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CHAPTER 7

Language interaction as a window into bilingual cognitive architecture

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The present chapter approaches bilingual language interaction from a psycholinguistic perspective and considers bilingual switching and transfer within the cognitive architecture of language representation and processing. Specifically, switching (overt use of words from the other language) and transfer (covert use of linguistic structures from the other language without overt switching to that language) are discussed across syntactic and semantic constraints, across lexical class (nouns, verbs), and across concrete and abstract entities. We suggest that language architecture (e.g., semantic representation, lexical access) and linguistic environment influence the nature of cross-linguistic interaction in bilinguals.

Keywords: code switching, language interaction, bilingualism, psycholinguistics, transfer, semantic representation

Introduction

"My French and my English play with one another as two children do in a playground."

(Federman, 1993)

Studying cross-linguistic interaction can provide important insights into bilingual cognitive architecture and the organization and processing of language. Existing

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psycholinguistic research suggests that a bilingual's two languages interact during both comprehension and production at the phonological (e.g., Blumenfeld & Marian, 2007; Brysbaert, Van Dyck, & Van de Poel, 1999; Dijkstra, Grainger, & van Heuven, 1999; Marian & Spivey, 2003; Spivey & Marian, 1999), orthographic (e.g., Bijeljac-Babic, Biardeau, & Grainger, 1997; Kaushanskaya & Marian, 2007; Van Heuven, Dijkstra, & Grainger, 1998), syntactic (e.g., Harrington, 1987; MacWhinney, 1987), and semantic levels (e.g., Basden et al., 1994; Snodgrass & Tsivkin, 1995).

The present chapter discusses cross-linguistic interaction during bilingual language production, focusing specifically on the psycholinguistics of bilingual switching and transfer behaviors. Although exact causes of cross-linguistic interference effects in spontaneous speech are often difficult to pinpoint, psycholinguistic studies of bilingual language processing have revealed a number of variables that are particularly relevant in switching and transfer behavior, including syntactic and semantic aspects of language, grammatical class, concreteness effects, and bilingual status. Here, we consider the constraints placed by these variables on language interference. The chapter starts with a general overview of switching and transfer behaviors, followed by discussions of syntactic effects, semantic effects, lexical category effects and concreteness effects on language interaction. In addition to these structural aspects of language, the role of linguistic environment and the speaker's language experience are considered. Finally, implications for models of bilingual language production are discussed and final conclusions are drawn at the end of the chapter.

Bringing these topics together into one paper aims to accomplish two goals. One is to help explain switching and transfer from a psycholinguistic standpoint, thus complementing the linguistic and sociolinguistic papers in this volume. The second is to contribute to the understanding of the dynamic nature of bilingual cognitive architecture. The two goals mutually complement each other – by explaining language interaction in bilingual speech we gain a better understanding of bilingual cognitive architecture, and by drawing on existing psycholinguistic knowledge of bilingualism we help advance the study of switching and transfer behavior. In essence, to understand bilingualism, one has to understand language interaction; to understand language interaction, one has to understand switching and transfer; to understand switching and transfer, one has to understand language structure and the potential constraints it may place. What follows next is therefore an attempt to contribute to this body of knowledge.

Switching and transfer

During language production, bilinguals frequently exhibit overt and covert influences from the non-target language. Overt interaction consists of switches into the other language, with bilinguals using words or phrases from the non-target language. Covert interaction consists of transfer from the non-target language without actively switching to the other language overtly; in other words, using the target language in a way that is semantically or syntactically inappropriate for the target language, but consistent with the non-target language. For example, when a Russian-English bilingual says *"he called my babushka's doorbell"* (a modified example selected from narrative data collected in our laboratory), the noun *'babushka'* represents a switch to Russian to denote 'grandmother' and the inappropriate use of the verb *'called'* instead of *'rang'* represents a cross-linguistic transfer from Russian, where the verb *'pozvonil'* denotes both *'called'* and *'rang'*. Many of the errors made by bilinguals are in fact a product of language interaction and result from cross-linguistic influences of the non-target language onto the target language. (For a detailed discussion of viable definitions, distinctions, and problems with contrasting switching and transfer, see the chapter by Terence Odlin in this volume. Note also that the distinction between switching and transfer is not unlike the distinction that contact linguists make between borrowing and transfer/imposition, or between direct and indirect infusion.)

It has been suggested that cross-linguistic interaction during bilingual language production results from similarities and differences between the target language and any other language that has been previously acquired (Odlin, 1989). Language interaction in bilingual production is well documented (e.g., Gass, 1996; Jarvis & Odlin, 2000). Most studies have focused exclusively on the influence of L1 on L2, however evidence that L2 can also influence L1 is mounting (e.g., Bernardini & Schyler, 2004; Heredia & Altarriba, 2001), supporting the view that cross-linguistic influences are bi-directional (Pavlenko & Jarvis, 2002). Proposed causes of cross-linguistic interaction include lack of proficiency in the weaker language, retrieval problems, and ease of communication between bilinguals (e.g., Heredia & Altarriba, 2001), with interaction more likely in, but not limited to, a mixed language environment in which the co-activation levels of the two languages are higher.

Although linguistic influences from the non-target language are sometimes viewed as a stepping stone on the way to proficiency in the second language (Schachter, 1983), it is understood that code switching and transfer are not necessarily tied to proficiency. In fact, it seems that possibilities for transfer multiply as knowledge of L2 increases (Bhardwaj, 1986; Kellerman, 1983; Klein, 1987). Even highly proficient bilinguals can exhibit switching and transfer behaviors as a result of (a) differences in the structures of the two languages, and (b) differences in the

language setting and previous experience using the two languages (including habitual switching behavior).

