16).

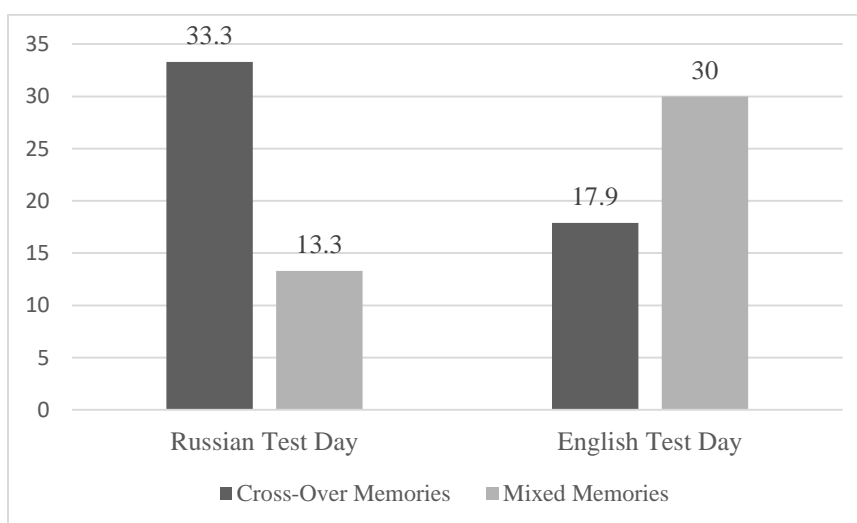


Figure 16. Cross-over and mixed memories recalled by advanced L1 attriters

When it comes to phenomenological properties, Russian, English, and mixed memories did not differ terms of vividness, emotionality, frequency of recall to others, and confidence in the event (Table 24).

Table 24. *One-way ANOVA and Tukey post hoc Results for the Phenomenological Properties of the Russian, English, and Mixed Memories Recalled by Advanced L1 attriters*

Phenomenological Properties F (2,551) Value and P Value	English Memories, n=239	Russian Memories, n=192	Mixed Memories, n=122
Vividness F=1.14, p=0.3	M=3.26, SD=0.8	M=3.23, SD=0.8	M=3.12, SD=0.9
Words F=3.23, p=0.04	M=0.08, SD=0.3	M=0.15, SD=0.4	M=0.13, SD=0.3
Words in Russian F=13.07, p=0.0*	M=0.01, SD=0.1	M=0.11*, SD=0.3	M=0.02, SD=0.1
Words in English F=3.17, p=0.04	M=0.07, SD=0.2	M=0.04, SD=0.2	M=0.11, SD=0.3
Emotion F=5.86, p=0.03	M=2.6, SD=0.9	M=2.8, SD=1	M=2.6, SD=0.9
Type of Emotion F=0.53, p=0.6	M=2.4, SD=0.7	M=2.5, SD=0.7	M=2.4, SD=0.6
Recall to Others F=0.85, p=0.4	M=1.82, SD=0.8	M=1.9, SD=0.8	M=1.77, SD=0.7
Recall to Self F=12.23, p=0.0*	M=1.89, SD=0.8	M=2.17*, SD=0.9	M=1.7, SD=0.7
Ease of Recall F=113.6, p=0.0*	M=1.08*, SD=0.2	M=1.7*, SD=0.6	M=1.61*, SD=0.5
Significance F=11.7, p=0.0*	M=2.5*, SD=0.8	M=2.8*, SD=0.8	M=2.7, SD=0.8
Confidence F=3.56, p=0.03	M=3.6, SD=0.6	M=3.6, SD=0.6	M=3.4, SD=0.6

Note. The statistically significant means are marked with () at $p < 0.005$*

As far as the differences, Russian memories were more likely to be accompanied by Russian words, were more frequently recalled to self, and were the most significant.

Although the advanced attriters stated that some of the words came to them in Russian, they could not name those words. Here is an excerpt from the cued recall portion of the interview that presents a typical response:

JFF A N 24_8: The way it came to me it was in words.

Researcher: As far as words, were those words in Russian or in English, what kind of words?

JFF A N 24_8: Am, it was Russian but I don't really know what word in Russian.

A more advanced degree of attrition seemed to interfere with the memory retrieval. Here is an example:

Cue “pirozhki” plays:

ASF A N 25_11: Pir piro, hmm. What is it? Man. Pirozh. I am thinking ... it is not it. I am thinking it either food or (pause) no, it is neither.

Researcher: Does it remind you of anything?

ASF A N 25_11: Pierogi? No, that is not even close. Ok, I am going to go with some kind of food. I cannot visualize it, so I do not know what it is. I am sorry. I encountered it somewhere in Russia. I am just thinking of pierogis. I guess it reminds me of eating pierogi in Russia (with hesitation).

Because advanced L1 attriters did not have access to the Russian language anymore, they had to rely on English in order to think about those events. Here is one example:

SHM N 19_8: it reminds me of the beach, beach I went to my first summer here. I remember running up and down the shore screaming and now thinking back about it I think that I was screaming like English or whatever (laughter) but I did not know any English at that time and maybe speaking Russian. I just remember shouting at the waves.

Here the participant is recalling a memory and in his mind he thinks that he was using English; however, he admits that it was impossible because he just arrived to the United States and probably was speaking in Russian. The Russian language was replaced with the English language. The original L1 memory tag was replaced with an L2 memory tag. This also could be seen in the fact that mixed memories were coming to the advanced attriters only with English words.

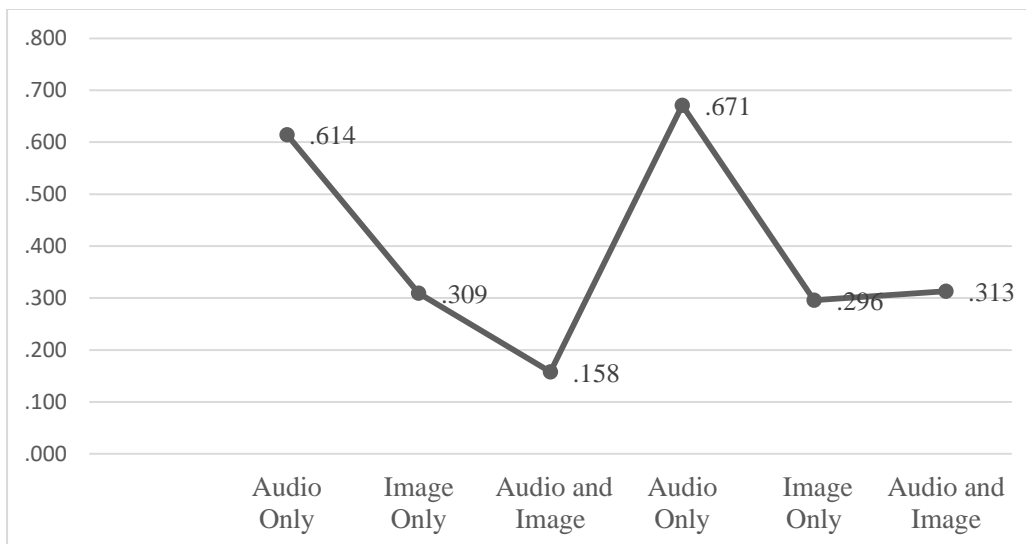
5.2.3.5 Advanced L1 Attriters: Self-Cueing Strategy for Memory Retrieval. When accessing memories, advanced L1 attriters commented on the challenge of retrieving memories. Here are two examples from the interviews:

- a) Researcher: How easy was it to recall this memory?
MVF N 30_9: Difficult to recall because I don't know the words for what I was trying to describe.
- b) Researcher: How easy was it to recall this memory?
SHM A N 19_8: Oh, difficult because I don't even know any more how to call these things.

These examples above demonstrate that attrition hindered memory recall in advanced L1 attriters. Overall, the ease of recall was rated at 1.7 for the Russian memories, 1.08 for the English memories, and 1.61 for the mixed memories.

Since accessing the memories was challenging, the advanced L1 attriters also relied on the verbal retrieval strategy with 141 (25.5%) times out of 554 possible. They used this strategy during both, Russian ($M=0.35$, $SD=0.04$) and English ($M=0.4$; $SD=0.04$), testing days [$F(1, 551) = 0.84$, $p=0.3$]. The language of the memories and condition¹¹ had an effect on the verbal retrieval. There was a significant effect of condition on the usages of the verbal retrieval strategy at the $p<0.05$ level for the six conditions [$F(5, 551) = 10.7$, $p=0.0$]. The post hoc comparisons using Tukey HSD test indicated that the mean scores for the first ($M=0.61$; $SD=0.06$) and fourth ($M=0.7$; $SD=0.06$) conditions were significantly higher than the mean scores for the second ($M=0.3$; $SD=0.06$), third ($M=0.2$; $SD=0.06$), fifth ($M=0.3$; $SD=0.05$), and sixth ($M=0.3$; $SD=0.06$). This means that the audio only conditions caused the struggling L1 users to employ the verbal retrieval strategy more frequently (Figure 17).

¹¹ The word “condition” here refers to the six types of cues used in the study: culture-specific audio only, culture-specific image only, culture specific audio and image, non-culture specific audio only, non-culture specific image only, non-culture specific audio and image.



Condition	Mean
Culture-Specific Audio Only (#1)	.614
Culture Specific Image Only (#2)	.309
Culture-Specific Audio and Image (#3)	.158
Non-Culture Specific Audio Only (#4)	.671
Non-Culture Specific Image Only (#5)	.296
Non-Culture Specific Audio and Image (#6)	.313

Figure 17. Advanced L1 attriters using self-cueing strategy across six testing conditions

A one-way ANOVA was ran in order to investigate the effects of the language of the memory on the verbal retrieval strategy. There was a significant effect of language of the memory on the verbal retrieval [F (3, 551)=6.86, p=0.001]. The post hoc comparisons using Tukey HSD test revealed that the mean scores for Russian memories (M=0.5; SD=0.05) was significantly higher than the means for the English (M=0.3, SD=0.04) and Mixed (M=0.3; SD=0.05) memories which means that the verbal retrieval strategy was utilized more frequent when advanced L1 attriters attempted to retrieve Russian memories.

As far as the Russian cues, they frequently attempted to repeat the cue, but many could not. Here is an example:

Cue “komp’uternye igry” (computer games) plays.
 AHF A N 26_14: Igr, igr (attempts to repeat the cue). I think it’s game it means game, the game you play. I don’t remember the first word. Maybe it has to do with kids, playing a game. I think *igra* means game (pause).
 Researcher: Anything comes to mind?
 AHF A N 26_14: No.

The example above demonstrates that inability to repeat the cue might have interfered with memory retrieval. Additionally, advanced attriters translated 35 cues (25%) into English. Here is one example:

A cue “komp’uternye igry” plays.
 ABM N 20_11: Hmm, I am probably wrong, it means *computer*... I guess it reminds me of my first school in the U.S. how I would have to walk across to the computer lab for my computer classes.

Here the participant translates the cue into L2 English. It is important to point out that the memory is retrieved from the L2 English-speaking context, not the L1 speaking context.

The translating of an L1 cue into L2 cue triggered a retrieval of an L2 memory.

5.2.3.6 First Memories of Advanced L1 Attriters. The advanced L1 attriters also shared 20 first memories, one during their Russian test day and one during their English test day. Most participants (8 out of 10, or 80%) retrieved divergent first memories during different testing days. Although the average age for the first memories during the Russian test day ($M=3.45$, $SD=1.3$) was lower than the average age for the English test day (3.85 , $SD=1.31$), the t-test did not reveal a significant difference between these means ($t(9) = -0.7$, $p=0.5$) (see Table 25).

Table 25. *Ages of the First Memories Recalled by Advanced L1 attriters during the Russian and English Test Days*

Age of the First Memories	Russian Test Day	English Test Day
Average Age	3.45	3.85
Standard Deviation	1.3	1.31
Minimum Age	1	2
Maximum Age	5	6

Not only this group of participants recalled different memories, they could not recall what they shared with the researcher. Some of them were not sure why they were thinking about a different first memory during the second session. Others offered explanations. Most of those interpretations related to a different state of mind and revisiting their first memories after their first session.

