Psychological Science and Linguistic Theory

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Psycholinguistics: A very short introduction (2025), by Fernanda Ferreira, Oxford University Press.

Abstract. In the study of human cognition, language is central in part because our species is the only surviving member of the primate lineage that is in possession of its distinctive properties. Evidence suggests that only in *homo sapiens*, spectacularly, did language emerge. Aside from the point of view of evolutionary origins, the other reason for language being a defining feature is its function as an indispensable instrument of higher order cognition. If language-related abilities are essential in this way, linguistics can be understood as a branch of psychology; and in general, the methods of cognitive science should be applicable to its study in every way. From another perspective, its centrality is related to the interconnectivity of language with the other higher order competencies of the mind. Thus, in all of the above, and in the following discussion, "language" should be understood as "knowledge of language." As in all the branches of psychology, rooted in turn in biological science, attention to the relationship between applied research and theory cannot in the long run be neglected.

Key words: psycholinguistics, learning and acquisition, bilingualism, language processing, cognitive architecture

1. Introduction: The systems of cognition

A recent retrospective on research in the psychology of language summarizes advances in the field and offers a reflection on challenges that today can be taken as a failure to yet consolidate this same progress. Fernanda Ferreira (2025) presents two sides of the uneven development. In fact, as of this writing, the balance sheet on its divided unfolding, in appearance disappointing, is one of long-standing (Ferreira 2005). On the other hand, the prospects of a gradual and progressive consilience should be more promising than they appear today. To this possibility, the book makes a contribution that readers can reflect on as they learn about new research opportunities. Upon covering the, so to speak, traditional topics of language comprehension and expression, conversational discourse and reading in the first chapters, Chapter 6 takes up the controversial questions of individual differences in language ability, and Chapters 7 and 8 the related fields of bilingualism and sign language. The conclusion looks forward to the applications and implications of Artificial Intelligence.

The interface between the Faculty of Language (FL) and other cognitive systems is one of the important themes beginning with chapters 1—3; and the book goes on to better explain the relationship, not always

clear in most discussions, between linguistic competence and cognition. Strictly speaking, the FL (linguistic competence) should be considered as one of the cognitive systems. All uses of linguistic knowledge (externalized and for inner speech) involve interface connections. Thus, a useful approach to more clearly specify what knowledge of language refers to is to start at the level of these interconnections: language ability – "performance" is the term often given by linguists. Language-related abilities activate the linguistic system (the *language faculty understood narrowly*) that interacts with the other cognitive systems required in each case:

- Visual cognition – for the ability to read,
- Motor cognition – for writing ability,
- Musical cognition – for poetic expression and appreciation (which includes or is closed aligned with singing ability),
- Cognitive structures that subserve the building of coherence – for narrative and expository expression/comprehension,
- Metacognitive competencies – necessary for related abilities of text/discourse processing in general and decoding/comprehension of written language in particular (known as "metalinguistic awareness"). The same meta-level competencies are applied in higher order spoken discourse and writing,
- and so forth, depending on how the particular ability is conceived and categorized (differentiated from a related ability, closely or distantly).

In this way, a language ability is a network of interfacing systems, some that are domain-specific and others that are domain-general (Fedorenko 2014).

Then, the FL(narrow) can be circumscribed variously by theorists and researchers; one well-known difference of conception being:

- that which includes phonological competence within the nucleus of the FL(n), together with syntax-morphology,
- in contrast to the model that sets phonology apart within the outer domain of language, the FL(broad).
  See, respectively, Pinker & Jackendoff (2005) and Hauser et al. (2002).

2. Divergence and new discussion

Chapter 1 outlines the progressive distancing between psycholinguistics and theoretical linguistics that has appeared to have progressively widened, taking into account the traditional relationship with Universal Grammar-oriented theories (Anderson & Lightfoot 2002). But in the end it is fair to say that there is no necessary reason to restrict the relationship to UG. Psycholinguistics, because of the way the field is defined, takes as its object of study language ability, typically focused on one or another kind of skill or instance of performance. Theory, on the other hand, concerns itself with describing the underlying competence structure of the narrow Faculty of Language (FLn). Here, it is important not to characterize the above mentioned divergence of research models as a crisis. Rather, the drifting apart stems from the natural uneven progression and reworking of conceptions and frameworks endemic to all interdisciplinary collaborations.[1]

But in the long run, looking into the relatively distant future, as things have turned out according to Chapter 1, the (largely amicable, with some possible exceptions) divorce of psycholinguistics and theoretical modelling cannot be sustained. Eventually, as the psychology of language continues to advance in its