As far as differences in the structures of the two languages, influences of linguistic architecture on bilingual transfer and switching stem from the fact that languages vary across semantic and syntactic properties. These structural cross-linguistic differences influence the organization of the bilingual lexicon, with languages interacting either on-line via a processing-based account (e.g., both during comprehension and production, as a result of co-activation and connections between different linguistic structures, levels, and languages), and/or off-line via a representation-based account (e.g., as a result of language acquisition and concept formation). The concepts of representation and processing in psycholinguistic research on bilingualism, including in research on switching and transfer, are as important to understand as they are difficult to separate. To be precise, most phenomena observed in psycholinguistic studies of bilingualism, including reaction time and accuracy data and frequency and type of code switching and transfer data, are driven by both representational and processing differences. Delineating the individual contribution of each is often difficult, if not impossible, since differences in representation usually result in differences in processing and processing differences can alter representational features. Here, we acknowledge that both representational aspects and processing aspects play a role in the ways languages interact in a bilingual system, and our attempts to consider the two when explaining code-switching and transfer phenomena are rooted in the understanding that these are only preliminary forays into this area, with additional work to be done in the future to understand how representational and processing aspects contribute to language interaction phenomena. In general terms, the *processing*-based account suggests that the non-target language influences selection of structures in the target language during on-line lexical access. The *representation*-based account suggests that language interaction is a product of change to the mental representation. These changes are manifested when, after acquisition of a second language, second-language structures are used during first-language production (e.g., Wolff & Ventura, 2003), or when, as a result of fossilized representations acquired through the first language (e.g., Waxman, 2004), first-language structures are used during second-language production (however, note that L1 influence is only one possible cause of fossilization).

Influences of the language environment on such forms of bilingual language interaction as switching and transfer include language used at the time of speaking and, if bilinguals are describing a previous experience, the language in which the described experience originally took place (e.g., Marian & Neisser, 2000). Influences from the bilinguals' language-use experiences stem from recency of use of the two languages, previous experience using the two languages with specific

topics, and variability in emotional emphasis across the two languages (e.g., Heredia & Altarriba, 2001). For example, bilinguals are more likely to switch to a non-target language if they have more experience using the non-target language with a specific topic and particular terminology associated with that topic.

Constraints on language interaction that operate on the syntactic level

Many language interaction phenomena experienced by bilinguals stem from application of syntactic rules of one language while using the other language. In an adult bilingual cognitive system, the syntax of the two languages is somewhat integrated. Shared aspects of grammar are believed to be represented in the system once and used when speaking both languages, but language-specific aspects of grammar are believed to be represented separately for two languages (e.g., Hartsuiker, Pickering, & Veltkamp, 2004). When syntactic rules differ across the two languages, syntactic expression in the target language can be influenced by the stored syntactic knowledge for the non-target language, thus yielding a detectable variance in language use. Syntactic transfers refer to constructing phrases and sentences that are grammatically deviant in the language spoken, but are consistent with the grammatical rules of the other language. These can include word order, inappropriate omission of pronouns (i.e., pro-drop), inappropriate use of determiners (i.e., *a*, *the*), inappropriate use of inflectional grammar (e.g., singular/plural), inappropriate use of grammatical gender, noun-verb and singular-plural agreement, etc.. Examples collected in our laboratory (Marian & Kaushanskaya, 2007) that show syntactic transfers from Russian while speaking English are provided below:

- 3.1. "because otherwise I was screaming" for "because otherwise, I would scream"
- 3.2. "I gave that essay to read to my teacher" for "I gave that essay to my teacher to read"
- 3.3. "I was there just with my grandmother" for "I was there with just my grandmother"
- 3.4. "when I first time drove" for "when I drove for the first time"
- 3.5. "the first what I saw" for "the first thing I saw"

In all of these cases, bilinguals use language in a way that is inappropriate for English, but is consistent with Russian morpho-syntactic rules or lexico-semantic representation.

In a recent study, Marian and Kaushanskaya (2007) collected 752 narratives from forty-seven Russian-English bilinguals and examined switching and transfer in bilingual language production. Results revealed syntactic transfers in both languages, suggesting that syntactic representations influence each other across languages during bilingual production. Syntactic transfers were more frequent when speaking the first and more-proficient language than when speaking the second and less-proficient language (e.g., Marian & Kaushanskaya, 2007), suggesting that L1 syntax may be more sensitive to cross-linguistic influence from the second language. While the exact reasons for this are unclear, three possible mechanisms may be driving the effect. The first relies on the native/non-native language distinction. Acquisition of a second-language is often tied to acquisition of new grammatical rules and the newly-acquired grammatical rules are then used in lieu of the earlier-acquired grammatical rules when speaking the native language (this is an unlikely mechanism, however, because bilinguals are generally able to differentiate the grammatical rules associated with each of their two languages and to select the grammar appropriate to the target language). The second and most likely explanation for increased syntactic transfer when speaking L1 is not tied to the native/non-native distinction, but to how specific or ambiguous the syntactic rules of the two languages are (an explanation similar to markedness constraints used in linguistics). That is, the increased likelihood of syntactic transfer is tied to the nature of grammatical rules in the two languages, with one language being more opaque and having fewer syntactic rules and the other language having more specified and detailed syntactic distinctions. These differences are not usually general across the entire language, but are localized to a specific distinction within a language; in other words, it is not that one language is more opaque overall, but rather that it is more opaque with regards to one specific linguistic distinction and relative to one specific language. For instance, whereas Russian possesses three grammatical genders for inanimate objects (feminine, masculine, neuter), English does not. Fluent Russian-English bilinguals who do not use grammatical gender or use it incorrectly when speaking Russian may do so due to decreased sensitivity to grammatical gender as a result of English use. One way to think about it is that distinctions made by the native language, but not by the second language, become more blurry than distinctions made by both languages and the more ambiguous syntactic rules of the second language influence production in the first language. The flip side of this process is that the opposite can take place when the second language has more specific distinctions than the first language. If the native language does not make a particular syntactic distinction and the second language does, acquiring these distinctions during second language learning may also alter syntactic processing in the first language. For example, if the native language relies on free word order and the second language places specific constraints on word

