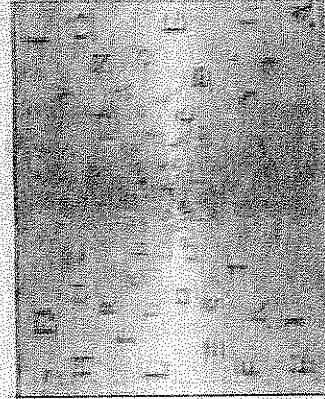


# Language-dependent memory: Insights from Bilingualism

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## 1 Language-dependent memory: An introduction

### Relations between Language and Memory



Nabokov, a bilingual Russian-English writer, gives a glimpse of what it is like for a bilingual to transfer memories across languages in this quote from the introduction to his autobiography: “[It] took a long time to write, a particularly agonizing labor, for memory was set in one way – musically under-spoken, Russian – and imposed upon it was a different way, English and thorough.” (Nabokov, 1954, 1). Because memory and language are intrinsically intertwined and because the imprint of language on memory runs deep, likely influencing memory’s every aspect – the structure, the rhythm, the content, the accessibility – recounting memories in a language other than the one in which they were originally ‘set’ is a task that is likely to redefine the memory itself. For people who speak two languages, the effect of language on memory can be dramatic. Bilinguals, by their very nature, experience the world around them in two languages, and this may have a profound effect on which events they remember, how well they remember them, and the actual content of these memories. For a bilingual, all the events and experiences that take place in life are marked for language, sometimes in a very vivid way, and sometimes in a more subtle way also experienced by monolinguals (for instance, the events experienced by monolinguals may be marked for dialect, register, or a speaker’s voice quality). In this way, language becomes part of the memory trace, colors a bilingual’s memory and may influence later recall.

In this chapter, we consider the relationship between language and memory via the prism of bilingualism and focus on the phenomenon of language-dependent memory. We suggest that language serves as a mental frame for encoded information, aiding recall and influencing

accessibility and that language may also influence the actual content of memories. Language is a component of the overall environment in which events are taking place, and, just like with other types of contexts (Smith, 1988; Tulving and Thomson, 1973), where memory is improved when retrieval takes place in the same environment in which the material was learned, so is memory facilitated when an event is recalled in the same language in which it originally took place. In the first part of the chapter, the relationship between language and memory is explored in the context of Language-Dependent Memory (Marian and Neisser, 2000). We describe a series of experiments on language-dependent memory in bilinguals, considering both autobiographical and semantic memory. In the second part of the chapter, we center our attention on the influence of language on the content of bilinguals' memories, particularly the effect of language on the expressed self-concept. We suggest that in addition to influencing the accessibility of memory, language may also influence its content, either directly, by imposing linguistic constraints upon the conceptual system, or indirectly, by acting as a cue for the culture in which the particular language is used. In the final part of the chapter, we consider potential mechanisms underlying language-dependent memory, and propose directions for future research.

## 2 Context-dependent memory

The role of context in cognition has been considered in a number of domains. Gestalt psychologists, for instance, considered the interplay between focal and contextual information in perception, and the role that organizational cues play in encoding visual information (Wertheimer, 1938). It has been proposed that for remembering, context may serve as an organizational cue, triggering clusters of memories (Smith, 1988). For example, one may remember different kinds of information at the supermarket vs. the opera, or when coming down with a cold vs. when going on a date. As early as 1957, Green spoon and Ranyard showed that a list of items learned in a brightly lit, noisy, and uncomfortable environment is better recalled in that environment than in a dimly lit, quiet, and comfortable environment

- and vice versa. The encoding specificity principle, introduced by Tulving and Thomson (1973), proposed that memories are context-dependent - that is, memory retrieval can be facilitated by putting the participant into the same environment, physical or emotional, in which the encoding originally took place (see Davis and Thomson (1988) for a review). Have you ever gone to get something from another room, forgot what you went to get, and had to return back to the original room to remember what it was you left for in the first place? Such occurrences illustrate the classical context-dependent memory phenomenon.