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[1] Ferreira (2005) has singled out the development of the Minimalist Program as marking the continued (wider) distancing between theoretical work in linguistics and cognitive psychology, a topic that needs to be deferred for now. Kinsella (2009) and Pinker (2013) echo the observation pointing to a parting of ways in other realms of investigation, such as biological/evolutionary foundations and the study of language beyond the core domain of syntax, narrowly defined.

understanding of language abilities, especially in the subfield of language acquisition, its findings will become more and more decisive for the theory of language competence, the narrow domain of linguistic knowledge. Likewise, the field of theoretical linguistics will find it more and more difficult to set these findings aside, giving way, with time, to a renewed converging dialogue. The representations that theory describes, in all cases structures that are biological and specific to humans, must be "processed by limited capacity systems in real time" (Ferreira 2025: 2). These knowledge structures that are accessed for comprehension and expression (processing, computation) must be stored in neural networks (biological representations).

3. The problem of evidence

In studying comprehension processes (Chapter 2), important questions arise about how listeners or readers parse sentences. How is the parser, part of the processing system, related to the knowledge of the language? Findings from experiments that reveal syntactic categories (for example ambiguity or garden-path effects that prompt readers to backtrack and self-correct) call on theorists to explain the observed performance by referencing the concept of structure dependence. Does the appearance of phrase hierarchy in performance reflect underlying linguistic knowledge described by theory, or can it be explained in some other way? Anticipating the chapter on bilingualism, each theoretical model should begin to account for the mental grammar in question in terms that are specific to the *language* spoken or written. In turn, the results of this research will help us understand *Language* (in general-upper case "L").

Language production (Chapter 3) also reveals the architecture of the mental grammar in speech error (Ferreira 2025: 32), ambiguity and switching/mixing of different kinds. Research on the question of stages is especially relevant to theoretical questions, for example to the problem of how thought and language are related. Widely accepted two-stage models begin with the selection of concept/meaning followed by the generation of concept-like representations linked to grammatical features – lemmas (p. 34). Phonological structure corresponds to the, final, word form.

Looking ahead, Chapter 6 introduces the important distinction between competencies and abilities that are domain-specific and domain-general. Considering language development in children, while the specific and specialized acquisition mechanisms, beginning with very early emergence of knowledge of phonology, are concentrated in such a way that we can identify them as domain-specific, there is evidence for the participation of domain-general learning as well. Thus, even some component parts of the central/prime, mother-tongue, linguistic competence of the FL(n) might be constructed with the intervention of the latter, non-specialized, domain-general, learning procedures. On these questions, the theoretical debate on modularity is especially relevant, regarding both processing and mental representation (Ferreira & Nye 2017).

4. Languages in contact

The chapters on the psycholinguistics of bilingualism and sign language address new research problems that will be directly relevant to the future dialogue with theoretical linguistics. This is because, as we will see, the two related fields of study touch on fundamental questions about the nature of the Faculty of Language more directly.

Central to the research on bilingualism, which includes sign language bimodal bilingualism, are the questions of representation (cognitive architecture) and how the language subsystems[2] are managed and coordinated. The mechanisms of management and coordination (Ferreira 2025: 86) refer to cross-

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[2] Following de Groot (2014), the neural instantiation of the languages of the bilingual speaker or bimodal signer are termed *subsystems*, as they form part of the overarching language *system*, in this case a bilingual network of the FL. The subsystems maintain a mutual autonomy in development, processing and even in cerebral trauma (Paradis 2004). As separate components/subdivisions of the same (upper-case L) Language system, cross-language interaction characterizes the active connections between the two linguistic subsystems of the bilingual (or among the subsystems of multilingualism). "Subsystems" is an apt term because the kind of knowledge (morphosyntax and phonology) is of the same kind, cognitively, across languages.

language interaction (CLI), a relationship of interface that accounts for transfer and other kinds of mutual influence and interconnectivity. No credible model of bilingual cognition posits an entirely non-interactive partition of the linguistic subsystems.

Chapter 7 summarizes the interesting aspects of CLI in studies of language processing. Studies demonstrate how interconnectivity between language networks is revealed, for example, in naming tasks. During a testing session in Language A, presented on the computer screen with a picture to identify in the presence of a related word printed in Language B (with instructions to ignore it), the bilingual subject experiences competition/interference, resulting in delayed response. Again, no hypothesis of bilingual mental representation presents a proposal for encapsulation of the subsystems A and B in relation to each other.

In addition, lexical items from both language subsystems can be co-activated in experiments that select words in Language-A and Language-B with similar phonology. Likewise, bilinguals can be prompted to express a proposition in Language-A with a parallel grammatical pattern that they heard in Language-B. While these results appear as predictable, and they confirm the consensus view of CLI effects, the exact nature of the relevant interface mechanisms and how the connections are implemented on-line remains as an interesting question for future investigation.

