



# RELATIONS AND INTERACTIONS BETWEEN LANGUAGES IN BILINGUALISM: REASONS AND RESULTS

(İKİDİLLİLİKTE DİLLERİN İLİŞKİ VE ETKİLEŞİMİ: NEDENLER VE SONUÇLAR)

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## ABSTRACT

A bilingual is not the sum total of two monolinguals. In a holistic sense, bilingualism is a construct in its own right, involving the relationship and interaction of two coexisting languages in one mind. Viewed cognitively, bilingualism should be conceptualized in terms of the roles played by the assimilation vs. accommodation of linguistic representations and the declarative vs. procedural memory systems. Viewed neurobiologically, it should be conceptualized in terms of the roles played by experience-expectant vs. experience-dependent neural systems and formational/organizational plasticity vs. associational/reactive plasticity. The contribution of these cognitive and neurobiological factors to success in bilingualism changes in relation to the age of exposure to second language acquisition, suggesting the need to learn a second language as early as possible.

**Keywords:** Holistic view of bilingualism, assimilation vs. accommodation as cognitive processes, declarative vs. procedural memory systems, experience-expectant vs. experience-dependent neural systems, formational/organizational plasticity vs. associational/reactive plasticity.

## ÖZ

İkidilli kişi iki tekdilli kişinin toplamı değildir. Bütünsel anlamda ikidillilik kendine özgü doğası olan bir olgu olup, kişide birliktelik içinde varolan iki dilin birbirleriyle olan ilişki ve etkileşimini simgeler. Bilişsel açıdan ikidillilik benzeşim veya uyum bilişsel süreçlerinin ve bildirimsel veya prosedürel bellek sistemlerinin ikinci dil ediniminde oynadıkları rolü içerir. Nörobiyolojik açıdan ikidillilik ‘deneyim-bekler’ veya ‘deneyim-bağımlı’ nöral sistemlerle oluşumsal/örgütsel esneklik veya ilişkisel/tepkisel esnekliğin ikinci dil edinimine yaptıkları değişik katkıların sonuçlarını içerir. Bilişsel ve nörobiyolojik etmenlerin kişinin ikinci dili öğrenmeye başlama yaşıyla ilintili olması, ikinci dilin ne denli erken öğrenilirse o denli başarılı bir ikidillilik olgusuna yol açacağına işaret etmektedir.

**Anahtar sözcükler:** Bütünsel ikidillilik görüşü, bilişsel süreç olarak benzeşim veya uyum, bildirimsel veya prosedürel bellek sistemleri, ‘deneyim-bekler’ veya ‘deneyim-bağımlı’ nöral sistemler, oluşumsal/örgütsel esneklik veya ilişkisel/tepkisel esneklik.

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## INTRODUCTION

Before making a scientific definition of bilingualism, it is necessary to eliminate certain myths about this term. It is therefore important to explain first what bilingualism is not. Bilingualism is not reaching a competence level in the L2 which is equivalent to the L1 competence level of a monolingual. This type of definition, which reflects the monolingual view of bilingualism, is not realistic because most often a person cannot reach the level of what is called 'balanced bilingualism', which refers to the ability to use both languages at mother tongue level. Besides, the language functions of bilinguals are quantitatively more numerous and qualitatively different from those of monolinguals. For example, whereas bilinguals possess the ability to translate from one language to another, monolinguals do not have an ability as such. For example, unlike monolinguals, bilinguals have the ability to code switch from one language to another when necessary. In both linguistic and cognitive terms, bilinguals go through a process of interlanguage and interculture while learning the L2. No such process is experienced by monolinguals. With bilinguals, the second language affects the mother tongue just as the mother tongue influences the second language--an interaction that does not exist in the case of monolinguals. When compared to monolinguals, the cognitive structure of bilinguals is different in that they think more flexibly, possess superior metalinguistic awareness, and have better communication skills, all of which are supported by scientific findings. The German philosopher Goethe has summarized these differences ironically by saying that a person who does not know a second language is actually ignorant of his or her mother tongue as well.

In the light of what has been said thus far, it is necessary to make a contemporary definition of bilingualism. As Grosjean (1992) points out, bilinguals are not the sum total of two monolinguals in one person. Hence, it would not be scientific to compare a bilingual to monolinguals from a linguistic perspective. An accurate definition should involve bilinguals possessing a unique holistic language system and languages within this system co-existing in interaction with each other. In this respect, the metaphor coined by Grosjean is interesting: a bilingual is like a high hurdler, who must do both high jumping and sprinting. This hurdler cannot run as fast as a sprinter or cannot jump as high as a high jumper, but taken as a whole he or she has a better performance level in the field when compared individually with sprinters or high jumpers. In other words, he or she is the person who puts into practice these two integrated competences in the most skilled way.

