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Second language Influence on First Language Animacy Constraints and Word Order in
Korean-English Bilinguals

by

Amy Lebkuecher

A Thesis

Presented to the Graduate and Research Committee

of Lehigh University

in Candidacy for the Degree of

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in

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Second language Influence on First Language Animacy Constraints and Word Order in Korean-English Bilinguals

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Table of Contents

List of Tables	(v)
Abstract	1
Introduction	3
Study 1	
Methods.....	25
Results.....	30
Discussion.....	38
Study 2	
Methods.....	43
Results.....	47
Discussion.....	53
General Discussion	54
References	59
Tables	67
Appendix A	72
Appendix B	73
Author’s Curriculum Vitae	75

List of Tables

Table 1	67
Table 2	67
Table 3	68
Table 4	68
Table 5	69
Table 6	69
Table 7	70
Table 8	70
Table 9	71

Abstract

Traditionally, L1 has been viewed as a static system once mature and fully acquired. However, recent findings in language research have challenged this idea. It is possible that language, even L1 in its fully mature state, is a far more dynamic system than originally conceptualized. This paper reports two studies that examine second language (L2) English influence on first language (L1) Korean animacy constraints and word order in Korean-English bilinguals and investigate under what conditions the L2 influence is present. The first study evaluated whether L2 syntactic influence occurs only due to cognitive load under conditions of time pressure, or if it occurs regardless of cognitive load and thus represents long-term changes to the way that bilinguals use and process their L1 syntax. Bilingual participants did not use the animacy constraints that Korean monolinguals did when making grammaticality judgments, and this difference was present in conditions both with and without time pressure. Although bilingual participants continued to employ canonical Korean word order in their grammaticality judgments, they relied more heavily on word order when making their grammaticality judgments in Korean than monolingual participants. The second study evaluated whether Korean-English bilinguals accessed their L1 knowledge of Korean animacy constraints and word order in a forced choice task that relieves participants of the need to retrieve the native grammatical form from memory. Korean-English bilinguals did not access monolingual-like Korean animacy constraints even under such conditions, as shown by not consistently choosing the more native-like option. However, they did not perform in a significantly different manner than monolinguals for choices involving word order. These

findings indicate that L2 English influence on L1 syntax is pervasive and may represent an inability to access L1 grammatical information even in conditions with the fewest cognitive demands. Together these studies provide more evidence pointing to the dynamic nature of L1 syntactic components.

Until recently, a speaker's first language (L1) has been viewed as a static system that is resistant to change once mature and fully acquired. However, research in the areas of statistical learning and connectionist modeling suggest that L1 is a system that updates as a result of exposure to a second language (L2) (MacWhinney, 2008). Non-linguistic variables such as the level of identification with the cultural group associated with L1, attitude towards the maintenance of L1, and the use of L1 at work can interact with L2 exposure and either intensify or lessen the effects of L2 exposure on L1 (Schmid & Dusseldorp, 2010). This research characterizes language in general (including L1) as a dynamic system that changes and adapts as a result of experience with linguistic factors. The studies reported in this paper focus on the influence of L2 on L1 syntax specifically.

In order to better understand the dynamic nature of L1 syntax, I will evaluate the L1 use of two specific syntactic structures (animacy and word order) in Korean-English bilingual speakers. We will first review previous results that provide evidence for L2 influence on L1. After discussing the results of L2 influence to date, we will then present the findings of two new studies that focus on cross-linguistic influence on syntax in Korean-English bilingual speakers. The first study evaluated L2 English influence on L1 Korean grammar in conditions both with and without cognitive load, and the second was designed to obtain a more detailed understanding of the extent and nature of the L2 influence observed in the first study. We then argue, based on the findings of these studies, that L2 influence on L1 syntax represents a long-term change to L1 syntactic representation that is present in multiple contexts.

Cross-language lexical transfer

One domain of L2 influence on L1 is the lexicon. Many words do not have equivalent translations across languages. While it may not be surprising to learn that words for abstract concepts such as emotion do not translate perfectly between languages, recent research in lexicalization patterns has even found differences for the naming patterns of concrete objects (Ameel, Malt, Storms & Sloman, 2005; Pavlenko & Malt, 2011). Although most studies evaluating language transfer in bilinguals provide evidence for forwards transfer (L1 influence on L2) of lexical items (e.g., Hamada & Koda, 2008; Liszka, 2004; Malt & Sloman, 2003; Paribahkt, 2005). Ameel et al. (2005) found evidence for bidirectional transfer between two languages (both L1 and L2 influence each other). They studied the lexical transfer of naming patterns for household objects in Belgian bilinguals who had acquired Dutch and French simultaneously in childhood. For instance, objects called "fles" in Dutch (roughly equivalent to "bottle" in English) are divided into two groups in French: "bouteille" and "flacon". If no linguistic transfer existed between the two languages spoken by a bilingual, then it would be expected that Dutch naming patterns for objects would be the same for both Dutch-speaking monolinguals and Dutch-French bilinguals, and French naming patterns would be the same for French monolinguals and Dutch-French bilinguals. Ameel et al. (2005) found that Dutch naming patterns for common, concrete items (bottles, jars, etc.) in bilingual subjects were influenced by French naming patterns and vice versa. The results of this study demonstrate bi-directional influence of lexical systems in bilinguals.

The Dutch-French bilinguals acquired both of their languages simultaneously which is not representative of the conditions for second language acquisition in all

bilinguals. Many bilinguals do not acquire their L2 until years later than L1 acquisition. Pavlenko and Malt (2011) studied lexical transfer in Russian-English bilinguals who acquired English after, rather than simultaneously with, Russian. Their findings indicated that the bilinguals' English naming patterns for household objects influenced their Russian naming patterns for the same objects, indicating the presence of backwards lexical transfer (L2 influence on L1). This study did not evaluate forward transfer and thus, evidence for forward transfer is not discussed.

Evidence for L2 influence on the L1 lexicon has even been found for bilingual speakers who experienced a very brief period of L2 immersion. A group of English-Spanish bilinguals performed more poorly on a verbal fluency task in English after only a semester of immersion in Spain than non-immersed counterparts matched for L2 proficiency (Linck, Kroll & Sunderman, 2009). Although these results do not demonstrate the use of L2 lexical patterns in L1, they do indicate that L2 influence on the L1 lexicon can occur without long-term immersion in and exposure to L2.

In sum, most research on lexical transfer in bilingualism has focused on the influence of the L1 lexicon on the L2 lexicon, but more recent findings, such as those by Ameel et al. (2005), Pavlenko and Malt (2011) and Linck, Kroll and Sunderman (2009), support the idea of influence from the L2 lexicon on the L1 lexicon as well. Next, I will discuss issues of L2 influence on L1 syntax.

Theoretical issues concerning L2 syntactic influence

Arguments and evidence for static L1 syntax. There are reasons to believe that cross-linguistic transfer may not occur for syntax the way that it does for lexical information. Chomsky (1988) proposed that language acquisition, specifically syntactic

acquisition, is restricted by certain rules (Universal Grammar or UG) that are naturally encoded in the human brain, and that once the syntax of L1 has been acquired, it is contained within an isolated module in the brain. While Chomsky no longer supports these ideas, “nativist” researchers still contend that there is a module for the acquisition of syntax, although it does not contain UG (Bylund, 2009; O’Grady, 1996). The “critical period hypothesis” theorizes that there is a critical age period for language development and that after this critical period ends (around age 13 or 14), language acquisition on a native-like level can never be obtained (Bylund, 2009; Granena & Long, 2012; Johnson & Newport, 1989; Li, 2014). Together, these theories suggest that the ability to learn a language's syntax with native-like proficiency is only available up to a certain age and becomes increasingly unachievable as a speaker progresses towards that age.

Chomsky's original theory of UG also distinguished syntactic acquisition from lexical acquisition stating that syntactic acquisition requires a specific module in the brain while lexical acquisition uses the same brain structures that are used to learn basic facts and general knowledge (Chomsky, 1988; Schmid, 2011). Since syntax is distinguishable from the lexicon, Chomsky's UG theory suggests that evidence found for L2 influence in the L1 lexicon is not necessarily evidence for L2 influence in L1 syntax (Schmid, 2011). If a bilingual's first or native language (L1) syntax is dominant and stable due to its location in an isolated module, then the second language of a late bilingual (L2) should not be able to influence L1 syntax. If this is true, then it indicates that L2 influence for syntax is likely when L2 is acquired after age 13 or 14.

Even without a commitment to the nativist view of syntactic development, there are still reasons that L2 influence on L1 syntax may differ from the L2 influence on L1

lexical information. A language can be divided into two major components: lexicon and structure. A language's lexicon can be changed without influencing the foundational structure (or grammar) of the language while the structural components of language (such as syntax) are those that cannot be changed without affecting the grammar of the language (cf. Schmid, 2011, who argues that open class words are more likely to undergo influence than closed class words that have structural importance). Essentially, the lexicon does not affect grammar while structural components do. Since structural components like syntax cannot be modified without affecting the overall grammar of a language, they are less likely to experience modification than the lexicon (cf. Schmid, 2011).

Similar to what Chomsky proposed, if a language's syntax cannot be altered without affecting the structure of a language, then L2 influence on L1 syntax may be highly unlikely. Overall, these theories suggest that L2 influence on L1 syntax may not be possible.

Arguments and evidence for dynamic L1 syntax. While the issues discussed above suggest that L2 influence on L1 syntax may not occur after a certain age, empirical evidence is accumulating for L2 influence on L1 syntax for at least some constructions and under some circumstances. I will first describe research on statistical learning and syntactic priming that provides insight on the mechanisms underlying language acquisition and the nature of syntactic representation that may make it possible for L2 syntax to influence L1 syntax. I will then discuss findings from research on cross-linguistic influence that illustrate occurrences of L2 syntactic influence on L1 in late bilinguals. L2 syntactic influence has been found for early bilinguals (bilinguals who

acquired L2 before puberty) (Argyri & Sorace, 2007; Liu, Bates & Li, 1992), but there are also numerous studies that have also found L2 syntactic influence for late bilinguals (bilinguals who acquired L2 after puberty). Some of the evidence comes from production and some from comprehension, each of which I will briefly review. These findings contradict the critical period hypothesis and a nativist view of grammar acquisition and maintenance.

Statistical learning and L2. Statistical learning is a cognitive mechanism that allows for humans and other animals to extract probabilistic relationships and associations from the environment. Some researchers suggest that statistical learning operates via the tracking of predictive dependencies or the learning of probabilistic cue-outcome relationships (i.e., contingency learning) (Misyak, Christiansen, & Tomblin, 2010; Shanks, 1995; Williams, 2009). Other researchers propose that statistical learning is not due to predictive statistical learning mechanisms, but rather to chunk formation. During this process, a chunk forms a memory trace and this is subsequently strengthened (i.e., through repeated exposure) or weakened (i.e., through decay and interference) (Knowlton & Squire, 1996; Perruchet & Pacteau, 1990; Reber & Lewis, 1977; Redington & Chater, 1996; Servan-Schreiber & Anderson, 1990). These mechanisms have been modeled and tested through the use of connectionist neural networks. Simple Recurrent Networks (SRNs) are one example of a model that tests the role of tracking predictive dependencies and learning of probabilistic cue-outcome relationships on statistical learning (Hamrick, 2014). The PARSER model is an example of a model that evaluates the role of chunk formation (Hamrick, 2014). These models have demonstrated mixed

success in terms of their ability to emulate human statistical learning (Boucher & Dienes, 2003; Kinder, 2000).

One domain of implicit learning associated with statistical learning is language acquisition (Misyak & Christiansen, 2012; Pelucchi, Hay & Saffran, 2009). Studies have demonstrated a direct association between implicit statistical learning abilities and syntactic acquisition in children. Kidd (2012) found that children's performance on a test of statistical learning was directly associated with changes in children's syntactic behavior in response to changes in input frequencies.

