

# Bilingualism: How Different Languages Sculpt our Mental Lexicon

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## Abstract

What is bilingualism? How different languages sculpt our mental lexicon?

The aim of the present paper is to present important concepts about the bilingualism definitions regarding the organization, representation, and processing of words in the mental lexicon. For this, first, the main concepts regarding bilingualism, such as Mother Tongue, Foreign Language, First/Second Language, early/late and simultaneous/consecutive bilingualism are investigated and discussed. Afterwards, different models of mental lexicon are presented and described in the light of bilingualism. Finally, evidence relating bilingualism and psycholinguistics are reviewed in the different linguistic levels: phonology, morphology, syntax, semantics, and pragmatics. As the main result, it is proposed that the main variables which influence the organization, representation, and processing of word in the bilingual mental lexicon depend on the age of acquisition or learning of the different language, the proficiency level achieved by the speaker in each language, the frequency of the use of the different languages, the specific typology of the language spoken, and the similarities between the different languages spoken by the individual.

**Keywords:** Bilingualism; First/Second Language; Language Processing; Mental Lexicon; Cognates

## Bilingualism

How are words from two (or more) languages organized in the mental lexicon? This is the guiding question of this paper intends to discuss how words from different languages are stored, organized and processed in the mental lexicon of bilingual speakers [1]. A better understanding of how words are stored in the mental lexicon allows a better understanding of the processes of language acquisition, learning, processing, and use. Also, the investigation of the bilingual mental lexicon is a window for understanding the functioning of thought and how it is translated to different languages [2]. In general, a person is considered bilingual when s/he has mastered the use of more than one language. Therefore, the concept of the word “bilingual” is directly associated with the level of language proficiency, being considered bilingual those speakers with advanced levels of mastery of two languages. However, this definition can be put into perspective and should be further detailed from the perspective of language acquisition and learning. While language acquisition concerns an implicit and automatic process of deducing and assimilating linguistic information from the environment, language learning concerns an explicit and intentional process of inducing and using a specific language [3].

Then, the concept of “critical period” is defined as a stage in the child’s development when s/he is more available for language acquisition. Some researchers consider that only language acquisition occurs during the critical period (typically up to five years old) through contact with language speakers and language learning occurs after the critical period, usually through instruction formal [4]. Therefore, a difference must be made between Mother Tongue (MT) and Foreign Language (FL) in relation to the social use of language. The first is the language acquired through contact with the child’s caregivers and also the main national language, while the second is a non-national language learned for communicating with foreign people [5]. For example, in Brazil, MT is Brazilian Portuguese, which in turn is also the national language of Brazil, acquired by children from the first moments of life in contact with caregivers. FL is a language not spoken nationally and normally learned at school or through language courses [6], typically English and Spanish in Brazil. Differently, First Language (L1) and Second Language (L2) are related to the order of acquisition/learning of different languages. L1 is the first language acquired by the speaker and L2 is the second language acquired/learned subsequently [7]. One can also differentiate other languages acquired/learned by

the speaker as L3, L4, and so on, however often they are simply considered L1/L2 linked respectively to the concepts of MT/FL, where L2 refers to all other spoken languages in addition to the MT/L1 [8].

By shifting the focus from languages to speakers, simultaneous bilinguals are individuals who acquire two languages at the same time, for example, when the mother speaks one language and the father speaks another language with the child. Consecutive bilinguals acquire/learn one language after another, such as an immigrant family who speaks a language at home with the child and later learns the national language at school [9]. Complementarily, early bilinguals are those who acquire their languages during the critical period and late bilinguals are those who learn their FL/L2 after the critical period [10]. Therefore, the concept of early and late bilinguals is directly related to the age of language acquisition/learning, while early bilinguals acquire more than one language during the critical period, late bilinguals learn FL/L2 after the critical period [11]. Thus, it is clear that monolingual and bilingual individuals have at least one MT/L1, but only bilingual speakers have two MT/L1 when acquired early and simultaneously, or one FL/L2 when acquired consecutively during the critical period or later and consecutively after the critical period [4]. In this sense, it should be noted that people who speak more than two languages are called trilingual and so on, however, the general term multilingual or multilingualism is used to refer to speakers or studies with more than two languages.

