

Words and their usage

Commentary on the special issue on the bilingual mental lexicon

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This special issue devoted to the bilingual mental lexicon focuses upon the consequences of second language (L2) vocabulary learning for bilingual lexicosemantic representation. Acquisition and representation are inseparable. So theories of development that are blind to the nature of the mature cognitive system are lacking,¹ as are theories of representation that ignore how this came about.² The study of cognition, its etymology notwithstanding, has traditionally been more concerned with knowledge than the getting of knowledge. But the tide is changing. We realize that we can only properly understand the final state of fluent expertise if we understand its processes of development. Therefore, cognitive science is concerned with functional and neurobiological descriptions of the learning processes which, through exposure to representative experience, result in change, development, and the emergence of knowledge. Likewise, as reflected in the goals of this journal, the proper study of the mental lexicon is interdisciplinary, its interests spanning, *inter alia*, the representation of words in the mind, lexical processing and use, lexical development across the lifespan, and empirical descriptions of language usage, monolingual and multilingual alike, across languages.

A psycholinguistic model which has been important in emphasizing the interactions in development between lexical and conceptual representations in the bilingual lexicon is the Revised Hierarchical Model (RHM, Kroll & De Groot, 2005; Kroll & Stewart, 1994). Experimental work motivated by this model has shown that beginning bilinguals access the meaning of L2 words indirectly via their first language translation equivalents (L2 → L1 → Conceptual system), whereas proficient bilinguals, as a consequence of their considerable L2 usage, have entrenched direct connections to meaning (L2 → Conceptual system), and can access the meanings of L2 words without relying on their L1.

As Barcroft and Sunderman point out however, much of this work has been system-based rather than item-based, emphasizing lexical systems rather than words.

And it has been a cross-sectional model describing the operation of the system at different stages of development, rather than a model of learning, development, and emergence. Yet learning is dynamic, it takes place during processing, as Hebb (1949), Craik and Lockhart (1972), Elman et al. (1996) and Bybee and Hopper (2001) have variously emphasized from their neural, cognitive, connectionist and linguistic perspectives, and the units of learning are thus the units of language processing episodes. Psycholinguistic research demonstrates language users' exquisite sensitivity to the frequencies of occurrence of a wide range of different linguistic constructions (Ellis, 2002) and thus provides testament of the influence of each usage event, and the processing of its component constructions, upon the learner's system. Usage-based theories of language analyze how frequency and repetition affect, and ultimately bring about, form in language, and how this knowledge affects language comprehension and production (Bod, Hay, & Jannedy, 2003; Bybee & Hopper, 2001; Ellis, 2008; Robinson & Ellis, 2008), with the representations involved, and their processing-relevant connections, being tallied and strengthened individually. Constructions are learned usage episode by usage episode; systems of constructions emerge from their historical conspiracy. Thus, the articles in this special issue focus upon traditional L2 vocabulary learning concerns regarding the quantity and quality of each exposure to individual L2 words. Barcroft and Sunderman have solicited papers that focus in particular upon the L2 vocabulary learning variables: (1) the presence/absence of L1 translation, (2) the amount of exposure to word form in input, (3) the amount of focus on meaning during exposure, (4) the amount of focus on L1-L2 overlap/redundancy in meaning, (5) the amount of focus on L2-specific meaning, (6) the clarity of context from which to infer meaning, (7) the amount of production (output) of the word, and (8) the quality of production of the word. How do different learning conditions and tasks affect the quality of representation of an L2 word, and how, in turn, do their integrated effects contribute to the emergence of the bilingual lexicon?

The paper by Guasch, Sánchez-Casas, Ferré, and Garcia-Albea investigates how Catalan L2 proficiency affects bilingual lexical access in Spanish L1 speakers. Beginning learners in a Catalan-Spanish L2-L1 translation recognition task (*ruc-burro* 'donkey-donkey'; "yes" response) did not show interference if the two words were either closely semantically related (*ruc-oso* 'donkey-bear'; "no" response) or very closely semantically related (*ruc-caballo* 'donkey-horse'; "no" response) whereas high proficiency learners were slowed in the closely relation condition, and both intermediate and high proficiency learners were slowed in the very closely semantically related condition. Participants in all three levels of proficiency showed interference in a translation recognition task if the L1 word was similar in form to the L2 word (*ruc-berro* 'donkey-watercress'; "no" response). Guasch, Sánchez-Casas, Ferré, and Garcia-Albea conclude that these results are in

line with the RHM with beginning learners accessing L2 -L1 word links, whereas in learners of higher exposure and proficiency, L2 words are directly linked to the conceptual system with its rich semantic associations.

