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Language architecture

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1.1 What is language? What is knowledge of language?

Pose the question of “What defines us as human beings?” to people around you, and most likely, among the first answers that you get, they will mention “language” or “languages.” The ability to produce and understand language in order to satisfy our communication needs is our most prized human ability. It is a fundamentally human capacity that relies on unique brain circuitry. It has probably played a decisive role in our evolving as a species. Man has been called *Homo loquens*, as the only animal capable of language.¹ The Harvard psychologist Elizabeth Spelke, interviewed by the actor Alan Alda for a PBS series called *The Human Spark*,² considers the question of what makes us uniquely human and distinguishes us from other species. Professor Spelke has looked for the answer to this question in

¹ This term is attributed to the eighteenth-century German philosophers J. G. Herder and J. F. Blumenbach.

² Available to view at <http://www.pbs.org/wnet/humanspark/episodes/program-three-brain-matters/video-full-episode/418/>. The quote is at around minute 7.

studying human babies. Although she argues that human infants and the infants and adults of other species have highly similar capacities early on, she suggests that it is language that ignites the uniquely human spark. It is when children start acquiring words at 9 or 10 months of age, and when they start to put these words together a few months later, that the uniquely human capacities emerge.

Also unique (and very useful) is the human ability to learn a second (and a third and a fourth, etc.) language, other than the mother tongue that we grew up speaking. Of course, many people around the world grow up with two or more native languages; the majority start out with one mother tongue but add other languages while they are still children, or learn them as adults. Not just “lingualism,” the ability to acquire and use a language, but *multilingualism*, being able to learn and use many languages throughout the lifetime, is another fundamental dimension of the human condition.

Indeed, available data indicate that there are many more bilingual or multilingual individuals in the world than there are monolinguals. In addition, a majority of children in the world have been educated at least partially through the medium of their non-native language. According to Grosjean (2012: 6), the extent of bilingualism is significant.³ For example, European Union documents report that 56% of the population of the 25 EU countries is bilingual, to the extent that they can have a conversation in a non-native language. In North America, 35% of Canadians and 18–20% of Americans are considered to be bilingual. These numbers are only slated to go up in our increasingly global world.

The emphasis in this book, however, is going to be on two or more language systems as represented in the mind/brain when we speak, write, sign, hear, and comprehend language. Contemporary linguistics is a cognitive science animated by the following fundamental questions:

What is knowledge of language?
How is that knowledge acquired?
How is that knowledge put to use?

³ See the amusing discussion on what scientists really know about those numbers at Grosjean’s blog: <https://www.psychologytoday.com/blog/life-bilingual/201411/chasing-down-those-65>.

How is that knowledge implemented in the brain?

How did that knowledge emerge in the species?⁴

Not all the answers to the fundamental questions are equally developed in our current understanding of language. Furthermore, the last question will remain largely outside our purview in this text. However, the other four questions are fundamental for the understanding of how humans acquire a second language, so we will start with the basics.

A central characteristic of language is that we have to account for the *infinite* number of sentences that any one of us can produce in the languages we know, but at the same time this infinite capacity is based on a *finite* amount of language experience (the number of sentences we encounter while learning a language), and a finite set of rules for what constitutes an acceptable sentence in that language. By the way, I use “sentence” to exemplify a unit of language. The same is largely true of smaller or bigger units of language, such as phrases or discourse.

Since the seminal work of Noam Chomsky in the 1950s, these five questions have constituted the focus of inquiry of generative linguistics. These research questions have come to signify that the human language faculty should be studied as another regular attribute of our species, and that the capacity for language is a function of the mind/brain like many other biological functions such as vision, hearing, etc. For Chomsky and his followers in science, language is a “natural object.” Such a view of the language faculty has been reflected in a new term currently in circulation, “biolinguistics.”⁵

In 2005, Chomsky published a programmatic article called “Three factors in language design.” In this article, he identified the elements essential to the growth of language within an individual, as follows:

- a. Genetic endowment
- b. Experience
- c. Principles not specific to the faculty of language.

⁴ Cited from Boeckx and Grohmann 2007: 1; see Chomsky 1986: 3, 1988: 3.

⁵ Not all generative linguists agree that the innate knowledge is to be understood entirely within the framework of evolutionary biology. For example, Mark Baker has argued for a nonbiological nativism (Baker 2007).

Knowledge of language is represented in the mind/brain. It critically relies on an innate biological endowment for language known as Universal Grammar. At a first approximation, it could be thought of as the information pertaining to language that we do not need to learn because it is universal, common to all languages and it comes to us as part of being human. This is the first factor of language design, which Chomsky called “the genetic endowment.” The second factor is the environment: language acquisition depends on abundant comprehensible input available to the language learner. Without comprehensible input, no specific language can be learned. The third factor subsumes generic principles of good design that are not specific to the language faculty, such as principles of data analysis and principles of efficient computation. We will be making frequent mention of the three factors in this textbook, as all of them are crucial in considering second language acquisition (abbreviated as either L2A or SLA).

