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Bidirectional lexical interaction in late immersed Mandarin-English bilinguals

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ABSTRACT

We compared naming patterns for common household objects by monolingual speakers of English and Mandarin and Mandarin-English bilinguals in both their L1 and L2. These bilinguals arrived in the U.S. no earlier than age 15, thus having a well-entrenched L1 and relatively late L2 immersion, and their two languages are dissimilar on many dimensions. Results showed changes to both L1 and L2 word use that increased with greater L2 usage, implying that the lexical network remains plastic over an extended time period. The influence of each language on the other can be understood in the context of specific L1–L2 lexical category differences and other semantic variables. The bilingual outcomes are not consistent with perspectives in which the network stabilizes once an L1 is well-entrenched, nor in which speaking dissimilar languages or continuing to use L1 protects L1 from change. Instead, it supports a more dynamic view of lexical representation in which L1 and L2 representations can be modified at any time and interconnections between them cause each to impact the other.

Introduction

Second-language learning research traditionally examined transfer from the first language (L1) to the second (L2) assuming a stable L1 (e.g., Odlin, 1989). Separately, language attrition research examined changes to L1 in the face of increasing L2 usage. Only recently has it been appreciated that L1 and L2 exert mutual influences, and performance in each may best be understood by studying their interplay (Jarvis & Pavlenko, 2008; Schmid, 2011; Schmid & Köpke, 2007).

Most inquiry from this new perspective has focused on phonology and morpho-syntax, considered to be governed by procedural memory and potentially affected by sensitive periods for learning (e.g., Abrahamsson, 2012; Abrahamsson & Hyltenstam, 2009; Paradis, 2009; Ullman, 2001). In contrast, lexical knowledge is considered to be stored in declarative memory and subject to memory parameters such as frequency of retrieval (e.g., Ullman, 2004). But appropriate use of words depends on much more than retrieval of word forms. Languages differ in their lexicalization patterns (see, e.g., Bowerman & Levinson, 2001; Malt & Majid, 2013; Malt & Wolff, 2010). For instance, in English, upholstered seats for one person receive the same name as hard wooden seats for one person (*chair*), whereas in Mandarin they receive the same name as upholstered seats for several (*safa*). Even cognates show differing patterns. In Spanish, a Coke bottle is *botella*

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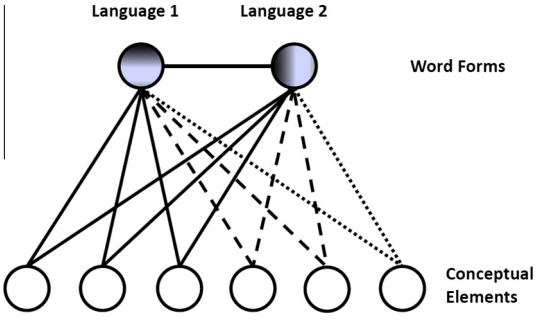

Fig. 1. Initial settings in which connection strengths of conceptual elements to a word in L2 mirror those of an associated L1 word. Adapted from Ameel et al. (2009); see also De Groot (1993).

but a baby bottle is *mamadera*, and a tennis ball is not *bola* but *pelota*.

These subtle differences in word meaning and use patterns can be thought of in terms of a lexical network in which the conceptual representation includes features, exemplars, and associations rather than unitary concept nodes. Elements of the conceptual layer can then have different strengths of association to related word forms of the two languages (Ameel, Storms, Malt, & Sloman, 2005; De Groot, 2013; Dong, Gui, & MacWhinney, 2005; Jared, Poh, & Paivio, 2013; Pavlenko, 2009; van Hell & De Groot, 1998). Given this sort of model, influences of one language on the other can be thought of in terms of the connection weights (strengths) between elements of the conceptual layer and word forms. When a new L2 word form is taught as, or implicitly assumed to be, a translation equivalent of an L1 word, the network will set initial weights to match those of the L1 word (see Fig. 1). The L2 word will be activated by the same features as the L1 word, and non-native L2 patterns of production will result.

With experience, the association of conceptual elements to L2 word forms might be fine-tuned via adjustment of the connection weights to more closely match those of the target community of native speakers of the L2. However, cross-connections between word forms of the two languages might feed back to cause adjustments to the L1 connection weights as well, making them different from those of native speakers not sharing the L2. These changes may result in occasional word choices that deviate from the bilingual's L1 community and his or her own past L1 naming patterns. The current study draws on this network perspective to help understand how L1–L2 lexical interactions are manifested under different learning conditions.

We adopt the connectionist framework to provide insights into the dynamics of L1–L2 interactions (see Li & Zhao, 2014), but our perspective is compatible with Pavlenko's (2009) Modified Hierarchical Model of the links among L1 and L2 word forms and conceptual representations. This model, an update to Kroll and Stewart's (1994) Revised Hierarchical Model, provides for links from L2-specific conceptual representations back to L1 word forms (see also Jared et al., 2013). Our perspective is also compatible with recent ideas about memory. Long-term memories were traditionally viewed as stable and permanent, but recent work shows that when reactivated, they are susceptible to change (e.g., Dudai, 2012; Hupbach, Gomez, Hardt, & Nadel, 2007). For the bilingual, using L2 words may cause re-activation and updating of L1 word knowledge such that the L1 memory trace integrates conceptual elements associated with the L2 word (Wolff & Ventura, 2009).

How network characteristics may influence L1–L2 lexical interaction

Once lexical knowledge is cast in the connectionist framework, the theoretical issues raised about cross-language influence in phonology and morpho-syntax become less unique. Depending on the nature of the lexical network's architecture and processes, different patterns of L1 change and L2 acquisition may emerge.

One possibility is that the network's weight configurations stabilize after mastery of L1 and become resistant to change (e.g., de Bot, 2007). Two consequences may result for late L2 learning. One is difficulty adjusting the L2 weights toward the native-speaker standard of the target language community. A second is that the L1 will be protected from an influence of L2 (both because the L2 weights initially derive from L1 weights, and because L1 weights are resistant to change even if L2 weights differ). This possibility implies that age of L2 learning is a key variable in determining how native-like a bilingual's word use will be for both L1 and L2.

Such a situation would resemble a critical period effect with regard to acquisition of the L2 (cf. Abrahamsson, 2012; Abrahamsson & Hyltenstam, 2009; Lenneberg, 1967 on phonology and morpho-syntax). Because it also entails protection of the L1 from change, though, it may better be framed in terms of entrenchment of the network (e.g., Hernandez, Li, & MacWhinney, 2005; MacWhinney, 2012). It makes no commitment about age-dependent neural plasticity because it is a consequence of learning, not brain maturation. Demonstrating the potential role of entrenchment, Zhao and Li (2010) simulated early versus late bilingual lexical learning by introducing L2 at different time points (with no architectural changes) and found significant differences in the resulting organization of nouns, verbs, and adjectives.

The alternative possibility is that the lexical network is never fully committed to weight configurations and so is subject to adjustment at any time. The degree to which a network should be flexible versus committed poses a classic 'stability-plasticity' computational modeling dilemma (see Li, Farkas, & MacWhinney, 2004). The notion of network flexibility is compatible with Dynamic Systems theory, according to which all languages of bi- and multilingual speakers may be in continual flux (Schmid, Köpke, & de Bot, 2013). The significant neuroplasticity demonstrated by the human brain in response to second language experiences, even relatively late in life, supports this possibility (see Li, Legault, & Litcofsky, 2014).

Under this possibility, several types of scenarios could emerge. One is a trade-off between L2 acquisition and L1