

## Bilingual speech congruence: cognitive and prosodic aspects

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**Abstract:** In the article, we considered the intersection of language, communicative and sociocultural proficiencies as determinants of the bilingual speech congruence. We described the cognitive mechanisms of L2 processing, namely implicit and explicit memory, language ability, priming etc. We characterized the specificity of the bilingual's prosodic competence maintaining and systematized the main manifestations of the prosodic interference by the example of the Ukrainians' English speech.

**Keywords:** *prosodic interference, bilingualism, congruence, priming.*

Foreign language acquisition (FLA) relates to the L2 sociocultural immersion and necessitates the maintaining of multiple L2 proficiencies. Therefore, the accuracy of the perceived and the relevance of the produced L2 speech equally depend on the level of communicative, language and sociocultural proficiencies and their overall congruence and compatibility in the bilingual speech and cognition. In this dimension, recent researchers (M.T. Banich, R.J. Compton, A.E. Hernandez, K.H.S. Kim, N.R. Relkin, K.M. Lee, J. Hirsch, J.C.L. Ingram, D. Larsen-Freeman, L. Cameron, N. Raz, J.F. Werker, R.C. Tees, etc.) view the L2 acquisition and production as cognitive and psychological processing as well as sociocultural immersions.

Synthesising the current neurolinguistic studies [1; 2; 3; 4; 6; 7], enabled us to scrutinize in the article the neurocognitive mechanisms of L2 processing, namely priming and interference overlapping the L2 prosody acquisition and production. Basing on the complexity paradigm [5], we also aimed to define the ways L2 proficiencies enable bilingual congruence referring to the overlap between stimuli as well as compatibility concerning the overlap between stimulus and response elements in L2 processing. Hence, our experimental corpus consisted of 348 utterances produced by 16 English native speakers (etalon realizations) and 92 Ukrainian bilinguals (their L2 proficiency graduated from low to high level). The research implied the comparative analyses of the English native and interfered prosodic realizations; to process the empirical data we employed discourse, semantic, auditory, acoustic, oscillographic, comparative and descriptive analyses.

As regards the key mechanism enabling the L2 processing, we start with the multitude of the maintained L2 proficiencies. In our opinion, here the prime constituent is the *language competence*, which we define as the awareness about the L2 means and their variant and invariant speech modifications. In turn, the *communicative proficiency* implies the bilingual's ability to implement acquired knowledge of L2 means in particular interactions. This type of L2 competence enables the doubletongued to communicate and perceive various propositional meanings in the diverse communicative contexts. L2 communicative and language competences are both maintained within a particular non-native sociocultural environment resulting into L2 socially and culturally marked communicative modes constituting the *sociocultural competence*.

The proficiencies mentioned above can maintain due to the basic types of the human language capacity (motor, sensory, dynamic, and semantic). Firstly, the motor capacity is the ability to express thoughts orally due to the motor strip. Secondly, the sensory capacity infers the ability to perceive the stimuli transmitted via sensory modalities. Thirdly, the dynamic capacity implies the connected speech ability associated with the work of the left hemisphere. Finally, the semantic capacity consists in the ability to match the language means and the stimuli resulting into their congruence and compatibility.

Along with described above L2 proficiencies, in each of bilingual's contacting languages, neuroimaging studies [6; 7] have also focused on the age of the first L2 exposure both serving as the entrance into the bilingual brain organization and processing. Accordingly, in our study we observed that predominantly in the adult's mind the L2 nominations become compatible with visual or auditory stimuli via L1 linguistic primes because of the late L2 exposure. In the child's mind, various stimuli are congruous with the multitude L1 and L2 responses where the latter perform as a set of optional language means to convey the former and serve various communicative needs irrelevant of the number of languages the child is acquiring. The same scheme is relevant not only to the age of L2 exposure but also to the degree of L2 fluency.

The researches [1, p. 250] defined that the mother tongues are used implicitly, i.e., according to automatic rules that are largely impervious to consciousness. By contrast, a second language, particularly if learned in adulthood, is probably learned and used explicitly, i.e., mainly by consciously applying rules. Moreover, some people are exposed to two languages from birth, whereas others learn L1 from birth but acquire L2 at a later age. Later-acquired languages are often learned through a different method, such as explicit schooling, rather than being learned implicitly from immersion within a specific language environment.

Current clinical and neuroimaging studies [1; 4] suggest that implicit and explicit memory systems do rely upon different neural structures. Bilateral language representation deeply intersects with working memory involved in the temporary processing and storage of information. Working memory consists of a 'central executive', which controls how information is passed around the system and of visual and phonological 'slave systems' which temporarily process and retain the information appropriate to their two modes. In particular,

a phonological system has a phonological store, which can hold information, and a phonological loop recycling information back through the store to extend its life.