Schwartz, Yeh, and Shaw examine how meanings transfer across languages for cognate words. The Subordinate Bias Effect, traditionally studied monolingually, describes how the subordinate meaning of ambiguous words (e.g. *novel* – *new*) takes longer to access in sentence processing contexts that bias towards that meaning because of competition from the dominant meaning (*novel* – *book*). Accessing the subordinate meaning requires active inhibition of the dominant but contextually irrelevant meaning. The degree of competition is usage-tuned, reflecting the user's history of relative frequency of access of the alternative interpretations. Schwartz, Yeh, and Shaw extend this design to show that in fluent bilinguals, interference from the dominant meaning was greatest when the ambiguous word was a cognate with the dominant meaning of the to-be-processed L2 word shared in the L1. Thus L1 semantic representations are coactivated even during exclusively L2 sentence processing tasks. They conclude that bilingual reading efficiency is affected by the functional identifiability of individual words, and this identifiability is a result of summed history of usage (how closely representations cohere across languages) together with dynamic factors relating to the particular immediate sentence context.

The results of these papers suggest that a usage-based approach to vocabulary acquisition can usefully inform models of the bilingual lexicon and its processing. They suggest that at any stage of development, the meaning that is accessed for a wordform is affected by the integrated history of meaning activations in L1 and L2 usage and by the immediate usage context.

What about recognition of the wordforms themselves? Recent research has shown that when bilinguals or second language learners are reading or speaking in one language exclusively, nevertheless, the wordforms that they are exposed to activate competitors from both languages. There is non-selective lexical access in reading (Dijkstra, 2005) and in listening (Marian, Spivey, & Hirsch, 2003). Again, these sensitivities to orthographic and phonological regularities, cohorts, and neighborhood effects, are testament to lexical structure emerging as a result of learners' implicit learning of these construction patterns from usage (Ellis, 2002).

Automatic non-selective access to the cohort of competitors in the bilingual's history of usage has another important consequence. The context-irrelevant competitors have to be inhibited so the relevant candidate can win the competition for election to consciousness. So too every time a bilingual selects a word form for speech output — every successfully realized word production requires the inhibition of cross-language competitors. Research by Bialystok (2007) shows that the cumulative experience of controlling attention to two languages boosts the

development of executive control processes for bilinguals. In their research into this issue, Linck, Hoshino, and Kroll close the circle by showing how bilingual individuals with greater working memory resources and enhanced inhibitory control are better at inhibiting cross-linguistic competitors in a range of lexical comprehension and production tasks. Bilinguals exhibited advantages over monolinguals in working memory span and in inhibitory control in a Simon task. Across individuals, those with superior working memory spans were better able to inhibit cross-linguistic competitors in word recognition. Those with better inhibitory control were better able to inhibit cross-language competitors in a picture naming task. This research, too, shows how the history of language processing in bilingual usage leads to the development of attentional resources that go beyond language itself. This work by Linck, Hoshino and Kroll is important because it takes forward the analysis of what aspects of bilingual processing lead to the emergence of these skills. They asked the important corollary questions about whether more usage experience led to greater levels of attentional control, whether rich immersion experience in the L2 was the primary source, and whether the greater competition resulting from reading L1s and L2s which share the same, rather than different, orthographies led to greater outcomes. Their findings were against expectations — more proficient bilinguals showed less control advantage than more proficient ones, students with immersion experience showed less advantage than classroom-only learners, and same script bilinguals did not show greater advantage over different script bilinguals. These are important issues, yet to be resolved in further research.