order, it is likely that the L2 word order constraints become applied when using the native language as well. However, these transfers of word order constraints may be difficult to detect because they are grammatically correct in the language that allows free word order. To detect transfers from a language that is syntactically more ambiguous into a language that is syntactically less ambiguous, researchers would have to examine rates of use of specific word order patterns in monolingual speakers and compare them to rates of use of the same word order patterns in bilingual speakers who acquired a syntactically less ambiguous language. In sum, a detectable syntactic transfer may be especially likely to take place when speaking a language in which syntactic rules are more specified and may be less likely when speaking a language with more lax/ambiguous syntactic rules. This explanation is similar to the markedness constraints concept used in linguistics, as well as to the constraints described in the Competition Model proposed by MacWhinney and colleagues (e.g., MacWhinney, 2005, 1987). Finally, a third potential explanation is closely tied to proficiency levels across the two languages, with syntactic transfer more likely when speaking a less proficient language than when speaking a more proficient language. The role of proficiency in patterns of language interaction is discussed in more detail later.

Constraints on language interaction that operate on the semantic level

In bilinguals, the semantic systems pertaining to the two languages appear to be integrated, with concepts shared across both languages (e.g., Basden, Bonilla-Meeks, & Basden, 1994; Snodgrass & Tsivkin, 1995). Yet, concepts may be viewed as sums of multiple features (De Groot, 1989) and even concepts that are shared for the most part may include features that are unique to each language. Because different languages may conceptualize the same notion in different ways (e.g., Boroditsky, Schmidt, & Phillips, 2002; Bowerman & Choi, 2001; Gumperz & Levinson, 1996), the semantic representations in bilinguals may remain somewhat distinct for the two languages. That is, while lexical translation equivalents share many conceptual features, they do not always share all of them (Van Hell & de Groot, 1998a). Activation of a lexical item activates all conceptual features associated with it, including those that are idiosyncratic to the non-target language. Therefore, preparation of a message in a target language includes activation of both shared and idiosyncratic features, co-activating the lexical item in the non-target language, a hypothesis confirmed by empirical evidence (e.g., Colomé, 2001; Costa, Miozzo, & Caramazza, 1999). When parallel activation of a lexical item in the non-target language entails a meaning not subsumed by the target language, cross-linguistic switching or transfer may occur.

Marian and Kaushanskaya (2007) found more lexical/semantic transfers when speaking the second language than when speaking the first language. Finding more lexical/semantic transfers when speaking the second and less proficient language is consistent with previous results that transfer is more prevalent when speaking a lower-proficiency language (e.g., Döpke, 1992). Although semantic transfer can and does take place when speaking the native language, the finding that it is more frequent when speaking the second language suggests that L1 semantic representations may be more stable and more likely to transfer relative to L2 semantic representations. Further, the pattern of results obtained for semantic transfer differs from the pattern of results obtained for syntactic transfers, suggesting that the two may be differentially susceptible to cross-linguistic influences. Specifically, L1 syntax may be more sensitive to cross-linguistic influence than L1 concepts, with L1 syntactic structures more malleable than conceptual representations acquired during first-language acquisition. Conversely, L2 conceptual representations are more likely to be influenced by L1 concepts, but L2 syntax is more likely to seep into L1 use. In other words, it may be that early acquisition may be more important for strength of conceptual representation, while recency may be more important for syntactic strength.

Examples of semantic transfers from Russian while speaking English are provided below:

- 4.1 “ordered a song for me” for “requested a song for me” – here, the verb *requested* has been replaced with the verb *ordered* because in Russian the same verb is used to refer to both, suggesting that the conceptual representation for ‘ordered’ and ‘requested’ may be somewhat different and potentially more fused for Russian-English bilinguals relative to English monolinguals.
- 4.2 “somewhere under Rome” for “somewhere near Rome” – here, the spatial representation of Russian-English bilinguals may be different from that of English monolinguals as illustrated by the fact that in Russian the locative preposition *under* is used to denote the location of any suburb or smaller town relative to a big city, while in English *under* is used to denote a location that is typically below an item only.
- 4.3 “she left into the second grade” for “she left during the second grade” – here, the preposition *into* is used incorrectly instead of the preposition *during* due to differences in ways Russian and English express motion and duration, specifically due to differences in ways in which the prepositions *in*, *into*, and *during* are used.