## The Mental Lexicon

The mental lexicon is defined as the repository of words, that is, the place where words are stored [1]. According to Structuralism, the Saussurean sign is formed by the dichotomy of signifier and meaning, phonology with semantics. Differently, contemporary approaches of Generative Grammar argue that the different properties of words (i.e., phonology, morphology, syntax and semantics) are distributed in the linguistic system and words are concepts that receive a motor structure (i.e., speech or sign language) [9]. Furthermore, word structures in different languages are subject to linguistic typologies. The Latin languages Portuguese, Spanish, French and Italian, as well as the Germanic languages English, German and Dutch are examples of flexional synthetic language; differently, agglutinating synthetic languages have words formed by the linear concatenation of morphemes, such as the Turkish, Mongolian and Japanese languages. Also, isolating analytic languages are represented by monomorphemic words, such as the Chinese, Vietnamese and Thai Chinese-Tibetan languages, as well as the Austro-Asiatic languages and the indigenous languages of Brazil of the macro-Jê family [12]. Therefore, the typological and morphological characteristics of languages are directly related to the way words are acquired, learned, represented, organized and processed in the mental lexicon of monolingual and bilingual speakers. Interestingly, bilingual speakers of languages that share the same typology use the same linguistic mechanisms for storing

and processing words, whereas bilingual speakers of languages of different typologies need to develop specific strategies for the organization and use of the properties of the mental lexicon. Related to this, one can consider the possibility of the existence of unified or separate bilingual lexicons. The unified bilingual lexicon proposes that all words from all languages are organized into a single list according to the lexical properties of the words; the separate bilingual lexicon proposes that words from different languages are stored in separate lexicons [6]. Also in this sense, a distinction must be made between the architecture of ranked/serial lexicon and connectionist lexicon. Ranked lexicons present the words organized according to their frequency of use; in contrast, connectionist lexicons are based on statistical probabilities of mapping between formal units (phonology/orthography) and meaning units (semantics) interactively mediated by weighting units [2].

Still on the bilingual mental lexicon, cognate words are those that present formal and semantic similarity between two languages. On the other hand, false cognates/friends are words that present formal similarity, but different meanings between languages. Therefore, it is argued that both cognate words and false cognates/friends have a special status in the mental lexicon of bilingual speakers. On the one hand, cognate words have more robust representations and are easier to be accessed in both languages; on the other hand, false cognates/friends must have their meanings inhibited in one of the languages and, therefore, have greater difficulty in processing and linguistic integration [12]. Finally, through the acquisition and learning of LM/LE/L1/L2 through the exposure, use and study of languages, words are now stored in the mental lexicon and somehow organized according to their typologies. Thus, these linguistic units are activated in the mental lexicon during the processing of external auditory/visual/tactile linguistic stimuli for language comprehension and are available for use and motor implementation during speech/writing/signal production [10].

## Psycholinguistics of Bilingualism

Regarding the methodologies for investigating bilingualism in psycholinguistics and language neurosciences, the main techniques used are behavioral and brain imaging, that is, functional magnetic resonance imaging (fMRI) and electroencephalography (EEG). While behavioral techniques only allow the acquisition of data on reaction time, accuracy/error, judgment scale and eye-tracker, fMRI allows precise localization in the brain of regions activated during language processing and the EEG allows accurate observation of the temporal scale of the processes involved in the recognition and planning of word production. In general, these techniques are applied through psycholinguistic experiments of lexical decision, priming, self-monitored reading, acceptability/grammaticality judgment and object/word naming. Thus, these studies investigate the different modalities of acoustic/orthographic comprehension

and production at different levels of language: spelling, phonetics/phonology, morphology, syntax, semantics and pragmatics. Research on language acquisition has shown that children younger than six months who live in a bilingual environment are more sensitive and attentive to the phonological characteristics of the different languages exposed than older bilingual or monolingual children. This result is explained through the dynamics of brain plasticity during language acquisition in the critical period [8].