Experimental manipulation of contextual changes consisted of having participants learn and retrieve stimuli in dramatically different environments, such as underwater or on land (Godden and Baddeley, 1975, 1980), underwater or on a boat (Emmerson, 1986), and inside or outside a sensory deprivation device (Suedfeld and Eich, 1995). Godden and Baddeley (1975), for example, had divers learn lists of words in two natural environments - on dry land and underwater, and recall the words in either the environment of original learning or the alternative environment. Results showed that the lists learned underwater were recalled significantly better under water, and lists learned on dry land were recalled significantly better on dry land. Less drastic manipulations of context consisted of having participants learn stimuli in one room and testing their memory in either the same or a different room (Eich, 1980; Fernandez and Glenberg, 1985), or of manipulating screen color, item color, font, case, or stimulus location on a computer display (Murnane and Phelps, 1993, 1995). Similarly, manipulations of olfactory qualities of the environment have also led to context-dependency effects (Herz, 1997), with a distinctive odor found to be an effective retrieval cue. Such empirical studies are corroborated by anecdotal evidence of cases in which smells and odors evoke memories from days long gone.

Context-dependent memory seems to manifest itself very early in the developmental trajectory with evidence suggesting that the encoding specificity principle applies not only to adults, but also to children and infants. Studies by Rovee-Collier and colleagues, for instance, demonstrated that infants who had previously learned to

vigorously kick their legs to activate a mobile attached to their feet with a string failed to generalize this knowledge to circumstances in which environmental differences were as small as the removal of the original bumper sheet from the crib (for reviews, see Rovee-Collier and Hayne (1987); Rovee-Collier and Shyi (1992). Rovee-Collier and colleagues suggested that infant memories are very specific and closely bound to the context in which they were acquired, so that changes to the context in which the infants acquired the memory often resulted in failure to retrieve the memory at testing.

Context may refer to an external environment, such as a room, a field, or a boat, or to an internal state, such as happiness, boredom, or nostalgia. External context, also called environmental context, arises outside the subject, while internal context arises from within the subject (and is also referred to as state-dependency). The distinction between external and internal contexts has long been part of the context-dependent memory discussion. Smith (1988, 31) proposed that the difference between the two is at the operational definition level only, since internal context is manipulated via external forces and external context must be internally represented to cue memory and that both are externally manipulated and internally represented. In a way, Smith expressed the position that almost every memory phenomenon is environmentally context-dependent. On the other hand, Suedfeld and Eich (1995) took the opposing view that almost every memory phenomenon is internally context-dependent. They proposed that environmental state-dependent effects are mediated by alterations in affect or mood and that data that on the surface appear to demonstrate place-dependent memory may, at a deeper level, denote the presence of mood-dependent memory (Suedfeld and Eich, 1995). Most of the time, however, external and internal contexts go hand in hand and different internal contexts accompany different environmental contexts. For example, being at a Hawaiian beach differs from being in a university classroom in environmental context, and it also differs in internal context: relaxed vs. tense, rested vs. tired. Such simultaneous differences in both the environmental and the internal contexts are common occurrences in everyday life.

Multiple underlying mechanisms have been proposed as possible explanations for the effect of context on memory. For instance, how the material is encoded may be an important factor. Tulving and Thomson proposed that "Specific encoding operations performed on what is perceived determine what is stored, and what is stored determines what retrievals are effective in providing access to what is stored" (1973, 369). McDaniel et al. (1989) conducted a series of experiments in which participants were instructed to use different encoding strategies. They found diminished context-dependency when subjects employed imagery at the time of encoding, organized the input material into sets, used self-referent encoding, and when the input described implausible and bizarre events. These findings suggest that dependence on environmental context cues is partly a function of the degree to which available retrievals are provided by the target encoding.

Another factor proposed to explain the effect of context on memory is the relationship between the context at encoding and the information that is being encoded. For example, Fernandez and Glenberg (1985) proposed that whether the events are construed as being causally related to a given environment, rather than simply contiguous with it, will play an important role in finding environmental context-dependent memory. Baddeley and Woodhead (1982), when considering the perceived relationship between context and stimuli in recognition memory, suggested that when stimulus and context bear an arbitrary relationship to each other and are perceived as such by the subject, the addition of the appropriate context or its deletion or substitution by another will have no influence on recognition performance.

These and other hypotheses – the Outshining hypothesis (Smith et al., 1978), the Integration hypothesis (Baddeley and Woodhead, 1982; Godden and Baddeley, 1980; Dalton, 1993), the Experimental Context hypothesis (Fernandez and Glenberg, 1985), the Familiarity hypothesis (Dalton, 1993), the SAM hypothesis (Gillund and Shiffrin, 1984), the Sensitivity hypothesis, the Situational Context hypothesis,

and the General Context Model hypothesis (Murnane and Phelps, 1995) – individually and in combination can account for different aspects of context-dependent memory data, but the exact mechanisms driving it remain unclear.