While the majority of research on statistical learning in language acquisition is conducted with children, there is also research conducted with adults suggesting that adults learn experimentally induced linguistic regularities in the same way that children do (Chang, Dell & Bock, 2006; Cunillera, Camara, Laine & Rodriguez-Fornells, 2010). Additionally, Hamrick (2014) demonstrated that statistical learning plays a significant role in early L2 syntactic acquisition for both adults and children.

Additional research comparing statistical language acquisition in adults and infants demonstrates that acquisition of novel words by both adults and children is facilitated by the presence of known words (Cunillera et al., 2010). Furthermore, this facilitatory effect is found for bilingual adult novel word learning for both L1 and L2. Overall the results of these research studies comparing statistical language learning in adults and children indicate that acquisition may operate with some similar mechanisms across different age groups and for both L1 and L2. Since these similar mechanisms, which are dynamic in nature, may underlie the acquisition of L1 and L2 in both adults and children, it is possible that similar dynamic mechanisms may also be involved in

language maintenance and allow for plasticity in aspects of language across age groups and in both L1 and L2.

Bilingualism and the brain. Evidence from cognitive neuroscience studies suggests that both L1 and L2 are activated in the brain when bilinguals use and encounter language even if they only intend to use one language (Kroll, Dussias, Bogulski & Valdes Kroff, 2012). The parallel activation of L1 and L2 creates a need for the bilingual to inhibit the language that they do not currently intend to use. While bilinguals do develop the ability accurately inhibit the language that is not currently relevant (Kroll et al., 2012), there are still errors in inhibition that may occur and lend to the possibility for cross-linguistic influence.

Cross-linguistic syntactic priming and representation. Syntactic priming is the tendency of a speaker to produce or more easily process syntactic structures that she has most recently encountered or produced (Bock, 1986). As a result of syntactic priming, it becomes easier for the speaker to recall that same structure and other similar structures. Recent research on syntactic priming has indicated that when syntactic representations are similar across languages, they are shared between the languages. In a production study with Spanish-English bilinguals, participants described picture cards to each other (Hartsuiker, Pickering & Veltkamp, 2004). Participants were more likely to produce a sentence with a specific syntactic structure in English if they had heard the same structure produced in Spanish and vice versa. Other studies on syntactic priming have also demonstrated a priming effect both within and across languages (Schoonbaert, Hartsuiker & Pickering, 2007). The cross-linguistic priming observed in these studies indicate that it

is possible for the use of L2 syntax to influence the use of L1 syntax in on-line processing due to the referencing of shared syntactic structures.

L2 influence on L1 syntax in late bilingual production. Several studies have evaluated the occurrence of backwards transfer in language production of late bilinguals. Stolberg and Munch (2010) studied L1 attrition in a German-English bilingual who had lived in Germany until age 28 and then moved to the United States where she lived for 50 years prior to the study. They found, after recording a series of conversations with her in German, that she produced syntax errors in spoken, conversational German. The syntax errors observed in her spoken German were due to the transfer of English syntactic structures into her use of German syntax. This case study demonstrates that it is possible for changes to occur for L1 syntactic representation even after L1 is fully acquired.

Similarly, Ramirez (2003) found an English influence on Columbian Spanish use of “ser focalizer” clauses during speech production for Spanish-English bilingual Columbian immigrants who had been living in the United States for several years. Ben-Rafael (2004) observed an influence of Hebrew syntax on French syntactic structures such as verbal agreement, subjunctive mode, and relative pronouns in the speech production of French-Hebrew bilinguals who immigrated to Israel in early adulthood and had lived in Israel for at least 15 years before participation. The findings of these studies contradict the critical period hypothesis and suggest that L2 influence on L1 syntax can occur during language production in late bilinguals when they are living in an L2 environment.

L2 influence on L1 syntax in late bilingual comprehension. Although the L2 influence on syntax observed in production studies discussed above is somewhat

surprising since the participants were late bilinguals, it is known that speech production is error prone due to cognitive processing demands (e.g., Fromkin, 1988; Jiang, 2007; Levelt, 1989). Since speech production is a process that typically occurs under the pressure of time constraints, it is a task that produces stress on cognitive faculties and is, therefore, vulnerable to error. Utterances may not be articulated as intended. On the other hand, written language comprehension also involves the processing of language, but typically without the pressure of time constraint. Given the lower stress on cognitive processes and opportunity for deliberation that occurs during written language comprehension when compared to speech production, observing backwards transfer in unspeded, written language comprehension may be more indicative of changes to underlying L1 representation.

Several studies provide evidence for backwards transfer of syntax in the written language comprehension of late bilinguals. It is intuitive that if backwards transfer of syntax does occur, then it will occur between languages that have high structural similarity (e.g., German and Dutch). Ribbert and Kuiken (2010) found that German-Dutch bilinguals living in the Netherlands for at least eight months tended to overgeneralize the appropriate context for the use of a certain German grammatical rule while making grammaticality judgments for sentences as a result of influence from a similar Dutch grammatical rule. They proposed that this transfer may have occurred due to the high level of similarity between German and Dutch language structure.

Other studies provide evidence for backwards transfer of syntax across languages that are not similar to one another. Some of the studies suggest that backwards transfer for syntax between dissimilar languages tends to occur when rules regarding the structure

in L2 are less constrained than rules in L1 (Gurel, 2004; Pavlenko, 2010; Schmid, 2010; Stolberg & Munch, 2010; Wolff & Ventura, 2009). This pattern is proposed to exist because of the mind's general tendency to simplify cognitive tasks. Bilingual speakers might tend to employ the syntactic rules from the language that has fewer constraints because it simplifies the use and comprehension of syntax.

For instance, Gurel (2004) evaluated late Turkish-English bilinguals who had been living in the United States or Canada for at least 10 years for backwards transfer in binding properties of overt and null pronouns. Similar to the German-Dutch bilinguals, Turkish-English bilinguals tended to overgeneralize the context in which it was appropriate to use certain pronouns in Turkish during a grammaticality judgment task, apparently due to English syntactic influence. Similarly, Wolff and Ventura (2009) studied transfer of animacy rules for sentence subject in causal phrases for Russian-English bilinguals who had been living in the United States for several years. These bilinguals tended to ignore animacy constraints on Russian sentence subjects in their acceptability judgments of sentences, consistent with the absence of animacy constraints on sentence subjects in English.

Although these studies suggest that backwards transfer is likely to occur when the use of a structure in L2 is less constrained than its use in L1, Dussais and Sagarra (2007) found evidence for backwards transfer even when the rules of L2 syntax would not result in the loosening of constraints on L1 use. They studied the parsing preferences of Spanish-English bilinguals currently living in Spain but with previous English immersion experience when selecting which noun in a sentence to attach to an ambiguous relative clause. Although both parsings are allowed in both languages, the preferences for

attachment in Spanish and English are different. Bilinguals with high immersion experience in English showed a preference for attachment to the second noun (English preference), even though bilinguals with low immersion experience showed a preference for attachment to the first noun (Spanish preference). Since utilizing the English pattern for parsing preference does not loosen constraints on Spanish usage, this study provides evidence that backwards transfer can occur even when the transfer does not involve a loosening of a constraint.

L2 influence on L1 syntax other than backwards transfer. All of the studies discussed above provide evidence for backwards transfer of L2 syntax into L1 syntax comprehension. While backwards transfer is a common pattern of L2 influence on L1 syntax, changes to L1 syntax that are not considered backwards transfer can also be observed as a result of exposure to L2. Cook, Iarossi, Stellakis and Tokumaru (2003) evaluated use of case markers, animacy rules and number/gender agreement for subject selection by Spanish-English, Japanese-English, and Greek-English bilinguals in their L1. All of the bilinguals were immersed in an English-speaking environment at the time of the study. While the bilinguals did not use English grammatical rules for these structures in their L1, bilingual participants did use different cues on the subject selection task in their L1 than monolingual speakers of their L1. Since backwards transfer of syntax is defined as the use of L2 syntactic structures in L1, the findings of this study do not provide evidence for backwards transfer per se. However, the findings of this study do provide evidence for L2 influence on L1 syntax in the sense that bilinguals performed differently than L1 monolinguals on the same task. Exposure to an L2 or the experience

of being a bilingual may impact use of the L1 even if the changes to L1 do not reflect the structure of L2.

Several studies by Brown also illustrate L2 influence on L1 syntax that cannot be classified as backwards transfer in the sense that L1 patterns did not directly reflect L2. Brown (2007) evaluated Japanese-English bilingual production of path and manner morphosyntax for bilinguals whose length of residence in the United States was between one and two years and found that the bilinguals showed differences in their morphosyntactic preference, but not in a way that was ungrammatical in Japanese. Brown and Gulberg (2010) evaluated the clausal packaging of this morphosyntax in a group of comparable Japanese-English bilinguals and found that the bilinguals displayed mixed patterns of clausal packaging and performed differently than both the Japanese and English monolinguals. This result was replicated with both L2 immersed and non-immersed Japanese-English bilinguals (Brown & Gulberg, 2013). These results suggest that L2 English is influencing the bilingual's L1 Japanese, but they are not evidence for backwards transfer since the bilinguals did not transfer English morphosyntax into their use of Japanese.

In sum, the studies reviewed in the sections above provide evidence for L2 influence on L1 syntax, whether the influence is backwards transfer or just changes to L1 syntax in a way that does not reflect the structure of L2 but still deviates from native-like use of L1. The findings suggest that L2 syntactic influence occurs for both early and late bilinguals, across many languages and bilingual language combinations in both speech production and written comprehension.

Possible interpretations for evidence of L2 influence on L1

Given the evidence from multiple studies on cross-linguistic influence of L2 syntax on L1, it can be concluded that L2 syntax is influencing L1 syntax in some manner. How can we interpret and explain this L2 influence on L1 syntax? There are several possible explanations for this phenomenon.

Some bilingualism researchers argue that L2 influence on L1 syntax only occurs as a result of the cognitive stress imposed by the speeded processing that occurs under time pressure (Schmid, 2011). As discussed in the previous section, speech production is a process that imposes the pressure of time constraint and, therefore, is a process that is affected by cognitive load (Fromkin, 1988; Jiang, 2007; Levelt, 1989). Speech production requires selecting among competing structures and lexical items and then monitoring speech as it is produced (Clifton, Meyer, Wurm & Treiman, 2012). This competition and monitoring under time pressure makes speech production a cognitively effortful process which can be exacerbated by the activation of representations from two languages (Kroll et al., 2012). Schmid (2011) argues that changes in L1 syntax only occur during speech production due to the cognitively demanding, time pressured nature of speech production and that exposure to L2 syntax cannot influence L1 syntactic representation in conditions that do not involve cognitive load. The comprehension and production of written language is typically less vulnerable to cognitive load imposed by time pressure than spoken language due to the sustained existence of written language in the environment (Clifton et al., 2012). This makes written language more available for deliberative evaluation than spoken language. Furthermore, materials presented in one language may not induce activation of representations of the other language, or at least will do so only

minimally. If changes to L1 syntax are observed only during conditions with high cognitive load, then it can be predicted that changes in L1 syntax will not be observed during tasks that evaluate written language comprehension, especially comprehension tasks that encourage bilinguals to deliberate about their language processing and are not time pressured.

However, studies regarding L2 influence mentioned previously that utilize comprehension tasks such as sentence subject selection (Cook et al., 2003) and grammaticality judgment tasks (Ribbert & Kuiken, 2010) do provide evidence that L2 influence occurs in comprehension. Study 1, presented later in this paper provides new evidence for L2 influence on L1 syntax during language comprehension tasks, using conditions both with and without time constraint. The findings, discussed in more detail later, argue against L2 influence on L1 syntax as an issue of production or time pressure in particular, since the same backwards transfer was observed in comprehension tasks both with and without time pressure. If L2 syntactic influence is not merely an issue that occurs as a result of cognitive stress and pressure on inhibitory processes, then how can it be interpreted?