When young children are learning their first language, they are learning about the world too. Their conceptual system is being acquired alongside their linguistic system. But for the L2 learner many of the concepts that the L2 wordforms refer to are (broadly) in place. Does this lead to positive transfer and give L2 lexical acquisition an initial leg-up? Or does proactive interference (the mutual exclusivity constraint) impair the associative learning of these new mappings? In processing, does cross-linguistic competition outweigh access to a pre-existing concept? Barcroft and Sunderman investigate the degree to which the acquisition of new L2 lexical items is affected by whether they refer to pre-existing or novel concepts. Learning was inferior when the novel lexis was paired with non-objects rather than known pictures, a result claimed to be at odds with the predictions of the Levels of Processing (LOP) framework (Craik & Lockhart, 1972) which here is taken to predict that learning nonword-nonobject pairs should encourage greater depth of processing, and consequent superior retention. Barcroft and Sunderman suggest instead that the results are more consistent with a model based on limited processing resources where the need to learn novel concepts, novel labels, and their mapping exhausts processing resources compared to where new labels have

only to be mapped to pre-existing concepts. The results are clear. Learning new words and new concepts is hardest of all. I'm less sure about the interpretation of LOP. As I read it, deep processing in the LOP model concerns successful semantic processing, enmeshing the new item with pre-existing knowledge and elaborating upon it. Non-objects clearly have less relations with existing knowledge. Whatever the explanation, the result is important in extending the RHM model and when comparing L1 and L2 learning and the rate/attainment issue (L2A is initially more rapid but the level of ultimate attainment is typically lower, Krashen, 1979).

Together, these papers clearly demonstrate a range of ways in which bilingual language input and usage affects what is acquired in the bilingual mental lexicon, and how these representations in turn affect subsequent processing. They demonstrate the potential of constructivist (input-based, usage-based) accounts of L2 vocabulary learning and bilingual lexicosemantic representation, the role of context in lexical acquisition and processing, and the importance of using a range of different approaches to investigate bilingual learning and representation.

The papers emphasize too the crying need to bring together models of learning with models of processing. In their review of experimental, neuropsychological, and computational research into bilingual memory, French and Jacquet (2004) describe developments in modeling the conceptual division of language knowledge and organization, on the one hand, and the mechanisms that operate on that knowledge and organization, on the other. They highlight the Bilingual Interactive Activation (BIA, Dijkstra, 2005; Thomas & Van Heuven, 2005) model, extended from the interactive activation model (McClelland & Rumelhart, 1981) first proposed for monolingual processing, as an example of connectionist models of bilingual memory that attempt to incorporate both the organizational and operational considerations that serve to bridge representation and processing. But they also highlight “one of the most glaring shortcomings of many current models,... that they do not learn and cannot handle sequences of words. They cannot, therefore, model the gradual emergence of bilingual memory organization” (French & Jacquet, 2004, p. 92). On the other hand, models that can learn from sequences of words such as Serial Recurrent Networks (Elman, 1990, 1998) or from Hebbian Association and Self Organizing Maps (Hernandez, Li, & MacWhinney, 2005) cannot yet model many of the high-level effects, such as orthographic neighborhood effects so elegantly modeled by the BIA. I echo their conclusion that models which combine these approaches to address learning from experience, emergent representations, and processing, are an essential next step in bilingual memory research.

The papers show the complexity of it all as well. There are many variables, agents, processing orientations, and factors affecting emergence. Let's consider another example of cross-linguistic transfer to illustrate this further, the case of L2-L3

lexical intrusions. The determinants of cross-linguistic transfer have been a long-standing goal of second language acquisition research, from Weinreich (1953) on *interference*, through the rise and fall of the strong version of Contrastive Analysis (James, 1980; Lado, 1957), the consolidation of the research in the major reviews of the 1980s (Gass & Selinker, 1983; Odlin, 1989), the recent surge of psycholinguistic investigations of the bilingual lexicon (Kroll & De Groot, 2005; Schreuder & Weltens, 1993), and now even the particular issue of transfer in third language acquisition (Cenoz, Hufeisen, & Jessner, 2001; Jarvis, 2000; Murphy, 2003). During L3 learning, language learners often find themselves unintentionally producing interlanguage forms where an L2 lexical item substitutes for that intended from the L3, i.e. the speaker fails to adequately inhibit the previously learned second language. What are the determinants of this? There are many (Jarvis, 2006; Murphy, 2003). Of the linguistic variables: the more frequent the L2 item, the more likely it will intrude; the more frequent the L3 item, the more it will resist; function words intrude far more than content words; free morphemes interfere more than bound morphemes; if the L2 and L3 are typologically similar, transfer is greater.