Following this definition of the 'bilingual', it will be appropriate at this point to view the interaction between the languages of this individual, first

from a cognitive and then a neurobiological perspective. In this context, based on scientific evidence, mention will be made of the relevance between memory systems and bilingualism, to be followed by a closer investigation of the relationship between second language learning and sensitive periods peculiar to language learning.

## **BILINGUALISM FROM A COGNITIVE PERSPECTIVE**

From a cognitive perspective, learning a second language is not generally similar to native language acquisition. In native language acquisition, a child creates grammatical representations comprising the syntactic, semantic, phonological and pragmatic rules of the mother tongue. For example, cognizing the past tense form, grouping the word 'sparrow' under the word 'bird' through hyponymy, determining phonemic differences (in particular minimal pairs), and learning the bonds between linguistic forms and pragmatic functions are all formed in time as grammatical representations. The formation of these representations starts from scratch and leads to an organizational system restricted by language-specific categories. It is not possible for another language to fully adapt itself to this organizational structure since this language is likely to have different categorical representations. As a case in point, the syntactic example of 'saksıdaki çiçek' vs. 'the flower in the pot', the semantic example of 'çorba içmek' vs. 'to eat soup', and the phonological example of /set/ vs. /sæt/ can be given to illustrate the various types of differences which usually cause difficulties in second language learning.

To begin with, second language acquisition does not start from scratch. There are actually two alternatives: the first involves the expansion of the restricted categorical representations of the L1 organizational system with a view to adjusting the different constituents of the L2 with the relatively similar yet not identical constituents of the L1. This is reminiscent of Piaget's assimilation process, which he classifies as one type of adaptation. Even if new practices and examples are not identical, they are considered similar and are thus integrated with existing cognitive/linguistic schemas. For example, penguins are included in the 'bird' category, no matter how differently they behave from typical specimens such as sparrows. From a linguistic point of view, this case is one of the reasons for developing an accent in the L2. The phonological system's inability to perceive the phonemic distinction in the minimal pair /set/ and /sæt/ results in accented speech. The vowel phoneme in the English word 'sat' is approximated to the Turkish vowel phoneme /e/, as this is considered to be the closest stored phoneme in the learner's perception. It is no surprise then that a great number of Turkish learners of English

pronounce 'sat' as /set/, which is a typical example of assimilation in the phonological context.

The second alternative materializes when one is aware of the distinctions between one's mother tongue and the developing second language, and creates new categories defining second language representations which are independent of native language categories. These new categories form the demarcation lines between L2 representations that include developing new and different constituents and those belonging to L1. From a cognitive perspective, this process is reminiscent of Piaget's concept of accommodation, which is another type of adaptation process. When the new input does not exactly fit in the structure of the existing schema, there occurs a change in the structure of the schema itself.

A typical example of this process lies in tomatoes being excluded from the fruit category despite a tomato being technically a kind of fruit. In linguistic terms, this case exemplifies the development of L2 competence devoid of accent: the cognitive/linguistic schema structure has changed in such a way that it is able to recognize and accommodate both vowel phonemes in /set/ and /sæt/ separately.

In the literature on second language learning, it is commonly believed that children, when compared to adults, learn a second language better. This can largely be attributed to children's ability to create new categories of accommodating new information as a foregone conclusion of their natural learning processes. On the other hand, it is known that adults adapt new information to their existing schemas by means of assimilation and subsequent reinforcement. The fact that these processes are also valid for language learning points to the need for efficient language(s) learning at early stages of one's life. Therefore, age plays an important role in the development of bilingualism. However, the focus on age will be addressed later, as there is a need to first deal with the neurobiological dimensions of cognitive aspects of learning in the light of neuroimaging studies. In more concrete terms, a discussion will follow on how neuroimaging studies corroborate the evidence concerning the differences between language acquisition based on assimilation versus that based on accommodation.

## **BILINGUALISM FROM A NEUROBIOLOGICAL PERSPECTIVE**

Language competence from a neurobiological perspective can be defined as a multidirectional sensory focalization (i.e. focusing on a tune) and enhancement system (enhancing the tune if it is the national anthem) that depends on motor, visual, and auditory components. The importance for

learning of the type of processing that this system uses in handling sensory stimuli which it receives from the environment can only be made possible through an understanding of how neural structures work. It is general knowledge that neurons, which are basic nerve cells, process environmental input by stimulating each other as well as by interacting among themselves. Processed knowledge is taken in, retained, and made ready for retrieval by synapses. However, it is necessary not to overlook an important point in this context. This involves the notion that certain neurons in the synaptic system process and store environmental input in an experience-expectant way, as opposed to others which process environmental input in an experience-dependent manner. Hence, it is possible to make a distinction between 'expert' neurons which focus on specific types of input and neurons of a general character that process every type of input. Given that the human cortex (the outermost layer of the brain) is composed of 30 billion neurons and approximately one billion neural connections, it appears natural that human metabolism has a variety of neurons with different functions. This state of affairs plays an important role in language development, as will be explained below.