ACM A N 22_10: After you asked me last time I thought about it again. So I remembered being bathed in cold water and I did not like it at all. We could not afford hot water. This memory happened the other one, yeah.

Here the participant admits that she was thinking about the last research session and it made her think of other events, including the earlier ones.

To sum up the results of the free recall, cued recall, and first memory tasks, the advanced L1 attriters provided consistent narratives of the self. Although the Russian language memory tag deteriorated, they were able to recall vivid childhood memories with high confidence ratings. The L1 attrition did not seem to affect those Russian memories because this group rehearsed the memories by recalling them frequently and re-encoding them into their dominant language, L2 English, which allowed them to successfully preserve those childhood memories.

5.2.3.7 *Inaccuracies of L1 Memories.* When analyzing L1 memories of advanced attriters, an interesting pattern emerged. Even if advanced attriters were able to recall L1 memories, some of the memories had factual or cultural inaccuracies. There were two cues that triggered the most inaccurate memories: *kasha* (porridge) and *novogodnie igrushki* (Christmas tree ornaments). Both of the cues were presented with an image and an audio.

Kasha that was depicted in the picture was an example of *mannaya kasha* which is made from boiled grains of semolina. Semolina is a left over grain after milling wheat. *Mannaya kasha* is usually served hot for breakfast with butter, sugar, or jam. This type of *kasha* was selected as a cue because it is frequently served to children in Eastern Europe. It differs significantly from grits, oatmeal, and even cream of wheat that are widely available in the United States. Some Russian-English bilinguals or non-attriters commented on how different *mannaya kasha* is in comparison to its presumable American counterparts. Here is one example:

Cue “kasha” plays and an image of *mannaya kasha* appears on the screen.
 APF 18-13: Каша. Моя мама делала манку на завтрак вот с маслом прям как здесь показано. Проблема в том что манная каша там везде продается в магазине а здесь невозможно найти нигде. / Kasha. Moia mama delala manku na zavtrak vot s maslom priam kak zdes' pokazano. Problema v tom chto mannaya kasha tam prodaets'a v magazine a zdes' nevozmozhno naiti nigde. / [Kasha. My mom made *mannaya kasha* for breakfast with butter just like in this picture. The problem is that *mannaya kasha* is sold everywhere there [in Russia] but here it is impossible to find.]

Here the participant comments on how it is hard to find *mannaya kasha* in the United States because it is a specific type of Eastern-European food that is not available here.

Advanced L1 attriters kept referring to *mannaya kasha* as grits or oatmeal. Here are some examples:

Cue “kasha” plays and an image of mannaya kasha appears on the screen.

- a) ADM A N 26_7: I have eaten this before. I think that it is grits. I remember being with my mom somewhere and we ate it. And I remember the smell too.
- b) AHF A N 26_14: It’s an oatmeal I think. I think that it is kind of sweet oatmeal, a lot of butter in it. I think that it had rice in or something like that. I just remember it is something that had a lot of butter in it maybe milk. I think that I remember the taste of it. It is warm.
- c) ABM N 20_11: I remember eating this oatmeal at the orphanage. It was at breakfast. I also remember eating it at the hospital.
- d) MVF N 30_9: It reminds me of eating grits with sugar. I feel that I used to do it in Russia a lot.

The examples above demonstrate that *mannaya kasha* was perceived as oatmeal or grits with no one commenting on how different *mannaya kasha* might be from those western counterparts. This differentiation might have been lost due to the lack of recent exposure to *mannaya kasha*. It is also possible to assume that advanced attriters might have forgotten what *mannaya kasha* is.

Another cue that triggered culturally inaccurate memories was “novogodnie igrushki” (Christmas tree ornaments, literally New Year). In Eastern Europe New Year is celebrated on 31st of December of each calendar year. It is the most significant holiday and has a lot of attributes of the Western Christmas: decoration of a fir-tree, presents under the tree, family dinner, and Ded Moroz (Father Frost) figure. The only difference is that it is a secular holiday and has no religious connotations. On another hand, the Christmas in Eastern Europe is celebrated on January 7th and does not include gifts or decorating of a tree; in fact, it is a religious holiday and was not widely celebrated in the 1990s but slowly is making its come back.

When advanced attriters retrieved memories for the *Novogonie igrushki* cue, these ornaments became “Christmas ornaments” and they were recalling memories of celebrating Christmas and decorating a tree for Christmas in Russia which, of course, cannot be the case. Here are two examples:

A cue “novogodnie igrushki” plays and an image comes one the screen.

- a) JFF A N 24_8: It makes me think of Christmas that we celebrated at the orphanage
- b) ADM A N 26_7: Oh my god. I have seen those on the floor. Hold on, hold on, hold on. I have seen those when we had Christmas in our orphanage. I think that everyone got to put one of those things on on the tree. Those are Christmas ornaments. I remember. Oh my god I love those things. These are so cool.

Here the participants refer to *novogodnie igrushki* as *Christmas ornaments* and remembering how they celebrated Christmas in their orphanage. This cannot have happened as Christmas was not widely celebrated in the 1990s. Even if this religious holiday was celebrated at that particular orphanage, it would not have been accompanied by tree ornaments.

There were also other factual inaccuracies when recalling L1 memories, especially when it came down to cartoon plots and characters. It is important to point out that many international adoptees reported having a television set at their orphanages.

Here is one example:

An image of a game boy “Nu Pogodi” comes on a screen

AHF A N 26_14: Aga. It is a cartoon. Well, it is a game here I remember. It is a wolf with a bird, no. I think it’s maybe it was a dog. I know he is a wolf. He always tried to get a revenge on one of the characters. I don’t remember who exactly the other character was but. Hmm, he used to try. I remember the cartoon.

This cue was a popular Gameboy themed after an even more popular cartoon “Nu Pogodi” where a wolf always tried to capture a bunny. AHF A N 26_14 was able to recall

that one of the main characters was a wolf, but she could not remember who was the second character: "... with a bird, no. I think maybe it was a dog". Many other participants reported that they might have seen or heard the cues but were not able to recall detailed memories.

5.2.4 Between-Groups Comparison: Non-Attriters, Moderate L1 attriters, and Advanced L1 attriters

In order to reveal any differences between the three groups of participants, I performed a between group comparison for each task. Non-attriters, moderate L1 attriters, and advanced L1 attriters shared 420 memories in a free recall format. They also recalled 1,988 memories with a help of a cued recall. The first memory elicitation resulted in 70 first memories. In what follows, I will present a between group comparison of the free recall, cued recall, and the first memory elicitation task by using the non-attriter group results as a baseline for my comparison.

5.2.4.1 Non-Attriters, Moderate L1 attriters, and Advanced L1 attriters: Free Recall

Results. These memories were shared under four conditions: 1) Russian memories told in English, 2) English memories told in English, 3) Russian memories told in Russian, 4) English memories told in Russian. The memories were coded for amount of detail, negative/positive valence, and absence/presence of direct speech.

Overall, the three groups of participants did not differ in the distribution of the positive and negative events [$F(2, 137) = 1.3, p = 0.2$] (see means in Table 26).

Table 26. *Distribution of Negative Events in Non-Attriters, Moderate L1 attriters, and Advanced L1 attriters*

	Advanced L1 attriters	Moderate L1 attriters	Non-Attriters
Negative Events	M=1.1	M=0.8	M=1.0

As far as amount of detail, non-attriters provided more detailed narratives of self during the free recall task (M=21.51, SD=0.7) in comparison to the moderate L1 attriters (M=18.3, SD=0.6) and advanced L1 attriters (M=17.8, SD=0.7). According to the one-way ANOVA, that difference was statistically significant [$F(2, 137) = 8.6, p = 0.00$]. If we break the data down by the experimental conditions, it becomes apparent that a higher level of attrition prevented moderate L1 attriters and advanced L1 attriters to provide detailed L1 memories during a Russian test day (Table 27).

Table 27. *One-Way ANOVA and Tukey Post Hoc Results: Amount of Detail in Four Experimental Conditions.*

Testing Conditions	One-Way ANOVA Results	Advanced L1 attriters	Moderate L1 attriters	Non-Attriters
Russian Memories during English Day	$F(2,32)=1.76, p=0.2$	M=19.2, SD=5.1	M=19.23, SD=4.2	M=22.25, SD=4.3
English Memories during English Day	$F(2,32)=3.1, p=0.6$	M=18.2, SD=4.3	M=22.01, SD=3.06	M=22.08, SD=4.9
Russian Memories during Russian Day	$F(2,32)=8.56, p=0.001^*$	M=16.5, SD=5.9	M=16.62, SD=3.2	M=22.75*, SD=3.4
English Memories during Russian Day	$F(2, 32)=1.69, p=0.2$	M=17.2, SD=5.3	M=15.38, SD=5.2	M=19.00, SD=4.2

Note. The statistically significant means are marked with “” at $p < 0.05$*

5.2.4.2 Non-Attriters, Moderate L1 attriters, and Advanced L1 attriters: Cued Recall

Results. Before analyzing Russian, English, and Mixed memories that were recalled by the three groups of participants, I will present the overall summary of the cued recall task (Table 28). The three participant groups recalled a similar number of memories that did not differ in terms of phenomenological properties, emotionality, or type of emotion which makes data from these three groups comparable. More specifically, the memories did not differ in the number of phenomenological components; they also had similar emotional valence with similar number of positive events. The three groups also had a similar proportion of memories that came to them with a visual component, kinesthetic sensations, olfactory information, taste, and words. All these descriptors make the data comparable.

Table 28. *Overall Characteristics of Memories Recalled by Non-Attriters, Moderate L1 attriters, and Advanced L1 attriters during the Cued Recall Task*

	Non-Attriters n=12	Moderate L1 attriters n=13	Advanced L1 attriters n=10
Total Number of Memories	694	740	554
Russian Memories	339 (48.8%)	346 (46.8%)	192 (34.7%)
English Memories	137 (19.7%)	241 (32.6%)	239 (43.1%)
Mixed Memories	195 (28.1%)	147 (19.9%)	122 (22.0%)
No Language Memories	22 (3.2%)	6 (0.8%)	1 (0.2%)
Cross-Over Memories, Russian Day	35 (10.1%)	51 (14.0%)	88 (33.3%)
Cross-Over Memories, English Day	117 (33.5%)	96 (25.5%)	52 (17.9%)
Mixed Memories, Russian Day	82 (23.8%)	59 (16.3%)	35 (13.3%)
Mixed Memories, English Day	113 (32.4%)	88 (23.3%)	87 (30.0%)
One Memory Trace	452 (65.0%)	513 (69.3%)	346 (62.5%)
Two Memory Traces	194 (28.0%)	174 (23.5%)	152 (27.4%)
Three Memory Traces	40 (5.8%)	46 (6.2%)	48 (8.7%)
Visual	547 (78.8%)	579 (78.2%)	496 (89.9%)
Kinesthetic	163 (23.5%)	189 (25.5%)	89 (16.1%)
Sounds	132 (19.0%)	93 (12.6%)	113 (20.4%)
Smells	54 (7.8%)	54 (7.3%)	39 (7.0%)
Taste	32 (4.6%)	32 (4.3%)	22 (4.0%)
Memories in Words	57 (8.2%)	80 (10.8%)	63 (11.4%)
Memories in Russian Words	36 (63.0%)	43 (53.7%)	25 (40.0%)
Memories in English Words	12 (21.0%)	36 (45.0%)	38 (60.0%)
Memories in Words in Both Languages	7 (12.3%)	1 (1.3%)	0.0
Strong Emotional Valence	114 (15.4%)	121 (16.4%)	113 (20.4%)
Moderate Emotional Valence	258 (37.2%)	235 (31.8%)	201 (36.6%)
Little Emotional Valence	196 (28.2%)	250 (33.8%)	188 (33.9%)
No Emotion	126 (18.2%)	134 (18.1%)	52 (9.2%)
Positive Events	342 (49.4%)	402 (54.3%)	292 (53.2%)
Neutral Events	236 (34.0%)	262 (35.4%)	206 (37.2%)
Negative Events	115 (16.6%)	75 (10.1%)	52 (9.4%)

In contrast, linguistic components of these memories did differ across groups.