On this research problem, the proposal of "language mode" – more precisely "monolingual-bilingual mode continuum" (Grosjean 2001: 58) - is highly informative. The "setting" along the continuum depends on a host of contextual and expectation factors: e.g. awareness of interlocutors' language knowledge, and assumptions and perceptions of the experimental setting. Recourse to the domain-general procedures of inhibitory control strongly constrains, or relaxes, to varying degrees, the restrictions on CLI. In the context of a known audience of monolinguals, L2 speakers are able to effectively block competition, completely, even from their dominant language for extended periods of conversation. The inhibitory mechanisms impose a monolingual mode, both consciously and without awareness, even as the speaker is being virtually compelled to resort to ungrammatical speech in the weaker language. Conversely, codeswitching among bilinguals allows for the language mode adjustment to be set to a threshold that requires the monitoring of cross-linguistic grammatical well-formedness at points of contact between Language-A and Language-B.

From this point of view, the implementation of both monolingual and bilingual mode is systematic as language processing operates on language-specific domains. Thus, conceptually, there is no contradiction between the differentiation (mutual autonomy) of language subsystems, a question of representation (cognitive structure, probably taking the form of networks), and interface processes of CLI (varying from highly prolific to highly constrained and inhibited). In particular, if inhibitory control is implemented in a nonrandom way, it takes effect upon systems and subsystems; inhibition takes effect on entire networks. In this regard, to be clear, the subsystems are what we understand as the language-specific mental grammars, of: French, Spanish, Navajo, Russian, and so forth.

Work in the area of sign language bilingualism (Chapter 8) extends the discussion to consider the dimension of modality. Whereas speech codeswitching must unfold sequentially, alternating between constituents of Language-A and Language-B, bi-modal (sign-speech) expression and comprehension can be effected simultaneously. Research on language mixing in this case can compare the patterning of constraints between the different kinds of coupling, varying by context and circumstance. For example, while for speech bilinguals the processor reliably inhibits codeswitching in the monolingual communicative setting, the same is not necessary, as is frequently observed, in bimodal expression. The latter could then be considered an instance of "co-activation without competition" (Ferreira 2025: 108-109). Here, the example of bimodal codeswitching (or code-blending) makes reference to co-activation of words and phrases in two linguistic subsystems (structurally contrasting lexical items and grammar, and expression/comprehension transmitted via two separate channels) that by any criteria would be autonomous one from the other.

The argument, for mutual autonomy, also applies to how co-activation is implemented in two linguistic subsystems transmitted via the same channel. The counterargument proposes that the linguistic representation in bilingualism is not distributed across subsystems but rather is unitary-undifferentiated. See the discussion of the opposing hypotheses in Jiang (2023) and Francis (2024).

Chapter 8 mentions what is perhaps the most compelling natural experiment for the future discussion of common ground between psycholinguistics and theoretical modeling: research on the genesis of Nicaraguan Sign Language (LSN, in Spanish) during the late 1970s and 1980s. In real time the emergence of a fully formed linguistic competence from a home-sign pidgin system was documented. The stages had never before been scrutinized comprehensively by scientific observation and direct assessment.

Deaf children, especially in remote rural areas, typically experienced isolation from signing adults or other children. An approximation to complete linguistic competence evolved in families: the home-sign pidgin. When a significant school-age population of home-signing children was brought together in a boarding school for teaching a type of oral version of Spanish, the home-signing pidgin, shared among the resident children, underwent an "upgrading" observed in other first language acquisition scenarios. The language change was most clearly evidenced among the youngest cohort. Researchers concluded that children within the Critical Period created LSN as they still had access to the acquisition mechanisms of the Faculty of Language (Morales López 2024).[3] The older cohort of home-signers of course also progressed in building up their communicative system, but as a group fell short of constructing a fully formed and complete LSN (Senghas et al. 2005).