The hypothesis of language-dependent memory is an extension of the encoding specificity principle into the domain of language. It proposes that language is part of the context, and exerts the same effect on memory as other contextual elements. Language is likely to simultaneously include both external and internal components, for language, especially in a bilingual, serves both as part of one's external context (with many memories characterized by linguistic interaction – either a conversation that one took part in during the remembered event, or din of others talking in the background while the event was taking place) and internal context (internal dialogue, linguistic encoding of information, and language as a mental frame). While linguistic environments at encoding and retrieval may differ for speakers of a single language (e.g., listening to the same vs. different speaker at encoding and retrieval), nowhere is language-dependent memory more evident than in the differences of linguistic environments experienced by bilingual speakers. By studying the language-dependent memory phenomenon through the prism of bilingualism, at least two predictions for the influence of language on memory accessibility can be specified. First, for a bilingual speaker it should be easier to recount events in the same linguistic environment in which they originally took place, and second, a bilingual speaker should remember information better if tested in the same language in which it was learned. These principles are expected to apply both to episodic memories (autobiographical memories of personal nature), and to semantic memories (general memories of everyday knowledge). The distinction between episodic memory and semantic memory refers to the distinction between memory for personal events experienced at a specific time or place, the specific 'episodes' that make up a life, while semantic memory is the internal collection of facts and figures, comprising knowledge of the world (Tulving, 1985, 1993). A series of experiments tested the language-dependent memory hypothesis for both types of memory, episodic and semantic.

### 3 Episodic memory and language in bilinguals

Although language is likely to always play a role in retrieval of autobiographical memory, a good place to begin the study of language-dependent memory effects is in bilingual contexts, as demonstrated by a study of autobiographical recall in Russian-English bilinguals (Marian and Neisser, 2000). Autobiographical life narratives of Russian-English bilinguals were collected by providing the participants with cue words in either Russian or English, and asking them to recount the first memory that came to mind after hearing the word (Marian and Neisser, 2000). Each memory was then coded for the language in which the events described took place. For instance, if the person, upon hearing the word *summer*, told a story of spending summer vacation visiting his grandmother in a village in the vicinity of Moscow, the memory was coded as Russian at encoding. Results revealed that bilinguals accessed more memories when languages at encoding and retrieval matched than when they mismatched, i.e., Russian-English bilinguals accessed more Russian memories when interviewed in Russian, and more English memories when interviewed in English. Moreover, they were faster accessing Russian memories when interviewed in Russian than when interviewed in English, and faster accessing English memories when interviewed in English than when interviewed in Russian.

In order to localize the effect of language on memory, the experimenters crossed the language of the word prompt with the general language of the interview in a follow-up experiment. For each interview language, half of the prompt words were presented in English and half in Russian, therefore yielding four conditions (Russian interview/Russian prompt words, Russian interview/English prompt words, English interview/English prompt words, and English interview/Russian prompt words). The reasoning behind this manipulation was that, on the one hand, language-dependent memory may be due to the prompt words, i.e. hearing the word *birthday* evokes a situation in which the word was used, which, in this case, is likely to have taken place during life in the United States, and in English. On the other hand, speaking a particular language may create an

overall linguistic context, which exerts influence on memory beyond that of a particular word used to trigger the memory. Results revealed that both variables – word prompt language and the overall linguistic environment – were driving language-dependent memory. Furthermore, when bilingual autobiographical narratives were analyzed for frequency of code-switches (overt switches to the other language using words from that language), it was found that code-switching behavior was influenced by the match/mismatch between languages of encoding and interview (Marian and Kaushanskaya, 2007a). That is, Russian-English bilinguals interviewed in English code-switched to Russian more for memories that were encoded in Russian than for memories that were encoded in English. It appears, therefore, that the match between language of encoding and language of retrieval influences the accessibility of memories not only by influencing which memories are retrieved, but also the ease with which they are reported.