Although the three groups had a similar proportion of memories that came to them in words (8.2% for non-attriters, 10.8% for moderate L1 attriters, and 11.4% for advanced L1 attriters), the three groups differed in the distribution of words in different languages. The non-attriters had more memories that came to them with the L1 Russian words

(63%), the moderate L1 attriters had slightly less at 53.7%, and the advanced L1 attriters had the least at only 40%. At the same time, most of the memories that came in words to the advanced L1 attriters were accompanied by the English (60%), moderate L1 attriters had a smaller proportion at 40%, and non-attriters had the least at only 21%. Lastly, non-attriters had 12.3% of memories that came to them with words in both languages, moderate L1 attriters had 1.25%, and the advanced L1 attriters had none. These are expected patterns: participants with a higher level of L1 attrition had fewer memories accompanied by L1 words. Figure 18 visualizes these reverse patterns.

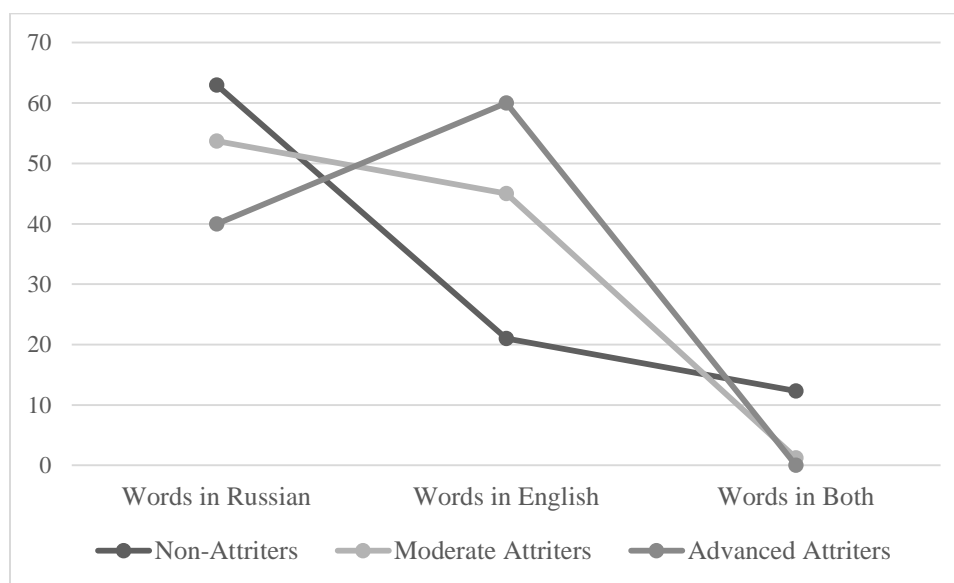


Figure 18. A proportion of memories that came with words in Russian, English, and in both languages to non-attriters, moderate L1 attriters, and advanced L1 attriters.

Let me now compare phenomenological properties of the memories that came with L1 Russian and L2 English words to the three groups of participants. When the memories came with the English words, the three groups did not differ in any of the parameters (Table 29).

Table 29. *One-way ANOVA Results: Phenomenological Properties of Memories that Came with English Words to Non-Attriters, Moderate L1 attriters, and Advanced L1 attriters*

Phenomenological Properties	Advanced L1 attriters	Moderate L1 attriters	Non-Attriters	F Value (2, 83)	P Value
Vividness	M=3.13, SD=0.8	M=3.03, SD=0.9	M=3.25, SD=0.9	.333	.718
Emotion	M=2.45, SD=0.9	M=2.44, SD=1.1	M=2.0, SD=1.1	1.036	.360
Type of Emotion	M=2.21, SD=0.7	M=2.4, SD=0.6	M=2.25, SD=0.6	.683	.508
Recall Others	M=2.11, SD=0.9	M=1.64, SD=0.9	M=1.75, SD=0.9	2.630	.078
Recall Self	M=2.21, SD=0.8	M=1.86, SD=0.8	M=1.75, SD=0.7	2.456	.092
Ease of Recall	M=1.51, SD=0.6	M=1.4, SD=0.6	M=1.0, SD=0.3	2.440	.093
Significance	M=2.47, SD=0.9	M=2.44, SD=0.9	M=2.33, SD=0.8	.111	.895
Confidence	M=3.58, SD=0.6	M=3.58, SD=0.6	M=3.5, SD=0.5	.105	.901

Note. Post hoc tests were not performed because there were no statistically significant results at $p < 0.006$

At the same time, as can be seen in the Table 30, the memories that came with the L1 Russian words (M=1.64) were harder to recall for the advanced L1 attriters in comparison to the non-attriters (M=1.25) and moderate L1 attriters (M=1.33) ($F(1,104) = 5.214, p < 0.007$). However, this finding is marginally significant.

Table 30. *One-way ANOVA and Tukey post hoc Test Results: Phenomenological Properties of Memories that Came with Russian Words to Non-Attriters, Moderate L1 attriters, and Advanced L1 attriters*

Phenomenological Properties	Advanced L1 attriters	Moderate L1 attriters	Non-Attriters	F Value (2, 104)	P Value
Vividness	M=3.14, SD=0.9	M=2.91, SD=1.0	M=3.39, SD=0.7	2.704	.072
Emotion	M=2.64, SD=1.0	M=2.49, SD=0.9	M=2.92, SD=0.9	1.888	.156
Recall Others	M=1.93, SD=0.8	M=1.6, SD=0.8	M=1.97, SD=0.8	2.373	.098
Recall Self	M=2.29, SD=0.9	M=1.91, SD=0.8	M=2.0, SD=0.8	1.828	.166
Ease of Recall	M=1.64*, SD=0.5	M=1.33, SD=0.6	M=1.25, SD=0.4	5.214	.007**
Significance	M=2.57, SD=0.9	M=2.53, SD=0.8	M=2.75, SD=0.8	.708	.495
Confidence	M=3.57, SD=0.7	M=3.53, SD=0.6	M=3.5, SD=0.6	.099	.906

Note. Statistically significant means are marked “” at $p < 0.007$*

Overall, there was a connection between the type of the cue¹² and whether the memory came in words to non-attriters, moderate attriters, and advanced attriters ($F(5, 1987) = 10.433, p=0.0$). According to a follow up Tukey post hoc test results, when a cue was audio only, regardless of whether it was culture-specific ($M=0.19; SD=0.17$) or non-culture specific ($M=0.13; SD=0.16$), it triggered more linguistic memories in comparison to culture-specific image only ($M=0.08; SD=0.16$), culture-specific image and audio ($M=0.10; SD=0.16$), non-culture specific image only ($M=0.07; SD=0.16$), and non-culture specific audio and image ($M=0.04; SD=0.16$). This means that audio cues triggered more memories that came with words to the three groups of participants.

¹² There were six types of cues 1) culture-specific audio only ($n=5$), 2) culture-specific image only ($n=5$), culture-specific audio + image ($n=5$), 4) non-culture specific audio only ($n=5$), 5) Non-culture specific image only ($n=5$); 6) non-culture specific audio + image ($n=5$)

As far as cross-over and mixed memories, the three groups demonstrated a different pattern with advanced L1 attriters recalling 33.3% of cross-over memories during the Russian test day, non-attriters retrieving 10.1%, and moderate L1 attriters recalling 14% (Figure 19).

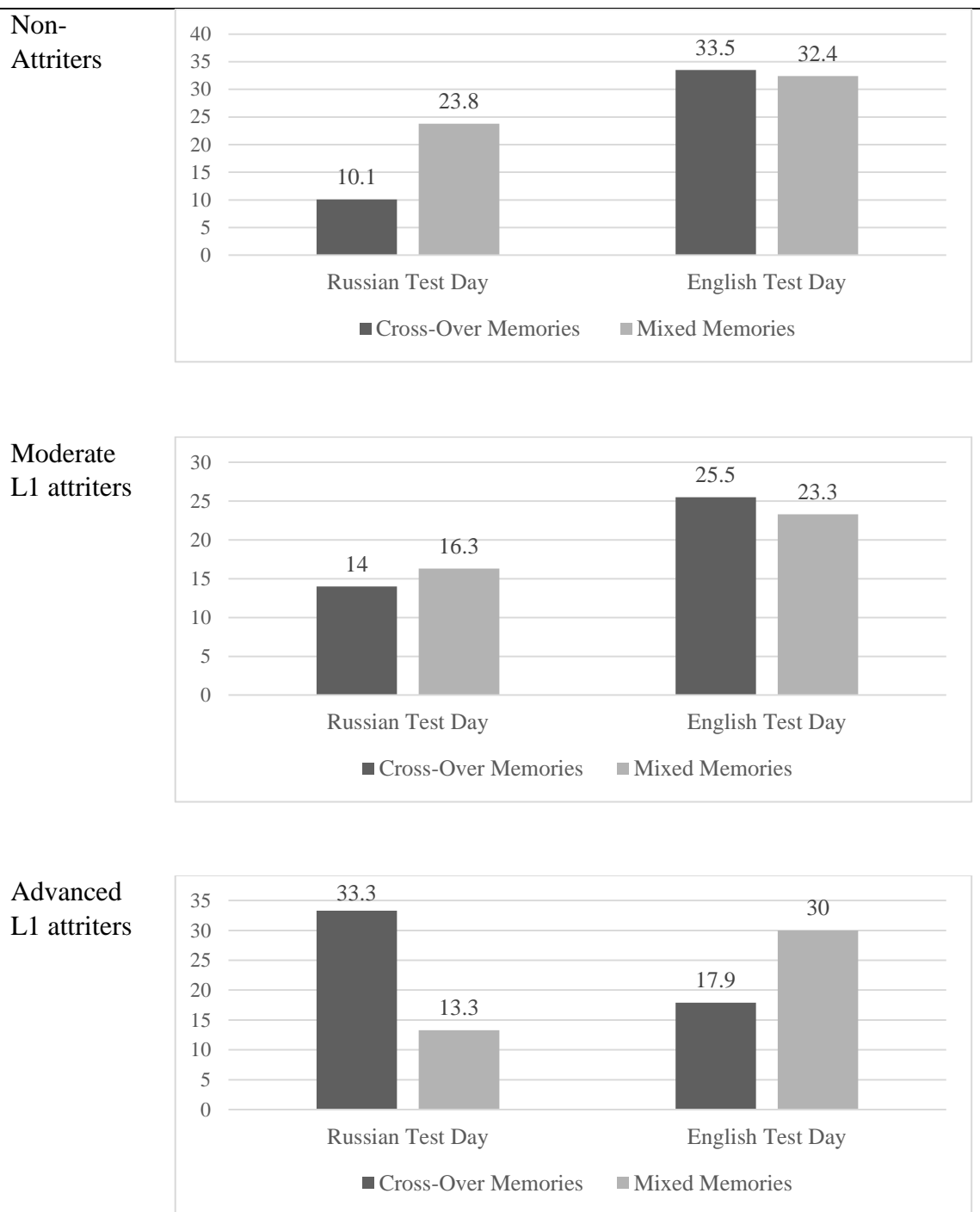


Figure 19. Proportions of cross-over and mixed memories recalled by non-atriters, moderate L1 attriters, and advanced L1 attriters

The finding that advanced L1 attriters recalled three times more cross-over memories during the Russian test day could have been affected by the fact that participants in this group did not recognize the majority of the Russian cues, translated them into English, and overall failed to activate their Russian language. For example, a cue *tikhi chas* (nap time) was perceived as an English word “chess”, a cue *gor’ka* (slide) was mistaken for another Russian word “gor’ko” (bitter), and a *peremena v shkole* (recess) became just “school”. All of these factors might have contributed to the large number of cross-over memories.