Moreover, some transfers, such as the transfer “trip in the wood,” include both grammatical (morphological) and semantic components. Here, in terms of

morphology, inflectional grammar was used incorrectly, singular ‘wood’ should have been plural ‘woods.’ In terms of conceptual representation, in Russian the noun for ‘woods’ is singular (*lyes*). A bilingual Russian-English speaker therefore uses inflectional grammar incorrectly probably because his or her conceptual representation of the word may be different from that of a speaker for whom the word ‘woods’ is in plural form. It is quite possible that Russian speakers represent the concept of woods more as a holistic entity (as one thing, one unit), or at least more so than English speakers. In other words, the observed transfer, although grammatical in nature, may stem from representational differences associated with the fact that in Russian the corresponding translation equivalent is a lexical word in singular form. For example, a bilingual who has no difficulties distinguishing between the words *finger* and *toe* when hearing them in English, but who consistently makes production errors in which *toes* are labeled *fingers* is likely influenced by the lexico-semantic representations of the first language in which no lexical distinction between the two is made and the same word is used to refer to both (as is the case for Russian or Romanian, for instance). This is not to say that Russian-English or Romanian-English bilinguals do not know the difference between the two – they are perfectly able to distinguish toes and fingers; rather, it suggests that their mental representations of *fingers* and *toes* may be less delineated than in speakers of languages that use distinct lexical units for the two words. Such production errors are a result of cross-linguistic transfer that may be due to fused conceptual representations (thus a representation-based account) or to parallel activation during lexical access (thus a processing-based account). They are also likely tied to frequency of use and have been suggested to sometimes lead to the attrition of one of the lexical labels in the semantically divergent pair of concepts (Isurin, 2000). The two possible mechanisms are represented graphically in Figure 1.

Additional research will need to explore whether such transfers are due to changes to the semantic representation or to parallel activation and interference of the non-target language during lexical access. It is possible that transfers that are rooted in representational differences are more likely to be produced consistently (at least until the conceptual representations undergo further changes), while transfers that are rooted in processing differences are more likely to be produced only some of the time. However, it is difficult to disambiguate language-interaction effects from deficiencies of knowledge, since transfers that are rooted in conceptual melding of the two languages are likely to be produced repeatedly. Future research would have to either document knowledge acquisition longitudinally or target specific structures experimentally for evidence of correct use.

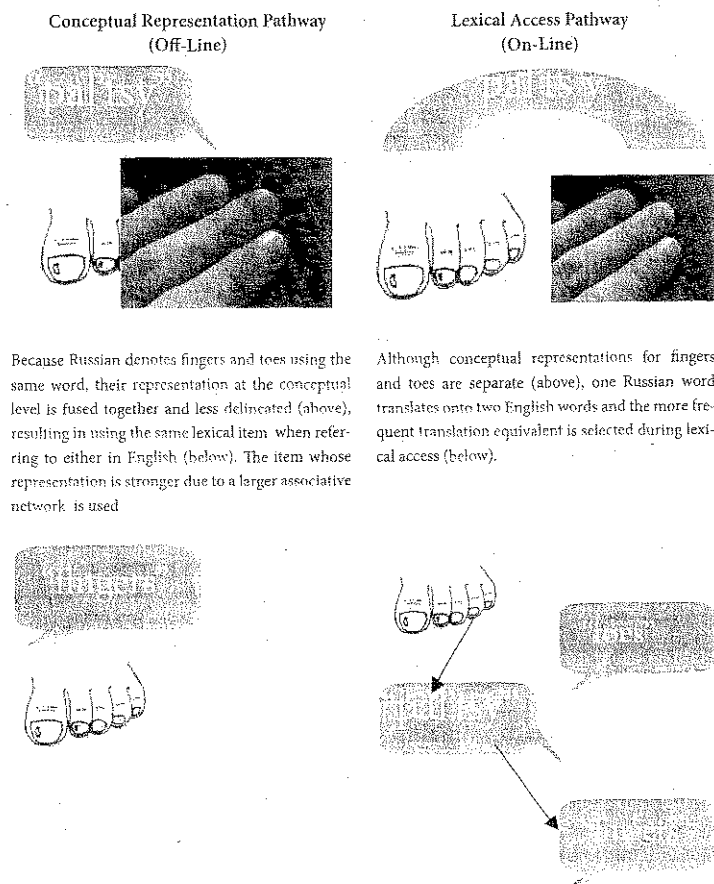


Figure 1. A graphical representation of the two possible mechanisms driving cross-linguistic transfer in bilinguals. Each of these mechanisms may operate independently, or the two may act together, to produce cross-linguistic interaction during production

Constraints on language interaction that operate on the level of lexical category

Given that differences in semantic and syntactic representations drive language interaction, any systematic variability in organization of the lexicon may then manifest itself in switching behavior. One of the main organizing principles of conceptual and syntactic representations relies on differences between grammatical categories, most notably between nouns and verbs. Previous studies have shown that nouns and verbs differ in a number of ways; for instance, nouns depict entities, which can often be identified by a set of sensory properties, while verbs depict relations between entities and are more difficult to define by sensory properties (Gentner 1981, 1982; Joannette & Goulet, 1991; Paivio, 1986; Zingeser & Berndt, 1990). Moreover, actions and relations, which are expressed by verbs, are encoded by other grammatical categories as well, and vary more drastically across languages (Gentner, 1981, 1982; Slobin, 1996). We know that nouns are generally acquired earlier than verbs (at least in English, e.g., Bates et al., 1994; Choi, 1997; Gentner, 1982; Nelson, 1973), are easier to access than verbs (e.g., De Bleser & Kauschke, 2003), and are more tied to real-world referents than verbs (e.g., Gentner, 1981, 1982).