Regarding the temporal course of morphological processing through EEG, research with late bilingual adults indicated that irregular words are processed differently from monolinguals. At around 380ms (N400) after visual stimulation, bilingual speakers seem to perform lexical access to the entire stored word, but not through morphological decomposition according to monolinguals [13]. Regarding the investigation of syntactic processing through fMRI, it has been shown that simultaneous, early, or highly proficient bilinguals have activations in the same region of Broca's area in the frontal lobe of the brain during syntactic processing of both languages. Differently, consecutive bilinguals, late or with low proficiency have more distributed and less consistent activations in Broca's area, as well as additional activations in other areas of the brain, suggesting a greater cognitive effort for FL/L2 processing [11].

Regarding word meaning processing, certainly bilingual speakers have a much more restricted mental lexicon in FL/L2 than in MT/L1. As a child, vocabulary expansion is quick and productive; later, as a teenager and adult, there is the learning of technical and specific vocabularies. Thus, late and/or low proficiency bilinguals usually have difficulties in the semantic processing of complex meanings, specific vocabularies and the use of metaphors, as well as often mistakenly transferring the semantic use of words from MT/L1 to FL/L2 [7]. Thus, after processing the linguistic levels discussed above, the pragmatic processing takes place from the world, cultural, local and individual knowledge of the use of FL/L2 [3]. Understanding and producing jokes, irony, word games and cultural and local references in a pertinent and contextualized way is often one of the most difficult tasks for FL/L2 speakers who do not have a great deal of contact and experience with the language [11].

In this sense, [9] proposed a model to explain the relationships between MT/L1 and FL/L2 in the mental lexicon. First, it is clear that the MT/L1 lexicon is larger than the FL/L2 lexicon, and the latter increases as the bilingual speaker learns, uses and improves FL/L2 proficiency. Then, while MT/L1 performs direct and consistent access to linguistic concepts, FL/L2 accesses concepts indirectly and inconsistently. Also, MT/L1 performs little indirect access through LE/L2 to concepts; FL/L2 initially accesses the concepts through MT/L1 access. Thus, it is clear that simultaneous and early bilinguals actually have two L1, providing direct and consistent access to concepts across both languages. In contrast,

later consecutive bilinguals learn FL/L2 after MT/L1 and often support their learning in the latter. Therefore, as the bilingual learns more words and their concepts and improves their proficiency in FL/L2, i. the lexicon in FL/L2 increases, ii. connections between FL/L2 and concepts become more consistent and iii. the translation connections between FL/L2 and MT/L1 are less dependent. Finally, as a consequence of the increase in the mental lexicon and improvement in proficiency, the translation connections between MT/L1 and FL/L2 become more consistent, and the speaker starts to dynamically explore lexical relations and conceptual relations in both the languages. Finally, it is interesting to note that the acquisition/learning of a FL/L2 involves three fundamental aspects for linguistic processing: i. MT/L1 rules recycling, ii. acquisition/learning of new FL/L2 rules and iii. inhibition of MT/L1 productive rules [5]. For example, the first aspect concerns the reuse of a structure or rule already present in MT/L1 that can be recycled and directly applied in FL/L2, such as the subject-verb-object order in Portuguese and English. The second aspect concerns the specific rules of FL/L2 that need to be acquired/learned, such as the negation structure or the pronunciation of the words. Typically, LE/L2 specific pronunciation rules, grammar rules and irregularities must be acquired/learned for their correct use. The third aspect concerns the inhibition of MT/L1 productive rules in the use of FL/L2, such as double negation. Finally, the relationship between psycholinguistics and bilingualism in the study of the mental lexicon is clear. Returning to the initial question: How are words represented in the bilingual mental lexicon? Evidence suggests that the main factors that determine how and where words are stored and processed in the mental lexicon depend on the following factors: a. age of acquisition/learning of FL/L2, b. proficiency level, c. frequency of language use, d. linguistic typology, and e. similarity of FL/L2 with other languages spoken by the individual.

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