The importance of the second factor for the growth of language is indisputable. Linguistic *input* is the language that we hear around us, for example, infant-directed speech. *Comprehensible input* is language that we can understand by linking the linguistic form with an extralinguistic situation, for example, hearing the sentence *The dog wants to go out* in the presence of a familiar dog, maybe the family dog, who is lingering by the door and looking at the speaker, begging. The mapping of linguistic form (in this case, the sentence) and meaning (the extralinguistic situation) is absolutely crucial for language acquisition, as neither of these two sides of language on its own constitutes knowledge of language, without the other side.

Children learn the language or languages of their surroundings, provided by parents, siblings, peers, and the whole linguistic community. For example, a child born to American parents and adopted at infancy by Brazilian adoptive parents, will be surrounded by Brazilian Portuguese and may grow up speaking only that language. A child born to a French-speaking mother and an English-speaking father in Quebec is likely to grow up with two first languages. A child born to Polish-speaking parents in the UK may learn to speak Polish at first, as long as she has no exposure to English. Chances are that this child will learn English later when she goes to preschool and become a child bilingual. Later on, that child may or may not forget how to speak Polish, or as linguists say, her Polish may *attrite*, depending on how much input and what quality of linguistic input she gets. She will then be a *heritage speaker* of Polish, bilingual in Polish and English, and possibly English-dominant.

Although it is indisputable that the language we learn is based on our linguistic experience, the necessity of Universal Grammar for language acquisition (Chomsky's first factor) is debated. In what is known as the *innatist* (*nativist*) view, the innate biological endowment, or language faculty, prepares us for the acquisition of whatever language we encounter at birth. Is there such a faculty? And if it exists, what does it consist of? Some generative linguists suggest that this is an innate ability that is also language-specific (aka domain-specific), that is, independent of other cognitive faculties. An alternative suggestion is that we are equipped with learning mechanisms, such as being able to pick out statistical regularities in the input, which can be applied to many types of learning, only one of which is language learning. The second approach is referred to as *emergentist* or *usage-based*, since according to it, linguistic representation in the mind/brain emerges solely based on the linguistic experience and is in a sense created by that usage.

In this book, we will entertain arguments for the former, generative approach, because this approach has uncovered more facts about SLA than other approaches. But first, a short aside. Why do we call it "generative?" Because it is a description of language with the purpose of listing the explicit rules that (ideally) *generate* all the grammatical sentences of that language, but only the grammatical sentences. It all started in the late 1950s. Linguists before Chomsky assumed that almost everything in linguistics was known, and that describing all languages adequately was a finite task that would be accomplished sooner rather than later. They also assumed that languages were so different from each other that it would be difficult to establish any common ground among them. Chomsky turned those two assumptions on their head, showing that there are many more commonalities across languages of the world than there are differences. As a result of that, it became obvious that almost nothing about this linguistic common ground, Universal Grammar, was known, and so in a sense contemporary linguistics had to start from scratch.

The 1970s and 80s were characterized by the tension between describing all possible natural languages and explaining the ease and speed of language acquisition: the fact that children seem to generate their native grammar without being taught it by their caregivers, relatively fast and effortlessly. In order to accommodate the ease and speed of language acquisition, Universal Grammar (what we are born with) had to be quite complex, detailed, and highly specific. Acquisition according to the Principles and Parameters

approach, which took shape in the early 80s, was a matter of putting to good use the universal principles, the properties common to all languages, and picking out the parameter values that were relevant to the language being acquired. In order for this process to be easy and productive, the parametric values, or options, were considered to be predetermined by Universal Grammar. Following a suggestion of the linguist Hagit Borer, these parametric options were thought to be grammatical choices that every language makes; they are fixed in our lexicon of functional morphemes. And without a doubt, lexical properties, including idiosyncratic words such as nouns and verbs, but also functional morphemes such as past tense and plural endings, are acquired based on experience.

How does Universal Grammar prepare us, or allow us, to acquire the language we encounter? First of all, it supplies a number of universal rules and properties that come to the language learner for free. As the linguist Mark Baker likes to say, the more languages differ, the more we discover that they are the same. Such language universals may include grammatical functions such as subject and object, the rule that every sentence must have a subject, be it pronounced or not, as well as a subject–object asymmetry: the verb and object combine to make a unit first, to the exclusion of the subject. The child does not need to learn those linguistic facts from experience, although they will be confirmed by her experience.

