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Lemma selection without inhibition of languages in bilingual speakers

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The planning of speech involves making successive choices in a hierarchy of options. In the case of bilingualism, these options are provided by two lexicons and grammars rather than one internalized by a speaker. Conceptualization processes map a communicative intention onto a message indicating the conceptual information to be verbalized to reach a speaker's communicative goal. In bilinguals, the illocutionary intention may be to express oneself in one language rather than the other, or to mix languages. Formulation processes activate and select lemmas and forms for the message concepts, and plan a syntactic and a morphophonological structure. Lemmas specify the syntactic properties of words, crucial for their use in sentences. The result of formulation is an articulatory program, which, when executed by articulation processes, yields overt speech. A central theoretical problem is how bilingual speakers manage to keep the options provided by the two languages apart in monolingual conversation, and how speakers are able to integrate the options in bilingual conversation where language mixing (i.e., code-switching or borrowing) may take place.

Green proposes an inhibitory competition (IC) model in which the selection of lemmas in one language is achieved by inhibiting lemmas of the other language. In particular, a "language task schema" inhibits all activated lemmas whose language "tag" does not correspond to the target language. Consequently, the inappropriate language is prevented from controlling production. "Inhibition is assumed to be reactive though previous episodes of suppression may exert their effects since it takes time for the effects of prior inhibition to be overcome." Green discusses in some depth how the inhibition mechanism works in a translation experiment. "According to the IC model, at the start of a block of trials, the L1→L2 translation schema calls the production schema for L2. At the stage of selection for output, this schema actively suppresses those lemmas with an L1 tag. Competition then on trial N+1 is primarily among activated L2 lemmas since any L1 lemmas active on the previous trial (N) have been inhibited." To support inhibition, Green refers to competition effects in experimental studies of task switching, Stroop interference, and neuropsychological case reports.

I believe, however, that the evidence for inhibition is not conclusive. In this commentary, I therefore make a case for lemma selection without inhibition. First, the evidence referred to by Green concerns competition between tasks, but not necessarily between lemmas. Secondly, competition effects at the behavioral level do not necessarily point to an underlying inhibition mechanism (cf. Dell & O'Seaghdha, 1994). Thirdly, inhibition does not seem to be the appropriate underlying mechanism for separating languages in monolingual conversation and integrating languages in bilingual conversation. Like monolingual production, bilingual conversation can be fluent. Green argues that if lemmas of one language are selected to fill lexical gaps in the other language, his model predicts no dysfluencies because then there are no competing lemmas. However, filling language gaps is only one of the many linguistic and social reasons for code-switching (e.g., Grosjean, 1982, for review). Furthermore, advance planning does not necessarily prevent dysfluencies. Finally, evidence from monolingual production suggests that lemmas in sentence production may be planned in parallel. If bilingual production is like monolingual conversation in this respect, code-switching points to the need to accomplish selection without inhibition. During the planning of mixed-language sentences, lemmas of both languages should be simultaneously active to a certain degree.

The evidence for parallel activation of lemmas in monolingual production comes from speech errors and chronometric studies. For example, word exchanges such as the reversal of "roof" and "list" in "we completely forgot to add the list to the roof" (from Garrett, 1980) suggest that more than one lemma (i.e., "roof" and "list") was active at the same moment in time. Similarly, Meyer (1996) obtained chronometric evidence for parallel activation of lemmas in planning phrases and sentences. Speakers had to refer to pictured pairs of objects by producing noun phrase conjunctions (e.g., "the tree and the house") or sentences (e.g., "the tree is next to the house"). During each trial, spoken distractor words were presented. These distractors were semantically related or unrelated to the first or second noun (e.g., the semantically related distractor for "tree" would be "bush"). For the conjunctions and the sentences, Meyer obtained semantic inhibition from relatedness both for the first and for the second noun. This suggests that the lemmas of the nouns are retrieved in parallel. Bilingual speakers can produce mixed-language sentences at the same rate as monolingual sentences, which suggests that the advance planning of utterances proceeds the same in both cases. However, if lemmas in one language are selected by having a task schema inhibit all active lemmas in the other language, then the parallel planning of lemmas in a mixed-language sentence is not possible.

Below, I propose a simple mechanism for selection without inhibition. The proposal concerns an extension to bilingualism of the mechanism in the monolingual theory of lexical access, WEAVER++, proposed by Levelt, Roelofs, and Meyer (in press; Roelofs, 1992, 1997). To account for control issues in the planning of speech, the theory combines a spreading-activation network with a parallel system of production rules (i.e., condition-action

pairs). The network represents a speaker's knowledge about words, whereas the production rules account for the computational problem of selection. To explain production costs observed in tasks requiring filtering (such as Stroop-like situations), the theory advances a competition-sensitive response time mechanism. In particular, a selection ratio is proposed that weighs the activation of the target lemma against the activation of all the other lemmas in the lexicon. As a consequence, the speed of selecting a lemma depends on how active other lemmas are. This underlying selection mechanism without inhibition has been shown to account for both inhibitory and facilitatory effects at the behavioral level. For example, computer simulations have demonstrated that, with an appropriate parameterization, the selection mechanism accounts quantitatively for the Stimulus Onset Asynchrony (SOA) curves of the semantic facilitation and inhibition effects of word and picture distractors in picture naming, picture categorizing, and word categorizing (see Levelt et al., in press; Roelofs, 1992).

In conceptually driven access, a production rule selects "its" lemma if the lemma is activated and connected to the message concept. For the bilingual case, two additional assumptions are required. First, similar to what Green proposes, the lemmas in the lexical network and the task representation should be specified for language. Second, production rules should make reference to the target language (and to the source language in translation). Thus, the system should contain production rules that say, informally, for example: <IF the concept is HOUSE(X) and the language is French, THEN select "maison">, where HOUSE(X) is the message concept, French the target language, and "maison" the corresponding lemma. Production rules marked for language would account for the computational problem of how bilingual speakers manage to keep the languages separate in monolingual conversation. The rules would also account for the problem of selection in rapid code-switching. They select lemmas of the appropriate language while keeping the lemmas of both languages active, which allows for parallel retrieval. For example, in planning the (artificial) mixed-language sentence "the tree is next to la maison," the production rules <IF the concept is TREE(X) and the language is English, THEN select "tree"> and <IF the concept is HOUSE(X) and the language is French, THEN select "maison"> would fire, possibly at the same moment in time.

In conclusion, I am not convinced that there exists conclusive evidence for selecting lemmas of one language by inhibiting those of the other language. Competition effects at the behavioral level do not necessarily point to an underlying inhibition mechanism. Furthermore, inhibition of one language does not seem to be the ideal candidate for selection in bilingual conversation where code-switching takes place. Therefore, I made a case for language markers as a means of selection (as Green assumes) but production rules (i.e., condition-action pairs) referring to these markers as the mechanism of selection. Certainly, the evidence for selection without inhibition is not conclusive either, which is just another way of saying that more bilingual research is needed.

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