In a follow-up to Marian and Neisser (2000), autobiographical memories of Russian-English bilinguals were analyzed for emotional intensity (Marian and Kaushanskaya, 2004). Each memory was coded for intensity of the expressed emotion using a Likert scale. Results revealed that memories tended to be higher in emotional intensity when the languages of encoding and retrieval matched than when they did not match. Thus, it appears that emotional expression is strengthened by reinstating the encoding language at the time of speaking. This finding is consistent with the overall hypothesis of language-dependent memory, and extends it to content aspects of episodic memory, in addition to memory accessibility and retrieval efficiency.

The notion that both accessibility and emotional intensity of episodic memories are facilitated by the match between the languages of retrieval and encoding is supported by other studies of autobiographical memories. Otoya (1987) used the word-prompt methodology to examine the effect of cultural transition and language on autobiographical memory in Spanish speakers, who learned English as a second language. She found that, although the effect did not hold for all word-prompts, some Spanish word prompts triggered earlier memo-

ries than their English translation equivalents. Other measures, such as internal language of retrieval (i.e., asking bilinguals in which language a memory ‘came to them’ internally, as in Schrauf and Rubin (1998), also corroborate the Marian and Neisser findings. Schrauf and Rubin (1998) studied the internal language phenomenon in Spanish-English bilinguals, and found that memories recalled internally in Spanish tended to come from the pre-immigration stage of the participants’ life, while memories recalled internally in English tended to cluster within the post-immigration age. Evidence for language-dependent memory can also be found in psychoanalytic literature. For instance, Javier et al. (1993) found that memories of bilinguals tend to be richer and more elaborate when retrieved in the language of encoding. Together, these studies of autobiographical memories in bilinguals illustrate the effects of language on episodic memory and provide evidence for language-dependent memory effects in autobiographical remembering.

#### 4 Semantic memory and language in bilinguals

The finding that Russian-English bilinguals retrieved more Russian autobiographical memories when interviewed in Russian, and more English autobiographical memories when interviewed in English Marian and Neisser (2000), demonstrated the language-dependent memory phenomenon experimentally. It also prompted questions about the universal nature of language-dependent memory effects. Is language-dependent memory characteristic of autobiographical retrieval only, or does it extend to other types of memory? To answer this question, Marian and Fausey (2006) and Marian and Kaushanskaya (2007b) tested semantic memories of Spanish-English and Mandarin-English bilinguals in an attempt to generalize the language-dependent memory hypothesis to other types of memory and other groups of bilingual speakers. Marian and Fausey focused on memory for academic-type knowledge, and Marian and Lu focused on memory for real-life semantic information.

#### 4.1 Semantic memory and language in academic learning

Marian and Fausey (2006) tested Chilean Spanish-English bilinguals in an academic setting, and taught them story-form information about History, Biology, Chemistry, and Mythology in two languages, English and Spanish. The stories contained fictitious but reasonable information in order to make the content meaningful while at the same time preventing previous knowledge of the material. The mythology story described a myth associated with celebrating the beginning of winter held by a fictitious group of people. The history story described the causes, course, and consequences of a war between two fictitious nations. The biology story described the flora of a fictitious island. The chemistry story described the accidental discovery and properties of a fictitious chemical element. The participants were then tested in either English or Spanish and answers were coded for accuracy of retrieved information and speed of retrieval (reaction time).

Spanish-English bilinguals showed a language-dependent memory pattern for both response accuracy and response speed when answering questions about the stories they heard. Bilinguals produced more correct answers, and responded faster, when the languages of encoding (story language) and retrieval (question language) matched than when they did not match. Subsequent analyses of response accuracy data revealed that the relative proficiency in the bilinguals' two languages mediated the language-dependent memory pattern, so that only *balanced* bilinguals, with similar levels of understanding in both English and Spanish, remembered information more accurately when the languages of encoding and retrieval matched than when they did not match. For *unbalanced* bilinguals (those who were better at understanding Spanish than English), accuracy in the match and mismatch conditions did not differ significantly. Both balanced and unbalanced bilinguals showed language-dependent memory patterns in speed of response data. Thus, accessibility of semantic memories in bilinguals appears to be influenced by proficiency in the two languages. This influence of proficiency on language-dependent memory may be easier to uncover in studies of semantic retrieval, because

while autobiographical memories are subjective and cannot be scored for accuracy, semantic memories are based on factual information and can be judged as either accurate or inaccurate.

