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Essay

Predictions of Individual Differences in the Acquisition of Native and Non-Native Languages: An Update of BLC Theory

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Abstract: BLC Theory proposes that individual differences (IDs) in language proficiency (in both native and non-native speakers) can poorly be mapped on a single proficiency scale. Instead, IDs can best be understood and studied in terms of two fundamentally different dimensions: (1) the cognition of oral language (receptive and productive speech processing) and (2) the cognition of the written language (reading and writing). This paper presents an update of BLC Theory placed under a non-nativist, usage-based, neural-network metatheory of language as a complex system. The paper includes predictions for the absence or presence of IDs in the oral and written domains, separately for native and non-native speakers. The theory predicts that while cognitive factors such as executive functions, non-verbal memory, and intelligence positively affect the acquisition of reading and writing skills in both native and non-native speakers, they do not play a significant role in the acquisition of speech processing in either native or non-native speakers. Contrary to folk wisdom, one does not need to be particularly intelligent to learn to understand and produce speech in a non-native language. Attention is given to typological differences between children's home language(s) and the standard language(s) of literacy.

Keywords: individual differences; language proficiency; oral language; literacy; first-language acquisition; second-language acquisition; usage-based linguistics; BLC Theory

1. Introduction

Adult native speakers of a language differ in the control of their language. Non-native speakers of a language differ also, both in their speed of acquisition and their level of ultimate attainment. These phenomena are uncontroversial in the literature on first and second language acquisition. Most lay people believe that language proficiency must be understood as a single scale. Instead, BLC Theory, building upon the earlier language-proficiency models of Cummins (1980a, 1980b) and Bialystok (2001), makes a fundamental distinction between two types of language cognition (proficiency): the cognition of oral language (speech reception and speech production), called Basic Language Cognition (BLC), and the cognition of written language (reading and writing proficiency), called Extended Language Cognition (ELC). This distinction allows us to account for the existence not only of differences but also of commonalities among language users. Thus, BLC Theory offers a single framework for understanding individual differences in language proficiency of both native and non-native speakers.

BLC Theory was first proposed in a journal article (Hulstijn 2011) and later presented in a book-length publication (Hulstijn 2015). The present article provides an update of BLC Theory, necessitated by recent insights in the literature (usage-based linguistics, neural-network psychology, language as a complex system, and the distinction between metatheory and local theory). The essence of this theory, as presented in Hulstijn (2015), remains intact. The present update offers (1) an explicit embedding of BLC Theory in a metatheory, (2) some changes to the definitions of the theory's main constructs, (3) new explicit predictions, (4) implications for empirical research in related areas of scientific

inquiry, and (5) a new discussion. Relevant differences with Hulstijn (2015) are pointed out in the main text or in the footnotes.

2. Metatheoretical Framework

According to Muthukrishna and Henrich (2019), it is useful to make a distinction between *theories* (also called local theories) and *metatheories* (also called theoretical frameworks). Theories address what the ecologist Tinbergen (1963) called proximate questions about causation and development. Metatheories (theoretical frameworks) address ultimate questions, concerned with evolution and function (Hulstijn 2020, 2023). BLC Theory is a local theory, a theory pertaining to commonalities and differences among language users. BLC Theory is placed under the umbrella of a non-nativist, non-modular metatheory of language processing, language use, language acquisition, and language change. The non-nativist view has been proposed by scholars in usage-based linguistics, neural-network psychology, and in work on complex systems. Under this metatheory, the view on language, language acquisition, and language use can be summarized as follows:

- Each language is a complex adaptive system (Mufwene et al. 2017; The Five Graces Group 2009).
- Children learn language in a bottom-up way, through social interaction. Learning mechanisms are not specific to language (Tomasello 2003).
- Mental representations of linguistic constructions emerge from processing (Christiansen and Chater 2016; MacWhinney 2015; O'Grady 2005).
- Network elements are more or less strongly connected (Goldberg 2013; Diessel 2019, p. 10; see also Huettig et al. 2022).
- Constructions (form—meaning mappings) are more or less abstract (Goldberg 2013).
- There is no principled distinction between grammar and lexis (Bybee 2007, p. 287; Croft 2001, pp. 16–17; Jackendoff 2007).