However, in addition to the complexity and the fact that each variable explains only a small part of the variance, it is important to note that these variables interact in non-additive ways: L2 and L3 lexical frequency factor in dynamic competition; L2-L3 transfer of function words is amplified in situations of typological closeness. They are modulated by a wide range of learner-based variables too: varying degrees of L2 and L3 proficiency; amount of L3 exposure and use; language mode (Grosjean, 2001); recency; learner perceptions of the relatedness of L2 and L3 and their linguistic awareness of transferability (psychotypology, Kellerman, 1995); age; educational background; level of formality of context; attentional demands of the task (the more the working memory load of the production task, the less cognitive resources are available to inhibit the L2); and so on. So there are not only many variables, each on its own contributing a part, but also the variables interact, sometimes overriding each other, sometimes converging as powerful multiple effects (Andersen, 1983; Herdina & Jessner, 2002; Murphy, 2003; Selinker & Lakshmanan, 1993). And they do so always as a function of time (MacWhinney, 1998), time on all scales: in hundreds or thousands of years — the recency of the diachronic divergence of the L2 and L3 in the evolution of languages, in years — the age of the learners and their length of exposure to the language, in milliseconds — the particular point in language processing in dynamical patterns of interactive-activation, both excitatory and inhibitory (Dijkstra, 2005; Green, 1998; McClelland & Elman, 1986).

Conceptions of language representation are changing. Words are not static entries in a mental dictionary. Instead they are part of human communication, ever contextualized in people and their lives, languages, meanings, interactions, and

selves. Elman (2004, p. 6) encourages us that “words do not have meaning, they are cues to meaning. On the face of it, this might seem to demote the role of any given word in determining the meaning of utterances, but in fact it gives it far greater potential for interacting flexibly with other cues.” In the same spirit, but with the more general target of cognitive science itself, Spivey (2006) presents a compelling case for replacing the notion of representation as discrete symbolic structures with that of continuous spaces of mental states, with changes in activity over time producing smooth trajectories through those spaces as new cues are experienced in the prior context space.

In the wider scale of things, a complete understanding of the multilingual mental lexicon has to take all of these factors into account, and more. Cognition, consciousness, experience, embodiment, brain, self, and human interaction, society, culture, and history are all inextricably intertwined in rich, complex, and dynamic ways in language. So we require additional perspectives on dynamic interactions at all levels, perspectives provided by approaches such as Emergentism (Bybee, 2005; Bybee & Hopper, 2001; Ellis, 1998; Ellis & Larsen-Freeman, 2006a, 2006b; Elman et al., 1996; MacWhinney, 1999), Chaos Complexity Theory (Ellis & Larsen-Freeman, 2009; Holland, 1992, 1998; Larsen-Freeman, 1997; Larsen-Freeman & Cameron, 2008), and Dynamic Systems Theory (de Bot, Lowie, & Verspoor, 2007; Ellis, 2007, 2008; Port & Van Gelder, 1995; Spivey, 2006; Thelen & Smith, 1994; van Geert, 1991).

More locally, we can do more to bring together research on the monolingual mental lexicon and the bilingual lexicon, and between the latter and second language research more generally. If what has been said here about the general indivisibility of representation and acquisition is correct, then so too for the specific cases of the bilingual mental lexicon and second language acquisition. A complete understanding involves the role of consciousness in learning and the ways in which implicit representations are activated and compete in processing (Ellis, 2005); the social-gating of language (Kuhl, 2007) and the social-construction of L2 knowledge (Lantolf, 2006); the interactions where language use affects the structure of words (for example, Zipf’s laws of frequency distribution and shortening, 1935) and where the proportion of L1:L2 learners of a language affect its complexity and learnability (Ellis, 2008); and, as Barcroft and Sunderman exhort us here, all the other factors that affect learning of vocabulary in another language (Nation, 2001; Schmitt, 2000).

What brings these diverse approaches to the mental lexicon together is usage. Wittgenstein had it that “the meaning of a word is its use in the language” (Wittgenstein, 1953, p. 43). The structure of a word, its learning, its representation, and its dynamics likewise are all in its usage too.

Notes

1. “No discipline can concern itself in a productive way with the acquisition and utilisation of a form of knowledge without being concerned with the *nature* of that system of knowledge.” (Chomsky, 1977, p. 43)
2. “the formal structures of language emerge from the interaction of social patterns, patterns implicit in the input, and pressures arising from the biology of the cognitive system. The emergentist approach to language acquisition views language as structure arising from interacting constraints.” (MacWhinney, 1998, p. 200)

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