5.2.4.3 Phenomenological Properties of Russian, English, and Mixed Memories Recalled by Non-Attriters, Moderate L1 attriters, and Advanced L1 Attriters. The English memories did not differ in terms of vividness, emotionality, frequency of recall to self, and confidence (Table 31).

Table 31. *One-way ANOVA and Tukey post hoc Results: Phenomenological Properties of English Memories Recalled by Non-Attriters, Moderate L1 attriters, and Advanced L1 attriters*

Phenomenological Properties	Advanced L1 attriters	Moderate L1 attriters	Non-Attriters	F Value (2, 614)	P Value
Vividness	M=3.25, SD=0.8	M=3.14, SD=0.9	M=3.22, SD=0.9	1.086	.338
Words	M=0.08, SD=0.27	M=0.11, SD=0.31	M=0.1, SD=0.3	.746	.475
Words in R	M=0.02, SD=0.12	M=0.00, SD=0.06	M=0.01, SD=0.9	1.039	.354
Words in E	M=0.07, SD=0.25	M=0.11, SD=0.31	M=0.08, SD=0.3	1.315	.269
Words E+R	M=0.00, SD=0.00	M=0.00, SD=0.00	M=0.01, SD=0.09	1.756	.174
Emotion	M=2.56, SD=0.9	M=2.49, SD=1.0	M=2.25*, SD=0.9	4.836	.008
Type of Emotion	M=2.41, SD=0.7	M=2.42, SD=0.7	M=2.1*, SD=0.7	11.341	.000*
Recall Others	M=1.82*, SD=0.9	M=1.6, SD=0.7	M=1.66, SD=0.7	5.188	.006*
Recall Self	M=1.91*, SD=0.8	M=1.69, SD=0.7	M=1.77, SD=0.7	5.087	.006
Ease of Recall	M=1.08*, SD=0.27	M=1.37, SD=0.7	M=1.28, SD=0.5	19.178	.000*
Significance	M=2.47*, SD=0.8	M=2.34, SD=0.8	M=2.15, SD=0.7	7.254	.001*
Confidence	M=3.61, SD=0.6	M=3.65, SD=0.5	M=3.65, SD=0.6	.370	.691

Note. The statistically significant means are marked “*” at $p < 0.004$

As far as the differences, the English memories were rated as more neutral by non-atrriters, were perceived as more significant to advanced atrriters, and were easier to recall by advanced atrriters.

The Russian memories recalled by the three groups of participants were mostly positive or neutral (Table 32). These memories demonstrated a similar pattern when they came in words, including words in Russian and in both languages.

Table 32. *One-way ANOVA and Tukey post hoc Results: Phenomenological Properties of Russian Memories Recalled by Non-Attriters, Moderate L1 attriters, and Advanced L1 attriters*

Phenomen. Properties	Advanced Attriters	Moderate Attriters	Non-Attriters	F (2, 875)	P Value
Vividness	M=3.2, SD=0.8	M=2.87*, SD=0.9	M=3.13, SD=0.8	13.167	.000*
Words	M=0.15, SD=0.3	M=0.11, SD=0.3	M=0.09, SD=0.2	2.117	.121
Words in R	M=0.11, SD=0.1	M=0.1, SD=0.3	M=0.09, SD=0.2	.343	.710
Words in E	M=0.04*, SD=0.2	M=0.01, SD=0.08	M=0.00, SD=0.00	10.467	.000*
Words E+R	M=0.00, SD=0.00	M=0.00, SD=0.00	M=0.00, SD=0.00	n/a	n/a
Emotion	M=2.85*, SD=0.9	M=2.30*, SD=0.9	M=2.54*, SD=1.0	20.977	.000*
Type of Em.	M=2.49, SD=0.67	M=2.45, SD=0.67	M=2.36, SD=0.73	2.335	.097
Recall Others	M=1.9, SD=0.82	M=1.6*, SD=0.63	M=1.8, SD=0.72	12.944	.000*
Recall Self	M=2.17*, SD=0.9	M=1.8*, SD=0.71	M=1.9*, SD=0.85	13.871	.000*
Ease of Recall	M=1.7*, SD=0.56	M=1.5*, SD=0.74	M=1.3*, SD=0.55	29.001	.000*
Significance	M=2.9*, SD=0.84	M=2.38, SD=0.78	M=2.41, SD=0.83	23.715	.000*
Confidence	M=3.6, SD=0.55	M=3.4*, SD=0.74	M=3.6, SD=0.58	8.338	.000*

Note. The statistically significant means are marked “” at $p < 0.004$*

As far as the differences, Russian memories that were produced by moderate L1 attriters were less vivid ($F(2, 875) = 13.167, p < 0.004$) less emotional ($F(2, 875, p < 0.004)$), had a lower confidence rating ($F(2, 875) = 8.338, p < 0.004$), were less likely to be recalled to others ($F(2, 875) = 12.944, p < 0.004$) and themselves ($F(2, 875) = 13.871, p < 0.004$), and

were harder to recall ($F(2, 875) = 29.001, p < 0.004$) in comparison to the Russian memories of non-atriters.

This group in particular did not seem to have an access to a large L1 social network because they were frequently immersed in an English-speaking environment with no L1 communicative opportunities. Even if they had Russian-speaking friends, they did not seem comfortable using their L1. Here is one example from the interview:

Researcher: Do you use Russian?

ABM N 20_11: No, I have some Russian buddies but they tell me that I have an American accent. I can say some words but when I try to say sentences, I just cannot do it.

In the example above the participant reveals that even though she has some Russian-speaking friends, she is not welcomed to use her L1 which probably affected her L1 attrition; it also might have interfered with her opportunity to share those L1 memories.

The advanced L1 attriters demonstrated a different pattern: while their Russian memories were harder to recall ($F(2, 875) = 29.001, p < 0.004$), they were able to retrieve vivid memories with a high confidence rating in comparison to non-atriters. Those memories were more emotional ($F(2, 875) = 20,977, p < 0.004$) and more significant ($F(2, 875) = 23.75, p < 0.004$) in comparison to the Russian memories of non-atriters and moderate L1 attriters. They also shared their Russian memories more frequently with themselves ($F(2, 875) = 3.871, p < 0.004$). When they thought of those L1 memories, they used their dominant language, L2 English, which can be seen in the finding that their Russian memories were coming to them with the English words ($F(2, 875) = 10.467, p < 0.004$). Non-atriters reported their Russian memories to be the easiest to retrieve ($F(2, 875) = 29.001, p < 0.004$) in comparison to moderate and advanced L1 attriters.

As far as the mixed memories, they did not differ in terms of vividness, emotional valence, type of emotion, personal significance, and confidence. They were also accompanied by an even number of words in Russian and in both languages (Table 33).

Table 33. *One-way ANOVA and Tukey post hoc Results: Phenomenological Properties of Mixed Memories Recalled by Non-Attriters, Moderate L1 attriters, and Advanced L1 attriters*

Phenomenological Properties	Advanced Attriters	Moderate L1 attriters	Non-Attriters	F Value (2, 461)	P Value
Vividness	M=3.12, SD=0.9	M=3.27, SD=0.8	M=3.30, SD=0.7	1.993	.137
Words	M=0.13, SD=0.33	M=0.11, SD=0.31	M=0.07, SD=0.2	1.958	.142
Words in R	M=0.02, SD=0.16	M=0.05, SD=0.21	M=0.03, SD=0.21	.803	.449
Words in E	M=0.11*, SD=0.32	M=0.05, SD=0.22	M=0.02, SD=0.07	9.977	.000*
Words E+R	M=0.00, SD=0.00	M=0.01, SD=0.17	M=0.02, SD=0.12	2.905	.056
Taste	M=0.02, SD=0.16	M=0.06, SD=0.24	M=0.03, SD=0.17	1.490	.226
Emotion	M=2.64, SD=0.9	M=2.82, SD=0.9	M=2.74, SD=0.9	1.286	.277
Type of Emotion	M=2.43, SD=0.6	M=2.47, SD=0.7	M=2.45, SD=0.7	.131	.877
Recall Others	M=1.77, SD=0.7	M=1.69, SD=0.6	M=2.03*, SD=0.8	9.697	.000*
Recall Self	M=1.7, SD=0.7	M=1.76, SD=0.7	M=2.15*, SD=0.8	16.798	.000*
Ease of Recall	M=1.61, SD=0.5	M=1.81, SD=0.6	M=1.67, SD=0.6	4.209	.015
Significance	M=2.65, SD=0.78	M=2.63, SD=0.8	M=2.52, SD=0.8	1.290	.276
Confidence	M=3.44, SD=0.6	M=3.56, SD=0.6	M=3.59, SD=0.5	2.812	.061

Note. Statistically significant means are marked “” at $p < 0.004$*

As for the differences, the mixed memories were recalled to others and oneself much more frequently by non-attriters ($F(2, 461) = 9.697, p < 0.004$; $F(2, 461) = 16.798, p < 0.004$). Lastly, advanced L1 attriters had their mixed memories coming to them with the words in English ($F(2, 461) = 9.977, p < 0.004$). This can be explained by the fact that they experienced a greater degree of L1 attrition in comparison to two other groups.

5.2.4.4 Self-Cueing Strategy of Non-Attriters, Moderate L1 Attriters, and Advanced L1 attriters. During the cued-recall part of the experiment, participants seemed to rely on a

specific strategy when accessing their memories. More specifically, they would repeat a cue, sometimes several times, in order to facilitate a retrieval. While all three groups relied on the self-cueing technique in order to retrieve their memories, non-atrainers used it most frequently ($M=0.56$, $SD=0.5$). Moderate L1 atrainers relied on the strategy less frequently ($M=0.46$, $SD=0.5$), and advanced L1 atrainers used the strategy least often ($M=0.38$, $SD=0.6$). According to the one-way ANOVA, this difference was statistically significant [$F(2, 1985)=18.76$, $p=0.00$]. The Tukey post hoc revealed that all three groups differed from each other in how they applied this strategy.

If we break the data down by the language of the event and the test day, it becomes apparent that the advanced L1 atrainers relied on the self-cueing technique less frequently during the Russian test day ($F(2, 969) = 7.08$, $p<0.05$) and when recalling mixed memories ($F(2, 1985) = 15.22$, $p<0.05$), while non-atrainers utilized the strategy more frequently during the English test day ($F(2, 1013) = 13.83$, $p<0.05$) and when recalling English memories ($F(2, 1985) = 19.7$, $p<0.05$) (Table 34).

Table 34. *One-way ANOVA and Tukey post hoc Results: Self-Cueing Strategy Use by Non-Attriters, Moderate L1 attriters, and Advanced L1 attriters*

Self-Cueing	One-Way ANOVA Results	Advanced L1 attriters	Moderate L1 attriters	Non-Attriters
Overall	F (2, 1985)=18.76, p=0.00*	M=0.38, SD=0.6	M=0.46, SD=0.5	M=0.56*, SD=0.5
Russian Memories	F (2, 1985)=0.39, p=0.7	M=0.49, SD=0.7	M=0.46, SD=0.5	M=0.49, SD=0.5
English Memories	F (2, 1985)=19.7, p=0.00*	M=0.34, SD=0.6	M=0.41, SD=0.5	M=0.68*, SD=0.5
Mixed Memories	F (2, 1985)=15.22, p=0.00*	M=0.29*, SD=0.5	M=0.51, SD=0.5	M=0.61, SD=0.5
Russian Test Day	F (2, 969)=7.08, p=0.001*	M=0.37*, SD=0.7	M=0.48, SD=0.5	M=0.54, SD=0.5
English Test Day	F (2, 1013)=13.83, p=0.00*	M=0.39, SD=0.5	M=0.44, SD=0.5	M=0.58*, SD=0.5

The observation that advanced L1 attriters relied less on the strategy during the Russian test day can be explained by the fact that the participants from this particular group did not recognize many of the Russian cues and couldn't even repeat them. Here is one example from the interview:

Cue “nevolyashka” (Roly-Poly) plays
 ASF A N 25_11: Nevol... nevol.. could you translate it?
 Researcher: I can play it again.
 ASF A N 25_11: It sounds like some kind of Soviet toy. I will go with a Soviet toy. It is one of those toys maybe it is one of those dolls that spins. No, that is not it. I am not sure. I doubt myself.