The majority of the neurons which establish the synaptic connections towards language storage while acquiring our mother tongue are in fact the very neurons which become active at brain-wide level and store information by processing environmental input in an experience-expectant way. This storage is congruent with the neuroplastic structure of the brain at an early stage. In other words, it carries the characteristic of formational-organizational plasticity and can be generalized to the entire brain system (Jacobs, 1988). The localization of linguistic functions is not operative at this early stage. The individual's mother tongue, which grows and organizes itself parallel with neural development during the early stages of childhood, eventually tends to accomplish its development in an environment of associational-reactive plasticity. At relatively later stages of language learning, then, neurons are stimulated by environmental input, interact among themselves, and generate storage of knowledge in synapses. The situation is more indicative of local/regional type of knowledge storage than a brain-wide case of storing knowledge. It also suggests that neuroplasticity has gradually begun to decline and that language is about to be lateralized, that is, localized in the left hemisphere of the brain.

In sum, L2 learning of adults from a neurobiological perspective consists of the integration of the second language to the localized neural system underlying the mother tongue. The process generally reflects associational-reactive plasticity and has a localized nature. That is, a brain-wide language development characterized by formational-organizational

plasticity is not the case for L2 learning; instead, the new system makes use of the existing neural structures of the L1, particularly those components that have been freed from controlled processes as a result of automatic processes taking over the handling of continually used L1 data. Therefore, among bilinguals, the L1 and the L2 use the same areas of the brain in a competitive way. The only difference between the two lies in the L2 not being able to make use of these areas as efficiently as the L1. The intense activity associated with L2 use in language-related areas of the brain, which neuroimaging procedures suggest, indicates that most of the language functions are carried out by controlled cognitive processes. For example, it is known that large sections of the left prefrontal cortex (where working memory is) are active during L2 use, although the activity level is much lower in the same region during mother tongue use. The reason for this difference is that the use of the mother tongue is generally connected with automatic cognitive processes and therefore does not generate activity-based intensity (Stowe & Sabourin, 2005). This is similar to the difference between the intense activation observed in the brain of a new chess player and the limited activation observed in the brain of an expert chess player. The former plays the game by making use of controlled cognitive processes whereas automatic cognitive processes are sufficient for the latter to play it.

### **CONGRUENCE BETWEEN COGNITION AND NEUROBIOLOGY IN BILINGUALISM**

At this point, one may speak of the possibility that there is some sort of congruence between the contributions of cognitive and neurobiological factors to bilingualism. Adult L2 learning, in essence, evokes Piaget's concept of assimilation due to its associational- reactive nature. L2 learning is realized through assimilation, which is a problematic cognitive process, and is deprived of accommodation, which characterizes the formational-organizational plasticity of mother tongue acquisition. Naturally, the case of learning the L2 at early stages or preferably simultaneously with the mother tongue could make the process benefit from formational-organizational plasticity, as in mother tongue acquisition. Accommodation, in fact, is achieved when there is no long interval between mother tongue acquisition and L2 learning and when the learning process is in tune with the sensitive periods of language acquisition. In view of the cognitive and neurobiological evidence, it becomes evident that age is of crucial importance in efficient bilingualism.

### **THE AGE FACTOR AND BILINGUALISM**

As is common knowledge, despite a number of views to the contrary, the literature on L2 learning generally emphasizes the importance of age in

acquisition and speaks of certain 'critical' or 'sensitive' periods. Even magazines like *Time* and *Newsweek*, known for their interest in popular science, cover the subject with attractive names like 'windows of opportunity', which they coin to refer to the sensitive periods of acquisition in order to draw attention to the importance of L2 learning as early as preschool. It is pleasing to see a gradually growing public opinion favoring early exposure to foreign languages in Turkey. For instance, it is a positive step forward that many private schools have incorporated a second language teaching component to their preschool curriculum. However, it is also a well-known sad fact that the majority of the preschool students still remain unaffected by this positive development.