The Marian and Fausey findings corroborate the language-dependent memory hypothesis, and extend it to semantic memory. This study is consistent with monolingual research on the role of context in semantic memory for linguistic material. For instance, Tulving and colleagues found that semantic context played a critical role in remembering linguistic material such as word pairs (Thomson and Tulving, 1970; Tulving, 1972; Tulving and Thomson, 1973). Higham (2002) showed that cue-reinstatement facilitated retrieval of learned word pairs, and Thornton et al. (2002) found that retrieval of semantic memories in patients with Multiple Sclerosis who have memory deficits is facilitated by evoking the contextual environment in which semantic information was learned. Studies with monolingual speakers also suggest that using language with similar phonological features at encoding and retrieval improves some types of learning and memory (Bradlow et al., 1999; Nygaard et al., 2000; Singh et al., 2004). The experiment on context-dependent memory in academic learning extends laboratory-style research (using syllables and word lists) to more ecologically-valid research (using information students are likely to learn in science and humanities classes).

#### 4.2 Semantic memory and language in real life knowledge

The Marian and Fausey study extended the hypothesis of language-dependent memory to semantic memory, specifically, to remembering academic information akin to the kind of information learned in educational contexts. The question remained whether language dependency influenced other types of semantic memory, and generalized to everyday, real-life knowledge. This question was the focus of Marian and Kaushanskaya (2007b) study.

Marian and Lu examined semantic memories of Mandarin-English bilingual speakers who were educated in both China and the United States. Bilingual participants were interviewed in both Mandarin and English, and were asked to recall common-knowledge information

about the everyday world, such as geographical landmarks, famous personalities, and literary characters. At the end of the experiment, each participant was asked to indicate in which language the information was learned, Chinese or English. The question of interest was whether Mandarin-English bilinguals would retrieve more information, and be faster during retrieval in the match conditions than in the mismatch conditions. Findings corroborate those of Marian and Fausey, and indicate that language influences accessibility of semantic memories. Mandarin-English bilinguals retrieved significantly more information when the language of the interview matched the language in which that information was learned than when the two did not match.

In sum, both Marian and Fausey (2006) and Marian and Kaushanskaya (2007b) found evidence for language-dependent semantic memory. When considered together with earlier research on language-dependent memory in autobiographical narratives (Marian and Neisser, 2000), evidence for language-dependent memory appears reliable. In the next section, we consider the idea that language influences not only the accessibility of memories, but also their content. We mentioned the effect of language on emotional content earlier. Next, we focus on such content effects as representation of the self. Because language was found to influence autobiographical retrieval, and because autobiographical memories are linked with a person's identity, language-dependent memory effects on content, if they exist, are likely to be seen in self-construal. The influence of language on self representation is considered within the framework of linguistic relativity, according to which mental representations are language-specific.

## 5 Language and self-concept in bilinguals

Linguistic context at the time of memory encoding and retrieval may influence not only the accessibility of memories, but also their content. The idea that language influences thought has been conceptualized in terms of the linguistic relativity hypothesis, which is based on the differences between languages of the world on the one hand, and

the subjective worldview on the other hand. In one of the most cited quotes on linguistic relativity, the linguistic anthropologist Edward Sapir wrote: "Human beings do not live in the objective world alone, nor alone in the world of social activity as ordinarily understood, but are very much at the mercy of the particular language which has become the medium of expression for their society." (1958, 209). Sapir's student, Benjamin Lee Whorf, further proposed that "we dissect nature along lines laid down by our native languages. The categories and types that we isolate from the world of phenomena we do not find there because they stare every observer in the face; on the contrary, the world is presented in a kaleidoscopic flux of impressions which has to be organized by our minds – and this means largely by the linguistic systems in our minds" (1940, 213).

The work of Sapir and Whorf laid the framework for what is now known as the Sapir-Whorf hypothesis. The stronger version of the hypothesis, *Linguistic Determinism*, proposes that if a language does not contain a linguistic label for a concept, the speakers of that language will not possess that concept. The weaker version of the hypothesis, *Linguistic Relativity*, states that language does not determine thought, but influences cognition by imposing certain constraints on the mental processes. Linguistic determinism has not found much support in empirical studies. For instance, even though the Dani language has only two words for color – *light* and *dark*, Dani people are able to differentiate other colors of the spectrum, i.e., red, blue, green, etc. (Rosch, 1972; Rosch and Olivier, 1972). While the effect of language on thought has not been found across the board (Malt et al., 2003; Li and Gleitman, 2002), evidence for a weaker version of linguistic relativity has been found in a number of domains. For instance, speakers of languages that grammaticalize gender of inanimate objects tend to categorize objects based on gender similarities (Boroditsky et al., 2003), and speakers of a language that employ an absolute system of spatial reference (east/west) tend to have a better sense of direction than speakers of a language with a relative frame of reference (left/right) (Levinson, 1996). We propose that language influences not only how speakers of a language represent the external world, but, in a similar manner, how they represent

their internal world, their self construal. As Kerby wrote, "The self is to be construed not as a prelinguistic given that merely employs language, much as we might employ a tool, but rather as a product of language" (1991, 4-5).