In general, there is no evidence that radically different brain regions are used for L2 than for L1. However, the degree to which those regions are recruited during language processing may vary for monolinguals compared to bilinguals, and it may vary depending on age of acquisition of the second language. Importantly, the acquisition of the phonological system by infants has been well documented [7] for the case of monolingual acquisition. Infants can detect the contrasts that define the phonological system for all human languages almost from birth. Still, their ability to perceive these contrasts in languages that are not heard in their native environment begins to decline at about 6 months of age. Until about 6 months old, there is no detectable difference in the perception of phonetic contrasts by infants in monolingual and bilingual environments. Diverging patterns appear as bilingual babies maintain the categorical distinctions for the phonetic system in both languages and monolingual infants lose the ability to detect contrasts that are not part of the language they are about to learn. By about 14 months old, infants being raised in bilingual environments have established a clearly demarcated phonological representation for both languages. Therefore, bilingual infants develop the phonological basis for both languages on roughly the same schedule as monolingual children do for their only language. It may be that it is this very early experience that leaves its lifelong trace as a foreign accent when childhood monolinguals attempt to learn new languages later in life.

Interestingly, the results [2, p. 100] reveal that the basic speech recognition mechanism is formed very early in life and does not change substantially across age when a person is only exposed to one language. The pattern of results showed interesting similarities and differences in the bilingual group. The youngest group of bilinguals showed increased activity in the superior temporal gyrus, a pattern similar to that seen in monolingual children. However, by age eight, bilinguals began to differ from both the younger bilingual group and monolinguals. In this case, there was increased activity in speech areas but also in the prefrontal cortex and the inferior parietal areas of the brain both on the left and right. This pattern changed again in adulthood. Bilingual adults with a similar learning history did not show this increased activity in nonspeech areas. Hence, recruitment of areas in the frontal and parietal cortex was most likely due to the need for additional cognitive resources when learning the speech sounds of the second language. Taken together these results suggest that learning a second language during childhood results in an adjustment process. Specifically, the brain of children must recruit areas involved in working memory and cognitive control to understand L2 speech. As time passes and bilinguals transition to higher proficiency in adulthood, these differences largely vanish.

The above suggests that still one of the most important factors in the activation of linguistic resources in bilingual brain is the ability to respond to various communicative stimuli based on a level of L2 proficiencies. In this dimension, a lot of evidence favour the assumption that

higher levels of productivity in bilingual children rather than monolingual probably reflects their ability to focus on the necessary information and inhibit the unnecessary. This ability can be explained by enhanced selective attention as the ability to focus on specific aspects and inhibit insignificant or wrong information. On the other hand, this age dependant model predicts that brain mechanisms responsible for keeping attention in bilingual case on particular language is more vulnerable in childhood and in old age. One of these mechanisms is the integrated functioning of the frontal lobe, because it slowly develops in childhood and is one of the first regions in the brain, which reduces efficiency in the elderly [6, p. 68]. N. Raz also insisted on the correlation between age and linguistic environment that mediates the lateralization of brain functions and mental redistribution of responsibilities between the right and left hemispheres during L1 and L2 processing [6, p. 86].

A. Hernandez [2] examined bilinguals' sentence processing that offered that language comprehension is a process during which a set of linguistic forms competes to yield a particular interpretation. The researcher suggested that bilingual adults predominantly use an amalgamation strategy of combining morphosyntactic forms taken from the two languages, rather than a differentiation strategy of using language-specific forms for each of their languages. Another suggestion is that bilinguals might be capable of processing two languages independently, yet in parallel. Thus, lively debate continues as to whether adult bilinguals fully differentiate their linguistic systems and can ever achieve monolingual-like language competence in two systems.

Consequently, speakers exhibit substantial individual differences in L2 proficiencies. Learners' age of immersion is known to influence their ultimate level of L2 ability, but even when this factor is taken into account, striking individual differences still exist, especially among those speakers who started acquiring an L2 after childhood. Although some adult L2 learners attain near-native proficiency, others speak with strong foreign accents and frequent grammatical errors long after their immersion in the L2.

In our research, we studied the prosodic alignment of the natives' and bilinguals' English speech processing. We observed that the differences in prosodic systems of languages in contact cause significant prosodic interference or priming effects for second language learners, reducing intelligibility for English listeners and inducing considerable foreign accent. J. Ingram [3, p. 26] defines the altered prosody as a prominent characteristic of the rare neurological speech disorder known as 'foreign language syndrome' as far as prosodic dysfluency considerably impairs speech production and perception.