Consistent with these differences between nouns and verbs in monolinguals, the two grammatical categories also show different organizational patterns in the bilingual lexicon. Using a bilingual word-association task, Van Hell and de Groot (1998a) found that nouns elicited more similar responses and shorter reaction times across languages than verbs, suggesting that verbs may be represented in language-specific conceptual stores, while conceptual representations for nouns may be more integrated in the bilingual lexicon. Further, it has been suggested that memory for nouns is superior to memory for verbs (Earles & Kersten, 2000; Engelkamp, Zimmer, & Mohr, 1990; Kintsch, 2001) and that memory for verbs is more dependent on reinstating the linguistic context of the original encoding than memory for nouns (Kersten & Earles, 2004). Because fluent bilinguals switch between languages, the changing linguistic context may influence encoding of nouns and verbs, and may result in different cross-linguistic interaction patterns for the two grammatical classes. Specifically, because verbs are more tied to a specific linguistic context, nouns may be more "portable" across languages and contexts, as a result verb-encoding may be more influenced by language change than noun-encoding. (Note that in addition to the meaning part of the lemma, the syntactic part likely plays an important role in generating the difference between nouns and verbs as well.)

Empirical research supports these predictions. Studies on language switching suggest that switches occur more frequently on nouns than on verbs (e.g., Angermeyer, 2002; Joshi, 1985; Myers-Scotton, 1993). For transfer, both noun transfer (e.g., Jarvis & Odlin, 2000; Pavlenko & Jarvis, 2000) and verb transfer (e.g., Helms-Park, 2001; Wolff & Ventura, 2003) have been documented. For

example, Marian and Kaushanskaya (2007) found different patterns of language interaction for nouns than for verbs: Verbs were subject to covert cross-linguistic transfer more than nouns (227 instances or 0.53% for verbs vs. 79 instances or 0.17% for nouns, $p < 0.05$), but nouns were subject to overt cross-linguistic switches more than verbs (23 instances or 0.24% for nouns vs. 3 instances or 0.03% for verbs, $p < 0.05$). Such findings reinforce existing knowledge about the organization of the bilingual lexicon, as well as existing knowledge about processing differences between nouns and verbs. In the bilingual lexicon, nouns are more likely to be integrated across the two languages, and verbs are more likely to be represented in language-specific conceptual stores (Van Hell & de Groot, 1998a). In addition, verb meanings (e.g., action, motion, etc.), by virtue of being encoded by additional grammatical categories (or arguments within the verb phrase), are more tightly interconnected within a sentence, making them more difficult to switch as single words intra-sententially (e.g., Joshi, 1985; Myers-Scotton, 1993). Therefore, language interaction that takes place at the lexical level influences nouns more than verbs (since nouns are more integrated conceptually and easier to access lexically) and language interaction that takes place at the conceptual level influences verbs more than nouns (since verbs are more distinct conceptually and are more connected within a sentence). It is therefore not surprising that more switches take place for nouns and more transfers take place for verbs.

The findings that switching is more prevalent for nouns than for verbs is consistent with Muysken's (2001) hierarchy of borrowability: A similar hierarchy for transfer has yet to be developed, with future research needed to compare and contrast patterns of switching and transfer for adjectives, adverbs, function words, and so on. It is likely, for instance, that closed class words (such as prepositions, determiners, modifiers, and complementizers) are more prone to transfer than to switching. Open class words (such as nouns, verbs, adjectives, adverbs), on the other hand, may vary in the direction of the difference depending upon their relation to other grammatical categories, representational and processing differences, and acquisition patterns. For example, adjectives may mirror the patterns observed for nouns, while adverbs may mirror patterns observed for verbs. These theory-driven hypotheses need to be tested empirically, requiring extensive samples of bilingual speech with copious instances of language interaction to be analyzed statistically in future studies.

Constraints on language interaction that operate on the concreteness level

Within each grammatical class, some nouns and verbs are more concrete than others. For example, nouns referring to imageable concepts (e.g., *apple*) are more con-

crete than nouns referring to unimageable concepts (e.g., *peace*). Similarly, verbs referring to highly-imageable actions (e.g., *jumped*) are more "concrete" than verbs referring to feelings or states (e.g., *felt*). Concreteness has been found to facilitate noun acquisition and processing so that concrete nouns are more easily acquired by children (e.g., Brown, 1957; Gentner, 1982), and are recognized and processed more rapidly by adults (e.g., Kroll & Merves, 1986; Paivio, 1971; Strain, Patterson & Seidenberg, 1995). Schwanenflugel and Shoben (1983) suggested that concrete words rely on greater availability and greater processing ease than abstract words, and Plaut and Shallice (1991) suggested that processing of concrete words is supported by more semantic features than processing of abstract words. In studies with bilinguals, concrete nouns were translated faster than abstract nouns (e.g., De Groot, Dannenburg, & Van Hell, 1994; Van Hell & De Groot, 1998b), and showed more reliable cross-linguistic priming effects than abstract nouns (e.g., Jin, 1990; Paivio, Clark, & Lambert, 1988). Van Hell and De Groot (1998b) suggested that meanings of concrete translation equivalents share more features, while features of abstract translation pairs may be more language-specific. Moreover, meanings of abstract translation equivalents may be less similar than meanings of concrete translation equivalents (e.g., Taylor, 1976), and may depend more on linguistic context than concrete words (e.g., Breeding, Saffran, & Coslett, 1994).