Here we can see that the participant attempts to repeat the cue but fails to do so which seems to interfere with the memory retrieval.

Advanced L1 attriters also relied less on the self-cueing strategy when they were recalling mixed memories (Table 35). In order to understand this pattern, we need to draw a comparison with the groups that had less attrition. The mixed memories appeared

to be harder to recall for both, non-atriters and moderate L1 attriters. While those memories were more likely to be accompanied by words in both languages, somehow the presence of both languages seemed to negatively affect the ease of recall. Since the Russian language tag was gone in advanced L1 attriters and their mixed memories were only accompanied by the words in English, that interference was not present. It was also shown that the self-cueing strategy was utilized in more challenging testing conditions that did not facilitated retrieval. Thus, because there was no interference from another language and because it was an easier testing condition, advanced L1 attriters did not rely on the self-cueing technique when recalling mixed memories.

As far as the observations regarding non-atriters using self-cueing when recalling memories during the English and Russian test days, as well as when retrieving English memories, it could be explained by the fact that for non-atriters the presence of another language, English or Russian, created interference and they had to rely on the help of the self-cueing in order to access the memories.

5.2.4.5 First Memories of Non-Attriters, Moderate L1 Attriters, and Advanced L1

attriters. Overall, all three groups were recalling divergent first memories during their Russian and English test days with Russian test day yielding slightly younger memories in non-atriters and moderate L1 attriters (Table 32). However, this difference was not statistically significant [$F(2,31)=1.66, p=0.2$]. The ages of the first memories for the English test day also was not significant for the three groups [$F(2,31)=0.56, p=0.5$].

Table 35. *Ages of the First Memories Recalled by Non-Attriters, Moderate L1 attriters, and Advanced L1 attriters during the Russian and English Test Days*

	Russian Test Day	English Test Day
Non-Attriters	M=3.25, SD=0.78, Min=2, Max=4.5	M=3.54, SD=0.95, Min=2, Max=5
Moderate L1 attriters	M=4.13, SD=1.42, Min=2, Max=7	M=4.04, SD=1.13, Min=2, Max=6
Advanced L1 attriters	M=3.45, SD=1.3 Min=1, Max=5	M=3.85, SD=1.31, Min=2, Max=6

Since most participants did not remember what first memory they shared during the first session and since they provided different interpretations regarding recalling a different first memory (including language of the interview, different state of mind, revisiting memories after the first session, etc.), it remains inconclusive why this unexpected pattern was observed.

5.3 Summary of the Results

The 35 participants had a comparable level of L2 English mastery but demonstrated various degrees of L1 attrition. Based on the six measures of 1) can-do-scales; 2) language usage; 3) lexical diversity; 4) fluency; 5) syntactic complexity; and 6) L1 stimuli recognition, the participants were divided into three groups: non-attriters, moderate L1 attriters, and advanced L1 attriters. The group of non-attriters comprised 12 participants who had a high level of L1 and L2 mastery. This was demonstrated by the six measures as well as their ability to speak Russian, provide complex and elaborate L1 narratives, and participate in an L1 testing condition. The moderate L1 attriters contained

13 participants who were able to carry out a conversation in Russian and provide L1 narratives, but demonstrated some signs of attrition in their grammar and lexicon. Lastly, a group of advanced L1 attriters had 10 participants. Attriters in this group were not able or did not feel comfortable enough to speak Russian, could not provide an L1 narrative, and had to rely on their L2, English, when performing experimental tasks.

The group of participants (n=35) engaged in three tasks: free recall, cued recall, and first memory elicitation. The analysis of their performance suggests the following answers to the research questions asked in the study.

5.3.1 Answering Research Questions: Does Language Attrition Affect Bilingual Autobiographical Memory? If so, What Aspects of Recall will be Particular Affected in Speakers with L1 Attrition?

The L1 attrition seemed to negatively affect bilingual autobiographical memory. The three aspects affected most are: 1) amount of overall detail of L1 memories; 2) ease of retrieval of L1 memories; and 3) phenomenological properties, such as vividness and confidence in the event.

As far as the amount of overall detail, during the free recall, the non-attriters provided the most detailed L1 memories in comparison to moderate L1 attriters and advanced L1 attriters. The non-attriters comprised a group of Russian-English bilinguals who had a relatively high mastery of both, L1 Russian and L2 English. The lack of attrition and/or their bilingual status gave them an advantage when recalling pre-immigration memories that were encoded in L1 Russian. It is important to point out that it is understandable why moderate L1 attriters might not have provided detailed self-narratives of self when speaking in L1 – they lacked linguistic resources to provide

elaborate descriptions. Thus, having fewer details might not be a sign of memory deterioration for the moderate attriters; lack of detail was simply affected by their L1 attrition. However, advanced L1 attriters spoke English during both testing days; which means that they used their dominant L2 English when talking about pre-immigration memories. This finding suggests that advanced level of attrition, where an L1 is completely replaced with an L2, might negatively affect the amount of details one remembers. Something seems to be lost in the case of dominant language replacement.

Another aspect that was affected by L1 attrition was the ease of memory retrieval. More specifically, advanced L1 attriters rated their Russian memories as the hardest to recall in comparison to non-attriters and moderate L1 attriters. Additionally, if memories came to the advanced L1 attriters with Russian words, they were also harder to recall in comparison to memories that came to them with no words. This means that a greater degree of L1 attrition made it more challenging to access L1 memories and especially the memories that were accompanied by L1 words.

The last aspect that experienced a negative effect of L1 attrition is the phenomenological properties of L1 memories. The L1 memories stood out in their vividness and confidence ratings in comparison to L2 English memories. More specifically, moderate L1 attriters reported their L1 Russian memories being less vivid in comparison to L2 English and mixed memories. The moderate attriters were also not as confident that the events that were encoded in Russian actually happened. These findings mean that even a moderate degree of L1 attrition may interfere with phenomenological properties of memories that were encoded in L1 which may lead to memory deterioration and forgetting.

All of the aforementioned findings indicate that L1 attrition might negatively affect memories of the self, with memory retrieval and phenomenological properties affected the most. However, frequent sharing or rehearsing of memories that were encoded in a forgotten language may reverse these negative effects. This was demonstrated by the group of participants who experienced the greatest degree of L1 attrition and who were thinking about their L1 memories. Since they relied on their dominant L2 English, they were able to recode their L1 memories into L2 English which allowed them to preserve L1 memories. It was shown by the fact that advanced attriters were able to recall vivid L1 memories with high confidence ratings similar to non-attriters. Additionally, those L1 memories were coming to them with L2 English words which suggests replacing of an L1 memory tag with an L2 memory tag.

CHAPTER 6 DISCUSSION AND CONCLUSION

When I began the study, I expected to see signs of memory deterioration in L1 attriters, especially in the memories that were encoded in the L1. The findings of this study both confirmed and challenged my expectations. The moderate attriters did retrieve vaguer L1 memories and were not confident that the events happened to them, which was an anticipated finding. However, advanced attriters were able to recall vivid L1 memories. Since the original language of encoding was not available to advanced attriters at recall, they relied on visual memory traces and their L2 to retrieve and share L1 memories. This rehearsing allowed the original L1 memories to be re-encoded into L2, which helped to preserve L1 memories. Even though phenomenological properties of L1 memories in advanced attriters seemed to be intact, the re-encoded L1 memories were less detailed, which suggests a negative effect of L1 attrition on bilingual autobiographical memory. In the following subsections, I will relay the main results of this study regarding bilingual autobiographical memory in non-attriters. Then, I will discuss specifics of autobiographical memory in L1 attriters by highlighting negative impact of L1 attrition on memory of self.

6.1 Bilingual Autobiographical Memory in Non-Attriters

As expected, Russian-English bilinguals who had a comparable L1 and L2 mastery provided consistent narratives of the self. L1 Russian memories, mixed memories, and memories that came with Russian words were rated as more emotional and significant in comparison to the L2 English memories and memories that came with

words in English. These findings are consistent with previous work on bilingual autobiographical memory, including a study by Harris, Aycicegi, & Gleason (2006). The authors demonstrated that bilinguals report a heightened emotional reaction to L1 taboo words. Although the present study did not employ taboo and negative words (this was done to avoid triggering traumatic memories), an expressive reaction to some L1 cues was still observed. Here are some examples:

- a) A cue “kasha” plays and a picture of “kasha” is displayed.
PBF A 18_11: О! Каша! Какая прелесть! Я давно ее не ела. / О! Kasha! Kakaya prelest’! Ya davno ee ne ela. / Oh, kasha! What a wonderful thing! I haven’t eaten it in a while.
- b) A cue “vinni pukh” plays and a picture of “vinni pukh” is displayed.
ВВМ 22_7: Винни Пух! Кто ходит в гости по утрам. Замечательный мультик. Просто классный! / Vinni pukh! Kto khodit v gosti po utram. Zamechatel’nyi mul’tik. Prosto klassnyi! / Winnie the Pooh! (Singing a song from the cartoon). What a wonderful cartoon! Just awesome!
- c) GKM 20_8: All these words make me feel nostalgic, kind of sad actually, I don’t know why.

The above examples demonstrate that even seemingly neutral L1 words may trigger emotional and expressive reactions. This can be explained by the *emotional context of learning hypothesis* which states that language is experienced as emotional when it is acquired and used in an emotional context (Harris, Gleason, & Aycicegi, 2006, p. 277). Upon qualitative analysis of the Russian and mixed memories, it turned out that most of those memories were encoded around bilinguals’ families and friends. These memories include birthday parties, parting with biological parents, making first best friends, etc. Many memories also came from an important part of the bilinguals’ lives – the time of transition during the immigration. Almost all the participants shared stories about their struggles and joys of living in a new country with a new language. Here is one example:

GKM 20_8: I moved here and I went to third grade, but about a month after coming to America and I, yeah, very well remember that day too, my first, I guess, my first day in the new school. And what really, it was really kind of overwhelming and, and maybe a little depressing because it was like there was not really many people who understood Russian in that school ... and I wasn't really sure how to communicate with people or there was, I only had one friend who could kind of speak Russian, but it was really, I guess, tough to understand what teacher was trying to say, what he, what he tried asking me and, I guess...it was just really overwhelming experience because he, I saw people try and come up and talk to me but I couldn't really talk back and it was just kind of this weird period that I never experienced before. And because I never really talked to anyone, any English speakers before and, and it was just something that it was a tough time (laughter).

The example above demonstrates how the first day of school in a new country stands out in this participant's memory: the anxieties of not being able to speak, awkwardness of not understanding others, and worries of not being understood. It does not come as a surprise that a memory like that would be perceived significant and emotional. Russian and mixed memories may hold a special place in a bilingual mind because of the significant people and contexts they were encoded in.

Besides rating their L1 Russian and mixed memories more significant and emotional, non-attriters demonstrated no effect of the match or mismatch between language of encoding and language of recall on the amount of detail. This means that when pre-immigration memories were told in Russian, the L1 did not facilitate a more detailed recall. Russian-English bilinguals who had equal command of both languages could provide equally detailed childhood memories when using either L1 Russian or L2 English.

This finding contradicts previous research. For instance, Javier et al. (1993) discovered that Spanish-English bilinguals provided more elaborate narratives of dramatic personal events when the language of the event and language of the recall

matched. Similarly, Schwaneberg (2010) argued that her participants could recall more detailed and more vivid memories if the events were told in the language that was spoken at the time of the event.