To carry out the phonetic survey on bilinguals' L2 prosodic congruence and compatibility, we primarily differentiated the basic type of L2 immersion (natural, synthetic and combined). The natural L2 immersion consists in L2 acquisition aligning with native speakers only. The bilingual speaker comes with the advanced competence because of the years of bilingual practice in L2 local communities honed through actual exposures. This development is mainly not marked by miscommunication or deficient usage. The synthetic L2 immersion implies L2

acquisition apart from its native social and cultural context. Here, the main L2 intermediary is the L2 teacher, a non-native speaker who may even intensify the L1 priming effect. Finally, complex L2 immersion infers either the L1 environment and the exposure with L2 native speakers or the L2 native environment along with the L1 speakers (usually immigrants aligning with their family, friends, etc.). Here we stick to the point that acquisition does not involve a linear progression from L1 to L2, with the first language influencing the second, or one placed on top of the other without implications for either. We are now open to the possibility of recursive language acquisition, where the language acquired later shapes the proficiency of the earlier languages, and both mutually influence each other to move in new hybrid directions. Here adopting the complexity theory, we can understand how localized changes in acquisition can have far-reaching implications for competence. Evidently, in durable L2 immersion unlike in short-term contact, bilinguals are not trying to imitate native speakers. Their identities relate to their own communities appropriating L2 to suit their own values and interests. Furthermore, multilinguals relate to all the languages in their repertoire as part of an integrated hybrid continuum and socialize into all their languages equally that they will not be able to consider one language as coming first in terms of time of acquisition, sequence of acquisition, or level of proficiency.

As for the bilinguals' prosodic competence, we gradually distinguish imitative, reproductive and productive types. At the early or short-term L2 immersion, a doubletongued is usually incompetent of semantic and pragmatic synergy of the L2 prosodic means and merely mimic L2 prosodic patterns. By no means it must be confused with the subconscious prosodic performance which is defined as the innate native tongue capacity, a prime element of the congruent speech processing of the native speaker requiring no conscious verification or mental monitoring. In turn, the reproductive prosodic competence is characterized by conscious verification and monitoring of L2 prosody use though accurate almost native-like speech processing. Whereas the productive prosodic performance consists in subconscious native or native-like prosodic fluency and congruency relevant to various pragmatic needs. We concluded that two former

levels are typical of the late or short-term bilingualism whereas the latter level is characteristic of the early or long-term L2 immersion.

Our considerations substantiate the results [2, p. 93-94] that revealed differences between high and low proficiency of late bilinguals. Interestingly, both groups showed increased activity in areas involved in cognitive control. The main distinguishing factor was that the high proficiency late bilinguals demonstrated relatively more activity in the right fusiform gyrus involved in the processing of visual information. Furthermore, lower proficiency bilinguals showed increased activity in the superior part of Broca's area involved in the motor planning of verbal responses.

Finally, we defined that the L1 prosodic priming deeply inhibits the bilingual L2 speech processing having approached the priming as the unconscious activation of certain associations, thus predisposing the bilingual's perception, memory, or response. Accordingly, we determined that the proactive interference causes the disruptive effect of prior L1 prosodic learning on the recall of the new prosodic information whereas the retroactive interference disrupts the new L2 prosodic learning on the recall of the old L1 information. The most inhibited L2 prosodic areas we detected were the distribution and intensity of the utterance stress, the variation of the pitch range, the syntagmatic division, the vowel reduction in unstressed syllables, the production of strong and weak forms, the variation of tempo and loudness on the communicative centres, etc. Lastly, grounding on the complexity theory, we concluded that the prosodic interference in the L2 speech processing has a multiplex physiological, psychological, linguistic and sociocultural nature occurring in bilingual's mind and speech resulting from the overlapping of native (Ukrainian) and foreign (English) languages. Accordingly, we defined that intensity of the prosodic interference depends on the homogeneity and congruency of both prosodies in contact. The greater priming effect is evolved by the subconscious emotional attachment to the native tongue as well as its inertial and stereotyping use considerably inhibiting the bilingual's cognitive flexibility and compatibility in the L2 immersion.

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#### Конгруентність мовлення білінгва: когнітивний і просодичний аспекти

##### Л. Шнуровська

**Анотація:** У статті розглянуто взаємозв'язок мовної, комунікативної та соціокультурної компетенцій як факторів конгруентності іншомовного мовлення білінгва. Описано когнітивні механізми мовлення білінгва, а саме функціонування імпліцитної та експліцитної пам'яті, мовної здатності, праймінгу тощо. Охарактеризовано специфіку формування

просодичної компетенції білінгва та систематизовано основні прояви просодичної інтерференції на прикладі англійського мовлення українців.

**Ключові слова:** *просодична інтерференція, білінгвізм, конгруентність, праймінг.*

**Конгруэнтность речи билингва: когнитивный и просодический аспекты**

**Л. Шнуровская**

**Аннотация:** В статье рассмотрена взаимосвязь языковой, коммуникативной и социокультурной компетенций как факторов конгруэнтности иноязычной речи билингва. Описаны когнитивные механизмы речи билингва, а именно функционирование имплицитной и эксплицитной памяти, языковой способности, прайминга и т.п. Охарактеризована специфика формирования просодической компетенции билингва и систематизированы основные проявления просодической интерференции на примере английской речи украинцев.

**Ключевые слова:** *просодическая интерференция, билингвизм, конгруэнтность, прайминг.*