From this perspective, adult native speakers understand and produce utterances predictively and probabilistically. This is made possible as a result of massive (earlier) exposure to, and processing of, spoken input. Thus, learners do not create, and language users do not possess a mental, rule-based or principle-constrained grammar (Christiansen and Chater 2016; Frank et al. 2012; MacWhinney 2017; McCauley and Christiansen 2019; O'Grady 2005, 2012, 2015; Diessel 2019; Schmid 2020; and many others). In the words of O'Grady (2012, p. 124), "language acquisition is in fact just processing amelioration: attempts by the processor to improve its speed and efficiency by forming routines". According to Christiansen and Chater (2016, p. 243), representation does not exist separate from use (speech processing). Thus, the distinction between competence and performance, made by Chomsky (1965, p. 4) as part of a nativist metatheory, is not needed for solving fundamental questions concerning language acquisition and use in the human species.

The phenomenon of unequal frequencies of language elements (Bybee and Hopper 2001; Ellis 2002), put forward by Zipf (1935), fits well with the metatheory of language as a complex system (Hulstijn 2020, p. 7). Crucially, there is *no* gradual decrease in frequencies along a straight regression line. Instead, the curve of raw frequencies shows a sharp decrease first and later levels off in a long asymptotic slope. Grammatical categories have different sizes, and size differences are associated with frequency. For example, in most European languages, the class of pronouns contains relatively few members but pronouns occur relatively frequently. In contrast, the class of nouns is huge and the large majority of nouns appear only very rarely. The members of small classes, such as pronouns, efficiently compress information. In contrast, in open word classes, such as nouns, there exists semantic hierarchy, so that we can refer to our dog, for example, with expressions that differ in specificity: spaniel (very rare), dog (not as rare), animal (frequent) (Lestrade 2017). In other words, natural languages *must* contain ambiguity, fuzzy constructions, and fuzzy word-class categories, and spoken and written discourse *must* reflect Zipf-like unequal distributions of linguistic elements (Piantadosi 2014), in a push-and-pull struggle

between pressures to make language more complex and pressures to make language more simple and economical (Mufwene et al. 2017; Hawkins 2004, 2014).

3. The Main Constructs of BLC Theory

From the perspective of Popper's critical rationalism (Popper 1959), one can regard theories as tools. Constructs and construct definitions are also tools. Construct definitions are not cast in iron. It is totally acceptable to explore whether a theory would gain in explanatory power if one changed the definition of a construct. In other words, one can conditionally 'play' with definitions: if we changed a given definition, might we gain a better understanding of the phenomena? This section provides definitions of BLC Theory's main constructs: *native speaker*, *Basic Language Cognition* (BLC) versus *Extended Language Cognition* (ELC), and *Core* versus *Periphery*.

3.1. Native Speaker[1]

In *social* terms, a native speaker is someone who has been exposed to the spoken language from birth onwards, for at least several years. A typical *adult* native speaker has been exposed to the spoken language from birth, throughout childhood and adolescence, well into adulthood[2]. In *linguistic* terms, the typical adult native speaker has acquired BLC. Native speakers who have only been exposed to the spoken language during infancy and early childhood will normally not have received exposure long enough to attain BLC[3]. In other words, a person can be a native speaker of more than one language; an adult person may have acquired BLC of more than one language[4].

3.2. Basic Language Cognition (BLC)

In terms of *internal* language, BLC refers to a person's ability to comprehend and produce spoken language in situations of everyday life, common to all adult native speakers in a given language community.

In terms of *external* language, BLC refers to frequent lexical items and frequent grammatical structures—that is, to lexical items and morpho-syntactic structures that may occur in any communicative situation, common to all adult native speakers, regardless of age, literacy, or educational level. Let us assume that we computed the raw frequencies of lexical and grammatical elements in a huge corpus of spoken language, truly representative of language, produced—in a wide variety of communicative situations—by people of different ages and different levels of education and profession. The idea then is that BLC pertains to the ability to fluently process (in listening and speaking) the elements in the steep part of the skewed distribution of raw frequencies, i.e., the elements and constructions that occur frequently in such a corpus (Hulstijn 2015, pp. 22–24; Hulstijn 2019, p. 160).

In *psycholinguistic* terms, BLC is defined as the largely implicit, unconscious experience-based cognition in the domains of phonetics, prosody, phonology, lexis, morphology, constructions, and syntax, plus the mapping of words, phrases, constructions and patterns onto meaning (semantics) and use (pragmatics)[5].