Just as processing of nouns is influenced by concreteness, so is processing of verbs influenced by the degree to which a verb is tied to its perceptual referent. For example, verbs of motion such as *ran* and *walked* are likely to be more concrete, while state verbs such as *liked* and *imagined* are likely to be more abstract. Action and state verbs have been found to be processed differently in bilingual contexts, with classification of motion verbs taking longer than classification of state verbs in the first language, but not in the second language, possibly due to greater interconnectivity of verbs in the first language compared to the second language (Segalowitz & De Almeida, 1992). Moreover, languages differ in how they encode verbs (Slobin, 2003), especially action verbs of motion, such as "walked" (Talmy, 1975, 1985, 2000). For example, unlike English, Russian has an extensive prefixal system that encodes the direction of action. A Russian-English bilingual who says "come to the house" instead of "come into the house" is likely adapting the Russian verb-framed system (instead of the English satellite-framed system), in which the same preposition 'v' would be used to denote both *to* and *into*, and the difference would be marked with a prefix before the verb 'come' (*prishel v dom* versus *voshel v dom*, where the prefix "pri" signifies movement toward and the prefix "vo" signifies movement inward). The lack of difference between the two prepositions in Russian is transferred to the use of preposition in English, with the speaker transferring the assumption that motion direction is encoded within the verb. Use of the Russian verb-framed system (where direction information is encoded within the verb by

changing the prefix) while speaking English is an example of grammatical transfer resulting from grammatical differences between the two languages.

Marian and Kaushanskaya (2007) found more transfers for concrete than for abstract nouns and more transfers for action verbs than for state verbs (the relatively low number of noun and verb switches did not permit meaningful statistical analyses of switching rates between concrete versus abstract nouns and verbs). The higher number of transfers for action verbs could be due to the variable nature of representations for relations across languages, the high susceptibility of relational terms to language influences, and the differences in motion verb encodings across languages. Another mechanism driving transfers for action verbs may rely on the nature of L2 learning, with L2 words often learned in a linguistic context (either in a classroom setting or by forming translation equivalents, as opposed to matching entity to word during language acquisition in the real world). In a study of adult language learning, Gillette et al. (1999) found that adults learning words from a linguistic context (e.g., written sentences) acquired action verbs with more difficulty than state verbs. If action verbs are learned with more difficulty than state verbs in linguistic contexts, and if much of adult second-language learning takes place in a linguistic context, then it is not surprising that action verbs are more susceptible to transfer. Although this does not explain the pattern in the first language, it is likely acting as part of a cumulative mechanism that relies primarily on cross-linguistic interconnectedness for concrete nouns and verbs. The converging patterns of concreteness effects across nouns and verbs suggest that the concreteness constraint acts similarly on different grammatical categories.

It is feasible to suggest that concreteness effects and lexical category effects may act at different levels in the processing stream. Conceptual differences between nouns and verbs (verbs are represented in more language-specific ways, etc.) may make verbs more susceptible to cross-linguistic influences stemming from semantic representation. In other words, because differences between verbs across languages are postulated to be at the level of semantic representation, cross-linguistic influences are expected to stem from the semantic representation level for verbs. Meanwhile, because concrete nouns (and action verbs) are more integrated in the bilingual lexicon than abstract nouns (and state verbs), translation equivalents and their semantic neighbors are more likely to be co-activated during production of concrete items than during production of abstract items (e.g., Van Hell & De Groot, 1998b). Co-activation of non-target language translation equivalents for concrete entities may make them more vulnerable to processing-based transfer. Thus, it is possible that concreteness effects are more likely to act at the lexical level, while word-class effects (verbs vs. nouns) are more likely to draw upon the representational level, in addition to the lexical level. Noun/verb effects may be a result of representational differences between the two grammatical classes, while

concreteness/abstractness effects may be a result of processing differences in activation patterns. However, boundaries between conceptual and lexical representations have yet to be clearly defined (e.g., although lemma access is not typically considered to take place at the level of semantic representation, its exact placement and even its very existence as a bona-fide level continues to be debated), making discussions of grammatical classes and concreteness effects at different levels in the processing stream very preliminary and in need of further empirical research.

Finally, there are two other possible methodological factors that are contributing to finding a greater number of transfers for concrete vs. abstract nouns. One is the number of synonyms available—since concrete words tend to have fewer synonyms than abstract words, it could be more difficult to detect the transfer of an abstract concept. In the same vein, transfer of state verbs may be more difficult to detect, due to greater flexibility in ways of expressing mental states than in ways of expressing actions and motions. The other methodological factor is the number of possible translations that concrete and abstract words may have. For example, Tokowicz and Kroll (2007) found that the number of translation equivalents and the associated ambiguity influence within and across-language processing. Future research will need to examine empirically how the number of synonyms and the number of translation equivalents a word has influence patterns of language interaction.