There could be two possible explanations to the fact that I did not find a language congruity effect. One of them is that previous studies did not control for L1 and L2 proficiency of their participants and we cannot, therefore, exclude a possibility that the L1 Spanish was still the dominant language of the participants. The present study collected L1 and L2 proficiency measures: the bilinguals had a comparable L1 and L2 mastery which may explain lack of the language congruity effect – they were able to provide detailed narratives of events in both, their L1 Russian and L2 English.

Another explanation is that the previous studies which discovered a language congruity effect focused on dramatic and traumatic personal events (Javier et al., 1993; Schwaneberg, 2010) which was not the case with the present study. The participants were encouraged to share any events they wished. In fact, the Russian-English bilinguals in this study only recalled 40 out of 144 (30%) events that were coded as negative.

This can explain the lack of the language congruity effect – it is known that traumatic events may have impaired encoding (Byrne, Hyman, Kaia, Scott, 2001; Tromp, Koss, Figueredo, Tharan, 1995) or be less specific (Barry et al., 2018). Therefore, it is possible that language congruity effect manifests itself only for traumatic memories or dramatic personal events. In fact, Schrauf (2000) analyzed clinical cases of bilingual speakers and reached a conclusion that the L1 leads to more emotional and more detailed retrieval of traumatic events (p. 412). However, when events are non-traumatic in nature, they do not differ in the amount of detail. For example, Schrauf and Rubin (2001)

analyzed pre- and post-immigration memories of Spanish-English bilinguals revealing that pre- and post-immigration memories did not differ in the amount of detail.

Despite not demonstrating the language congruity effect, having an access to the language of encoding seemed to give non-atriters an advantage. This was seen in the amount of details of the pre-immigration memories: non-atriters provided more detailed L1 memories in comparison to attriters. However, this was observed only when the language of encoding and recall matched. This means that bilinguals who retained their L1 had a better memory of their pre-immigration events.

Schroeder and Marian (2012) argued that bilinguals may have a stronger episodic memory. The authors relied on picture recall and Simon task to test episodic memory in a group of monolinguals and bilinguals. They revealed that individuals who frequently relied on two languages in their everyday lives, had a much better recall during the tasks. The authors interpreted their results in the light of bilinguals having a better executive function which enhances memory.

The present study similarly demonstrates that bilinguals may have a better memory for certain events. However, this finding is not due to a stronger executive function; if that was the case, non-atriters would provide more detailed memories during all the testing conditions. Non-atriters only shared more detailed memories when language of encoding and language of recall matched. This means that having access to an L1 is advantageous to remembering events that were encoded in that language, at least as far as the amount of detail is concerned.

6.2 L1 Attrition Effect on Bilingual Autobiographical Memory

As hypothesized, L1 attriters demonstrated a different pattern in how they accessed, remembered, and recalled their L1 memories in comparison to non-attriters.

The first difference was observed during the interviews – their inability to access their L1 memories with the help of L1 cues. Here are two examples:

a) A cue “peremena v shkole” (recess) plays.

SHM 19_8: I have no idea, nothing comes to mind.

b) A cue “pirozhki” (pirogi) plays.

ADM A N 26_7: Oh my God. I don’t know what this is either. Nothing comes to mind at all. I do not know this word. *Nothing shows up in my mind.*

It can be seen from the examples above that L1 words were unsuccessful at triggering memories. A quality of a cue is an important element in the memory retrieval process (Anderson, 2012). A cue should be recognized in order to activate a certain memory. In the case of L1 attriters, the L1 words were not adequate at triggering memories: “I don’t know this word. Nothing shows up in my mind”.

When an audio cue was accompanied by an image or if a cue was represented as an image, sometimes L1 attriters were able to retrieve memories that were encoded in L1.

Here are three examples:

a) An image of “plastilin” (Russian play-doh) is displayed on the screen.

AND A N 26_7: Oh my god! I remember playing with those. It is clay, not playdoh. I played with those before in Russia I remember playing with those.

b) An image of “vinni pukh” (Russian Vinnie the Pooh) is displayed and a cue “vinni pukh” is played.

AHF A N 26_14: I remember this. This is from a cartoon. I remember he had something maybe with honey. I don’t remember much about him. I remember his face. It is almost like what the American thing is. I think it is something I just remember the word “med” or “honey”. He was collecting honey. Look, I don’t remember much about him. I just have a picture of him like I don’t know if he had friends. I don’t remember that. I remember him.

c) An audio “nevolashka” (roly-poly toy) is played.

MMF A 20_11: Ты знаешь как это по-английскому языку? / Ty znaesh kak eto po angliiskomu iazyku? / Do you know how to say this in English?

Researcher: [silence].

MMF A 20_11: [laughter] Если бы я могла увидеть, то я бы вспомнила.

Только слово. / Esli by ia mogla uvidet' to ia by vspomnila. Tol'ko slovo. / If I could see it, I would be able to recall the memory. It is just a word.

L1 attriters seemed to rely on the images in order to retrieve L1 memories. The examples above demonstrate that a presence of an image was crucial during recall because the words were not recognizable. During the debriefing, MMF A 20_11 asked the researcher to show her a picture of “nevolashka”. When she saw the picture, she said: O! I know this one. I saw it before. It is an old Soviet toy, it does not fall.” Seeing the image did help her to recall the memory of this toy.

However, even when L1 attriters were able to recall L1 memories, the memories demonstrated signs of deterioration. More specifically, moderate L1 attriters reported their L1 memories to be less vivid in comparison to non-attriters. Here is an example:

A cue “nevolashka” plays.

DMF 21_8: Красная кукла которая никогда не падала у меня в Москве была. Я с ней играла. / Krasnaya kukla kotoraya nikogda ne padala e menya v Moskve byla. Ia s nei igrala. / A red doll that would never fall. I had something like that in Moscow. I played with it.

Researcher: Как четко это воспоминание? / Как chetko eto vospominanie? / How vivid is this memory?

DMF 21_8: Не очень потому что я даже слова не помню как описать. / Neochen' potomu chto ia dazhe slova ne pomnu kak opisat'. / Not really because I do not even remember the words how to describe it.

Here the participant states that her L1 attrition is interfering with how vivid a memory is perceived. She blames her insufficient L1 proficiency: “I do not even remember the words to describe it.”

The moderate attriters also were not confident that L1 memories actually happened which suggests memory deterioration. Here is one example:

A cue “sanki” [sled] plays.

EDF A 23_11: Я помню санки в России. Я думаю что когда в школе были зимой мы в санки играли. / Ia pomnu v Rossii. Ia dumaiu chto kogda v shkole byli my v sanki igrali. / I remember when we were in school, I think, we went sledding.

Researcher: Насколько Вы уверены что это произошло? / Naskol’ko vy uverenny cho eto proizoshlo? / How confident are you that this actually happened?

EDF A 23_11: Ммм, даже и не знаю. Скорее всего не уверена чем уверена. Как-то странно даже. / Mmm, dazhe I ne znaiu. Skoree vsego uverenna chem ne uverenna. Kak to starnno dazhe. / Hmm, not sure. It is more in a realm of “not sure” than “confident”. It is kind of strange, really.

Here the participant states that she is not sure whether this particular event really happened. She is surprised at this revelation: “It is kind of strange, really”.

The dual-coding theory posits that a memory encoded with dual codes, an audio and a visual component, is more resistant to deterioration. When one code is weakened or deteriorated, it may destabilize the memory leading to forgetting. This is precisely what was observed in the present study. L1 attrition caused the L1 language code to deteriorate which in turn destabilized the L1 memories. This process resulted in attriters recalling fewer L1 memories, vague L1 memories, and L1 memories with low confident ratings which means that attriters were not sure whether those memories actually happened.

However, some of the aforementioned negative effects of L1 attrition appear to have been reversed with the help of *rehearsing*. Advanced attriters who experienced a greater degree of L1 attrition recalled L1 memories to themselves more frequently than non-attriters and moderate attriters. While it cannot be deduced why this particular group of participants recalled L1 Russian memories very frequently to themselves, this rehearsing had a positive effect on their memory. More specifically, their L1 Russian memories were vivid, emotional, significant, and had similar confidence ratings in

comparison to non-atrainers. In other words, L1 attrition did not seem to affect the L1 memories in this group of participants.

The fact that repetition enhances memory has been widely known in the discipline of psychology (Mulligan & Peterson, 2013). If a piece of information is repeated, it is reinforced in the mind (Greene, 2008). It could be explained by the fact that a rehearsed memory is more accessible in comparison to an event that is never shared (Sutterer & Awh, 2016). In fact, shared reminiscing plays a crucial role in remembering (Langley et al., 2017; Neale & Pino-Pasternak, 2016). What is interesting is that participants engaged in shared reminiscing with themselves. Here is one example:

MMF A 20_11: Ok. Um, so when I, when I was about seven. I was diagnosed with leukemia, um, cancer. I, um, was in the hospital, most time alone. So there was one moment, um, the doctors in Russia weren't very nice [...] I remember that moment where, um, I became so weak and I, um, didn't have my mama with me so all that time I was thinking, you know, I should stop fighting for this, um, life [...] doctors told me that I needed to just die because I was just an orphan. And I remember I went into a coma in a way where I wasn't functioning but I understood everything and the doctors were telling me: "Oh she is just an orphan, maybe it is a good thing for her to just die." I remember in that moment, um, I felt, um, like uh, a rush of "I can do this". I was thinking you know it wasn't the time for me to die so I just remember in that moment, um, I woke up and it was actually the next day and, um, I actually started feeling even better and I just remember that moment 'cause, um, it was like, like scary knowing that I could have died right there and then but I didn't give up so it was really cool.

Researcher: what a great story!

MMF A 20_1: Yeah, it is kind of cool. *I love thinking about this one.* Um, *I recall this one a lot* (laughs).

Here this adoptee shares a touching story of her battling cancer in a Russian hospital. She triumphantly declares that she was able to overcome the disease on her own. Also, she mentions how she "loves thinking about this one" and how she "recalls this one a lot".

While rehearsing memories by sharing with others may have a positive effect on

remembering, this finding suggests that even thinking about events to yourself could be beneficial for preserving of memories.

Not only rehearsing of L1 memories ensured that advanced L1 attriters remembered L1 memories, the rehearsing also led to *re-encoding* of those L1 memories into L2 English. This happened because L1 attriters had to rely on the L2 English. It could be observed in the finding that L1 Russian memories were coming to advanced L1 attriters with L2 English words. The Russian language was replaced by the English language. Here is a telling example:

STF A N 20_11: The memory came to me with words.

Researcher: What were the words?

STF A N 20_11: Just thinking how frustrating it was, the words were definitely in Russian.

Researcher: Do you remember those words?

STF A N 20_11: No, I do not. Sorry, my mind thinks more in English now.

Here the participant is recalling a Russian memory, however that memory comes to her with an English word “frustration”. That word was attached to that Russian memory later because it represents a concept that is only encoded in the English language and does not have a direct translation equivalent in Russian (Pavlenko, 2005). The Russian language tag is being replaced by the English memory tag.

The aforementioned pattern that memory codes could be updated has been documented in the discipline of psychology. In fact, every time we recall a memory, it becomes malleable and “new information can update the content of existing memory traces” (Kensinger, 2015, p. 179). This is exactly what was observed with advanced L1 attriters who did not retain their L1 but kept rehearsing their L1 memories in L2 English – they *re-encoded* those L1 memories into their L2.

While re-encoding of L1 memories into L2 seemed to help preserve phenomenological properties of these L1 memories, unfortunately, it did not safeguard against memory loss in the group of advanced attriters. During the free recall, advanced attriters provided less detailed L1 memories in comparison to non-attriters despite the fact that advanced attriters used their strongest language, English. This means that rehearsing and re-encoding of memories that were originally encoded in an attrited language is not sufficient for fully preserving those memories – some details seem to get lost in the re-encoding process despite frequent rehearsal and recall.