BLC is acquired through massive exposure to spoken input. Through massive exposure to input, learners acquire the ability to predict upcoming elements (phonemes, morphemes, words and grammatical constructions and patterns) in an unfolding utterance (during listening or speaking). Over time (typically several years), the accumulated exposure results in fast, fluent, and mostly automatic processing of incoming speech (listening) and speech production (speaking).[6]

Because not all neurotypical children are exposed to the same amount and quality of input during their pre-school years, they differ in language proficiency at the age of school entry. Exposure to oral language during elementary school will iron out most of these differences (but other differences, in the domain of ELC will emerge; see below). Therefore, neurotypical children may *differ in their pace* of BLC acquisition.

It is BLC, not ELC, that is characteristic of the human species. A theory of the learnability of human language (i.e., explaining why human languages are learnable) should

focus on the fundamental question of why humans are capable of learning to understand and produce utterances in common situations of oral communication (cf. Hulstijn 2019, p. 161 with references to Biber (1988, p. 8) and Pawley and Syder (1983, p. 569)).

3.3. Extended Language Cognition (ELC)

In Hulstijn (2011, p. 231), Extended Language Cognition (ELC) was presented as the complement or extension of BLC. The content of ELC was defined in two ways[7].

"ELC is identical to BLC, except that

(a) in ELC, utterances that can be understood or produced contain low-frequency lexical items or uncommon morphosyntactic structures, and

(b) ELC utterances pertain to written as well as spoken language.

In other words, ELC utterances are lexically and grammatically more complex (and often longer) than BLC utterances and they need not be spoken".

In contrast to this definition (repeated in Hulstijn 2015), I define ELC, in the update of BLC Theory presented here, solely in terms of literacy skills. The purpose of this more narrow definition is to avoid confusion between frequent and infrequent language and oral and written discourse, which could arise from the wider definition. *ELC is the control of the written standard language, as taught in school.*

Approximately 7000 languages are currently spoken around the world (Hammarström et al. 2021). Only around 120 languages have obtained the status of official language in the 193 countries belonging to the United Nations[8]. Official standard languages are used by governments (judiciary, legislature, and/or administration) and are taught in school. Official standard languages are typically codified in norms for what is appropriate language use for a given genre[9]. In elementary and secondary school and in professional tertiary education, pupils, students and adults are taught metalinguistic, declarative knowledge of the writing system and metalinguistic, declarative knowledge of what, in various genres of the official standard language, is considered appropriate/inappropriate or correct/incorrect language. The current view in neurolinguistics is that this declarative knowledge is mainly subserved within the temporal cortex, in particular by the hippocampal system, and its associated circuitry (Ullman 2001; Morgan-Short and Ullman 2023).

Not all students in elementary and secondary school are equally successful in attaining control of the written standard language. Attainment is affected by a range of factors, such as

(i)   Typological differences between spoken home language(s) and the official national or regional standard language taught in school;

(ii) The complexity of the script with which the standard language is rendered, in particular the transparency or opacity of the grapheme-language relationship (in a variety of meaning-based and sound-based scripts);

(iii) Personal attributes of the student (apart from the possible role of heritability), e.g., intellectual capacities and motivation to learn the standard language and to crack the code of its writing system.

Learning to control the written standard language requires explicit learning and focused practice, resulting in conscious, declarative knowledge. Some of this knowledge becomes automatized through massive reading and writing practice (Seidenberg 2017). In adult populations, the level of education, level of profession, and language-related leisure-time activities are potentially related to the amount and types of literacy experiences. In societies with compulsory education for all children, almost all typically developing children (not affected by language-related disorders) learn to read and write, at least at a basic level. But not all children, adolescents or adults read and write to the same extent. Many so-called aliterate people (not illiterate but aliterate people) limit themselves to reading and writing short messages, for example on social media[10]. The content of people's ELC is therefore likely to vary widely by literacy-related attributes and practices (Hulstijn 2019, p. 164).

Note that the two-dimensional view proposed here (BLC vs. ELC) pertains to language *proficiency*, not to language as a form-meaning system. For a descriptive linguist, there is no reason to map the sets of frequent and infrequent elements or the sets of oral and written language on two scales.