Representational changes

If L2 syntactic influence is not a reflection of error-inducing cognitive load, then it reflects some sort of change to L1 syntactic knowledge. Such changes might entail: 1) Permanent changes to the underlying L1 grammatical knowledge (rules and representations); or 2) Changes in the ability to access underlying L1 grammatical knowledge as a result of L2 exposure. In this section I will discuss the possibility of

changes to underlying grammatical representations and in the following section I will discuss issues of accessibility to these structures.

Bilingualism researchers typically refer to changes or loss of L1 as *L1 attrition*. In the strictest sense of the term, L1 attrition results in a complete alteration of elements of L1 such that there are no remaining traces of the original L1 structures (Schmid, 2011). Attrition in this sense is thought of as a permanent, irreversible change. However, the term *attrition* has also been used to refer to a variety of lesser changes in L1. While the term attrition is still frequently used, some researchers use other terms that more accurately describe different patterns of L1 change as a result of L2 influence. One of the more common alternatives to attrition is *restructuring*. Restructuring is described as the loss of L1 lexical items and syntactic structures or the integration of L2 lexical items and syntactic structures into L1 resulting in alterations to L1 representation of lexical items and syntactic structures (Pavlenko, 2004).

The interpretation of attrition as relatively permanent and difficult to reverse is associated with the perspective that L1 is a static system that is resistant to change or influence. Although attrition itself is a change to L1, it is thought to occur only after long periods of separation from L1 exposure. According to this interpretation, change to L1 can only occur after an extended period of isolation from L1 and is very difficult to reverse once it has occurred. Conversely, restructuring characterizes L1 as a dynamic system that is constantly changing and updating as a result of exposure to L2. The view that characterizes language as a dynamic system suggests that L1 is not so resistant to change. While both views argue for changes to underlying grammatical representations, attrition is representational change that only occurs due to long-term, consistent changes

in language exposure and other linguistically related factors. Restructuring also argues for change to underlying grammatical representation, but suggests that this change can occur rapidly in response to varying situational factors.

Accessibility

Exposure to L2 may not affect the underlying L1 representations themselves, but rather may affect the accessibility of those representations (Gurel, 2004). The more that a representation is activated by exposure, the lower its activation threshold becomes (Stolberg & Munch, 2010). The lower a representation's activation threshold, the more accessible it becomes. For example, the more that L1 representations are used, the more these representations become activated. This activation is what lowers the threshold for retrieval. If L1 is not activated frequently enough, then the thresholds for the activation of L1 representations will become very high and the representations will become difficult to access. Some of the L2 representations may be used to structure L1 output or process L1 input instead if they are more accessible.

Findings from research using connectionist models support the idea that perceived changes to L1 syntax are due to decreases in accessibility. MacWhinney's (2008) Unified Competition Model (UCM) hypothesizes that the bilingual brain acquires L1 and L2 utilizing the same structures and processes. Since the two languages utilize the same cognitive resources, they are often simultaneously activated and in competition with one another. The UCM proposes that different languages rely on different grammatical cues and have different values or "cue validities". *Cue validity* is defined as the product of *cue reliability* and *cue availability*. *Cue reliability* is the proportion of times the cue is correct out of the total times that the cue is present, and *cue availability* is the proportion of times

that the cue is available when it is appropriate (MacWhinney, 2008). Given that cue reliability and cue availability are both increased by frequency of exposure to specific cues, the shifting of cue weights illustrated in the UCM may be representative of decreases and increases to the accessibility of these cues.

The ability to access L1 grammatical knowledge may differ depending on situational or task demands. In a case study by Jarvis (2003), a Finnish-English bilingual's acceptability ratings of certain syntactic structures in Finnish varied as a function of the task demands. The Finnish-English bilingual woman had been living in the United States for 11 years before the study and had rarely used Finnish during that time. In a proofreading task, the participant could identify that certain sentences contained a grammatical error, but she could not provide the correct alternative. For other ungrammatical sentences, the participant was not even able to properly identify them as unacceptable let alone provide a correct alternative. However, the participant did not produce the syntactic errors that she deemed acceptable during the proofreading task while describing a film in a speech production task.

These task-based differences in performance for the Finnish-English bilingual woman suggest that access to grammatical knowledge may vary depending on the demands of the situation at hand. Study 1 described below found evidence for L2 English influence on L1 Korean grammar comprehension in conditions with and without time pressure. Study 2 was aimed at better understanding the L2 influence found in Study 1 by further examining under what conditions L2 influence on L1 syntax is seen and under what conditions, if any, the original native-like L1 knowledge can be accessed. In order

to investigate whether or not different syntactic structures vary in their vulnerability to L2 influence, I selected two grammatical structures to evaluate potential L2 influence.

Grammatical structures of interest in the current studies

Animacy constraints on sentence subjects. In certain languages, animacy rules place a restriction on which nouns can be used as subjects of a causal sentence in a given language (Wolff & Ventura, 2009). A causal sentence is a sentence in which the sentence subject contributes to or causes the outcome described in the sentence. Two main types of languages have been identified in terms of the animacy rules of causal sentence subjects: Type A languages (Russian, Korean, etc.) and Type B languages (English, Chinese, etc.). Type A languages are languages with animacy rules that require the subject of a causal sentence to be able to generate its own energy (i.e., "The man cut the bread with the knife"). Type B languages do not have an animacy constraint and allow all nouns to be causal sentence subjects (i.e., "The knife cut the bread"). It is important to note that "able to generate own energy" not only includes humans and animals, but, in some Type A languages, also includes natural forces such as sunlight and certain objects (e.g., an air conditioner) that are capable of generating some sort of energy in one manner or another. Examples of objects that are not able to generate their own energy are objects such as a knife or a key. It is also worth noting that objects that are not able to generate their own energy can be the subject of a non-causal sentence (e.g., "The knife was sharp" or "The key fell to the ground") even in Type A languages. This distinction indicates that the level of animacy attributed to objects is at least partially based on their ability to act on and cause changes in the environment.

Wolff, Jeon and Li (2009) evaluated Chinese, English, and Korean monolinguals for differences in perceived grammatical acceptability of sentences having inanimate subjects. They found that Korean speakers performed in a significantly different fashion from the English and Chinese speakers in all three experiments. Korean speakers rated sentences with low animacy subjects as less acceptable than English and Chinese speakers as the subject of causal sentences.

Since Korean has a constraint on the animacy of sentence subjects and English does not, it is possible that Korean-English bilinguals immersed in an English speaking environment might lose the animacy constraint in Korean. Previous research has indicated that backwards transfer tends to occur when L1 is more constrained than L2 for a particular structure (Gurel, 2004; Pavlenko, 2010; Schmid, 2010; Stolberg & Munch, 2010; Wolff & Ventura, 2009). It has also been argued that structures located at the syntax-semantics interface are more susceptible to backwards transfer than narrow syntax which is not semantically engaged (Bolonyai, 2007). Since animacy constraints are related to conceptualizations of an entity's ability to internally generate energy, animacy is a grammatical structure located at the syntax-semantics interface.

Word order. Certain syntactic regularities are more difficult for L2 learners to acquire while others are much more easily acquired. Word order appears to be a relatively easily acquired syntactic domain. Johnson and Newport (1989) asked Korean-English and Chinese-English bilinguals to make grammaticality judgments about a group of sentences (half ungrammatical/half grammatical). A number of syntactic properties were manipulated in different sentences to be grammatical or ungrammatical, one of

them being word order. Among all of the syntactic properties, word order was found to be one of the more easily learned grammatical patterns by Chinese learners of English.

English word order is Subject-Verb-Object or "SVO" and Korean word order is Subject-Object-Verb or "SOV" (Onnis & Thiessen, 2013). If word order is relatively easily learned, then it may not be difficult for a bilingual to accurately maintain the correct word order of both their L1 and L2 in spite of these differences. On the other hand, if word order is so easily learned, it may also be possible for L2 word order rules to influence or supplant L1 word order rules. Furthermore, the canonical Korean SOV order is most common and acceptable but it is not always required, especially when using language informally. While they are less common, other orders can be used for slang, poetry and other artistic uses of language (Onnis & Thiessen, 2013). This flexibility could provide room for bilinguals to shift toward the less dominant order under English influence.

Although the conclusions of the Johnson and Newport study are ambiguous about implications for the vulnerability of word order to L2 influence, conclusions from other research suggest that word order is not likely to be vulnerable to L2 influence. As mentioned above, previous research has indicated that grammatical structures at the syntax-semantics interface are more likely to be susceptible to backwards transfer than structures not at the syntax-semantics interface (Bolonyai, 2007). Since word order is not located at the syntax-semantics interface, word order may not be susceptible to backwards transfer. Additionally, word order structure is very rigid and a critical cue for grammaticality in English but tends to be more flexible and take a back seat to animacy cues in Korean (McDonald, Bock & Kelly, 1993). Since word order is a secondary cue

for grammaticality in Korean and is more flexible and varied in its usage, it seems unlikely that Korean-English bilinguals would begin to use English word order (SVO) in their use of Korean. Contrasting effects of L2 influence on animacy and word order will help us to better understand which grammatical structures tend to be more or less vulnerable to backwards transfer.

Study 1: Grammatical Acceptability Judgments

The first study examined whether or not backwards transfer of syntax is just an issue of cognitive load and on-line processes in production due to time pressure, or if it is more pervasive and is demonstrated with other task demands such as acceptability judgments. Since the rules for animacy and word order are different in Korean and English and potentially differ in their vulnerability to L2 influence, these structures provide a contrast for evaluating backwards transfer. In order to see whether time pressure is necessary to observe backwards syntactic transfer, the first study evaluates grammaticality judgments for sentences that vary in whether or not they conform to Korean animacy constraints and word order for Korean-English bilinguals, and participants were tested in conditions with time pressure (speeded) and without time pressure (deliberative).

Time pressure creates cognitive stress when multiple language structures compete for processing. These structures from both languages compete for activation during both production and comprehension tasks and across different components of language (e.g., lexicon, syntax) (Kroll et al., 2012). Additionally, research on syntactic priming has demonstrated that syntactic structures shared across a bilingual's L1 and L2 can be primed across both languages (Hartsuiker et al., 2004). Since representations from both

of a bilingual's languages are constantly in competition during language processing, any language processing task will be influenced by cognitive stress when performed under time pressure. If backwards syntactic transfer occurs as a result of cognitive stress (such as cognitive stress imposed during speech production and comprehension due to competition of multiple structures and difficulty monitoring under time pressure), then L2 influence on L1 syntax will only occur in the speeded processing condition. However, if backwards syntactic transfer reflects long-term change to L1 syntactic representation as a result of exposure to L2 rather than cognitive stress, then L2 influence on L1 syntax will occur in both speeded and deliberative processing conditions. In the speeded condition, participants were asked to make grammaticality judgments as quickly and accurately as possible. In the deliberative condition participants were asked to deliberate about their grammaticality judgments. Based on the results of previous studies demonstrating the vulnerability of structures at the syntax-semantics interface (Boloynai, 2007) and the ease of learning and maintaining word order (Johnson & Newport, 1989), we predicted that backwards transfer would occur for animacy rules but not word order regardless of the task.

Method

Participants

Twenty-two English monolinguals were recruited from the participant pool of undergraduate psychology students at Lehigh University. Seventeen Korean-English bilinguals, also students at Lehigh University, were recruited by a Korean-English bilingual research assistant. Eleven Korean monolinguals, living in Seoul, South Korea, were recruited by Korean-English bilingual Lehigh University students and faculty. All

participants were between the ages of 18 and 24 years of age. Bilingual participants all arrived to the United States at age 14 or older (i.e., all participants were late bilinguals) and had similar educational backgrounds in terms of English. Both Korean-English bilinguals and Korean monolinguals have some classroom instruction of English beginning around age six. Korean monolingual participants considered themselves functionally monolingual and had never been immersed in an English speaking environment. All English monolingual participants received course credit for their participation. Korean-English bilingual participants were compensated \$15 for two sessions totaling approximately one hour, and Korean monolingual participants completed the online survey voluntarily.