How about the properties that differ across languages? Universal Grammar restricts and defines the options that we entertain when we encounter the comprehensible input of the language we are learning. Generative linguists demonstrate that language variation is tightly controlled, both across grammars and in acquisition. A light switch that can be turned On or Off provided an apt metaphor to illustrate the idea. To take an example, let us consider the Null Subject Parameter proposed by Nina Hyams, one of the first parameters to be studied in child language acquisition (Hyams 1986). In English every sentence must have an overt subject, see example in (1) where the variant without a subject pronoun is unacceptable. In some languages, notably Italian and Spanish, the subject can be null (silent, or not pronounced), because the relevant information (who is doing the eating) is already encoded on the verb in the form of agreement morphology, as in (2). Importantly, the context, not the verb ending, points to the actual person who consumed the pizza, but that is true of the English pronoun *she* as well. So the Italian–English contrast can be described as a parameter with an On

value (null subjects are possible) and an Off value (null subjects are not possible).

- (1) She ate the pizza. / *Ate the pizza.
- (2) Ø Ha mangiat-o la pizza
 Ø has eaten-3SG the pizza
 ‘She/he ate the pizza.’

To recap, Universal Grammar, according to generative linguistics, contains a blueprint of all the rules that a speaker will need to generate all and only acceptable sentences in a language. This blueprint includes universal rules, operating in all human languages, as well as the options for the variable rules, or parametric options.

Note, however, that the number of sentences that can be generated in each human language is infinite, while the rules that generate them, including principles and parameters, is finite. This critical tension in the human language capacity is as valid for the usage of a native language as for all subsequent languages: the distinction between *competence* and *performance*. What is it that we know when we know a language? We know the rules necessary and sufficiently to generate every possible acceptable sentence in this language, along with its words and its functional lexicon. This is our linguistic competence. Do we have to have heard or produced every acceptable sentence? Of course not. Nobody can do that, since there seems to be no obvious limit on what we could say. That would be our linguistic performance. Language is freely compositional and creative. From a finite number of words and rules, we can compose entirely new, unheard-of sentences every time we open our mouths to talk, or write an email, or engage in internal monologue called thinking. Note that those same rules tell us when a sentence is unacceptable, as the sentence marked with a star symbol (*) in (1).

This finite competence–infinite performance dichotomy is extended to language acquisition as well: learners acquire the grammar of a language based on finite input, but once they have even a modest competence in a language, they can produce and interpret sentences they have never heard before. This is true of the first language, as well as of the additional languages a person acquires. To cite a brilliant illustration of this duality of the human linguistic experience from Baker (2001: 51–52), our knowledge of language (our competence) is like a recipe for baking bread. Using

that recipe, one can bake a concrete loaf of bread (in performance) as many times as needed. But each and every bread contains the information of its recipe inside, although slight variations are inevitable.

1.2 The language architecture

In the previous section, we mentioned that cognitive scientists in general, and linguists in particular, find language interesting to study because it is a structured and accessible product of the human mind. As such, language offers a means to study the nature of the mind that produces it. Describing how language is structured, or what the “language architecture” is, allows cognitive scientists to work out both how it is acquired and how it is put to use in everyday communication. From the very beginning of generative grammar, linguists have spent a lot of time thinking about what the ingredient parts of a linguistic message are and how these come together to produce a message. From now on, I will use the term “grammar” to refer to the system of rules that underlies our knowledge of language.

The major domains of linguistics mirror the processes involved in encoding and decoding a linguistic message. A sentence pronounced in appropriate discourse is made up of sound waves produced by the speaker and perceived by the hearer. For example, the word *bag* is composed by the sounds [b], [æ], and [g] arranged in a sequence acceptable in the grammar of English. In sign language, the equivalent would be linguistic gestures. The study of the acoustic signal and the articulation of speech sounds is *phonetics*. In hearing an utterance, the speech sounds are translated into mental representations in the mind of the hearer, using the language-specific rules for combining the sounds into syllables. *Phonology* studies the system of relationships among the speech sounds. The phonological system of a language includes an inventory of sounds and their features, as well as rules that specify how sounds interact with each other, such as how one sound might change when it is next to another. While the distinction between phonology and phonetics can often be blurred, it will be useful to understand it properly here. Phonetics analyzes the production and perception of all human speech sounds regardless of the language and is the basis for further phonological analyses. Phonology analyzes the sound patterns of a particular language by determining which phonetic sounds are significant and explaining how these sounds are combined by the speakers.

Once the sound waves are perceived and analyzed, they are assembled into morphemes, the smallest meaningful units of language, and then into words. The word *work-s* as in the example in (3) is made up of two morphemes: the lexical verb *work* and the grammatical morpheme *-s* signaling a present tense verb form agreeing with a third person subject (Josh). The study of this domain of language is called *morphology*. For the assembly of lexical items, a hearer needs access to her *mental lexicon*, where verbs, nouns, adjectives, etc., as well as functional (grammatical) morphemes, are stored.