Role of language environment and language experience

As mentioned in the introduction, in addition to the structure of the two languages, patterns of language interaction can also be impacted by language environment and the bilingual's previous language experience. (For a thorough review of the literature on the role of language environment and bilinguals' language history in patterns of language interaction in bilinguals, see the Altarriba chapter in the present volume.) Interestingly, the effect of language experience on language interaction has been found to vary across the two types of cross-linguistic influence, with switches and transfers showing different patterns. Marian and Kaushanskaya (2007) found that bilinguals were more likely to switch when speaking their first and more proficient language, a result consistent with previously reported code-switching patterns in bilinguals (Heredia & Altarriba, 2001). The pattern of language transfer differed from the pattern of code switching in that more transfers were observed when speaking the second and less proficient language. The bilinguals tested in the Marian and Kaushanskaya (2007) study were college students in the USA who grew up speaking Russian in the former Soviet Union and immigrated to the United States in their early teens. They acquired their second language in the USA and were highly proficient in both languages at

the time of testing. While most of the bilinguals tested indicated that L2 was their preferred language, they were rated as more proficient in their L1 than in their L2 by independent bilingual coders (based on error rates, disfluencies, accent, etc.). Whether or not the results obtained from that study can be generalized to other bilingual populations, and how the patterns may differ for bilinguals whose second language is the more proficient language, are questions for future research.

In addition to effects of proficiency, switching and transfer may also be driven to some extent by accessibility and sociolinguistic factors such as linguistic context, language status, etc.. It is possible that the bilinguals in Marian and Kaushanskaya's study borrowed more English words when speaking Russian because English was the language of the immediate surrounding environment (the campus of an American university). The immediate linguistic environment may have influenced the frequency of use and relative status of English, causing higher activation of English lexical items. An alternative explanation is rooted in acquisition patterns. Switching may be more frequent when speaking Russian because some of the concepts that have been acquired in an English-speaking environment had no equivalents in Russian when the speaker lived in a Russian-language environment. Although labels have since become available in Russian and are known to the bilingual, the English labels continue to be used as a result of acquisition order and previous experience using one, but not the other, label. It is likely that bilinguals with different proficiency levels in their two languages, with different language history backgrounds, or in a different linguistic setting would show different patterns of cross-linguistic influence. Separating out the individual contributions of proficiency, order of acquisition, and specific language is often difficult. Moreover, sociolinguistic factors such as language status, prestige/stigma associated with a language and the local production context may also impact language interaction. For instance, the number of switches would likely decrease if participants were interviewed by monolingual speakers of the two languages and would likely increase if participants were interviewed by a bilingual who habitually switched between the two languages. Such differences would only be observed for language interactions that result from on-line interference, but not for those that stem from modification of the conceptual representation. In general, the influence of perception on code switching in production is only at early stages of investigation (but see Kootstra & van Hell, this volume).

An interesting finding in Marian and Kaushanskaya's 2007 study is that bilinguals switch more when speaking about an event that took place in the other language. For example, when a bilingual speaking in Russian used the English word 'apartment' instead of the Russian word 'kvartira' when talking about finding an apartment upon their arrival to the US ("*nashli apartament*"), what contributed to this switch was likely the fact that English was being spoken (including the actual use of the English word 'apartment') when the original event took place. That is,

when speaking Russian, bilinguals were more likely to switch to English if talking about an event during which English was used than if talking about an event during which Russian was used. This increase in switching behavior when there was a mismatch between the languages of encoding and retrieval is consistent with the language-dependent memory hypothesis (Marian & Neisser, 2000), which suggests that accessibility of information is influenced by the match between the language used during retrieval and the language used during the encoding of that information (e.g., Marian & Fausey, 2006; Marian & Kaushanskaya, 2007 b). It is also consistent with findings of increased likelihood of switching if the switched item was previously used in the non-target language (Angermeyer, 2002). Unlike frequency of switching, frequency of transfer was not influenced by language of encoding at the time of the event, suggesting that transfer may be subject to changes in the linguistic environment to a lesser extent than switching. Instead, transfer may be influenced more by linguistic architecture, including representational differences. Switching and transfer likely differ in the degree to which they are episodic, with transfer and syntactic processing less tied to a specific occurrence.

Implications for models of bilingual language processing

Models of bilingual language processing incorporate control mechanisms into their frameworks to different degrees. While some postulate top-down mechanisms in deactivating the non-target language when speaking the target language (e.g., Green, 1986; 1998), others suggest that different activation thresholds for target and non-target lexical items account for language selection during comprehension (e.g., Thomas & Van Heuven, 2005; Van Heuven, 2000). Figure 2 shows a graphical representation of the likely loci of switching and transfer in bilingual language production and suggests that, in addition to overlapping loci of switching and transfer at the lexicon/lemma/wordform level, transfer (at least, semantic transfer) is more likely to stem from underlying conceptual representation differences between languages, while switching is more likely to be due to control mechanisms during lexical selection (either as a result of failure to inhibit the inappropriate lexical unit or due to its higher activation without the explicit use of suppression). However, although the lexicon (as opposed to semantic and conceptual representation) is more often the locus of switching, while the conceptual store is more often the locus of transfer, the actual language interaction system is more complex, allowing switching and transfer to happen at both the lexical and the conceptual levels (note that code switching at the clausal/sentential level was not the focus of the present work). For example, switching may take place at the conceptual level if a lexical item does not have a representational equivalent in the