3.4. Core versus Periphery

In Hulstijn (2015, pp. 41–42), I distinguished core proficiency from peripheral proficiency, in addition to the BLC–ELC distinction. Core linguistic cognition includes proficiency in the phonetic–phonological, morphonological, morpho-syntactic, and lexical domains and knowledge of how to use language forms in a way that is semantically and pragmatically appropriate to the communicative situation. Peripheral linguistic cognition includes (i) interactional ability, i.e., the general ability—not specific to a particular language—to communicate with other people in monolingual and multilingual encounters; (ii) strategic competence of how to perform in verbal communication under adverse conditions (e.g., time constraint or with limited linguistic knowledge); and (iii) metalinguistic knowledge (explicit, declarative knowledge of grammar and knowledge of the characteristics of various genres of oral and written discourse). While BLC falls within the core, ELC pertains to both the core and the periphery.

In Hulstijn (2011, 2015), I presented the notions of core and periphery as a response to various models of language proficiency, proposed by, among others, Lado (1961), Carroll (1961), Canale and Swain (1980), and Bachman and Palmer (1996) (see Hulstijn 2015, Chapter 4 for a review). These models were typical of the first wave of the cognitive revolution, treating the mind as consisting of distinct components (with interfaces between them). The componential view of language knowledge and proficiency does not play a major role in explaining individual differences. The notions of core and periphery will therefore not feature in the remainder of this paper (for recent meta-analyses of empirical work, see Jeon and In'nami 2022; for a discussion of componential views of language proficiency, see Hulstijn 2022).

4. Falsifiable Predictions

In recent years, I have tried to formulate falsifiable predictions concerning individual differences (IDs) more precisely than in my 2015 book. These predictions are presented here, separately for early and late learners and separately for BLC and ELC.

P1. With respect to *BLC* and *adult native speakers*, BLC Theory predicts IDs in the *speed* of language acquisition but no IDs in *ultimate attainment* (of BLC), except in clinical populations. Furthermore, if the home language and the standard language taught in school are identical or similar, it is expected that developmental differences, observed at the beginning of school education (i.e., in preliterate children), will diminish during the years of school education because of the quantity and quality of oral input at school.

With respect to native speakers of mid and old age, BLC Theory predicts that continued oral language use modulates the decline in processing speed in old age (e.g., word retrieval problems, articulation problems). "(T)he vast majority of old people remain capable of processing linguistic information fast enough to allow for relatively unimpaired functional language use, provided that they continue to practice their language skills on a daily basis and do not suffer from severe mental disorders" (Hulstijn 2015, p. 53).

P2. With respect to the acquisition of *reading and writing skills* in *native speakers*, BLC Theory predicts large differences caused by differences in cognitive abilities, such as executive function, memory, and non-verbal intelligence, even after controlling for socio-economic factors such as access to high-quality education. In adults, differences in reading and writing skills are predicted, caused by the level of education and profession.

To my knowledge, there exists no research on possible changes in these influences across the lifespan. Such research is urgently needed. There is virtually no large-scale *longitudinal* cohort research, with the exception of a cohort study among adolescents in the

U.S., conducted by Tomblin and Nippold (2014). In the health sciences, psychology, and economics, big cohort studies are quite common.

P3. With respect to *BLC* in *non-native speakers*, BLC Theory predicts large differences caused by input, typological distance between L1 and L2, and health factors (e.g., hearing ability)[11]. BLC is attainable by late L2 learners in the domains of receptive and productive vocabulary and receptive *processing* of grammatical structures. However, BLC will generally not be attainable (i) in the domains of pronunciation or (ii) with respect to the production of some grammatical features in spontaneous, unmonitored speech. The main reasons for this limited success are (1) a loss of plasticity (after early adulthood) in the brain areas involved in articulation and procedural language processing and concomitant entrenchment of the procedures of the language(s) acquired before this loss, and (2) (for many adult L2 learners) a lack of sufficient, prolonged exposure to spoken L2 in everyday situations, necessary for the acquisition of procedural cognition (MacWhinney 2017).

BLC Theory does *not* predict differences caused by *cognitive* factors in neurotypical populations of non-native speakers. One does not have to be particularly intelligent to learn an additional language, with respect to listening and speaking. There is a widespread erroneous folk wisdom saying that one has to be clever to learn another language. It would be worth the effort to explore the feasibility of foreign-language and second-language instructional programs which give priority to speech recognition under massive aural input and to explore their effect among learners differing in cognitive abilities.