- (3) Josh works in the library.
- (4) *Josh in library the works.

Next, morphemes and words are arranged together into phrases and sentences, following a language-specific word order. For example, the word arrangement in (4) is not an acceptable word order in English. (The star (*) indicates that a sentence is ungrammatical.) Possible word orders and subsequent displacement of some phrases to other positions in the sentence is the study of *syntax*. It is very common in generative linguistics to talk about *morphosyntax*, simply because the grammatical features that regulate the word order and the displacement of phrases in the syntax reside in the functional morphology. We shall see exactly how that happens in later chapters. The functional morphology encodes the language-specific information, while syntactic operations are considered to be universal. In a sense, morphology provides the blueprint of what is going to happen in the syntax, and that is why these two areas of the grammar are considered indispensable to each other.

The message thus composed in the mind/brain of the hearer needs to be interpreted by the Conceptual-Intentional system. To that aim, another series of compositional operations of interpretation is executed, following the rules of *semantics*. Finally, the sentence meaning is examined in light of the extralinguistic context and the discourse information; the meaning can potentially be amended to take these into account. Both semantics and *pragmatics* have to do with the meaning of language, but semantics refers to the meaning of words (lexical semantics) in a language and the compositional meaning of the whole sentence, while pragmatics brings the context to bear on the message. In each situation, the speaker and the hearer in the conversation define the ultimate meaning of the words, based on other clues

that lend subtext to the meaning. Let us take an example to illustrate the semantics–pragmatics distinction.

- (5) Q: Have you seen my gym bag?
A: No, I haven't.

In example (5), it seems that the questioner is looking for his bag, maybe because he needs it to go to the gym. In this case, he is not really asking whether the hearer has ever seen his bag, but he is talking about *today*. The question is really a masked request for information on the bag's whereabouts. The hearer, of course, is aware of the intended additional meaning, and responds that she does not have that information. However, another discourse situation is also possible. The questioner has just bought a gym bag, maybe because he intends to start going to the gym on a regular basis, and is really asking the hearer's opinion of the new bag. The answer then could be extended in the following way: *No, I haven't. It's very nice*. In both situations, the speaker and the hearer are aware of the contextual circumstances, how subtly they change the meaning, and the conversational exchange is appropriate. You, as readers of the conversational exchange, have no problem interpreting the meaning in the situations I described, and probably in others, too. These literal and subsequently subtly changed additional interpretations are also part and parcel of the language faculty. In sum, what is said, or the literal meaning of the output of syntax is the realm of semantics; while what is additionally conveyed and understood, depending on the context and other factors, is within the realm of pragmatics.

I mentioned earlier that linguists have been engaged in describing the relationships between these parts of the grammar, technically known as linguistic *modules*, from the earliest days of the generative enterprise. Ever since Aristotle, it has been known that linguistic signs are a pairing, or a mapping, of sound and meaning. In contemporary linguistic terms, they are known as the Articulatory-Perceptual system (A-P), the sound, and the Conceptual-Intentional system (C-I), the thought. It is a truism that the faculty of language interfaces with at least these two systems that human beings have independently of language. Thus, the first generative model of the language architecture illustrated the conception of language as a vehicle to relate sound and meaning. Figure 1.1 illustrates the production of a sentence. Words from the lexicon are combined in the syntax until the

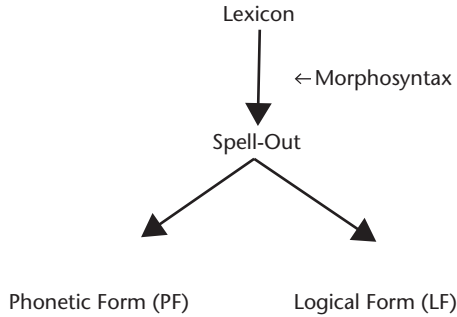


Figure 1.1 A representation of the classic inverted Y model of language architecture

point of spell-out, where they divide into sound (Phonetic Form) and meaning (Logical Form). Since form and meaning are independent of each other, the two are represented as bifurcating from spell-out and not touching after that. PF and LF are the linguistic representations that interface with and instruct the A-P system and the C-I system. This is known as the classic inverted Y model (you can see why).