The concluding section (Ferreira 2025: 92-99) on bilingualism presents two perspectives on the growing number of studies regarding the effects on general cognitive development of the knowledge and use of two languages. An important distinction in this regard may be, precisely, that between knowledge and use. The recent tendency in findings has been to emphasize positive outcomes or advantages perhaps as a reaction to earlier views, today by and large discredited, that a second or concurrently acquired language frequently results in different kinds of interference or disruption that negatively affect either cognitive development or language ability itself. The discussion as a whole is interesting from a theoretical point of view as it falls under the larger research problem, consisting of many interrelated questions going back many years, of the relationship between language and thought (i.e., the relationship between the domain of linguistic knowledge and general cognition).[4]

One research question asks if bilingualism is associated with stronger cognitive skills. Studies began to suggest that the processing mechanisms and learning outcomes that we considered above such as inhibitory control, monitoring and managing information, task-switching between and attention to patterns

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[3] The concept associated with the rapid transition from a pidgin system to a fully formed grammar is *creolization* (Singleton & Newport 2004). The account of Nicaraguan Sign Language genesis remains controversial, in the same way that the concepts of Critical Period and Poverty of Stimulus are controversial in general. Singleton and Newport summarize the discussion: "Creolization has attracted the interest of language researchers because of the claim that children's output differs markedly from the reduced and inconsistent input to which they were exposed. However, creolists disagree regarding the source of this structural expansion, and also regarding whether this expansion is unique to children" (p. 374). Similar to other language acquisition case studies, future clarification regarding the stages of LSN emergence will contribute to the psycholinguistics-linguistic theory discussion.

[4] This review acknowledges the objection of many readers regarding the proposed separation of linguistic competence and general cognition. In fact, the field is divided between two points of view, that:

  o knowledge of language (its faculty narrowly defined) forms an autonomous domain interfacing with the separate domains of conceptual structure, visual cognition, etc.

  o language and general cognition form a unitary representation, allowing us to dispense with the hypothesis of an independent, domain-specific, Faculty of Language.

For discussion see, respectively, Newmeyer (2003) and Tomasello (2003). While many of the examples of processing and representation in Ferreira (2025) assume or tend to lean toward the former, overall, the summary of the research on language processing, in particular, is compatible, strictly speaking, with both theoretical approaches.

in Language-A and Language-B, and metacognitive awareness might favor the development of general higher order abilities. As this kind of language-related processing falls under the category of so-called executive functions, it was not surprising that results indicated a correlation. At the same time, mixed findings suggested that the relationship was not as clear cut. Rather than bilingualism, per se, the causal link may be related to *use* of language in contexts of greater cognitive demand. Bilingual speakers encounter such opportunities in some settings, such as translating, and monolingual speakers find themselves performing analogous tasks, related to differences in register and discourse/text complexity for example, the advantage of bilinguals amounting to specific challenges among others distributed unevenly among all language users.

As important as investigations on language processing are, work in the fields that involve bilingualism and exceptional language ability seem to present especially promising opportunities for the eventual convergence of psycholinguistics and linguistic theory. The reason for pursuing this potential opening is the closer connection, in both cases, to the research on language acquisition, in particular early child language development, which happens to be a central concern of linguistic theory, for good reason. It is here where the basic conceptual foundations still remain to be confirmed or disconfirmed. The problem of acquisition that cannot be fully accounted for by explicit learning is one that, in the end, will be resolved by the application of new methodological approaches of cognitive science.

In the subsequent discussions the hypotheses of Poverty of Stimulus and Critical Period for example, will be at the center of an informed exchange of views. One promising avenue of research is to consider the possibility that the core grammar, FL(n), as it emerges in early child development draws on the resources of both domain-specific acquisition and domain-general learning (Pearl 2021). This kind of confluence between modular and non-modular processes of acquisition/learning would be more easily accepted in the domains of FL(b). These include the broader ability structures that show wide variation in ultimate attainment, as in literacy learning and complex higher-order discourse expression and compression; see Schleppegrell (2004) for examples. But to reiterate, in this case, the realm that the study of Pearl (2021) is considering, in which, hypothetically, both domain-specific acquisition and domain-general learning participate, is FL(n).

5. Interface in performance

The chapter on conversation and dialogue provides a good example of a language ability which in this case brings together the components of linguistic competence and knowledge of social interaction (pragmatic competencies). The latter corresponds, for example, to the kind of interpersonal cooperation required when two persons are engaged on the same workspace, focused on a task. Each participant must monitor the sequence of actions or expressions of his or her partner, accurately predict—"forward modelling" (Ferreira 2025: 55)—and simultaneously plan a coherent follow-up action or response. "Pragmatic inference is at the center of communication… [each turn is] is enhanced and expanded with information that the comprehender adds through inference to the literal content" to make the interaction meaningful and coherent (p. 47). Common ground is established and maintained by interactive alignment, constructed mutually and typically below awareness (Pickering & Garrod 2021). In the example of this kind of ability, both of the required competencies are acquired by implicit acquisition ("simple immersion" in the native language and culture of the child). Unlike other kinds of language ability, no explicit teaching is normally provided by caretakers, siblings and neighbors as it is superfluous, despite the high level of internal complexity of each of the component competencies.