P4. In the acquisition of *reading and writing skills* by *non-native speakers*, BLC Theory predicts maximal differences in speed and ultimate attainment, caused by typological differences between L1 and L2, differences between L1 and L2 writing systems, and differences in the cognitive abilities needed for acquiring reading and writing skills. "Late L2 learners can become as proficient in ELC as native speakers of the same intellectual, educational, professional and cultural profile, despite some deficiencies in their L2 BLC" (Hulstijn 2015, p. 53).

5. Related Research Questions

From BLC Theory, not only corollaries and falsifiable predictions can be derived—this theory also leads to research questions of an *exploratory* nature. This section presents two exploratory questions.

5.1. Linguistic Contents of BLC

A fascinating question pertains to the lexical, morphological and syntactic elements of BLC, i.e., the set of frequent language elements. Is this part of the oral language, used and shared by adult native speakers, trivially small or intriguingly large? Which syntactic patterns are already acquired before the onset of literacy, before children are taught to read and write? In a study in progress, I am exploring pre-school children's acquisition of three truly abstract word-order pairs in German and Dutch[12]. These patterns are *not* constrained by lexis, semantics, or pragmatics. Preliminary findings suggest that at least some children (mainly children growing up in input-rich homes) acquire these three word-order pairs before learning to read and write in school. This would mean that neurotypical human beings can acquire highly abstract patterns solely on the basis of (sufficient) oral input, without any formal instruction. In the case of agglutinative languages (e.g., Finnish), it would be interesting to investigate which complex word forms occur frequently in oral communication and are acquired by all adult native speakers. In the case of fusional languages with rich flection of verbs (e.g., Spanish), it would be interesting to investigate which flectional forms occur frequently in oral communication and are acquired by all adult native speakers. It might well be that 'knowing' a given verb does not imply that a native speaker is able to process, receptively and productively, *all* of its many forms listed in grammar books.

There are two approaches to research aiming at answering the question of what belongs to BLC. The first one consists of creating big, representative corpora of spoken language

and then finding out which constructions occur highly frequently. In an exploratory study, using a very small corpus of Dutch, spoken by 98 native speakers, differing in age and level of education, I investigated which syntactic patterns were produced by (almost) all participants (Hulstijn 2017). The other approach consists of collecting language experts' intuitions about which constructions are common or uncommon and then constructing tests assessing familiarity with these constructions, administering these tests to a representative sample of native speakers (or subpopulations thereof), and investigating to what extent these intuitions come to bear in test takers' responses. This approach was adopted in a study conducted by Favier and Huettig (2021).

5.2. The Cost Function of BLC Acquisition

Another fascinating question is as follows: are there limits on the number of typologically similar or dissimilar languages a person can acquire in terms of BLC? What is the cost function of language learning in terms of exposure time? A person cannot simultaneously be the world's best chess player and the world's best violin player. But the literature on child bilingualism shows robust evidence that children can acquire oral control in at least two typologically different languages. How much exposure (in terms of quantity, quality, variability of speakers, and distribution over time, from birth) is needed for BLC acquisition? Of how many languages, learnt earlier and later in life, can a person reach BLC?[13]

6. Implications for Research on Individual Differences

BLC Theory makes a fundamental distinction between cognition in the oral and written domains. From this distinction, important implications ensue for the measurement of language skills in research and for practice in a wide variety of fields of scientific inquiry. So far, little attention has been given to the distinction between constructions typical of oral and written discourse.

For many decades, a variety of tasks have been used, and are still in use, to assess participants' language skills and subskills or to study the processing of linguistic input in L1 and L2 acquisition. This practice has been implemented in clinical linguistics (across the life span), in high-stakes language testing, in language education (the evaluation of teaching methods), in the study of implicit and explicit language teaching and learning, in sociolinguistics, anthropological linguistics, forensic linguistics, discourse analysis, in the study of language dominance in multilinguals, in the study of language attrition, in neuro-linguistic research on alleged bilingual advantages (ERP, fMRI, and eye movement), in the assessment of (verbal) working-memory capacity, in experimental pragmatics, in the study of language aptitude, etc. In these fields, various kinds of tasks and tests are used, measuring receptive and productive vocabulary size, speed of word recognition and word retrieval, word articulation, speed and fluency of speech production, gesture-supported speech production, sentence imitation, dictation, grammaticality judgments, judgments of semantic plausibility, the supply of words deleted from single sentences or texts (cloze tests), and more. In research using such tasks, a distinction is seldom made between, on the one hand, high-frequency elements occurring in everyday oral communication, and, on the other hand, words, constructions and grammatical patterns characteristic of written discourse in standard language. For example, the notion of a *sentence* is characteristic of formal written discourse, but not of oral discourse. In most European languages, written with an alphabetical script, a sentence is a proposition with at least a finite verb form and an explicit or implicit grammatical subject, written with a capital letter on the first word and with a period, question mark or exclamation mark after the final word. In contrast, most *utterances*, characteristic of oral discourse, are not complete sentences (Biber 1988). Relative subclauses (subject and object clauses) in English are more characteristic of written than of oral discourse. In languages with rich verb conjugations, many conjugated verb forms do not occur in spoken discourse. Testing the receptive and productive control of these low-frequency verb forms may reflect literacy-related language knowledge rather