Twenty-eight participants (11 English monolinguals and 17 Korean-English bilinguals) completed a “lab” version of the experiment which consisted of both the speeded and the deliberative tasks completed on a computer in a lab, and 22 participants (11 English monolinguals, 11 Korean monolinguals) completed an “online” version of the study which consisted of only the deliberative task hosted on the survey website. Since it was not possible to bring Korean monolingual participants into the lab, they completed only the online (deliberative) task. In order to ensure that differences in performance between Korean-English bilinguals and Korean monolinguals were not due to procedural differences, we divided the English monolingual participants in half and had half complete the lab experiment (both tasks) and half complete the online study (deliberative only). We then compared their performance on the deliberative task administered each way.

Design

The study used a 2 (high vs. low animacy) x 2 (SVO vs. SOV word order) x 2 (Korean vs. English language) x 3 (Korean-English bilingual vs. Korean monolingual vs. English monolingual language group) design.

Materials

Language History Questionnaire. Materials included a language survey developed by the Language and Thought lab at Lehigh University and collaborators. Questions on the survey included questions about demographics, age of exposure, years of immersion, ratio of usage in each language overall and in different contexts (e.g., home vs. work), self-rated proficiency, and other questions related to language experience. A modified version of the survey (monolingual Language History Questionnaire) was created for monolingual participants and only contained questions regarding demographic information and what other languages they speak (to ensure that the participants were indeed functionally monolingual). The modified version was translated into Korean for the Korean monolinguals by a Korean-English bilingual research assistant.

Stimulus Sentences. The stimuli were the set of sentences used in Experiment 1 by Wolff et al. (2009) except that we manipulated word order as well as using the animacy manipulation in the original materials. They were divided in the following manner per language: one fourth of the statements had SVO word order and high animacy subjects (e.g., “The fire burned the house.”), one fourth had SVO word order and low animacy subjects (e.g., “The knife cut the bread.”), one fourth had SOV word order and high animacy subjects (e.g., “The fire the house burned.”), and one fourth had

SOV word order and low animacy subjects (e.g., “The knife the bread cut.”). (See Appendix A for the complete list of sentences.)

The Korean and English materials were identical in all aspects except for language. The Korean sentences were translated by a Korean-English bilingual research assistant. The monolingual versions of the language survey and deliberative acceptability judgments were hosted online on SurveyMonkey <http://www.surveymonkey.com>, (for both the English and the Korean translation) in order to ensure accessibility for all participants completing the online study. The lab experiment was hosted in the Language and Thought lab at Lehigh and consisted of a paper and pencil version of the Language History Questionnaire and two tasks (speeded and deliberative) for evaluating grammatical acceptability judgments created using EPrime software (Schneider, Eschman, & Zuccolotto, 2001).

Procedure. Before beginning the study, participants were told that they were participating in a bilingualism study. Lab participants (Korean-English bilinguals and half of the English monolinguals) signed a paper consent form while online participants (Korean monolinguals and half of the English monolinguals) read the consent information on a web page and clicked a web link to participate in the study. Bilingual participants were engaged in brief conversation to establish language context before completing the experimental session. This conversation took place in the language of the experimental session (e.g., if the experimental session was going to be completed in English, then the conversation was held in English). A Korean-English bilingual research assistant conducted the experimental sessions that took place in Korean.

Online Experiment. All Korean monolingual participants and half of the English monolingual participants completed the online study. First, the participants completed a version of the Language History Questionnaire modified for monolinguals. Participants then completed only the deliberative task. They viewed all sentences from the stimulus set presented in a random order and were asked to rate them on a scale of grammatical acceptability from 0 to 100 with 0 being "completely unacceptable" and 100 being "completely acceptable". After completing the study participants viewed a web page that thanked them for their time and informed them in more detail about the purpose of the experiment.

Lab Experiment. All Korean-English bilingual participants and the other half of the English monolinguals participants completed the full study in the lab. Bilingual participants completed two lab sessions a week apart with the first session in English and the second session in Korean. All participants were scheduled in English first and Korean second due to the scheduling constraints of the Korean-English bilingual research assistant who ran participants through the Korean session of the experiment. In order to ensure that no influence from the English session would carry over to the Korean session, the two sessions were scheduled one week apart from one another. Greeting, consent, and instructions for each session were completed in the language of the tasks for that session.

All Korean experimental sessions were conducted by a Korean-English bilingual research assistant. Monolingual participants only completed one session in English. During the first (English) session only, participants were first asked to complete a modified version of the Language History Questionnaire. The questionnaire contained items regarding their demographic information, which languages they speak, how

proficient they are in each language, the age that they acquired each language, how long they have been immersed in the society of their second language, and how frequently they write/speak in each language. After completing the questionnaire, the participants then completed a speeded task and a deliberative task.

For the second (Korean) session of the experiment, participants only completed the Korean translations of the speeded and deliberative tasks.

Speeded task. All sentences were presented in random order one at a time. Participants were asked to indicate using “yes” and “no” key presses whether or not each sentence was grammatically acceptable as quickly and accurately as possible. Once participants had provided a judgment, the next statement immediately appeared. Participants had a maximum of five seconds to respond to each statement.

Deliberative task. Once the participants completed the speeded task, they were presented with the same set of sentences in a new random order and were told that they could take their time evaluating each statement and were asked to rate each one in terms of grammatical acceptability from 0 “not at all acceptable” to 100 “very acceptable”. After completing this task, participants were thanked for their time and provided with a debriefing form and bilingual participants were given compensation.

Results

Before conducting the main analyses on the data, we conducted two manipulation checks. In the first manipulation check, we confirmed that participants’ reaction time was significantly longer in the deliberative than the speeded task (see Table 1). The obtained difference ensures that participants spent significantly longer making grammaticality judgments in the deliberative task than in the speeded task ($F(1,16)= 35.66, p= .001$). In a

second manipulation check, we confirmed that English monolingual participants who completed the lab study did not show a significantly different pattern of responses than the English monolingual participants who completed the online study in the deliberative grammaticality judgments (see Table 2). There were no significant differences in deliberative grammaticality judgments between English monolingual participants who completed lab versus online studies ($F < 1$).

English monolingual performance (deliberative task). Results reported for English monolinguals here are from the online (deliberative only) version of this task to allow direct comparison with the Korean monolingual version.

We expected the English monolingual participants to rate all sentences with Subject-Verb-Object (SVO) word order as high in acceptability, all sentences with Subject-Object-Verb (SOV) word order as low in acceptability and to ignore high versus low animacy subjects. That is, we predicted a main effect of word order, but not a main effect of animacy or an interaction between animacy and word order.

The pattern of ratings was consistent with our predictions in the critical respects (see Table 3).

As predicted, English monolingual participants rated sentences with SVO word order as highly acceptable and sentences with SOV word order as very unacceptable. Not entirely consistent with our predictions, sentences with high animacy subjects were rated as slightly more acceptable than sentences with low animacy subjects. There was a significant main effect of word order ($F(1,31) = 133.23, p < .001$), a marginal effect of animacy ($F(1,31) = 4.89, p = .05$), and no interaction between word order and animacy ($F(1,31) = 3.57, p = .09$).

These results indicate that English monolingual participants used canonical English grammar to judge the grammaticality of the sentences. While we did not expect to observe marginally higher ratings for sentences with high animacy subjects than low animacy subjects, we do not believe that this pattern reflects a deviation from English canonical grammar since the differences were small and did not influence the use of word order for grammaticality judgments. Additionally, other research that has evaluated animacy preferences in English has indicated that subjects with higher animacy tend to be preferred in English even in the absence of explicit animacy rules (McDonald et al., 1993).

Korean monolingual performance (deliberative task). For the Korean monolinguals, we predicted that the participants would rate sentences with high animacy subjects as highly acceptable and sentences with low animacy subjects as unacceptable. We also predicted that Korean monolinguals would consider sentences with SOV word order highly acceptable and sentences with SVO word order less unacceptable. Given that word order rules are more flexible (word orders other than SOV may be used in informal situations of artistic expression) in Korean than animacy rules, we can also expect more of a difference in ratings due to word order when sentences have high animacy subjects than low animacy subjects (Onnis & Thiessen, 2013). That is, if the sentence has a low animacy subject, Korean monolinguals are likely to rate the sentence as low in acceptability regardless of word order. Thus, we expect a main effect of animacy, a modest main effect of word order, and an interaction between animacy and word order.

The data are presented in Table 3. As predicted, Korean monolinguals rated sentences with high animacy subjects as significantly more acceptable than those with low animacy subjects, and sentences with SOV word order as marginally more acceptable than ones with SVO order. The impact of word order was marginally greater for sentences with high animacy subjects than low animacy subjects. There was a main effect of animacy ($F(1,31)= 15.41, p= .02$), a marginal main effect of word order ($F(1,31)= 7.30, p= .05$), and a marginal interaction between animacy and word order ($F(1,31)= 8.36, p= .05$).

Korean monolinguals displayed a strong preference for sentences with high animacy subjects over sentences with low animacy subjects. While the Korean monolinguals did show a marginal effect of word order, the difference was not as large as the word order effect for English monolinguals. This difference indicates that although the Korean monolinguals were considering both animacy and word order cues when making judgments, animacy was the more dominant cue. These results indicate that Korean monolingual participants were referencing canonical Korean grammar while making grammaticality judgments.

Bilingual English performance vs. Monolingual English performance (deliberative task). Since we only expected to observe backwards transfer and not forwards transfer, we predicted that bilingual participants would rate English sentences using the same criteria as English monolinguals. Based on the literature, we only predicted that we would observe cross-linguistic influence for animacy constraints (Bolonyai, 2007). Since English has no animacy constraints and we did not predict any cross-linguistic influence for word order, we did not expect Korean-English bilinguals to

perform significantly different from English monolinguals in English. Specifically, we expected to observe a main effect of word order (with SVO higher than SOV), no main effect of animacy, and no interactions between word order and animacy. We expected to see no main effect of language group (monolingual vs. bilingual), nor interaction of word order or animacy with language group.

The mean grammaticality ratings are displayed in Table 4. Korean-English bilinguals rated sentences in the same manner as English monolinguals in their English judgments. They rated sentences with SVO word order as much more highly acceptable than sentences with SOV word order and showed little impact of animacy on their ratings. There was a main effect of word order ($F(1,37)= 152.70, p < .001$), no main effect of animacy ($F(1,37)= 2.48, p = .14$), and no interactions between animacy and word order ($F < 1$), animacy and language group ($F < 1$) or word order and language group ($F < 1$). These results indicate that Korean-English bilingual participants performed like English monolinguals in their grammaticality judgments of English sentences.

Bilingual Korean performance vs. Monolingual Korean performance

(deliberative task). We predicted that bilingual participants would rate Korean sentences using canonical Korean word order but would ignore animacy constraints in their judgments. Specifically, we expected to see a modest main effect of word order but no effect of animacy and, importantly, an interaction between animacy and language group.

The mean ratings are given in Table 5. Bilinguals rated sentences with SOV word order as more acceptable than those with SVO order. While Korean monolinguals also preferred SOV word order over SVO word order, the impact of word order on the ratings of the Korean-English bilinguals is much more highly pronounced (we discuss a possible

reason for this below). In contrast to the monolinguals, bilinguals showed only a small effect of animacy. For the two language groups together, there was a main effect of animacy ($F(1,26)= 23.34, p = .001$), a main effect of word order ($F(1,26)= 60.96, p < .001$), and a marginal interaction between animacy and word order ($F(1,26)= 4.69, p = .05$). There was also an interaction between animacy and language group ($F(1,26)= 4.95, p < .05$), and an interaction between word order and language group ($F(1,26)= 17.70, p = .001$). For bilinguals alone, there was a main effect of animacy ($F(1,16)= 6.43, p = .02$) and a main effect of word order ($F(1,16)= 138.30, p < .001$), but no significant interaction between animacy and word order ($F(1,16)= 1.347, p = .26$).