With the Minimalist Program in the 1990s, there came a realization that the linguistic message can be too long and complicated to process as a whole, and the syntactic derivation had to be divided into more manageable chunks.⁶ At least partially, the motivation for this development of the theory was to accommodate processing concerns such as observable cycles in the pronunciation and interpretation of an utterance.⁷ Chomsky later developed this intuition into Phase Theory, whose cornerstone is the hypothesis that the syntactic derivation proceeds phase by phase—by building up a smaller chunk of syntactic structure, evaluating it at several steps, and then continuing to successively construct the next relevant chunk(s) until the lexical array of all words to be used in the sentence is depleted. The overriding principle is *Minimizing Computation* (Chomsky 2012), a third-factor principle ensuring maximal simplicity of linguistic operations (see the three factors of language design in Section 1.1). Currently, the verb phrase, the complementizer phrase, and the determiner phrase, to be discussed later on, are proposed to be such phases. Figure 1.2 below illustrates Multiple Spell-Out as a series of inverted Y-s. Once a chunk of a sentence is cyclically

⁶ This idea, originally due to Joan Bresnan, was developed by Uriagereka (1999).

⁷ The primary motivation for multiple spell-out and phases was syntax-internal, (Uriagereka 2012; Chomsky 2012).

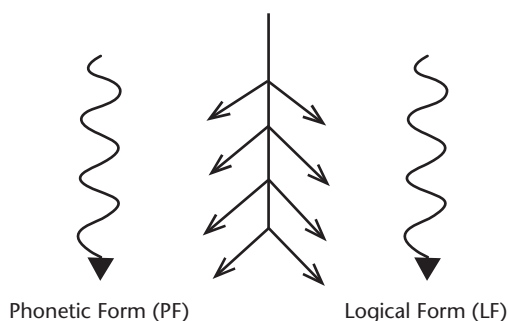


Figure 1.2 Visual representation of Multiple Spell-Out

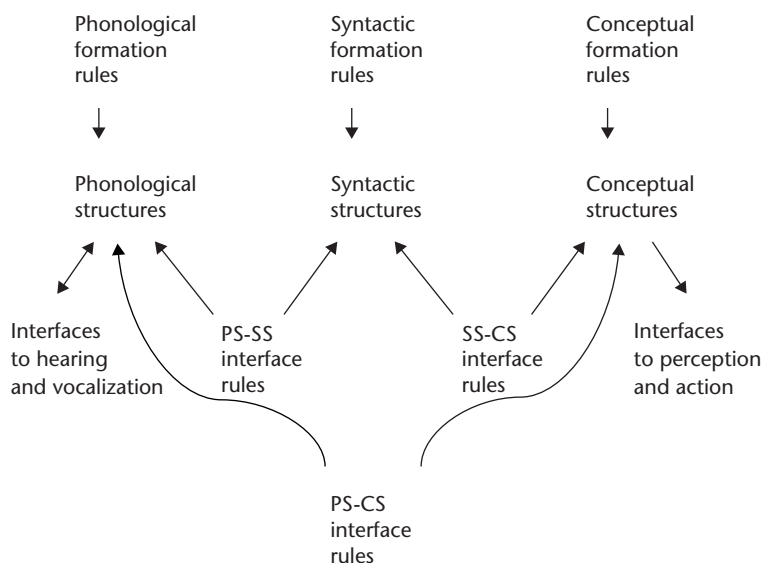


Figure 1.3 Jackendoff's (2002) Parallel Architecture of the language faculty

shipped out to pronunciation and to interpretation, it can no longer be changed.

A different, and dissenting, view of the language faculty has been proposed by Ray Jackendoff, illustrated in Figure 1.3.

Jackendoff's major objection to the classical inverted Y model of language architecture is that it is too "syntactocentric," in the sense that it views the syntax as the only module of the grammar where structure is generated. Jackendoff proposes that structure is generated at all three levels of his model: phonological structures, syntactic structures, and conceptual structures. Note that the modules we discussed earlier (phonetics and

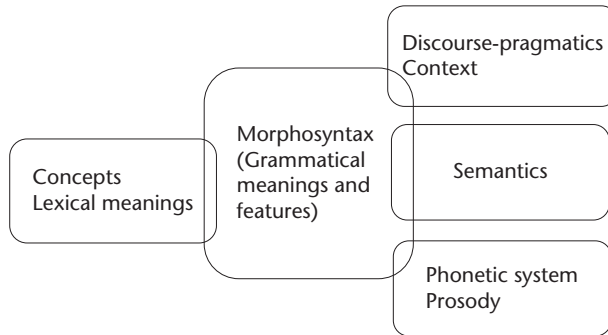


Figure 1.4 Modular design of the language faculty, following Reinhart (2006)

phonology, morphology and syntax, semantics and pragmatics) fit neatly two by two into Jackendoff's phonological, syntactic, and conceptual structures. For example, he places the pragmatic notions topic and focus (to be discussed later) on a separate tier within conceptual structures.