than the cognition of oral language. *Thus, researchers designing test items representative of everyday oral language use, on the one hand, and items representative of standard written language, on the other hand, stand to gain a lot in explaining or diagnosing individual differences in test performance*[14].

7. Discussion

Many theories are reductionist in the sense that they account for observations (phenomena) in a rather simple way. The observations of individual differences in the acquisition and control of native and non-native languages, which BLC Theory attempts to explain, may well be so diverse that the two-dimensional conceptualization of language proficiency (BLC and ELC) and the ID factors mentioned in the four predictions presented above will not suffice to bring us closer to an understanding of observed individual differences. At first sight, then, there appears to be a contradiction between the simplicity of the theory and the complexity (diversity) of the phenomena. However, neither theories nor puzzling observations (phenomena) are 'true' per se. Theories, with their abstract constructs (and construct definitions) and propositions of how constructs may or may not be associated (causally or otherwise), are hermeneutic *tools*, as Popper (1959) argues. Theories help us to conduct empirical research *in a concerted, theory-driven way*. They are part of the cycle of scientific inquiry. Theory-driven empirical research may prove the theory partially or totally wrong. The findings will then necessitate the rejection or adaptation of the theory. In either scenario, we will have reduced our ignorance somewhat concerning the puzzling phenomena we sought to understand in the first place. The adapted theory will then be tested in the next round of empirical research, following the cycle of inquiry.

Some people have criticized my definitions of, for instance, BLC, ELC, and native speakers. Some people find the definition of a native speaker morally or ethically wrong because it excludes some individuals. Other people have asked me whether certain words or grammatical constructions do or do not belong to BLC, demanding that I answer their question before they can accept BLC Theory. Such comments overlook the cyclical idea of scientific inquiry in Popper's critical rationalism.

For example, with respect to construct definition, the German linguist Rudi Keller, in a lucid book about language change, said, concerning the definition of language, "The issue is not what language 'is', but how one would conceive of it if one is interested in solving certain problems" (Keller 1994, p. 154). With respect to worries about a theory's perceived simplicity, the famous psycholinguist Marc Seidenberg (2017, p. 189)—referring to the philosopher Hilary Putnam (1972)—wrote "A good theory (...) explains the phenomena in terms of general principles that bring out their essential aspects rather than burying them in a mass of unessential detail". BLC Theory offers a motivated conjecture, with falsifiable predictions, of how phenomena of IDs could be explained. The research community will not embrace the theory for its truth (it remains a conjecture), but it will hopefully use it for its potential fruitfulness for new empirical research, as a promising research agenda.

My own expectation is that empirical research conducted outside Europe and North America will show the weaknesses of BLC Theory. Most research on first- and second-language acquisition and on multilingualism (published in English, in international journals) has been conducted in Europe and North America, by European and North American researchers (see, however, for a healthy exception, *The Cambridge Handbook of Bilingualism*, edited by De Houwer and Ortega (2019)). The risk is large that this has created a Western bias in theory construction and empirical research. As pointed out above, across the world there exists an enormous diversity in the languages with which children grow up in their pre-school years and a wide variety of contrasts with the standard language(s) taught in school. I imagine that BLC Theory may not suffice to explain observed individual differences in the control of native and non-native languages in all the countries and regions of the world. I therefore hope that researchers will test BLC Theory's predictions not only in Western but also in non-Western countries.