In short, the bilinguals did not transfer the English SVO word order into their Korean judgments, but they did rely far less on the animacy cue than Korean monolinguals when making grammaticality judgments. The interaction of word order with language group was unexpected. It reflects a much larger effect of word order on bilingual Korean judgments than monolingual Korean judgments. Word order may have been a more dominant cue for bilingual grammatical judgments since they would have been motivated to discriminate among the sentences on some basis and were not as sensitive to the animacy cue.

It is also possible that the increased effect of word order on the bilinguals' grammaticality judgments is the result of L2 influence but not backwards transfer. In a previous section I discussed examples of L2 influence on L1 syntax that were not considered backwards transfer (Brown, 2007; Brown & Gulberg, 2010; Cook et al., 2003). In these studies, bilingual use of L1 syntax did not reflect L2 structure, but still deviated from monolingual-like use of L1 syntax. Although the Korean-English

bilinguals did not demonstrate a preference for SVO word order in their Korean judgments (backwards transfer), they did demonstrate a stronger reliance on SOV word order as a cue for grammaticality than Korean monolinguals which may reflect reduced exposure in Korean to the low frequency alternative ordering due to their English immersion

Bilingual English performance vs. Bilingual Korean performance (speeded task). For the speeded task, since we do not have Korean monolingual judgments for comparison, we focus on the comparison of bilingual's performance in their two languages. We predicted that bilingual participants' speeded grammaticality judgments would follow the same pattern as their deliberative grammaticality judgments. The mean percentage of sentences to which "Yes" ("grammatically acceptable") responses were given was our main dependent measure. For the bilinguals' English performance, we expected that more sentences with SVO word order would be selected as "yes" more acceptable than sentences with SOV word order, but animacy would not have a significant effect on their judgments since English has no animacy constraints and we predict that cross-linguistic influence on syntax is more likely to occur in such a way that loosens grammatical constraints rather than making them more constrained (Gurel, 2004; Pavlenko, 2010; Schmid, 2010; Stolberg & Munch, 2010; Wolff & Ventura, 2009). For the bilinguals' Korean performance, we expected that, in contrast to English, more sentences with SOV word order would be selected as "yes" acceptable than sentences with SVO word order, but animacy would also have no effect on their judgments. On this basis, we expected to observe a significant interaction between language and word order for bilinguals, no significant main effect of animacy or word order, and no

significant interaction between language and animacy nor between animacy and word order.

The means are displayed in Table 6. These results mirrored the results of the deliberative task. As predicted, bilingual participants rated sentences in English with SVO word order as grammatically acceptable, and the acceptability did not differ whether the subject of the sentence was high or low animacy. They also rated sentences in Korean with SOV word order as “yes” grammatically acceptable, and the acceptability did not differ whether the subject of the sentence was high or low animacy. When comparing bilinguals' responses on the speeded task for English and Korean sentences, there was a significant interaction between language and word order ($F(1,16)= 59.86, p <.001$). There was no significant main effect of animacy ($F(1,16) = 1.52, p = .26$) or word order ($F < 1$) and no significant interaction between language and animacy ($F < 1$) or animacy and word order ($F(1,16)= 4.67, p= .07$). For bilingual performance in Korean alone, there was no main effect of animacy ($F(1,16)= 1.73, p= .23$), a main effect of word order ($F(1,16)= 62.319, p < .001$), and a marginal interaction between animacy and word order ($F(1,16)= 5.898, p= .05$).

Since the pattern of results observed in the speeded task is similar to the pattern that was observed in the deliberative task, the evidence suggests that backwards transfer has occurred in both conditions with and without time pressure. The key difference in bilinguals' Korean performance due to time pressure is the absence of a main effect of animacy in the speeded task. Although Korean bilingual use of the animacy cue for grammaticality judgments in the deliberative task differed from Korean monolingual use, the bilinguals still demonstrated some awareness of the animacy cue in their

grammaticality judgments. Bilinguals used animacy even less for Korean grammatically judgments in the speeded task, as evidenced by the lack of a main effect of animacy. Additionally, bilinguals also relied heavily on SOV word order for their grammaticality judgments in the same manner as the deliberative task. Although there is evidence for backwards transfer in conditions both with and without time pressure, there appears to be more backwards transfer in conditions with time pressure since bilinguals did not seem to use animacy as a cue at all in the speeded task. There is also evidence for L2 influence on word order preferences, but not backwards transfer.

Discussion

The purpose of this study was to investigate whether L2 influence on L1 syntax only occurs due to cognitive stress under conditions of time pressure, or if it occurs as a result of long-term changes to the processing and use of L1 syntax in conditions without cognitive stress and time pressure. Specifically, the study evaluated whether or not there is L2 syntactic influence on L1 animacy and word order structures for Korean-English bilinguals. Since bilinguals rated English sentences in the same manner as English monolinguals, but did not rate Korean sentences in the same manner as Korean monolinguals, these results provide evidence for an influence of English syntax on Korean syntax. These results imply a loosening of constraints on which nouns are viable sentence subjects in Korean. The loosening of these constraints may be due to the absence of animacy constraints in English and the Korean-English bilinguals' current immersion in an English speaking environment. The bilinguals appear to be losing their ability to distinguish between which nouns are and are not acceptable sentence subjects in Korean while immersed in an English-speaking environment. Since the bilinguals

showed a decreased effect of animacy in the deliberative task, this indicates that the backwards transfer is not just a result of excess processing load induced by conditions of time pressure. Although these results suggest that backwards transfer does not occur solely in conditions of time pressure, the absence of an effect of animacy in the bilinguals' Korean grammaticality judgments during the speeded task, compared to the presence of a decreased effect of animacy in the deliberative task, demonstrates that the presence of time pressure may facilitate backwards transfer due to an increase in cognitive load.

Since we have observed a shift in the grammatical judgments of this sample of Korean-English bilinguals' L1, we have observed backwards transfer for bilinguals who acquired their L2 after the hypothesized critical age period. However, even though we have observed backwards transfer, we only observed backwards transfer for the animacy cue and not the word order cue. Transfer may occur for animacy and not word order because disregarding animacy distinctions in Korean as a result of backwards transfer from English involves a loosening of constraints. In order for backwards transfer to occur for word order, the English SVO word order would have to supplant the already existent SOV word order in Korean. Transfer may also be observed for animacy and not for word order because animacy is located at the syntax-semantics interface and word order is not. We propose that it is for these reasons (the loosening of L1 constraints and the location of animacy at the syntax-semantics interface) that we observed backwards transfer for animacy and not word order.

While the results did not provide evidence for backwards transfer for word order, the results may indicate L2 influence on L1 word order. Although the bilinguals'

preferences for word order in Korean (native-like is SOV) did not switch to canonical English word order (SVO), word order was a more critical cue for grammaticality judgments in Korean for bilinguals than Korean monolinguals. There are several possible reasons for this L2 influence. It could be that presence of stricter word orders in English makes Korean-English bilinguals more stringent with their word order use in Korean. Another possibility is that Korean-English bilinguals are losing the ability to access word orders that are less frequently used in Korean than SOV due to lack of exposure to L1 use of these structures. As a result of this lack of experience, bilingual speakers may lose their sense of when it is appropriate to use word orders other than SOV in Korean and begin to treat SOV word order as if it is the only acceptable word order. A third possibility is that this difference could be due to the bilinguals' decreased consideration of the animacy cue. If bilinguals are not able to rely on animacy as a cue for grammaticality, they may rely more heavily on word order than monolinguals to make grammaticality judgments in Korean.

In sum, the findings of Study 1 have determined that L2 influence on L1 syntax is not just an issue of cognitive load, but that the loss of the L1 Korean animacy constraint represent an influence of L2 English on L1 Korean grammar. While time pressure is not necessary for the presence of backwards syntactic transfer, it may increase L2 influence on L1 syntax by increasing cognitive load.

Study 2: Forced Choice Study

Study 1 revealed the existence of L2 English influence on L1 Korean animacy constraints and potential L2 influence on word order. The goal of Study 2 is to help refine the understanding of the nature of this L1 change, by identifying under what conditions

(if any) Korean-English bilinguals can access and use monolingual-like L1 knowledge of animacy constraints. While Study 2 will continue to evaluate whether or not L2 influence exists for both animacy constraints and word order in Korean, the primary focus of the study is to evaluate L2 influence on animacy rather than word order. Since Study 1 demonstrated clear and strong L2 influence on L1 animacy but only potential L2 influence for word order, Study 2 is designed to specifically evaluate the nature of changes to the L1 animacy constraint. The inclusion of word order in Study 2 is mainly to continue to provide a contrast between L2 influence on narrow syntax and L2 influence on structures at the syntax-semantics interface.

The purpose of this study is to investigate whether or not the L2 English influence observed on the L1 Korean animacy constraint represent an inability to access monolingual-like representation of L1 animacy rules. Given that Study 1 found L2 influence on grammaticality judgments for animacy constraints (and potential L2 influence for word order) in speeded as well as deliberative judgments, we now want to evaluate whether or not L1 monolingual-like knowledge of animacy constraints can be accessed given a task that requires neither retrieval from memory nor explicit recognition of correctness. Since the animacy cue had less of an effect on bilinguals' Korean performance in the speeded task than it did for the deliberative task, the presence of cognitive load may exacerbate existent L2 influence on L1 syntax. If this is true, then we expect a decrease in cognitive load (due to minimal demands on memory) to result in a decrease of L2 influence on L1 syntax.

The forced choice task presented participants with sentence pairings that contained one grammatical sentence and one ungrammatical sentence and participants

were asked to select which is the correct sentence. This study provided optimal conditions for bilingual participants to be able to access the monolingual-like Korean grammatical knowledge without explicitly instructing bilingual participants about the animacy constraint. The judgments can be made above chance level based only on intuition of preference with the added benefit of a contrast between a good and bad exemplar. This success might be achieved even if each option, if judged in isolation, might be considered acceptable.

There are several possible outcomes for bilingual performance in this study: At one extreme, Korean-English bilinguals may be able to employ monolingual-like knowledge of Korean animacy constraints in the forced choice task in the same way that Korean monolinguals employ animacy. At the other extreme, the bilinguals' performance on the forced choice task might reflect the same level of L2 influence as their performance on the grammaticality judgment task. An intermediate possibility is that the bilinguals' performance will still reflect L2 syntactic influence, but that their use of Korean animacy constraints will become more monolingual-like when compared to their performance during Study 1. If Korean-English bilinguals are able to use Korean animacy constraints to achieve monolingual-like performance on the forced choice task, then the results would indicate that Korean-English bilinguals are able to access monolingual-like grammatical knowledge of animacy constraints in certain conditions. However, if Korean-English bilinguals still do not employ Korean animacy constraints in the same way as monolinguals on the forced choice task in Korean, then the observed L2 English influence on the L1 Korean grammar would suggest that the bilinguals have little ability to access monolingual-like Korean knowledge of animacy constraints. The

existence of this long-term change to L1 syntax in conditions that are minimally demanding on memory may suggest that the bilinguals' L1 knowledge of this syntactic structures has been altered by contact with English to the extent that it is effectively lost from memory. If, however, bilinguals' performance becomes more monolingual-like but still provides evidence for L2 influence, then it may be possible that bilinguals have reduced sensitivity to monolingual-like L1 knowledge of animacy constraints rather than a functional inability to access monolingual-like knowledge.

Method

Participants. Twenty-four Korean-English bilinguals, 20 Korean monolinguals and 23 English monolinguals were recruited from Lehigh University, from Korean Student Associations at various universities, and from linguistlist.org (an on-line community of language researchers and multilingual speakers) to participate in the study. The Korean-English bilinguals had not lived in an English speaking country earlier than age 14 (to ensure full mastery of L1 before immersion) and had lived in an English speaking country for at least one year before participation (to ensure full immersion). The Korean monolinguals had generally have been exposed to English in the classroom starting around age six, but their level of classroom instruction was minimal, they had never lived in an English speaking country, and they considered themselves functionally monolingual. The qualification of both bilingual and monolingual participants was determined using data collected through the Language History Questionnaire and monolingual version of the questionnaire used in Study 1. Bilingual participants were compensated with a \$15 Amazon gift card for their time and Korean monolingual

participants were compensated with a \$5 Korean Happy Money gift card for their time. English monolingual participants received course credit for their participation.