Finally, a model that conceives of semantic and discourse-pragmatic information separately is Reinhart's (2006) model, illustrated in Figure 1.4. In this model, as you can see, the discourse-pragmatics is a separate module from the semantics, having its own box in the graph. The motivation of that representation would be that processes at the semantics level are checked separately and possibly re-interpreted in view of the discourse context, which may very well be the case, as my example (5) illustrated.

Before going forward, say whether Reinhart's model is syntacto-centric or not. Why?

Next, I shall elaborate on the interfaces between the different modules. To borrow some terminology from Jackendoff, the processes that take place within each module can be considered *integrative* processes, they build up linguistic units (phonemes, morphemes, words, phrases, sentences) on each level. However, the linguistic object already built in one module has to pass for further compositional calculation onto another module. This happens at the *interfaces* between modules and is essentially a matching procedure. Let's take as an example the interface between syntax and semantics. Fairly uncontroversially, syntactic structure needs to be correlated with semantic structure for a form–meaning mapping; however, this correlation is not

always trivial (Jackendoff 2002). The syntactic processor works with objects like syntactic trees, their constituents and relations: noun phrases, verb phrases, grammatical features, etc. The semantic processor operates with events and states, agents and patients, individuals and propositions. The operations at the interface are limited precisely to those structures that need to be correlated and they “do not see” other structures and operations (such as the marking of case: Nominative, Accusative, etc) that would have no relevance to the other module.

It has been proposed that grammatical operations that happen at the interfaces between linguistic modules are somehow harder and more demanding, since they have to take information into account at two modules, not just one. Furthermore, when we take a cross-linguistic perspective, we can see that conditions are created for mismatches at the interfaces. To take one example, while the English past progressive tense signifies an ongoing event in the past, Spanish Imperfect can have both an ongoing and a habitual interpretation. The English simple past tense, on the other hand, has a one-time finished event interpretation and a habitual interpretation, while the Spanish preterit has only the former. Thus, the same semantic primitives (ongoing, habitual, and one-time finished event), arguably part of universal conceptual structure, are distributed over different pieces of functional morphology.

Whether linguistic properties at the interfaces are harder than integrative properties is ultimately an empirical question that can be solved through experimental research.

1.3 What exactly has to be acquired?

Why would we be interested in these models of language architecture in a textbook on second language acquisition? How are they relevant to the process of acquiring another language? In this section, I address the teaching relevance of the language architecture and knowledge about language. First of all, students of language acquisition have to have a good grasp of what language is, the complex object that is first being internalized and then externalized. Yes, I am biased in thinking that everyone should know some basic facts about linguistic structure; I am a linguist, after all. However, this is particularly true of language teachers, the people who shape and guide learners’ acquisition process.

Secondly, and much more importantly, the language architecture is the foundation of proposals on where the differences among languages lie. Consequently, we are able to formulate concrete proposals on how the differences between language X and language Y will be acquired. If we can be extremely specific on precisely what it is that has to be acquired, we can also be explicit on the specifics of the learning task. For example, as mentioned above, the Minimalist assumption is that language variation is relegated to the functional lexicon, while the syntactic operations are essentially the same across languages. Furthermore, Jackendoff has explicitly argued that conceptual (meaning) structures are universal. Consequently, a child acquiring her native language does not need to learn syntactic operations, but she does have to learn the grammatical features pertinent to her language that are captured in the functional morphology. It makes sense, then, to argue that acquiring the functional lexicon constitutes one of the most important acquisition tasks.

What happens when we learn a second language? Again, we would like the answer to this question to follow logically from the language architecture discussed in the previous section. A second language learner has access to the universal properties of language through Universal Grammar, or through his/her native language, which exemplifies these universal properties. There are several things to acquire. First of all comes the lexicon: all the words of the second language are likely to be new to the learner. Then, all the parametric options that are different between the L1 (native language) and the L2 (second language), such as word order, null subject, etc., have to be acquired, as well. Parametric differences may be encoded in the functional lexicon, but they are manifested through various word dislocations, null versus overt grammatical functions, and grammatical meaning associations. For example, the question words may go to the beginning of the sentence or remain in place (*in situ*), and some languages even allow *wh*-words in intermediate locations: this information is encoded in the complementizer phrase but it is visible in the various dislocations.

Finally, when learning a second language, a speaker may be confronted with different mappings between units of meaning and units of morphosyntactic structure, such as the example mentioned in the previous section between grammatical morphemes and what aspectual meanings they subsume in English and Spanish. We can make concrete hypotheses about the variable degrees of difficulty that learners encounter, but only if we are aware of the matches and mismatches between L1 and L2 grammar structures.

In this and subsequent chapters, I will provide information in boxes like this one. In them, I will try to make explicit the connection between linguistic and language acquisition theory, and teaching practice. In this first case, this whole section is intended to discuss the relevance of the language architecture to language learners and teachers. There is one more such point of relevance, in the box below.