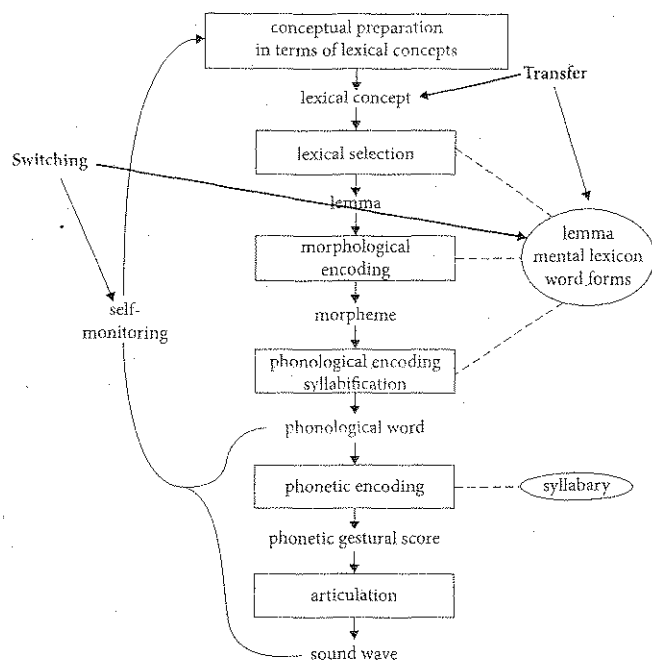


Figure 2. A graphical representation of the Levelt (1999) model of bilingual language production showing a proposal for potential loci of transfer and switching behaviors

other language. In fact, in cases in which there is no lexical concept for a lemma to match with, the boundaries between lexical and semantic are further blurred, with both likely to play a role. Similarly, transfer may include the lexical level when the underlying representations are highly imageable and include numerous overlapping features, as is the case for concrete nouns and action verbs

An on-line control mechanism that can inhibit interference of the non-target language during target-language production would have a stronger influence at the lexical level than at the conceptual level (given the more integrated conceptual system). Accordingly, models of language processing that include inhibitory control mechanisms typically propose that these mechanisms act at the lexical level. It is hereby proposed that a control mechanism would therefore influence switching more than transfer, resulting in higher rates of transfer than switching in situa-

tions in which bilinguals are consciously attempting to communicate in one language only and to control language output. This hypothesis is consistent with findings that bilinguals are able to exert more control over switching than over transfer, with covert interactions more frequent than overt ones, and is in line with linguistic views that there are stronger constraints on borrowing than on transfer/imposition. Moreover, an asymmetry in the control mechanism is possible across the two languages and this asymmetry is likely reinforced by previous experiences. For example, more switches are likely when speaking L1 if the proportion of time bilinguals are able to switch into L2 when speaking L1 is greater than the proportion of time bilinguals are able to switch into L1 when speaking L2. This is precisely the case with many proficient bilinguals in the United States whose second language is English -- most of their L1-speaking interlocutors in the US also speak at least some English (making switching into L2 feasible), however not all of their English-speaking interlocutors also know the L1 (making switching into L1 while speaking English often not possible). This suggested asymmetry is also consistent with the Inhibitory Control Model (Green, 1998) and with empirical findings that switching costs are higher when speaking L2 and switching to L1 than when speaking L1 and switching to L2 (e.g., Meuter & Allport, 1999). Therefore, switches would be more likely when speaking L1 because it is typically easier for unbalanced bilinguals to inhibit L2 after it has been activated; in other words, a switch into L2 would produce less unwanted L2 interference subsequent to the switch than a switch into L1 while speaking L2 would. For a review of the literature on switching costs, see the chapter by Renata Meuter in this volume.

Finally, a control mechanism may also influence lexical category constraints (likely due to differences in semantic representation), as well as level of concreteness constraints (likely during lexical selection). Specifically, recall the earlier inference that level of concreteness exerts constraints on-line, during selection, while lexical category exerts constraints off-line, at the level of semantic representations. If a control mechanism influences concreteness constraints more than lexical category constraints, then differences between nouns and verbs should remain regardless of the degree to which a control mechanism is involved during language production. Differences between concrete and abstract entities may be more susceptible to control mechanisms, with abstract nouns being more sensitive to control mechanisms than concrete nouns and with state verbs being more sensitive to control mechanisms than action verbs. Future studies can further test these hypotheses.

Conclusions

To conclude, the bilingual language system is highly interactive at all levels of the cognitive system, including lexical access and semantic representation, with processing in one language influenced by knowledge of another language. Cross-linguistic interactions during production appear to be influenced by the architecture of the two languages and by differences in linguistic structures in semantics, grammar, lexical category, and degree of concreteness, as well as by differences in language environment (at the time of speaking and at the time when the content was formed) and previous language experience (recency of language use and proficiency in the two languages). Different patterns of cross-linguistic interaction can be observed for overt switching compared to covert transfer. For example, transfers appear to be more resistant to control mechanisms than switches, switches appear to be more common for nouns than for verbs, transfers appear to be more common for verbs than for nouns, concrete entities appear to be transferred more than abstract entities, and bilinguals are more likely to switch (but not to transfer) when describing an event that originally took place in the non-target language (Marian and Kaushanskaya, 2007). The different effects of language architecture and language environment on switching vs. transfer suggest that the two types of cross-linguistic interaction may take place at different levels of cognitive processing. Switching may be rooted in lexical access phenomena, and transfer may be rooted in representational/conceptual phenomena, although this dichotomy is not absolute and both representational and processing differences can contribute to the two types of language interaction. Future research will need to focus on disambiguating the representational-based and the processing-based accounts, for example by targeting specific linguistic phenomena such as word frequency and polysemy – with word frequency effects most likely due to differences in lexical access and polysemy effects most likely due to differences in mental representation.

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