Design. The study used a 3 (ungrammatical for animacy only vs. ungrammatical for word order only vs. ungrammatical for animacy and word order sentence pairing type) x 2 (Korean vs. English language) x 3 (Korean-English bilingual vs. Korean monolingual vs. English monolingual language group) design.

Materials. The Language History Questionnaire and its monolingual adaptation from Study 1 were used. Twenty-two sentences were selected from the original 30 stimulus sentences in Study 1. We eliminated some of the original stimulus sentences if they were supposed to be considered grammatical in Korean (high animacy subject and SOV word order) but received a mean grammaticality rating below .6 from Korean monolinguals in Study 1. Four sentences were ungrammatical in Korean in terms of word order only, five were ungrammatical in Korean for animacy only, two were ungrammatical in Korean for both animacy and word order, and the other eleven were grammatically correct in Korean. The imbalance in the number of sentences occurred because the number of sentences in the original set of sentences was limited and did not allow for us to both manipulate the sentences for grammaticality and maintain an even number of sentences of each type. We wanted to use this specific set of sentences so that the stimuli in Study 1 and 2 remained the same. The sentences were organized into pairings such that one sentence of the pair is grammatically correct in terms of Korean grammar and the other is grammatically incorrect, for a total of 11 pairs (see Appendix B for a complete list of the Korean and English sentence pairs). The English versions of the sentences were also taken from Study 1.

All of the sentences were paired up in exactly the same way across languages such that one sentence in the pair was grammatical in Korean and the other was ungrammatical in Korean. The sentence pairings for both the Korean and English stimulus sets were made in terms of what is acceptable for the Korean grammar so that we would be able to perform analyses that compare performance on the same sentence structures across languages. Since the sentence pairings were designed with Korean grammar in mind, the sentences in the pairings that contrasted grammaticality in Korean for animacy only were both ungrammatical in English (because they had the Korean SOV word order). The English sentence pairs therefore consisted of six pairs where one sentence was grammatically correct in English and one was ungrammatical for word order in English (four pairs with ungrammatical word order in Korean and two pairs with ungrammatical word order and animacy in Korean), and 5 sentence pairings where both sentences were ungrammatical for word order in English (five pairs that were ungrammatical for animacy in Korean). The sentences were organized into pairings such that one sentence of the pair is grammatically correct in terms of Korean grammar and the other is grammatically incorrect, for a total of 11 pairs (see Appendix B). The sentences in pairings that contrasted animacy only in Korean were both ungrammatical in English. The sentences in pairings that contrasted grammaticality in Korean for word order only and for both word order and animacy consisted of, for English, one sentence that was grammatically correct and one sentence that was ungrammatical for word order.

Procedure. The study was administered on-line and hosted by Qualtrics (2005). Before beginning the study, participants were told that they were participating in a bilingualism study. Participants read the consent information on the first web page, typed

their name, and clicked a submit button to participate in the study. Bilingual participants were randomly assigned to begin with the experiment in either English or Korean first and completed the experiment in the other language one week after the completion of the first session. Monolingual participants only completed one session in their native language.

Next, all participants responded to some conversational free response questions presented on the computer screen in the language of the current session to establish the appropriate language context (e.g., bilingual participants answered these questions in Korean when doing the experiment in Korean and in English when doing the experiment in English). The conversational free response tasks consisted of three open-ended questions: “How has school been for you this year? What do you find to be most and least stressful?”, “What are a few of your favorite things about your university?”, and “What are a few of your least favorite things about your university?”. Participants supplied brief, open-ended responses in text boxes to the conversational prompts. Participants then filled out either the bilingual Language History Questionnaire or the monolingual version (depending on language group). All monolingual participants completed the monolingual Language History Questionnaire before beginning data collection and bilingual participants completed the Language History Questionnaire at the beginning of their experimental session in English (whether it was the first or the second session) because it was written in English.

The participants in both settings were presented with all of the sentence pairings (one sentence grammatical/one sentence ungrammatical in terms of Korean grammar), with pairings of sentences appearing in random order. Before beginning the task,

participants were presented with the following instructions: “You will now be presented with a series of sentence pairings. Pick which one sounds more correct. For some pairs, both sentences or neither sentence may sound correct. Do your best to pick one of them as more correct. Just guess if you need to - pick one or the other even if you don't have a clear sense that one is better.” After completing the study, participants viewed a web page that thanked them for their time and provided them with information on debriefing and compensation. Bilingual participants were debriefed and compensated after their second session.

Results

While 49 bilinguals initiated participation in this study, 25 were eliminated from the analysis due to either failure to complete the experiment or failure to complete the conversational free response task. Responses for the remaining 24 bilinguals' judgments in both languages and those of the monolinguals of each language were scored with a “1” if the sentence choice aligned with canonical Korean grammar and a “0” if the sentence choice did not align with canonical Korean grammar. As a result, the higher the score, the more performance is aligned with Korean grammar. This is true for both Korean and English sentences; thus English scores are expected to be low if performance is English-like on them.

English monolingual performance vs. Korean monolingual performance. We expect English monolingual judgments to reflect English grammar and Korean monolingual judgments to reflect Korean grammar. Therefore, because scoring for both languages is done against the Korean standard for purposes of comparison, we predict that ratings of English monolingual judgments will be lower than those for Korean

monolingual judgments for all sentence types. When comparing English monolingual scores with Korean monolingual scores, we expect to observe a main effect of sentence pairing type (one sentence of the pair ungrammatical in Korean for animacy only, or ungrammatical in Korean for word order only, or ungrammatical in Korean for both word order and animacy) and language group (English monolingual vs. Korean monolingual). We also expect to observe an interaction between sentence pairing type and language group such that the ratings of English monolingual participants will be lower for sentence pairings that are ungrammatical for word order only and both word order and animacy than sentence pairings that are ungrammatical for animacy only since both sentences in the animacy only pairings will be grammatically unacceptable in English and we expect performance to be around chance level.

The mean scores are displayed in Table 7. English monolinguals scored lower than Korean monolinguals for all sentence pairing types. Since the sentences were scored higher if they aligned with canonical Korean grammar choices, this pattern indicates that each group performed the task in the expected way and aligned their choices with their respective grammars. There was a main effect of sentence pairing type ($F(1,41)= 143.62$, $p < .001$), a main effect of language group ($F(1,41)= 426.33$, $p < .001$), and a significant interaction between sentence pairing type and language group ($F(1,41)= 64.28$, $p < .001$). Both Korean and English monolinguals preferred sentences with high animacy subjects in pairings that were ungrammatical for animacy only. Since both sentences in the pairing would be ungrammatical in English due to SOV word order, this indicates that English monolinguals may have been slightly sensitive to the level of animacy of an object, consistent with judgments in Study 1. Overall, Korean monolinguals selected more

sentences in all conditions that aligned with Korean grammar than English monolinguals and English monolinguals demonstrated floor effects in their performance on sentence pairings that were ungrammatical for word order only and animacy and word order only.

Bilingual English performance vs. Monolingual English performance. Based on the results of Study 1, we predicted that we would only observe backwards syntactic transfer, we expected to observe only L2 influence on L1 syntax and not L1 influence on L2 syntax. In other words, we did not expect bilinguals' rating of English sentences to differ from English monolinguals'. We predicted a main effect for sentence pairing type, no main effect of language group, no interaction between sentence pairing type and language group, and no significant differences in ratings for any of the sentence pairing types.

The pattern of ratings did not match our predictions (see Table 8). Surprisingly, bilingual participants scored higher (more Korean-like) on English sentence pairings that were ungrammatical for word order only and ungrammatical for both word order and animacy in Korean than English monolingual participants. Conversely, bilingual participants scored lower on sentences that were ungrammatical for animacy only. There was a main effect of sentence pairing type ($F(1,45)= 90.90, p < .001$), a main effect of language group ($F(1,45)= 7.08, p = .011$), and a significant interaction between sentence pairing type and language group (bilingual vs. monolingual) ($F(1,45)= 9.73, p < .001$).

While these results indicate the presence of L1 influence on L2 for sentence pairs with one sentence that is ungrammatical for word order only in Korean and ungrammatical for both word order and animacy in Korean, there is no indication of L1 influence on L2 performance for sentence pairs with one sentence that is ungrammatical

in Korean for animacy only. Although there is evidence for L1 influence on L2 English sentence judgments, bilinguals' English scores for sentence pairings types were still very low which indicates that bilinguals are referencing canonical English grammar. Surprisingly, bilingual performance for animacy only sentence pairings was significantly lower than performance by English monolingual participants. Although we did not expect to observe this pattern in the English performance of the bilingual participants, it is likely that this pattern occurred because the participants were picking sentences in a random fashion since there are no animacy rules in English grammar and since they knew that both sentences were technically ungrammatical in English due to their word order. It is possible that native speakers of English are more confident than bilinguals about both sentences in the pairing being ungrammatical due to word order which allowed their intuitive judgments to be based on slight animacy preferences even though no grammatical rules about animacy exist in English. Perhaps the bilinguals' performance on these sentence pairings was more strongly affected since they were less confident about both sentences being ungrammatical in English. The bilinguals' focus on word order in these sentence pairings may have hindered their ability to make intuitive judgments about animacy preference in English.

Bilingual Korean performance vs. Monolingual Korean performance. This comparison is the most critical one for evaluating to what extent bilinguals can access their L1 knowledge of Korean animacy constraints when judging Korean sentences. There were several possible outcomes for the bilinguals' Korean performance in this study. One possibility was that Korean-English bilinguals would perform in a monolingual-like manner on the forced choice task. Another possibility was that Korean-

English bilinguals would demonstrate that same level of L2 influence in their performance on the forced choice task as they did on the grammaticality judgment task. The intermediate possibility was that bilinguals would still demonstrate evidence for L2 influence in their performance on the forced choice task but that their performance would be more monolingual-like when compared to performance on the grammaticality judgment task. If the bilingual participants are able to access monolingual-like L1 animacy knowledge on the forced choice task, then we would not observe a main effect of sentence pairing type or an interaction between language group (bilingual vs. monolingual) and sentence pairing type. That is, bilingual performance would mirror monolingual performance on all sentence pairing types. If bilinguals are still unable to access monolingual-like L1 animacy knowledge, but are able to access monolingual-like word order knowledge on the forced choice task, then we expect to observe a significant interaction between language group and sentence pairing type, and that bilingual participants will have lower ratings on the forced choice task than Korean monolingual participants for sentences that are ungrammatical for animacy only in Korean.

The pattern of ratings indicated that bilingual participants were still unable to access monolingual-like knowledge of the L1 Korean animacy constraint (see Table 9). Bilingual participants' scores were substantially lower than those of Korean monolinguals for sentence pairs where one sentence was ungrammatical in Korean for animacy only, sentence pairs where one was ungrammatical in Korean for both animacy and word order, and somewhat lower for sentence pairs where one was ungrammatical in Korean for word order only. There was a marginal main effect of sentence pairing type ($F(1,42)= 2.92, p= .06$), a significant main effect of language group ($F(1,42)= 15.90, p<$

.001), and a significant interaction between sentence pairing type and language group ($F(1,42)= 4.54, p= .013$).

Bilingual participants' performance on the forced choice task did not mirror the performance of Korean monolingual participants for sentence pairs where one was ungrammatical for animacy only (that is, sentences pairs where one sentence had a high animacy sentence subject and the other had a low animacy sentence subject). Bilingual participants were less likely than monolinguals to choose the sentences that were congruent with canonical Korean animacy rules ($t(42)= -5.066, p< .001$). The difference in performance between monolingual and bilingual participants for sentences of which one was ungrammatical for word order (that is, where one sentence had SOV order and one had SVO) was non-significant and far less divergent than differences in performance between monolinguals and bilinguals for sentences that were ungrammatical for animacy only ($t(42)= -1.826, p= .08$). This outcome indicates that L2 use had relatively little effect on judgments of word order.