In this sense, when considered within the framework of linguistic relativity, the effect of language on memory and its content may consist of influencing the representation of the self – the way one chooses to describe oneself, one's behavior, feelings, etc.. As Gibson pointed out "Information about the self accompanies information about the environment, and the two are inseparable" (1979, 126). Multiple studies (see Wilson and Ross (2003) for a review) have shown that the way people talk about themselves and their personal experiences influences the way they remember events, with the past continuously rewritten to accommodate the ever-changing self-construal, and with self-construal frequently altered to accommodate memory. Since memory of past events influences a person's self and perception of oneself in relation to the social environment, we hypothesized that for a bilingual, speaking a particular language may influence his or her self-construal.

Marian and Kaushanskaya (2003, 2004) explored the influence of language on memory content by studying the effect of language on self-construal within the context of autobiographical memory in bicultural Russian-English bilinguals, focusing on the individualist/collectivist aspect of the self. The extent to which the self is defined in relation to society, and thus formulates the very basis of human behavior, is often seen as being located on the individualism-collectivism continuum (Triandis, 1995). In individualistic cultures, behaviors and attitudes are attributed to the individual's likes and dislikes, while in collectivist cultures, an individual is seen as part of the whole, and a person's behavior is seen as reflecting influences of society (Chiu, 1972; Heine and Lehman, 1995; Hong et al., 2000; Kitayama et al., 2002; Matsumoto et al., 2002; Ross et al., 2002). On the cultural dimension of individualism-collectivism, the former Soviet Union has been rated as more collectivist (Chirkov et al., 2003; Diener et al., 2000; Hofstede, 2001; Realo and Allik, 1999), while the United States has been rated as more individualistic (Hoistede, 1980;

Triandis, 1995). Marian and Kaushanskaya (2004) examined whether Russian-English bilinguals' self-construal is more collectivist in Russian narratives than in English narratives, and more individualistic in English narratives than in Russian narratives. Previously, differences in self-construal have been observed for bilinguals completing questionnaires in their two languages (Ross et al., 2002).

In Marian and Kaushanskaya (2004) study, frequency of personal pronoun usage was used as the linguistic measure of individualism-collectivism. When narratives were analyzed for personal pronoun usage, it was found that bilinguals tended to describe events using different pronouns depending on the language they were speaking at the time. It was found that Russian-English bilinguals tended to use more 1<sup>st</sup> person singular pronouns, such as *I, me, mine* when speaking English, but tended to use more 1<sup>st</sup> person plural pronouns, such as *We, Us, Ours* when speaking Russian.

In addition to a linguistic measure of individualism-collectivism, a non-linguistic measure coding for the main actor in the story was also used. We predicted that when speaking English, bilinguals would produce more stories in which they themselves were the main actor, but when speaking Russian, bilinguals would produce more stories in which the role of main actor was shared with other people. Indeed, this is what was found: Russian-English bilinguals tended to tell stories in which they themselves were the main actors when telling stories in English, but when telling stories in Russian, Russian-English bilinguals tended to tell stories in which they shared the spotlight with someone else.

Both the linguistic measure (frequency of personal pronoun usage) and the non-linguistic measure (main actor) converged to suggest that Russian-English bilinguals expressed a more individualistic self-construal when speaking English, and a more collectivist self-construal when speaking Russian. In that sense, self-representations appear to be highly fluid, and shift in response to a language cue. When speaking Russian, a Russian-English bilingual will project a self-schema more in line with the Soviet, collectivist view, while when speaking English, the pattern will be reversed. This is akin to findings from the cognitive domain of SPACE, where a person can utilize