Teaching relevance

In acquiring a second language, some linguistic modules may present more difficulty than others. For example, it is well known that the phonetics/phonology of a second language, if it is acquired after childhood, may never become nativelike. This is not true of the semantics or the morphosyntax, however. In short, different modules may be acquired in different ways. That is why knowledge of the modules is relevant for teachers.

1.4 The scientific method in SLA research

The scientific method is a system of techniques for investigating natural phenomena, acquiring new knowledge, as well as correcting and integrating previous knowledge. To be termed scientific, a method of inquiry must be based on empirical and measurable evidence and subject to specific principles of reasoning. Generative linguistics uses the scientific method in investigating language and language acquisition. The method generally involves scrutinizing some data, making generalizations about patterns in the data, developing hypotheses that account for these generalizations, and testing the hypotheses against more data. Finally, the hypotheses are revised to account for any new findings and then tested again. Of course, there are adjustments one has to expect for the various scientific disciplines, and we will see how the method works in linguistics.

When describing a language that has not been described so far, linguists start by gathering some sentences from informants in the field who speak the language natively. Based on these preliminary data, they form hypotheses. To take an example from word order, one hypothesis can be that the subject in this language must precede the object and the verb. This is the case in many languages, so it is an informed hypothesis. Then linguists check this hypothesis against more data. Linguistic theory allows us to make predictions. Any theory or linguistic model worth its name should

be capable of making predictions. For example, if there is a lot of agreement morphology on the verbal forms in a language, a reasonable prediction would be that the subjects could be possibly null, not pronounced. When more data from newly described languages is uncovered, linguistic theories change, sometimes slightly, sometimes more dramatically, in order to be able to accommodate the new data.

In generative second language acquisition (GenSLA), we start with the foundational assumptions and the language architecture we have already discussed in this chapter, as well as the theories of L2 development that we will discuss in the next chapters. We normally choose a linguistic phenomenon that we would like to investigate, such that it addresses the predictions of a certain theory. The next step is to find a description of this phenomenon in the native and in the target language literature (or provide that description ourselves, if we speak these languages natively). It is fairly typical to investigate properties that differ in the L1 and L2, for the common sense reason that if they don't differ, there might be nothing much to acquire.

GenSLA is theoretically motivated. Researchers test a particular theory or model proposing how the L2 development unfolds. There are no (published) studies in the generative literature that are motivated just by noticing that learners make a certain error, or whose purpose is to see how learners acquire a certain construction. The research questions of GenSLA are always informed by hypotheses and predictions based on theory of linguistic behavior and development. At the end of the experimental study, we want to be able to say something about the L2 competence and how it evolves. A common outcome of such studies is support or lack of support for the existing body of theories. That is, these theories are *falsifiable*, a necessary condition of the scientific method. Often researchers who reject a certain theoretical hypothesis come up with an alternative proposal in order to accommodate the new findings. However, that alternative proposal has to be able to explain everything that the rejected proposal explains, plus the new data.

Let's take for example L1 transfer, the theoretical proposal postulating that, in acquiring a second language, learners are influenced by the particular parameter value in their native language. We will encounter other developmental theories and proposals later on. L1 transfer of morphosyntactic parameter values and meanings into the second language is the most fundamental, although self-evident, proposal about L2 acquisition that one

can think of. It also obeys Occam's razor⁸ because it is a parsimonious and economical hypothesis. For instance, if the learners' L1 is a null-subject language and they are acquiring a non-null-subject language, they might tend not to pronounce subjects, at least at first. That is exactly what the theory of L1 transfer predicts.

Before continuing, think of what the prediction would be in the opposite direction, that is, if the learners' L1 is a non-null-subject language and they are learning a null-subject language.

Next, in order to test a prediction, we have to obtain quantifiable data, either longitudinally from a small number of learners over the course of their development, or cross-sectionally, from a larger number of experimental participants at one time. A control group of native speakers is obligatorily tested as well, in order to validate the test instrument. In some cases, the control group results also serve to support or refute various theoretical claims in the literature. If we want to be able to make claims about development with a cross-sectional design, we include learners at various levels of proficiency, say, beginner, intermediate, and advanced learners. In order to ascertain proficiency levels, it is customary to offer an independent test of language proficiency.

In fact, one of the earliest studies in generative SLA, White (1985), was designed just as I described above: Lydia White tested the Null Subject Parameter in the English L2 competence of Spanish native speakers.⁹ She hypothesized that learners initially apply the Null Subject Parameter value to the target language, English, which does not allow null subjects. Eventually, the *L2 input* (the second language data that learners are exposed to), working together with Universal Grammar, will allow learners to overcome the L1 transfer and start using overt subjects in all English sentences. She tested learners at five proficiency levels from beginning to advanced, as well

⁸ This is a problem-solving principle attributed to William of Ockam (*c.* 1287–1347), an English Franciscan friar, theologian, and scholastic philosopher. The principle states that among competing hypotheses, the one with the fewest assumptions should be selected.