We did not predict that the difference in monolingual and bilingual participant performance would be significant for sentence pairs that were ungrammatical for both animacy and word order in Korean (that is, pairs where one sentence was grammatically correct and had a high animacy subject and SOV word order and one was incorrect and had a low animacy subject and SVO word order). However, this outcome did occur ($t(42)= -3.05, p= .004$). We conjecture that the reason for this difference is due to loss of animacy rules in Korean and not loss of Korean word order, since bilingual participants did not perform in a significantly different manner than monolingual participants for sentences that were ungrammatical for word order only. It is possible that the need to

consider both word order and animacy (instead of only a single cue) on these sentence pairings combined with the functional inability to access monolingual-like knowledge of the animacy constraint led to decreased performance by bilingual participants in this category of sentence pairings.

Discussion

The purpose of this study was to investigate whether or not Korean-English bilinguals could access monolingual-like L1 knowledge of Korean animacy constraints given the fewest cognitive demands possible in the form of a forced choice task. The results indicate that bilingual participants were less able to access L1 knowledge of animacy constraints than monolingual participants.. Even when given the fewest task demands possible, Korean-English bilinguals still have trouble accessing monolingual-like L1 knowledge of Korean animacy rules. The findings of this study suggest that mere re-exposure to the standard L1 grammatical structure does not enable bilinguals who exhibit backwards syntactic transfer to operate on a par with native speakers.

In addition to L2 influence of English on L1 Korean animacy constraints, the bilinguals' performance also exhibited some L1 Korean influence on L2 English word order judgments. Although the bilinguals' did choose SOV word order significantly more often than English monolinguals for sentence pairings involving word order differences, the proportion of SOV sentences that they chose in English was still very low. Overall, bilingual participants' performance on the forced choice task suggests that cross-linguistic influence pervades even conditions that are minimal in cognitive demand.

General Discussion

Together, these studies investigate the occurrence of L2 influence on L1 syntax in Korean-English bilingual speakers. The results of the first study demonstrate that L2 influence on L1 syntax does not only occur under conditions of cognitive load due to time pressure, but also occurs in conditions without time pressure and thus represents long-term changes to the use and processing of L1 syntax. The difference in bilinguals' performance in the speeded task when compared to the deliberative task indicates that, while time pressure is not necessary for L2 influence on L1 syntax, the presence of time pressure may increase the impact of L2 influence by making it more difficult to select the appropriate L1 structures and inhibit the competing L2 structures. Study 2 further investigated the nature of the backwards syntactic transfer observed in Study 1 and tested the Korean-English bilinguals' ability to access their L1 knowledge of Korean syntax and choose the correct sentence of a pair of sentences that differ in grammaticality. Re-exposing the Korean-English bilinguals to Korean sentences that utilize animacy constraints in a monolingual-like way through a forced choice task did not allow them to access monolingual-like L1 knowledge of Korean animacy rules.

The findings of these two studies suggest that L2 syntactic influence is not just a linguistic by-product of cognitive load, but represents long-term change to the use and processing of L1 syntax. The findings also suggest that L2 syntactic influence is pervasive and can occur even in conditions that are minimally demanding. Mere re-exposure to native-like L1 syntactic structure does not necessarily allow a bilingual who exhibits L2 syntactic influence to access their monolingual-like knowledge of L1 syntax. Since grammaticality judgments and forced choice tasks do not necessarily represent

typical language use and processing, future studies will investigate whether a natural language context facilitates the bilingual speakers' abilities to access L1 knowledge of animacy constraints or further hinders access.

Future research will embed the ungrammatical sentences used in the forced choice task into a narrative passage and participants will be asked to perform a proofreading task. One possible outcome is that embedding grammatical errors in a natural language context (a narrative passage) might make grammatical errors more salient when they are surrounded by grammatical and acceptable sentences. Another possibility is that embedding the grammatical errors in a narrative passage will make the errors more difficult to distinguish from the rest of the passage due to the increased overall difficulty of proofreading as a comprehension task. In addition to demonstrating the presence of L2 syntactic influence on L1, these studies also demonstrate that separate grammatical structures differ in their vulnerability to L2 influence. The studies both demonstrated clear L2 influence for Korean animacy constraints, but Study 1 only demonstrated potential L2 influence for Korean word order. We had predicted that this difference in vulnerability would occur since L2 influence on animacy results in a loosening of constraints due to the lack of animacy rules in English (Gurel, 2004; Pavlenko, 2010; Schmid, 2010; Stolberg & Munch, 2010; Wolff & Ventura, 2009) and because animacy is a grammatical structure located at the syntax-semantics interface (Bolonyai, 2007). It is of interest to further explore how being located at the syntax-semantics interface influences a structure's vulnerability to cross-linguistic influence.

While animacy rules in all languages determine which nouns can and cannot be the subject of causal sentences, the specific nouns that are considered acceptable as

causal sentence subjects varies across languages (Yamamoto, 1999). In Korean, all humans, animals and certain inanimate objects are considered acceptable causal sentence subjects, and other inanimate objects are not considered acceptable sentence subjects. While there is no clear pattern of categorization for inanimate objects that are considered high animacy in Korean grammar, the distinction between high and low animacy is related to the objects ability to internally generate energy of some sort (Wolff et al., 2009). Differences in internal energy generation explain why “electric kettle” is high animacy in Korean and “kettle” is not.

In Japanese grammar, humans and animals are acceptable causal sentence subjects and all other nouns are not acceptable (Yamamoto, 1999). Given that there are these differences in animacy rules across languages, we conjecture that the animacy rules of some languages may be more related to the way that animacy is conceptualized and categorized non-linguistically than the rules of other languages. Based on the role of animacy for structure across languages (regardless of explicit rules about animacy), humans tend to categorize humans as being most animate, then animals, then inanimate objects and natural forces (Yamamoto, 1999). Although an evaluation of non-linguistic categorization of animacy is needed, we propose that the Korean-English bilinguals may not have maintained access to a monolingual-like representation of Korean animacy constraints because the Korean animacy constraint is not congruent with the way that people conceptually categorize animacy. Since Korean animacy rules consider some inanimate objects to be high animacy, this pattern is likely incongruent with the way that people non-linguistically categorize animacy (Yamamoto, 1999). We also propose that Japanese animacy constraints are more congruent with conceptual categorization of

animacy than Korean animacy constraints since only humans and animals are considered high animacy.

Future research will evaluate the nature of non-linguistic categorization of animacy and whether it differs between language groups and reflects the animacy constraints of a speaker's language, or if it truly is similar across language groups regardless of their language's grammatical animacy constraints. Based on previous studies of animacy use in language both with and without animacy constraints (McDonald et al., 1993; Yamamoto, 1999) and the evidence for slight high animacy preferences even among English monolinguals in Study 1 and Study 2, we propose that non-linguistic conceptualization of animacy will be similar across language groups and converge on a pattern that rates humans as the most animate, then animals, and then inanimate objects and natural forces.

Since we hypothesize that Japanese animacy constraints are more related to non-linguistic conceptualization of animacy than Korean animacy constraints are, we propose that Japanese animacy constraints may be more communicatively relevant if they are more congruent with non-linguistic animacy categorization than Korean animacy constraints. If animacy is more communicatively relevant in Japanese than it is in Korean, there may be more of an implicit motivation for Japanese-English bilinguals to maintain monolingual-like knowledge of L1 animacy constraints than there is for Korean-English bilinguals. Further, it may be a simpler constraint to implement and thereby less susceptible to change under L2 influence.

In future studies, we will perform the experiments from this paper with Japanese-English bilinguals in order to evaluate whether or not Japanese-English bilinguals also

demonstrate evidence for L2 influence in the way that they employ their L1 animacy constraints. The results of this study will illuminate the importance of conceptual relevance for the maintenance of syntactic rules and the relationship between the syntax-semantics interface and the vulnerability of L1 syntactic structures to L2 influence.

In addition to further evaluating L2 influence on structures at the syntax-semantics interface, it may also be of interest to investigate L2 influence on narrow syntax. Although Study 1 only demonstrated a potential for L2 influence on L1 word order, the Korean-English bilinguals' increased reliance on word order in their L1 grammaticality judgments may indicate that narrow syntax is also vulnerable to L2 influence even if structures located at the syntax-semantics interface are more vulnerable. It may be of interest in future research to elucidate whether this increased reliance on L1 word order is due to L2 influence from English or due to other factors such as the loss of monolingual-like knowledge of L1 animacy constraints.

In sum, the findings of these two studies suggest that L1 syntax is changeable and vulnerable to cross-linguistic influence, and also that language representation in general may be more flexible in nature than previously thought. Some consider L1 syntax to be static after it is fully acquired (Schmid, 2011) since Chomsky-inspired views of syntax are still influential. In spite of those that maintain this static view of L1 syntax, these studies have demonstrated that L1 syntax is vulnerable to cross-linguistic influence. It is possible that all aspects of language are dynamic in terms of their representation and are prone to change as a result of both linguistic and non-linguistic factors. If this is true, then it suggests that language is a dynamic system which is constantly updating.

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Table 1

Reaction time differences in ms across tasks, language and sentence types between speeded and deliberative tasks, Study 1

	Sentence Subject			
	High animacy		Low animacy	
	SOV	SVO	SOV	SVO
SVO				
English Speeded	2309 (428)	2453 (503)	2150 (284)	2160 (512)
English Deliberative	4932 (2097)	4297 (913)	3972 (2191)	4182 (1030)
Korean Speeded	1676 (579)	1595 (428)	1854 (518)	1635 (531)
Korean Deliberative	3488 (1847)	2382 (1067)	3405 (1571)	1421 (764)

Table 2

Mean Deliberative Grammatical Acceptability Ratings (0-100) for Sentences with Varying Animacy and Word Order of English Monolinguals in the Lab Study vs. the Online Study, Study 1

	Lab study		Online study	
	SOV	SVO	SOV	SVO
Sentence subject				
High animacy	5.30 (7.32)	96.15 (5.51)	9.10 (9.52)	89.43 (20.65)
Low animacy	4.16 (5.68)	90.60 (9.78)	8.99 (10.28)	85.65 (23.69)

Table 3

Mean Deliberative Grammatical Acceptability Ratings (0-100) of English vs. Korean Monolinguals for Sentences with Varying Subject Animacy and Word Order, Study 1

	Speaker Group			
	English		Korean	
	SOV	SVO	SOV	SVO
Sentence subject				
High animacy	9.10 (9.52)	89.43 (20.65)	54.74 (23.25)	37.17 (21.07)
Low animacy	8.99 (10.28)	85.65 (23.69)	39.88 (21.42)	28.76 (18.15)

Table 4

Mean Deliberative Grammatical Acceptability Ratings (0-100) of English Monolinguals vs. Korean-English Bilinguals for English Sentences with Varying Animacy and Word Order, Study 1

	Speaker Group			
	Monolingual		Bilingual	
	SOV	SVO	SOV	SVO
Sentence subject				
High animacy	9.10 (9.52)	89.43 (20.65)	18.21 (20.43)	92.30 (11.15)
Low animacy	8.99 (10.28)	85.65 (23.69)	12.15 (15.94)	86.27 (29.03)

Table 5

Mean Deliberative Grammatical Acceptability Ratings (0-100) of Korean Monolinguals vs. Korean-English Bilinguals for Korean Sentences with Varying Animacy and Word Order, Study 1

	Speaker Group			
	Monolingual		Bilingual	
	SOV	SVO	SOV	SVO
Sentence Subject				
High animacy	54.74 (23.25)	37.17 (21.07)	90.77 (12.26)	17.38 (22.08)
Low animacy	39.88 (21.42)	28.76 (18.15)	83.61 (20.23)	15.55 (22.26)

Table 6

Mean Percentage of Sentences per Category of Varying Animacy and Word Order that Bilinguals Said “Yes” for Grammatical Acceptability in English and Korean in Speeded Judgments, Study 1