The fact that advanced attriters who replaced their L1 with an L2 failed to recall detailed pre-immigration memories may be attributed to one of the negative effects of dominant language replacement (DLR). DLR is a phenomenon, previously known as subtractive bilingualism, where a language is learned at an expense of another language by completely replacing it (Cummins, 1994). It manifests itself when individuals who speak a non-majority language are forced to abandon that language once they enter a schooling system. It is a common occurrence in the United States where bilingual education is not widely supported (Menken & Kleyn, 2010). It is also a common practice with international adoptees: many are not encouraged to use their first language upon their arrival to the U.S. (Fogle, 2012). Many adoptees commented on how they did not have any opportunities to use their L1; one adoptee even admitted that his parents prohibited him to use Russian: “Our parents did not want us to use Russian” (ATM A 22_12).

Several negative effects of DLR have been recorded for overall academic achievement, L2 literacy development, and even native-like L2 attainment (Garcia, 2009;

Thonus, 2003; Valenzuela, 1999). In fact, Hyltenstam et al., (2009) demonstrated that international adoptees who experienced a DLR and may seem native-like in their second language, upon a throughout analysis of their speech production, speech perception, morphosyntax, and formulaic language, were outside of the native-like range. At the same time, bilinguals who retained both languages outperformed international adoptees who went through a dominant language replacement. This means that DLR had a negative effect on the overall L2 native-like attainment. The present study joins the argument regarding negative effects of this practice – so far DLR has been shown to negatively affect L2 attainment; apparently, the DLR also has negative consequences on memory of self.

This is a significant finding because autobiographical memories serve several crucial functions. They help individuals define who they are, maintain relationships, plan and project into the future (Fivush, 2011). Adoptees, including international adoptees, have a right to access their pre-adoption life story (Children and Families Act, 2014). The life story must represent a “realistic and honest account of the circumstances surrounding the child’s adoption” (Department of Education, 2011). In fact, there is an *adoption lifebook* initiative (O’Malley, 2008). This initiative gives a recommendation to adoptive parents to create a book together with a child; this book is to include a complete history of that child including the pre-adoption events. If adoptees have a right to know their early history and if remembering of pre-adoption events is encouraged, the L1 maintenance should become a part of that initiative because L1 loss would negatively affect phenomenological properties and remembered details of these memories.

6.3 Theoretical Implications for Bilingual Autobiographical Memory

The present study was grounded in the dual coding theory that was first originally developed by Paivio (1971). According to the dual coding theory, information that was encoded with two memory codes would be remembered better in comparison to information that was encoded with a single code. More specifically, I investigated whether a deteriorated verbal code would destabilize the memory and whether the non-verbal code would be enough to keep that memory intact.

A group of bilinguals who were on a continuum of L1 attrition were recruited in the study because if a language is forgotten, that language code deteriorates. Bilingual speakers who are attriters are a perfect group of individuals to examine whether deterioration of a language memory code would affect the memories that were encoded in that language, because they have access to more than one language code. L1 and L2 memories can, therefore, be compared in order to examine whether L1 loss affects phenomenological properties of L1 memories. The second reason is that monolingual speakers can only exhibit language loss due to trauma or disease. On the contrary, bilingual speakers may experience language loss due to immigration and infrequency of L1 use. Thus, any effects of L1 attrition on autobiographical memory would not be caused by pathological issues. Working with bilingual speakers who have experienced L1 attrition presents a unique opportunity to research a role of language, more specifically, loss of language, on memory of self.

The findings of this study have three theoretical implications for our understanding of autobiographical memory. To begin with, they show that L1 attrition can *negatively affect phenomenological properties* of memories that were encoded in the

language in question. This was observed in the group of moderate attriters who recalled vague L1 memories and were not sure that those L1 memories actually happened. This means that language memory code may be as important as the visual imagery when it comes to remembering events.

The visual memory code has been seen as the most important in episodic memory (Greenberg & Knowlton, 2014). Memories usually come with visualizations of an event with vivid memories having rich visual component; visual imagery has also been linked to the sense of relieving and confidence in the event which are two most important qualities of autobiographical memory (Greenberg & Knowlton, 2014, p. 923). In fact, memory retrieval activates posterior cortical regions that are responsible for visual imagery (Spreng, Mar & Kim, 2009). Also, individuals who have an acquired imagery deficit have poor autobiographical memory (Greenberg, Eacott, Brechin, & Rubin, 2005).

The reliance on the visual memory trace was demonstrated by the participants in the present study – 1,622 out of 1,988 (82%) memories were accompanied by a visual component. In fact, it was by far the most frequently reported memory trace, with kinesthetic sensations accounting for 22 % (n=441), sounds for 16% (n=314), words for 10% (n=200), smells for 7.4% (n=147), and taste for 4.3 % (n=86). Paivio and Lambert (1981) reported that items accompanied by a picture are remembered the best in comparisons to repeating or translating a word, which means that pictorial representations alone should be satisfactory for a successful memory recall.

My findings suggest that visual memory traces alone might not be sufficient (Greenberg & Knowlton, 2014; Greenberg et al., 2005) when the language of encoding experiences deterioration. More specifically, these memories were less vivid and had a

lower confidence ratings in comparison to the memories that were encoded in a stronger language. The reason why the role of language did not surface in the previous studies is because those studies recruited monolingual speakers or bilinguals who had a comparable L1 and L2 proficiency. The L1 attriters have a set of memories that were encoded in L1. The fact that those memories were less vivid and had lower confidence ratings suggests that attrition plays a crucial role in maintaining of vivid memories.

The second theoretical implication is that *L1 attrition may interfere with memory retrieval*. The bilinguals who have not experienced major L1 attrition were able to recognize L1 cues and rely on them in order to successfully retrieve L1 memories. The L1 attriters failed to recognize the L1 cues which interfered with successful recall. This was seen in multiple examples when the retrieval of an L1 memory was unsuccessful or when an L2 memory was accessed because the L1 cue was translated into L2 English. This means that deterioration of a language memory code hinders successful recall of memories that were encoded in that language.

Another argument for the negative effect of L1 attrition on memory retrieval comes from the observation that participants relied on verbal self-cueing when searching for memories. They would repeat the cue, even if it was an image, and that facilitated the recall. This was not asked of them; they were not even expected to demonstrate how they search for memories. The verbal self-cueing was something that surfaced naturally during the experimental sessions. The significant role of the verbal self-cueing in memory retrieval was especially demonstrated by L1 attriters. If during self-cueing they translated the L1 cue into L2 English, they would retrieve an L2 memory which means that the

language of the repeated word was responsible for activating memories not the language of the original cue.

There is more evidence for the role of L1 attrition in memory retrieval. For advanced attriters, memories that came to them with L1 Russian words were the hardest to retrieve in comparisons to non-attriters and moderate attriters. Additionally, memories that were encoded in L1 Russian were also reported to be the hardest to recall by advanced as well as by moderate attriters. This means that if a certain language was spoken at the time of the event, but that language is lost, it would be more challenging to retrieve that memory. Thus, L1 attrition may compromise L1 memory recall by making access to those memories more effortful.

The third and arguably most important finding of this study involves the *malleable* nature of bilingual autobiographical memory. Advanced L1 attriters who experienced a major degree of L1 attrition were able to recode their L1 memories into their dominant L2 English. This was accomplished by frequent rehearsing of these L1 memories – when the memories were recalled, they would be practiced in L2 English which allowed for the original L1 memory code to be replaced with an L2 memory code. Re-encoding made it possible for these memories to be shared in L2 English, but it also facilitated remembering. The re-encoded L1 memories maintained their phenomenological properties and were remembered well.

This was not the case with moderate attriters – they did not rehearse their L1 memories which was likely one of the reasons why their L1 memories were vague and had lower confidence ratings. While the collected data does not allow to explain why one group of participants chose to rehearse their memories and the other group did not, it

appears that a degree of L1 attrition may have been responsible for this disparity. The participants who had a major degree of L1 attrition could not hold a conversation in their first language, nor did they have access to an L1 social network. This inability to use L1 when sharing memories from a crucial part of their life, their childhood, led to a necessity to talk about those events in their L2. The participants who had a lesser degree of L1 attrition, were able to talk about their childhood in their attrited language which did not encourage re-encoding. Thus, for L1 attriters, re-encoding of L1 memories into an L2 seemed necessary for preserving of these L1 memories.

Memories encoded in one language could be malleable and undergo re-encoding into another language in case of L1 attrition, given that those memories are rehearsed in an L2. This malleable nature of L1 memories points to the flexibility of a bilingual mind that finds a way to adjust to changes in language proficiency. It is important to point out that while re-encoding of L1 memories helped preserve them in the group that rehearsed those memories, it is not clear whether anything was lost in that process of re-encoding. There is one piece of evidence suggesting that it may have. During the free recall, non-attriters provided more detailed narratives of the self in both L1 and L2. Most importantly, they provided the most detailed narratives when language of encoding for their pre-immigration memories matched the language of recall, even in comparison to the group that was able to successfully recode their L1 memories into L2. This means that advanced attriters who re-encoded their L1 memories into L2 and shared those memories in L2 English, had less detailed narratives of their pre-immigration events. This finding suggests that bilinguals who have not experienced a major degree of L1 attrition may have an advantage when accessing L1 memories. Also, although the mind may adjust to

the loss of a language and recode memories into a dominant language, some details of those memories may be lost in this process.

6.4 Methodological Implications for L1 Attrition and Bilingual Autobiographical Memory Research

6.4.1 Methodological Implications for L1 Attrition Research

The present study offers two methodological contributions to research on L1 attrition. To begin with, my findings demonstrate a strong correlation between self-reported measures and objective measures of L1 syntactic complexity, L1 fluency, and L1 lexical diversity. This means that self-reports and can-do-scales provide a reliable way to assess L1 attrition. Similar findings come from studies of self-assessments of L2 skills (Alexandria, 2009; Ellis, 2003; Litz, 2009) and L1 attrition (Schmid, 2014).

The second contribution of the study involves insight into participant selection. Traditionally, L1 attrition research has relied on monolingual control groups when assessing L1 attrition (Schmid, 2004; Yagmur, 2004). Isurin (2013) questioned the validity of this approach, raising concerns about the impact of attriters' L2, variation and language change.

The bilingual status of attriters seems to be the biggest concern when using a monolingual control group because we are forced to draw a comparison between multilingual and monolingual speakers which may be theoretically inappropriate. Cook (1999, 2013) and Grosjean (1989) have argued long ago that a bilingual is not two monolinguals in one; rather, a bilingual mind is uniquely different from a monolingual one. Similarly, Ortega (2013; 2016) argued that monolingualism should be abandoned as a principle in the discipline of Second Language Acquisition.

One of the ways to address a monolingual bias in L1 attrition research may be accomplished by comparing bilingual attriters to bilingual non-attriters. This approach was undertaken for the first time by Dewaele (2004); the author investigated a connection between L1 attrition, L1 dominance, and use of emotional terms. Instead of relying on a monolingual control group, he compared participants with less self-perceived L1 attrition to participants with more self-perceived L1 attrition. I incorporated this approach by recruiting bilinguals who are on a continuum of L1 attrition and by comparing them to each other, which was particularly useful given the focus of the study on bilingual memory. Offering valid comparisons, the use of different types of bilinguals appears to be the best possible way to avoid monolingual bias in L1 attrition research.

6.4.2 Methodological Implications for Bilingual Memory Research

The study also offers methodological contributions to research on bilingual autobiographical memory by showing that: 1) incorporation of a wider selection of stimuli may lead to production of a more diversified data set, 2) close attention to different dimensions of language proficiency may illuminate new aspects of bilingual autobiographical memory, 3) asking participants to date their memories several times may produce a more reliable data set.

I will start by discussing incorporation of a wider selection of stimuli. Most bilingual memory studies have relied exclusively on verbal cues, starting with Bugelski (1977) and ending with Esposito and Baker-Ward (2016). The only exception is a study by Schrauf (2009) where the researcher incorporated pictorial experimental stimuli. Such overreliance on verbal cues was assumed to produce a greater proportion of linguistic

memories (Pavlenko, 2014), but this assumption has never been tested. Therefore, both verbal and non-verbal cues were incorporated into the research design. The results revealed that verbal cues were more likely to trigger linguistic memories. This undermines some of the previous findings, such as the one in Schrauf and Rubin (2000) where participants had as many as 80% of their memories coming to them in words. This finding also serves as a caution against using only one type of a cue in an experiment.