Notes

1   Note that, in BLC Theory, the term native speaker does *not* have normative connotations. Instead, the notion native speaker is a construct (a tool) in a theory aiming to explain IDs in language proficiency. In Hulstijn (2019, p. 159) I suggested, for those who oppose the use of the terms native and non-native, the terms L1ers and L2ers as alternatives for native and non-native speakers.

2   The word *adult* has been added to the definition of native speaker in Hulstijn (2015, p. 28). Note that the term native is *not* synonymous with monolingual.

3   Thus, so-called heritage speakers (Rothman 2009) can be considered native speakers (Rothman and Treffers-Daller 2014). BLC Theory is targeted at adult native speakers who have acquired BLC.

4   In response to a clarification question of one reviewer, I would like to clarify that *native speaker* and *BLC* are orthogonal constructs. Typical adult native speakers attain BLC but heritage native speakers may not do so. Learners of non-native languages may or may not attain BLC, depending on a number of factors.

5   This definition differs from the one in Hulstijn (2011; 2015, pp. 21–22). Current views in usage-based linguistics and neural-network psycholinguistics necessitated a new definition.

6   The current view in neurolinguistics appears to be that procedural language processing is mainly subserved by the basal ganglia (and its subdivisions, and their associated circuitry), which plays an important role in motor control (Ullman 2001; Morgan-Short and Ullman 2023). With respect to specific types of linguistic cognition, MacWhinney (2017, p. 9) lists the following areas: the auditory cortex (for audition and statistical learning), the inferior frontal gyrus and motor cortex (for articulation), the superior temporal gyrus and the anterior temporal lobe (for the phonological organization of lexical units and mapping of lexical units to meaning), the inferior frontal gyrus (for syntactic processing), the dorsal lateral prefrontal cortex (for assigning case roles), and additional frontal areas (for pragmatics and conversational sequencing). In 2013, the European Commission provided a grant of EUR 600 million for the Human Brain Project (2013–2023). The initial ambitions were high, but the project taught the research community modesty. Much fundamental (mainly descriptive) work was completed, building a research infrastructure, to "further explore the different aspects of brain organisation, and understand the mechanisms behind cognition, learning, or plasticity" (https://www.humanbrainproject.eu) (accessed on 10 December 2023). Thus, experts' current understanding of language and the brain is partial and likely to become more detailed over the decades to come.

7   ELC was called Higher Language Cognition (HLC) in Hulstijn (2011). In this quote, HLC has been replaced by ELC.

8   I arrived at this number by consulting (in 2022) all 193 countries' pages on Wikipedia (English).

9   Spoken languages change without a plan or an intention, as a result of the so-called 'invisible hand' of the community of its users (i.e., the result of human actions). Changes in spoken languages do not result from the execution of any intentional human design. In contrast, written standard languages are often regulated by authorities. Written standard languages change, therefore, much more slowly (sometimes through new regulations) than spoken languages (Keller 1994, pp. 38, 154; Schmid 2020).

10   The PISA reading assessment, administered in 2022 among 15-year old students in 37 participating OECD countries, shows that 26% of students performed below level 2 (OECD 2023), meaning that these students can only "understand the literal meaning of sentences or short passages" (OECD, PISA 2022 Database, Table I.B1.3.2).

11   In the case of learning a third, fourth, etc., language, this claim pertains to the difference between the new language and all earlier learned languages.

12   The three word-order pairs are: (1) a subject–verb order when the subject takes the first position in main clauses versus a verb–subject order when another constituent than the subject takes the first position; (2) the presence of a separation of the auxiliary and main verb in main clauses versus the absence of such a separation in subclauses; and (3) the verb being second in main clauses versus the verb being the final word in subclauses.

13   The term cost in this paragraph refers to *exposure cost*, not to *processing cost*, as used in the cognitive neuroscience of bilingualism.

14   For an example of two speech-segmentation tasks, aiming at assessing solely BLC in native speakers of Dutch differing in age and level of education, see Hulstijn and Andringa (2014). Favier and Huettig (2021) designed a grammatical acceptability test with two sets of sentences: (1) sentences with grammatical constructions that a panel of 23 linguists had rated as "virtually known by all adult native speakers" (p. 3), called "core" items and (2) items that the panelists had rated as belonging to the "periphery" of grammar. The test was administered to 38 native speakers of Dutch with either high or low literacy experience.

With this methodology, the researchers were able to investigate whether an interaction existed between familiarity with core versus peripheral grammar, on the one hand, and high versus low literacy of participants on the other.

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