Development and adult-like attainment, exceptional cases of impairment aside, is uniform/universal. Higher-order awareness in this domain, involving metacognitive operations related to an advanced Theory of Mind capability, deserves further discussion, for now allowing us to skip ahead to Chapter 6 on variation in cognitive abilities and individual differences. Here, a different category of controversy presents itself. Research in this area has focused on the variation in: working memory capacity, efficiency of language processing, effective control of attention and skill in suppressing non-relevant information, and scope of and access to knowledge databases tied to the size of vocabulary. Related development in later

childhood, not uniformly nor universally attained to the same level, is about the different aspects of metacognition, in the realm of language: metalinguistic awareness. They are dependent on the richness of experience and the active and deliberate participation of domain-general learning, resulting in a range of individual differences in learning outcome. Chapter 6 reports on the variation in performance, reflecting levels of difficulty, even within the sentence grammar. Working memory capacity varies, and will be reflected in comprehension, involving the computing of cohesive ties, for example between pronoun and antecedent in different kinds of textual context (Ferreira 2025: 76). Important to keep in mind on this topic is that the language processing system is not unitary but rather composed of subsystems, "different architectures" (p. 73) whose components are both modular and domain-general, all nevertheless interactive along each relevant interface. Evidently, comprehension of text/discourse and coherent expression beyond the sentence level varies widely in all populations (p. 74). But as the concluding sections of the chapter call our attention to, direct measurement of what we might call the higher order language abilities remains difficult, and as mentioned above controversial. Theoretically, the contrast resides in the distinction, excluding the consideration of disability/impairment, between:

- abilities that evidence ultimate attainment leveling out at a uniform/universal plateau (developmentally "closed-ended"), and
- abilities that are developmentally "open-ended" – showing evidence of significant individual differences, varying along a normal distribution.

6. The components of reading and writing

The Chapters 4 and 6 now allow us to return to Chapter 5 on literacy. Not only does reading and writing correspond to the second category of "open-ended" development and attainment, but it is secondary from an evolutionary point of view. All spoken and signed language emerged, in a manner that characterizes human cognition, many thousands of years before the first *cultural invention* of writing. Literacy is not part of what defines thinking in our species.

One of the important advances in the psycholinguistic study of reading has been to expand its purview beyond the alphabetic sphere to take account of findings from the other orthographic systems, in particular the most contrasting case: morpho-syllabic writing. Learning to process writing in all orthographies, including the most exceptional, forges a new interface between language cognition and visual cognition to form a "brain network dedicated to reading" (Ferreira 2025: 60). As research began to converge upon the centrality of decoding, correcting early popular notions of top-down guessing dependent on context, a question was posed: to what extent, and how, is the contrasting case of Chinese character reading different? Might there also be parallels at some level, or in some way, with alphabetic reading (Pan et al. 2016), even though characters do not encode phonemes, neither holistically nor via any subcomponent (e.g. the phonetic radical)? Consistent findings over the years have indicated that, even in the processing of morpho-syllabic text, during reading silently, phonological representations are not bypassed or suppressed (Hsuan 2025).

In all decoding of written language, across all orthographies, reading activates, rapidly and automatically, the component parts of lexical items, or entries (orthographic form, meaning, morphosyntax, phonology). Within the lexical entry the components are firmly and reliably linked. While decoding text, skilled readers tend to fixate on every word, do not skip them to guess meaning, and even proceed through passages with multiple fixations, "regressive saccades," to confirm accurate decoding (Ferreira 2025: 61). Thus, at the level of sentence processing, the building of grammatical constituents typically, if not always, requires the activation of all the sub-lexical components of words (p. 66). In experiments that display single words out of sentence context, for example on a computer screen, it is possible that different patterns of activation may appear.

7. A concluding question regarding biolinguistic processes

Artificial Intelligence takes us back to a topic of the Abstract and the Introduction. The Conclusion, Chapter 9, discusses the applications of Large Language Models (LLMs) and their relevance to the theory of

linguistic knowledge, with special mention of the first "L" of LLM, because the problem of knowledge of language ultimately refers to its attainment in human children. Not only is language processed (recall from Chapter 1) by limited capacity systems in real time, but the language structures of long term memory are constructed by acquisition mechanisms with access to limited input (impoverished, compared to LLMs). It is limited/impoverished in regard to actual quantity and real time. The performance of LLMs are truly remarkable, likely in the near future to be in possession of capabilities in certain realms of performance far superior to human models, for example, in the field of translation. Psychological science and linguistic theory, however, are still interested in how knowledge of language emerges in biological entities, life forms without access to LLM-like input.

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