Let me now discuss the second implication – paying closer attention to different dimensions of language proficiency when investigating bilingual autobiographical memory. Most bilingual autobiographical studies have ignored language proficiency and language attrition in their research with very few exceptions. Mortensen et al. (2014) collected an L2 proficiency measure in their study but did not use it in their analysis. Esposito and Baker-Ward (2016) also collected an L2 proficiency measure and correlated it with the age of the event showing that less-proficient Spanish-English bilinguals retrieved earlier L1 memories to the Spanish cues. None of the previous studies looked into a connection between L1 attrition and phenomenological properties of autobiographical memories despite the fact that language is crucial for remembering, storing, and retrieving memories. L1 attrition should be considered when working with bilingual and multilingual speakers because a degree of L1 attrition may affect their autobiographical memory.

I will now discuss the third implication – asking participants to date their memories several times. The participants were asked to share their very first memory twice – during the first and second test days; the two test days were one week apart from each other. This was done for consistency reasons. However, an interesting pattern

emerged. Most participants, 23 out of 35 (66%) recalled divergent earliest memories on different testing days. Moreover, if the same memory was recalled, sometimes a different date was provided. Many of the participants did not even remember which earliest memory they shared during the previous experiment session. Wang and Peterson (2014) discovered a similar trend. In their study children provided different dates for their earliest memories when interviewed three times one year apart between the interviews. The researchers found that even when the children recalled the same event, they postdated it in the later sessions. The study by Wang and Peterson (2014) as well as the present study problematize all the previous studies that reported an effect of culture and language on the earliest memory – it is clear that the earliest memory may be more difficult to pinpoint than previously assumed and is not as stable as the researchers have thought before. This should be taken into an account when asking participants to name and date their earliest memory.

6.5 Limitations, Conclusions and Directions for Future Research

The main limitation of the present study is a relatively small sample size: 35 participants. This size, however, is consistent with the previous studies where the number of participants ranged from 12 (Schrauf & Rubin, 1998) to 39 by (Marsh et al., 2015). And while it does constrain generalizability, the advantage of a smaller sample size is the opportunity to conduct a closer qualitative and quantitative analysis of the findings which has been done in the present study.

Another limitation of the study is self-selection bias, unavoidable in studies that rely on volunteer participants. The self-selection bias dictates that individuals who choose to participate may share characteristics that make them different from the individuals who

decided not to participate in the study (Vu, 2014). The recruitment for this study lasted for over a year due to difficulties in finding attriters and international adoptees. Even after the researcher gained an access to one of the largest adoption networks – Families for Russian and Ukrainian Adoption (FRUA), the recruitment rate was slow. Since the study was advertised as an investigation of autobiographical memory in order to avoid participant deception, it may have deterred many participants. The study seemed to attract participants who were eager to talk about their memories. This may have affected the results, especially the fact that advanced attriters rehearsed their memories. It makes the results challenging to generalize to other attriters who do not think about or recall their L1 memories.

Future research on bilingual autobiographical memory in L1 attriters should expand the study of cued-recall to speakers of other languages and combinations of languages. As far as the L1 attrition research, more efforts are needed to avoid the monolingual bias. So far, most of the L1 attrition research has relied on some sort of comparison to a monolingual control group which is inappropriate due to the bilingual status of L1 attriters. One way to avoid monolingual bias is by comparing bilinguals with less or non-existent L1 attrition to bilinguals with a greater degree of L1 attrition. This can be accomplished by creating a database of bilingual speech that can be used as a point of reference.

Another possibly productive direction could be investigating self-cueing or any other strategies that bilinguals may employ when retrieving memories. The finding that bilinguals rely on verbal self-cueing when they search for memories highlights the crucial role of language in the memory retrieval stage. It also stresses an importance of

maintaining language proficiency for successful memory retrieval – if a word is forgotten, it cannot be used for self-cueing. In this case, memory recall may fail, which has been shown in this study.

In summary, language serves as one of the main modes for storing, sharing, and accessing memories of self. L1 attrition was shown to have a negative effect on phenomenological properties of these memories that were encoded in the attrited language. Since language attrition may interfere with remembering and recall, first language maintenance is recommended in order to preserve those childhood memories. In case of language loss, even the rehearsing of the memories that were encoded in that language may not be enough as was seen in the group of advanced attriters who replaced their L1 Russian with L2 English. Even though they were able to recall their L1 memories and reported that they rehearse them frequently, they provided less detailed childhood memories in comparison to non-attriters. This suggests that something *gets lost in translation* when bilinguals experience dominant language replacement, at least when it comes to their autobiographical memories, which may have unforeseen consequences for their sense of self.

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APPENDICES

A.CAN-DO-SCALES¹³

Listed below are a number of “can-do” scales. They consist of statements about your language proficiency in both Russian and English. Please read each description carefully and circle the appropriate number to indicate whether, at the present time, you would be able to carry out each task in the language in question. You can only circle one number per language and per statement. Please use the following scale:

- 1 = I cannot do this at all
- 2 = I can do this, but with much difficulty
- 3 = I can do this, although with some difficulty
- 4 = I can do this fairly easily
- 5 = I can do this without any difficulty at all

Listening:

- I can understand everyday conversations/interactions.
- I can understand movies and TV shows.
- I can understand news on TV or on the radio.
- I can understand academic lectures and presentations.
- I can understand telephone conversations.
- I can understand lyrics of songs.

Speaking:

- I can participate in everyday conversations.
- I can express my thoughts and ideas about current events.
- I can present a clear and detailed argument.
- I can participate in a debate/argument on a familiar topic.
- I would be able to present in front of an audience on a familiar topic.
- I can have a telephone conversation.
- I can talk to people through video chat (Skype/Face time).

Reading:

- I can easily understand e-mails.

¹³ Can-do-scales were adopted from the resources available to L1 attrition researchers at “The Language Attrition” website that was created by Monica Schmidt <http://www.let.rug.nl/languageattrition/>.

I can understand newspapers
I can understand textbooks and articles
I can understand prose (stories and novels) and poetry
I can understand social media (Face book/Twitter) language

Writing:

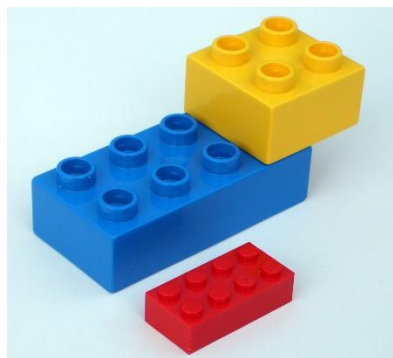
I can write e-mails
I can write short personal messages for my friends/relatives
I can write a report about current events
I can write an academic essay on a familiar topic
I can express my emotions and feelings through writing
I can write posts on social media (Face book/Twitter)

B. LIST OF LIFE EVENTS IN ENGLISH AND IN RUSSIAN

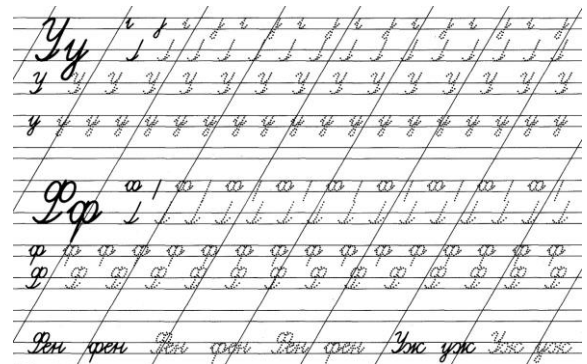
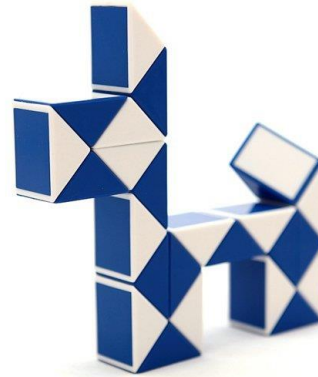
Time out	Стоять в углу
First day of kindergarten	Первый день в садике
Birth of a sibling	Рождение сестры или брата
Camping	Хождение в поход
Hiking	Прогулка
First pet	Первое домашнее животное
Learning to ride a bicycle/ski	Кататься на велосипеде или на лыжах
Learning to swim	Как вы научились плавать
First time away from home	Первый раз вдали от дома
Favorite holiday	Любимый праздник
Childhood best friend	Друг детства
First concert	Первый концерт
Scary moment	Когда вы испугались
Lying to parents	Соврали родителям
Embarrassing moment	Стыдный/неприятный момент
Failing a test	Провалить экзамен
First love	Первая любовь
First date	Первое свидание
First heartbreak	Первое разочарование
Sports team/big game	Спортивная команда/ игра
First job	Первая работа
Quitting job	Бросать работу
Quitting a team	Подводить команду
Being in a play	Участвовать в сценке
First music concert	Первый музыкальный концерт
First rollercoaster	Первый раз на Американских горках
High school graduation	Выпускной
Learning to drive	Учиться ездить на машине
First accident	Первая авария
Learning to trust people	Учиться доверять людям
First time flying/traveling	Первый раз лететь самолетом
Buying a first car	Покупка первой машины

C. EXPERIMENTAL STIMULI

Appendix C: American and Russian-culture specific stimuli



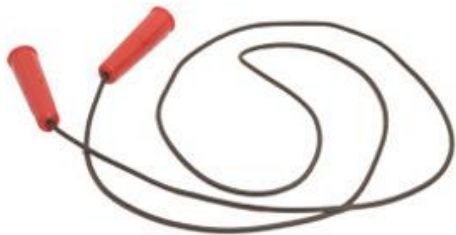






Appendix C: Non-culture specific stimuli





D. MEMORY QUESTIONNAIRE IN ENGLISH AND RUSSIAN

How vivid is this memory? (Very vague / vague / vivid / very vivid).
 Как четко это воспоминание? (Очень смутно / смутно / четко / очень четко).

Did this memory come to you in: words / visual / kinesthetic / sounds / smells / other.
 Оно пришло к Вам: словах / визуално / с ощущениями тела / звуками / запахами / другое.

Does this memory elicit any emotion in you? (No emotion / little emotion / moderate emotion / strong emotion).
 Вызвало ли это воспоминания какие-либо эмоции? (Нет / небольшие / некоторые / сильные).

If so, what kind of emotion? (Negative / neutral / positive)?
 Если да, то какие? (Негативные / нейтральные / позитивные)?

How often do you share this memory with others? (Never / seldom / often / very often).
 Как часто Вы рассказываете об этом событии другим? (Никогда / редко / часто / очень часто).

How often do you recall this memory to yourself? (Never / seldom / often / very often).
 Как часто Вы вспоминаете об этом событии наедине с самим собой? (Никогда / редко / часто / очень часто).

How old were you at the time of the event?
 Сколько Вам было лет?

What language(s) were spoken by you and around you at the time of the event? (English / Russian / English and Russian / other / none).
 На каком(их) языке(ах) Вы разговаривали и на каком(их) языке(ах) разговаривали вокруг Вас? (Английский / русский / английский и русский / другой(ие) / никакие).

How easy was it to recall this event? (Very easy / easy / difficult / very difficult).
 Как легко было вспомнить это событие? (Очень легко / легко / сложно / очень сложно).

How significant is this memory to you? (Very insignificant / insignificant / significant / very significant).
 Как значительно это событие для Вас? (Очень незначительно / незначительно / важно / очень важно).

How confident are you that this actually happened? (Very unsure / unsure / confident / very confident).
 Насколько Вы уверены что это произошло? (Очень не уверен(а) / не уверен(а) / уверен(а) / полностью уверен(а))