Another sad fact is that L2 learning at an early age is still carried out based on beliefs rather than rationale. A private school's offering an L2 course in its preschool curriculum can easily lead to changes in another private school's curriculum by virtue of sheer competition and without any required scientific preparations. Therefore, there are infinite benefits in keeping in mind that the concept of 'windows of opportunity' is based on empirically scientific data. This concept, when examined from the perspective of layers of language, yields interesting results. For example, the phonological structure of a language becomes fixed in the brain at the age of 5-6 at the latest, which is not surprising, since 95 % of the human brain is said to complete its neural wiring by the age of 6. Therefore, developing an accent in the L2 learned after the age of 6 should be considered normal.

As for the acquisition of morphological and syntactic language layers, it is said that the window of opportunity is closed with puberty, if not earlier. Therefore, it would be safe to assume that a post-puberty L2 learner is likely to confront problems in tackling morphological and structural properties. The only language layer whose window of opportunity remains open after puberty is the lexicon. It is not surprising, therefore, that adult L2 learners continuously develop their lexicon and, when speaking of 'language learning difficulties', normally refer to grammar and pronunciation problems.

### **AGE, MEMORY SYSTEMS AND BILINGUALISM**

Another concept related to sensitive language learning periods is the degree of contribution of memory systems to the development of bilingualism. According to Ullman's (2001) 'Declarative-Procedural' (DP) model of vocabulary (involving semantic-lexical properties) and grammar (involving syntax, morphology and phonology) acquisition, language is said to cooperate with two major memory systems. The first is the declarative memory system, whose function is to process, retain and retrieve explicit information that is

part of our consciousness. For Turkish citizens, the fact that Atatürk died on November 10th, 1938 is a piece of encyclopedic information stored by this memory. The other is the procedural memory system, which processes, retains and retrieves implicit information that lies outside our consciousness. Habit-based skills such as driving and playing backgammon are among its storage functions. These two systems work in collaboration and, if necessary, in competition. In the event a problem afflicts one of the systems, the other assumes control in order to compensate for the weakness. In the case of competition, one of the memory systems is in charge and takes over acquisition, thereby deactivating the other system or at least reducing its role in learning.

As these memory systems are not domain-specific, they are able to accommodate linguistic functions in addition to those cognitive in nature. In mother tongue acquisition, the declarative memory system is responsible for the storage of lexicon, including the phonological and semantic features of each word. As such, it constitutes our mental lexicon. Procedural memory, on the other hand, is responsible for the grammatical system of the language in terms of its syntactic, morphological and phonological properties. It is the storage house of our grammar. Mother tongue acquisition is realized through each system's regulation of the linguistic layers for which it is responsible and its cooperation with the other system.

With the effects of sensitive neurobiological periods on learning processes as well as exposure to frequent input, motor and cognitive skills turn largely into routines and habits; controlled cognitive processes are gradually replaced by automatic processes; and the role of declarative memory in learning increases at the expense of the role of procedural memory, which appears to decrease. Perhaps the last stage during which the two systems are on an equal footing occurs when they reach a 'plateau' at puberty. Consequently, adult L2 learning is essentially carried out under the responsibility of declarative memory (Ullman, 2001). What this means in practice is that adults will not have difficulty in cognizing the L2 lexicon, as declarative memory, responsible for lexical learning in mother tongue acquisition, is still in charge of vocabulary acquisition through lexical memory, which is a subcategory of the declarative memory system. On the other hand, adult L2 learners are obliged to learn the grammatical properties of the target language, which were handled by procedural memory in L1 acquisition, through the declarative memory system, thereby confronting difficulties. As a case in point, the word 'walked' is perceived and memorized as one word. Perceiving the infinitive form ('walk') and the past tense marker ('-ed') as separate morphological units is cumbersome. In short, it can be said



that learning the grammatical system of the L2 in post-puberty is likely to present more difficulties.

## CONCLUSION

L2 acquisition should parallel the developmental needs of human nature. In this sense, it is scientifically imperative that we become conscious of certain issues concerning the topic, which can be summarized as follows: the shorter the period between mother tongue acquisition and L2 learning, (a) the more easily learners will make use of language adaptation as accommodation; (b) the better they will benefit from both procedural and declarative memory systems; (c) the better chances they will have for their learning to be associated with formational-organizational neuroplasticity. The type of bilingualism formed by such cognitive and neurobiological processes refers to holistic bilingualism, in which languages coexist and interact with each other, as described by Grosjean (1992). It does not have unrealistic aims like imitating monolingual models or aping monolingual profiles. Unfortunately, however, the perception of bilingualism in monolingual societies still depends on syllogistic logic of the kind that is contrary to the needs of human nature in that it views mother tongue as the ‘main course’ and the L2 as an optional ‘dessert’. As such, aping monolingual profiles in L2 learning is still the ongoing practice!

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