multiple systems of spatial orientation, but tends to use the system imposed by the language he or she speaks (Levinson, 1996). Given the experimental design of the study, it is difficult to attribute the effect of shifting self-representations to either language or culture. While it is possible that the bias in describing events using 1<sup>st</sup> person singular pronouns may influence the person's self-construal, it may also be that the bias of pronoun usage itself is due to the individualistic values of the American culture, which seep into language. In fact, the difficulty of teasing apart linguistic and cultural influences on cognitive processes is ubiquitous – language and culture are tightly connected, and cultural affiliations are often defined by shared language. It is difficult, if not impossible, to separate the two in a viable experimental manner, and often, the joint influence of both language and culture on thought has been demonstrated. For instance, Nisbett (2003) suggests that a tendency of Westerners to focus on object categories and a tendency of Easterners to focus on relationship between objects during a categorization task can be attributed to both the difference in the languages spoken in the two parts of the world (nouns, which are referential in nature, predominate in Western languages, like English and German, but verbs, which are relational in nature, predominate in Eastern languages, like Mandarin Chinese and Korean), and to the cultural differences between East and West, with the West encouraging individualism, and the East encouraging collectivism. It is clear that both language and culture contribute to the representations and processes involved in self-construal and now that language dependency effects on self representation have been observed, further studies can consider language dependency effects on memory content in domains that are not sensitive to cultural differences.

## 6 Language-dependent memory: Principles and mechanisms

Studying the interaction between language and memory in bilinguals provides a fertile ground for exploring theories of language-dependent recall, linguistic relativity, and self-concept. In a series of experi-

ments on language-dependent memory with multiple groups of bilingual speakers, language was shown to act similarly to other types of context, and influence accessibility of memories. Memories were more accessible when retrieved in the same language in which they were originally encoded, and the retrieval process was more efficient when the language of retrieval matched the language of learning. As with many phenomena in the field of bilingual research, the effect of language-dependency was influenced by bilinguals' relative proficiency in the two languages. However, language-dependent memory appeared to be a robust enough phenomenon to play a role in both episodic and semantic remembering, as well as in representation of the self. Moreover, language dependent memory was found not only for memories that may have been verbally retrieved before, and thus rehearsed linguistically (like the autobiographical memories in the Marian and Neisser study), but also for memories that have never been retrieved before (like the semantic learning in the Marian and Fausey study). This suggests that while previous experience retrieving memories in a particular language may contribute to language dependent effects in some settings, other processes may offer better accounts of language-dependent memory and are therefore considered below.

The reliability of language-dependent memory may lie in the mark-edness of language. It is possible that for bilingual speakers, the linguistic cue is stronger than any other environmental contextual cue. For bilinguals, the language spoken at any time marks the events that take place around them, thus making language a highly salient part of encoding. In fact, it may be that in a bilingual's daily life, the language chosen to convey information serves to denote a change in meaning. On the other hand, we are inclined to predict that even in circumstances in which the choice of language is entirely arbitrary, language dependent memory will still be observed. Baddeley's (1982) suggestion – that when stimulus and context bear an arbitrary relationship to each other and are perceived as such, the addition of the appropriate context or its deletion or substitution by another will have no influence – may not hold for language dependent memory. That is, a bilingual may show language-dependent memory even in

circumstances in which the relationship between content and language is arbitrary. One could empirically test the role of the relationship between stimulus and language context in an experiment in which bilinguals are presented with lists of words in either one or the other of their languages and memory is later tested in match or mismatch conditions. Our prediction is that memory for word lists would be better in the match than the mismatch conditions, in spite of the absence of a meaningful relationship between stimuli and language. We would also expect language-dependent memory effects to arise in situations in which language of encoding is not easily identifiable (e.g., when recalling a conversation with another fluent bilingual with whom one frequently uses both languages, making it difficult to recall in what language this particular conversation took place).

These predictions are rooted in the observed generalizability of the language-dependent memory phenomenon and build on the hypothesis that language markedness is so strong that it persists in spite of the absence of any meaningful relationship between input and language. Language-dependent memory phenomena are situated within the field of context-dependent memory, and follow the same principles as other contexts subsumed by the encoding specificity principle. However, language-dependent memory may also be underlined by cognitive mechanisms that are specific to language. For instance, Slobin (2003, 177) noted that "it is quite likely that the language in which information is presented - both fictional and documentary - plays a role in the ways in which information is stored and evaluated." Slobin has also suggested that listeners and observers encode information so that it is easy to express linguistically. Encoding information in a way that will be consistent with subsequent retrieval can be formulated as a 'thinking for potential speaking' extension of Slobin's 'thinking for speaking' hypothesis. When applied to bilingual speakers, language-dependent retrieval may be related to bilinguals' expectations about the match and mismatch in the encoding and retrieval languages.