	Test Language			
	English		Korean	
	SOV	SVO	SOV	SVO
Sentence subject				
High animacy	10.90 (28.00)	87.50 (12.57)	88.30 (4.96)	6.00 (15.83)
Low animacy	5.90 (16.50)	81.70 (17.37)	77.50 (30.75)	10.00 (15.43)

Table 7

Mean Proportion of Sentences Congruent with Korean Grammar Selected by English Monolinguals vs. Korean Monolinguals, Study 2

Language group	Sentence Pair Type		
	Animacy Only	Word Order Only	Both Word Order and Animacy
English	.70 (.18)	.02 (.07)	.00 (.00)
Korean	.95 (.14)	.74 (.15)	.88 (.22)

Table 8

Mean Proportion of English Sentence Choices Congruent with Korean Grammar by English Monolinguals vs. Korean-English Bilinguals, Study 2

Language group	Sentence Pair Type		
	Animacy Only	Word Order Only	Both Word Order and Animacy
Monolingual	.70 (.18)	.02 (.07)	.00 (.00)
Bilingual	.58 (.20)	.29 (.35)	.17 (.32)

Table 9

Mean Proportion of Korean Sentence Choices Congruent with Korean Grammar by Korean Monolinguals vs. Korean-English Bilinguals, Study 2

Language group	Sentence Pair Type		
	Animacy Only	Word Order Only	Both Word Order and Animacy
Monolingual	.95 (.14)	.74 (.15)	.88 (.22)
Bilingual	.63 (.27)	.64 (.21)	.52 (.48)

Appendix A: Study 1 Stimulus Sentences

	English	Korean
High animacy	The air conditioner cooled the room.	에어컨이 식혔다 방을.
	The alarm clock awoke the kids.	알람시계가 깨웠다 아이들을.
	The burner warmed the coffee.	버너가 데웠다 커피를.
	The candle brightened the room.	양초가 밝혔다 방을.
	The dishwasher shook the dishes.	식기세척기가 흔들었다 그릇을.
	The electric kettle boiled the water.	전기주전자가 끓였다 물을.
	The eye glasses magnified the words.	안경이 확대시켰다 단어를.
	The falling stick broke the car window.	떨어지는 막대기가 부수었다 차창문을.
	The fire burned the house.	불이 태웠다 집을.
	The heat melted the butter.	열이 녹였다 버터를.
	The match melted the ice.	성냥이 녹였다 얼음을.
	The microwave defrosted the meat.	전자레인지가 해동시켰다 고기를.
	The sugar sweetened the cupcake.	설탕이 달게 했다 컵케익을.
	The sunlight dried the towel.	햇빛이 말렸다 수건을.
The wave flipped the boat.	파도가 뒤집었다 배를	
Low animacy	The knife cut the bread.	칼이 잘랐다 빵을.
	The key locked the door.	열쇠가 잠겼다 문을.
	The chopsticks squashed the noodle.	젓가락이 눌러 으갠다 국수를.
	The spoon moved the ice cream.	숟가락이 옮겼다 아이스크림을.
	The cork screw opened the bottle.	코르크 병마개 뺐이가 열었다 병을.
	The hanger dropped the shirt.	옷걸이가 떨어뜨렸다 셔츠를.
	The high heels scuffed the floor.	구두가 긁었다 바닥을.
	The jacket warmed the boy.	재킷이 따뜻하게 했다 소년을.
	The kettle boiled the tea.	주전자가 끓였다 차를.
	The calculator computed the velocity.	계산기가 계산했다 속력을.
	The keyboard finished the paper.	키보드가 끝냈다 레포트를.
	The bullet killed the president.	총알이 죽였다 대통령을.
	The magnifying glass ignited the fire.	돋보기가 붙였다 불을.
	The milk filled the glass.	우유가 채웠다 컵을.
	The switch brightened the room.	스위치가 밝혔다 방을.

*All sentences also had versions with Subject-Object-Verb word order.

Appendix B: Study 2 Stimulus Sentence Pairings

English	Korean
Ungrammatical for animacy	
The heat the butter melted. The hanger the shirt dropped. 떨어뜨렸다.	열이 버터를 녹였다. 옷걸이가 셔츠를
The spoon the ice cream moved. 움겼다.	숫가락이 아이스크림을
The wave the boat flipped.	파도가 보트를 뒤집었다.
The falling stick the car window broke. 차창문을 부수었다.	떨어지는 막대기가
The calculator the velocity computed. 계산했다.	계산기가 속력을
The bullet the president killed. 죽였다.	총알이 대통령을
The sunlight the towel dried. 말렸다.	햇빛이 수건을
The alarm clock the kids awoke. The keyboard the paper finished.	알람시계가 아이를 깨웠다. 키보드가 레포트를 끝냈다.

Ungrammatical for word order

The fire the house burned. The air conditioner cooled the room.	불이 집을 태웠다. 에어컨이 식혔다 방안을.
The microwave defrosted the meat. 해동시켰다.	전자레인지가 고기를
The sugar the cupcake sweetened.	설탕이 컵케익을 달게했다.
The electric kettle the water boiled. 끓였다.	전기주전자가 물을
The dishwasher shook the dishes. 접시를.	식기 세척기가 흔들었다
The match melted the ice. The candle the room brightened.	성냥이 녹였다 얼음을. 양초가 방을 밝혔다.

Ungrammatical for animacy and word order

The eye glasses the words magnified. 안경이 단어를
확대시켰다.

The cork screw opened the bottle. 코르크 병마개 뽑이가
열었다 병을.

The kettle boiled the tea.

전기주전자가 데웠다 차를.

The burner the coffee warmed.
데웠다.

버너가 커피를

*Sentences that are grammatical in Korean have been bolded.

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B.S., Psychology, East Stroudsburg University
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2008-2012

Experience:

**Lehigh University Psychology Department: Language and Thought Lab Graduate
Researcher
Aug. 2012-present**

Develop and test hypotheses, collect and analyze data, assist lab-mates and graduate advisor with research. Write papers describing research and findings and present on findings.

**Lehigh University Psychology Department: Graduate Research Assistant for
the Language and Thought Lab
June 2013-present**

Manage lab and undergraduate research assistants, schedule meetings, collect, organize and analyze data, assist with creation of presentation materials and research write-ups.

**Lehigh University Psychology Department: Teaching Assistant for PSYC 096
Human Neuroscience
Aug. 2014-Dec. 2014**

Assist students with understanding of course material (by office hour and appointment), proctor exams, assist with exam grading, facilitate group discussions.

**Lehigh University Psychology Department: Primary Instructor for PSYC 097
Current Topics in Human Neuroscience
Aug. 2014-Dec. 2014**

Assign contemporary readings in the area, lead discussions of assigned materials.

**Lehigh University Psychology Department: Teaching Assistant for COGS 007
Introduction to Cognitive Science**

Jan. 2014-May 2014

Assist students with understanding of course material (by office hour and appointment), proctor exams, assist with exam grading, facilitate group discussions.

**Lehigh University Psychology Department: Primary Instructor for PSYC 196
Mind and Brain Laboratory
Jan. 2013-June 2013**

Prepare materials and lead students in completion of lab activities and relevant discussion about lab activities, complete grading for lab work, assist students with understanding of course material (by office hour and appointment).

**Lehigh University Psychology Department: Teaching Assistant for PSYC 176
Mind and Brain
Jan. 2013-May 2013**

Assist students with understanding of course material (by office hour and appointment), facilitate group activities, assist with grading.

**Lehigh University Psychology Department: Teaching Assistant for PSYC 110
Statistical Analysis of Behavioral Data
Aug. 2012-Dec. 2012**

Assist students with understanding of course material (by office hour and appointment), facilitate group activities, instruct lab section on SPSS, assist with grading.

**Creative Energy Options: Statistical and Psychometric Consultant Internship
Jan. 2012-May 2012**

Analyze data in order to validate a leadership inventory with SPSS and SAS. Give psychometric advice based on these analyses. Write an executive report and present on the validation of the measure.

**East Stroudsburg University Nursing Department: Statistical Consultant
Jan. 2011-May 2012**

Analyze data using SPSS in order to evaluate the effectiveness of student nursing program in conjunction with Pocono Medical Center. Write reports on analyses and hold meetings to discuss new directions for the student nursing program.

**East Stroudsburg University Sustainability Committee: Statistical and
Psychometric Consultant
Sept. 2010-Mar. 2011**

Analyze data from surveys that evaluated the attitudes of East Stroudsburg University students on reducing the university's carbon dioxide emissions. Redesign the surveys

based on the analyses. Present findings and new survey design at the Sustainability Committee's forum.

**ESU Center for Social and Cognitive Research: Senior Research Assistant
Aug. 2009-May 2012**

Develop testable hypotheses, recruit participants, collect, analyze data using Microsoft Excel, SPSS and SAS. Organize and lead the research team. Presented research at the Eastern Psychological Association in March 2012.

**ESU Tutoring Center: Student Tutor/Teaching Assistant
Feb. 2009 – May 2012**

Individually tutor students in General Statistics, Pre-Calculus, Quantitative Sociology and other courses. Take and distribute notes to students with disabilities. Hold group study sessions weekly for Quantitative Psychology students.

Presentations:

Lebkuecher, A.L. & Malt, B.C. Korean-English Bilinguals Fail to Access Koean Animacy Constraints. Poster presented at 2014 Annual Meeting of the Psychonomic Society, Long Beach, California, November, 2014.

Lebkuecher, A.L., Malt, B.C. & Ping, L. Is First-language Syntax Susceptible to Second language Influence Without Time Pressure? Poster presented at 2014 Annual Meeting of Eastern Psychological Association, Boston, MA, March, 2014.

Lebkuecher, A.L., Malt, B.C. & Ping, L. Is First-language Syntax Susceptible to Second language Influence Without Time Pressure? Poster presented at 2013 Annual Meeting of the Psychonomic Society, Toronto, Canada, November, 2013.

Lebkuecher, A.L. Backwards Syntactic Transfer: Is L1 Syntax Susceptible to L2 Influence? Talk presented at Lehigh University Psychology Department Brown Bag Colloquium, Lehigh University, Bethlehem, PA., May, 2013.

Lebkuecher, A. L. Metaphorical comprehension in Chinese speakers vs. English speakers. Talk presented at 2012 Annual Meeting of the East Stroudsburg University Psychology Department Research Forum, East Stroudsburg University, East Stroudsburg, PA, April, 2012.

Lebkuecher, A. L. & Green, B. A. Evaluating Implicit Attitudes Using Schematic Web Exercises. Talk presented at 2012 Annual Meeting of the Sigma Xi Undergraduate Research Forum, East Stroudsburg University, East Stroudsburg, PA, March, 2012.

Lebkuecher, A. L. & Green, B. A. Assessing the Validity of Several Spatial Aptitude Measures. Poster presented at 2012 Annual Meeting of the Eastern Psychological Association, Pittsburgh, PA, March 2012.

Lebkuecher, A. L., Paz, M. M. & Matauic, T. The psychometric evaluation of the ESU Sustainability Survey. Poster presented at 2012 Annual Meeting of the East Stroudsburg University Sustainability Research Forum, East Stroudsburg University, East Stroudsburg, PA, March, 2011.

Guest Lectures:

Lebkuecher, A.L. (April, 2014). Culture, Language and Cognition. Guest lecture for Introduction to Cognitive Science Course at Lehigh University.

Lebkuecher, A.L. (November, 2012). Correlation and Regression in Behavioral Analyses. Guest lecture for Statistical Analysis of Behavioral Data Course at Lehigh University.

Awards and Offices:

John Kramer Research Award (East Stroudsburg University Psychology Department)

Sigma Xi Research Award for East Stroudsburg University's Psychology Department

President of Psi Chi (East Stroudsburg University Chapter)

President of East Stroudsburg University's Psychology Association

Organizations:

American Psychological Association (APA)

Association for Psychological Science (APS)

Psi Chi