

The role of learning on bilinguals' lexical architecture: Beyond Separated vs. Integrated lexicons.

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How are the two lexicons of a bilingual represented and how do they interact during language processing? These questions are central to bilingualism and have been the topics of a large number of studies. Dijkstra, Wahl, Buytenhuijs, van Halem, Al-jibouri, De Korte & Rekke (in press) put forward a model that tries to capture people's behavior in several tasks mostly involving reading, with the exception of word translation. A praise-worthy feature of the model is that it is computationally implemented following a local-connectionist architecture. The model is then used to quantitatively account for reaction time patterns on various tasks, with considerable success.

There is, however, one missing aspect in the model: it is silent about how its architecture emerges. That is, it does not specify how second language learning develops and the consequences that this may have for the architecture of the first and second language lexica. To be fair, the authors seem to be aware of this gap and briefly discuss it on page 41.

We believe that it is time for models to start capturing how learning unfolds and the consequences of such learning, since this surely affects the final architecture that bilingual speakers develop. And this is especially important for the some of the assumptions related to the integrated lexicon proposed by Dijkstra and collaborators

What does an integrated lexicon mean and where does it come from?

One of the core assumptions of Dijkstra et al. (2018) is that the two lexicons of a bilingual speaker are integrated. But what does this really mean? Does it mean that the activation of a lexical item in one language may be affected by lexical items in the other language? This does not seem to be what the authors have in mind. In fact, it seems that the integrated lexicon corresponds to two segregated lexicons that are activated in parallel. As the authors argue, a segregated lexicon that is activated in parallel and an integrated lexicon are functionally undistinguishable if one does not assume some sort of lateral inhibition within and across languages. And since MULTILINK does not assume lateral inhibition, the issue of separate or integrated lexicons becomes irrelevant. On this view it seems that the actual organization of the lexical items in the two languages is independent of each other. That is, the organization of the L1 lexicon is independent of whether there is another language in the mind of the speaker – the Dutch lexicon is structured (in terms of the relationship between Dutch words) in the same way regardless of whether a given speaker knows English or not. True, in their model there is parallel activation of the two languages in bilinguals, but this has consequences only at the decision level where different candidates may become available depending on the bilingual nature of the speaker. However, the structure of the lexicon is not affected by learning a new language. Indeed, this resembles the notion that a bilingual speaker is like the sum of two monolinguals, albeit allowing parallel activation that has consequences for the decision level but not for the structure of the lexica.

As we have recently argued (Costa, Pannunzi, Deco & Pickering, 2017; but see Oppenheim, Wu & Thierry, in press) this view of an integrated lexicon misses the potential effects of a crucial aspect of learning. If parallel activation flows across languages and allows learning to take place, then interaction between the two languages results is likely to result in

two lexica that have traces of each other's properties. In this way, the Dutch lexicon of a native speaker of Dutch would be re-structured when learning English, so that it would develop into something different from the Dutch lexicon of a Dutch monolingual. And similarly that speaker's English lexicon would be different from the lexicon of an English monolingual, or the English lexicon of a Spanish learner of English. This alteration of the lexical structure of the two languages can come about because of "Hebbian learning", in the sense that representations that fire together wire together, and hence the parallel activation of the two languages may lead to a re-structuring of a bilinguals' two lexicons. We have provided some preliminary evidence of the consequences of this cross-talk in previous work (Costa et al., 2017; 2018, see also Oppenheim et al., 2018; for a debate).

This type of explanation may explain cognate effects. Faster production of cognates than non-cognates might result from two independent lexica that are activated in parallel. On this account, there is nothing special WITHIN the English lexicon for tomato, and differences between it and potato in a Dutch–English bilingual occur because tomato is linked to a cognate in the Dutch lexicon and potato is not, and because there are between language effects at the decision stage. But the alternative explanation has it that tomato is represented differently in English for the bilingual versus the English monolingual. Specifically, its representation is enhanced by on-line cross-talk, so that its representation becomes equivalent to a higher-frequency word in English. Such an explanation is compatible with Strijkers, Costa and Thierry (2010), whose ERP data suggested that the production of cognates deviated from non-cognates at just the same time as the production of high-frequency words deviated from low-frequency words – after about 180ms, a time-course that suggests the effect is due to different representations rather than patterns of on-line cross talk over equivalent representations.

In our view, Dijkstra et al. (2018) are right at saying that the issue of separated vs. integrated lexica becomes irrelevant if one assumes the presence of parallel activation and the absence of lateral inhibition. But if the lexica develop via learning, then the structure of two lexica of a bilingual will look like quite different from what MULTILINK assumes. Hence, the time is ripe to develop models that have a more dynamic view of how learning interacts with lexical representations in the context of bilingualism.

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