⁹ She also had a second important research question, namely, whether all constructions in a cluster of constructions will transfer, which we will discuss in later chapters.

as a comparison group of French native speakers learning English, since French, just as English, does not allow null subjects.

Think of the predictions for the Spanish and the French learners of English. Do we expect them to behave differently?

The experimental participants evaluated acceptable sentences with a subject and unacceptable sentences without a subject, such as the second sentence in (6). A star in front of a sentence signals that it is unacceptable, at least for most native speakers.

(6) John is greedy. *Eats like a pig.

The findings suggested that indeed it was difficult for the low proficiency learners to identify the missing subject sentences as unacceptable in English. This difficulty was reflected in lower accuracy for the Spanish learners, as compared to the French learners. However, with increased proficiency, the Spanish learners were able to identify unacceptable sentences with higher accuracy. The hypothesis of L1 transfer of a parameter value was confirmed by this experimental study.

In summary, applying the scientific method is a central feature of GenSLA from its outset. GenSLA is a cognitive science because it describes the cognitive psychological processes that happen in a learner's mind while she acquires language and when she uses it. GenSLA is a window through which one fascinating aspect of the human mind can be viewed.

1.5 Exercises

Exercise 1.1. How can we explain these facts about human language, using the set of assumptions we developed in this chapter?

- Commonality of basic grammatical structures.
- A child born to Korean-speaking parents is adopted into a French family and learns French as her native language.
- Any normally developing child acquires one (or more) language(s) without too many errors and without explicit teaching.

- The sentences in any language are innumerable, but the grammar of every language can be described by a finite number of rules.
- Language offers a means to study the nature of the mind that produces it.

Exercise 1.2. Watch the following video from the BBC website: <http://www.bbc.co.uk/news/uk-17107435>. The video is about 20-year-old Alex Rawlings who speaks 11 languages. He was an undergraduate student at Oxford University. Describe the conditions of acquisition of all his languages. Is there a limit to how many languages an individual can speak? Discuss what that limit would be, if you said that there is one.

Watch two more videos of polyglots available on YouTube, such as this one <http://www.youtube.com/watch?v=eFpzeGoP-Kg>. Then think of your own linguistic experiences in learning languages. Do you find anything in common among the people describing their linguistic experiences?

Exercise 1.3. Fill in the following table, after class discussion.

L1 property	L2 property	What behavior would L1 transfer predict?
Null subjects	No null subjects	
SVO	SOV	
Past tense marking with a morpheme such as <i>-ed</i>	No dedicated past tense morpheme	
No definite and indefinite articles	Definite and indefinite articles	
The preposition comes at the end of the prepositional phrase	The preposition comes at the beginning of the prepositional phrase	
The adjective precedes the noun it modifies	The adjective follows the noun it modifies	

Exercise 1.4. “Semantics.” Read the following question Kitt asked on Ask.com:

Tonight a friend and I were joking about how much of a hamburger he ate. He said it was 1/4. But I said it looked more like 1/5. Then he said, “Well, that’s just semantics.” Now, I thought that semantics was the study of meaning behind the words, like different connotations and how meanings change overtime... Example: 100 years

ago, “gay” meant happy. Now it describes a person’s sexual orientation. But he thinks that semantics is when people mean the same thing, just describe it differently. What is semantics, really? And what is my friend talking about?

Describe Kitt’s informal definition of semantics? Is it correct?

Describe Kitt’s friend’s definition of semantics.

How do you use “semantics” in everyday speech? Are you familiar with the two meanings mentioned above?

Read the following comment on Kitt’s posting:

A & B are talking and A says “Why did you steal my jacket?” B replies “I didn’t steal it, I just borrowed it without asking.” A says, “That is just arguing semantics. You *stole* it!” This is a more proper use of the term “semantics” because it describes the connotation of the words (not the math). Your friend is correct that people could describe the same thing differently, but they often misuse words (and sometimes on purpose). When they get called on the error, they say it is a semantic argument.

Do you agree with the comment? Is the series of questions in this exercise “just a semantic argument”?

Exercise 1.5. In this TED talk, the linguist John McWhorter discusses the difference between speaking and writing as language modes, but also very different types of language use. He convincingly argues that texting is “fingered speech”; texting is a language in which we write like we speak. There are new linguistic signs developing in texting that do not exist in speech and in formal writing. Here is your question: If a person is fluent in speaking, writing and texting, are they bilingual? Or trilingual? Watch the video, and discuss: http://www.ted.com/talks/john_mcwhorter_txtng_is_killing_language_jk.html