Bilinguals often have well-defined expectations for when they will have to speak each language. If bilinguals have expectations about when encoding and retrieval linguistic contexts will match, they might attend more heavily to those linguistic distinctions important to the

encoding language rather than those of their other language. If bilinguals expect to face a linguistic context at the time of retrieval that is different from the linguistic context at the time of encoding, they may adjust their encoding strategies and encode different information than the kind of information they might encode if they expected the environments at encoding and retrieval to match. The outcome of this strategy may be the advantage experienced by bilinguals when retrieving information in the same language in which it was encoded, similar to the advantage that language-dependent memory predicts.

In addition to Slobin's 'thinking for potential speaking', another possible mechanism for language-dependent memory may be tied to mental representations underlying linguistic expression, and rely on principles of linguistic relativity. Within the framework of linguistic relativity, the content of memory may be affected by the language used to encode and retrieve memories. Language may be influenced by how people remember events by imposing a specific worldview through the linguistic structure and cognitive dimensions it grammaticalizes. Levinson writes, "...given the architecture of the [cognitive] system, once one puts serious semantic constraints on the output, the rest of the system will be forced to support, code, and operate on those features. And so the imprint of language-specific categories will run deep in cognitive processes" (2003, 301). For bilingual speakers, it may be the case that a match of encoding and retrieval linguistic contexts promotes recall of language-specific representations. These language-specific representations may act as an additional mechanism driving language-dependent memory. Most likely, a combination of mechanisms – language markedness, encoding strategy adjustments in 'thinking for potential speaking', language-specific representations, language as a mental frame and a cue – actively interact to yield language-dependent memory effects in bilingual learning. Further research is necessary to fully understand the complex relationship among the many interacting variables.

Research on interactions between language and memory in bilingual speakers carries multiple applied implications for the fields of psychotherapy, witness testimony, and education. For instance, the finding that, for Chilean Spanish-English bilinguals, information is

more accessible when probed in the same language in which it was encoded, may provide at least a partial explanation for lower academic achievement levels reported for Hispanic students tested in US American schools (Coltrane, 2002; Llagas, 2003), who are likely to have encoded at least some semantic information in their first language and had to retrieve it in the academic context of the second language. Similarly, the finding that emotional expression is stronger when the languages of encoding and retrieval match than when they mismatch, as in Marian and Kaushanskaya (2004), may have direct consequences for psychotherapy, and be a more reliable tool for assessing memories than the traditionally used distinction of the native vs. second language (Bond and Lai, 1986; Gonzalez-Reigosa, 1976).

The generalizability of language dependency to different types of memory is thought-provoking, given that the ultimate goal of learning (especially in an educational setting) is to decontextualize knowledge. Future experiments on language-dependent memory could vary the length of time between learning and testing as well as the surface form of material and of questions probing learning, and could incorporate rehearsals as well as cross-modal learning and testing (e.g., written language). It will also be useful to examine whether language is an important element of context for bilingual speakers only, or whether language-dependent memory would also reveal itself in bi-dialectal speakers (for instance speakers of Standard American English and African American English) and across different linguistic registers. These manipulations would enable us to test the ubiquity of language dependent memory and the different variables that influence its magnitude.

We'll close with the example of Mr. M. (Aragno and Schlachet, 1996), a bilingual client undergoing psychotherapy in English whose treatment breakthrough occurred when he translated a word from one of his dreams from English to Spanish (the language of his childhood). In a recurrent dream involving a bear, a cursive translation of the word *bear* to the Spanish *orso* jolted M.'s memory by cueing an association to someone whose nickname was Orso. The English translation equivalent did not provide access to the dream's meaning, the original Spanish label did. M.'s case falls somewhere at the ex-

treme end of the continuum of language dependent memory effects, yet it is an example of language dependent memory as described and studied in this chapter. For those who speak two languages, language choice and use at encoding and retrieval may matter a great deal and may carry cognitive and emotional consequences.

### Acknowledgements

The authors would like to thank Caitlin Fausey for her contributions to this work, Henrike Blumenfeld, Li Sheng, and Margarit Tadevosyan for their comments, and the National Institute of Health NICHD 1R03HD046952 grant for support.

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