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Processability Theory: Current issues in theory and application

Camilla Bettoni and Bruno Di Biase, eds

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Preface

Camilla Bettoni and Bruno Di Biase

Using a second or third language is the norm, rather than the exception, in today's world. Greater mobility and global communication require, increasingly, the use of languages other than one's first language. Yet, learning a second language is often not as successful as the eager learner might think at first. Teaching a second language also could do with a greater rate of success. Research into Second Language Acquisition (SLA from now on) can promote both faster learning and more effective teaching.

As is amply recognised, learning a second language (L2 from now on) is a complex and difficult task, involving cognitive and affective factors, both personal and social. Over the last fifty years research has gone a long way in outlining the stages of this process, and explaning it, although certainties are unevenly distributed, even if we are still a long way from a full understanding or a complete theory (Long ????). Theories of SLA are many and varied. Van Patten & Williams (2007a) have recently reviewed the main theoretical approaches, including linguistic, sociolinguistic, interactional, and processing approaches. Processability Theory (PT from now on, cf. foremost Pienemann 1998; Pienemann, Di Biase & Kawaguchi 2005) is one of the nine theories presented by these authors, along with four others sharing a cognitive processing approach. Like other theories, PT does not deal with all the phenomena and processes constraining, or contributing to, SLA. What PT offers is a principled transitional paradigm that deals specifically with grammatical development, and explains it. PT also contributes a consistent and universalistic definition of developmental stages, which, in turn, offers a stable point of reference to guide research into the most typologically diverse L1-L2 constellations. Furthermore, from a practical point of view, PT helps in assessing language development in individual learners, and constructing a syllabus.

This book presents PT research in its current state. Our intent is threefold. A first aim is to provide a consistent and coherent presentation of PT for readers both old and new, who seek an understanding of the theory and its potential scope across typologically diverse languages. We feel that this presentation is necessary because current books solely devoted to PT either present the original part of the theory (Pienemann 1998), or consist in collections of papers (e.g., Di Biase 2002a, Pienemann 2005a, Mansouri 2007, Keßler 2008, Keatinge & Keßler 2009a) which do not coherently integrate the old and expanded versions of PT. Among other books which include a presentation of PT, there are theoretical surveys such as Van Patten & Williams (2007a) providing critical commentary on individual theories, or more general SLA handbooks such as Doughty & Long (2003) pitched at a specialised audience. These presentations have their own biases, and do not do justice to the richnesss and constantly developing state of PT. They sometimes include material on the originally important but by now dated Zisa project (e.g. Jordens 2004), often reduce PT's breath by illustrating it mainly through the example of English (e.g., Saville-Troika 2005), and

at other times neglect its applications (e.g., Mitchell & Myles 2004), or are simply too brief (e.g. Ortega 2009).

Our second aim is to provide a source for the best quality and most recent work within the PT framework. As the theory is constantly being developed, even most recent publications have been slow in integrating the old and the new. Nowhere is this clearer than in the use of terminology, which all too often lags behind actual theoretical development in both PT itself and its feeder disciplines (i.e., psycholinguistics for language production, and linguistics for language knowledge). In this book, all contributions not only coherently use updated terminological labels, but also – more crucially – coherently incorporate PT's earlier concerns for obligatory morphological structures which are motivated by syntax as inputs for more novel concerns for optional syntactic structures which are motivated by discourse and pragmatics. This results in tidier schedules, and more convincing explanations.

Thirdly, by including explorations into areas and languages not previously treated in PT, or even in general SLA literature, we wish to encourage further research and suggest possible lines of development both for the theory itself and for its applications. This book widens the scope of PT in several directions. Among them, it explores the interfacing between grammatical and prosodic developements in early L2 learners, and adds considerations on automatization to those on emergence. As first ever, it includes explorations into verifying PT's stages with an autistic L2 learner, and applying them to the loss of L1 in aphasic patients. Furthermore, Serbian is a new language for PT, which exemplifies the way in which grammatical case can, and must, coherently integrate morphological and syntactic considerations.

The principal audience for this book consists of SLA researchers and advanced undergraduate students, graduate students, and their instructors. The editors and authors assume little previous knowledge on the part of the readers, especially regarding research outside of SLA. For this reason, the tone and style of the volume speaks also to novices, as well as more experienced scholars.

Part I of this book is introductory, and includes a presentation of PT designed not only to give conceptual and terminological coherence to the whole volume, and avoid repetitive introductions in each of the following chapters, but also to offer a critical review of the theory. Chapter 1 illustrates PT's universal schedules of morphological and syntactic development, and explains the reasoning behind them. This is why the presentation of PT's two theoretical bases – psycholinguistic for language production, and linguistic for language description – is given as much space as that reserved to the schedules that derive from them. After focusing on the universality of the theory, and on the integration of its two 1998 and 2005 versions in the first chapter, Chapter 2 draws the consequences of these two foci, and reconceptualises the staging of L2 development with reference to three typologically different languages. The developmental sequences of English, Italian and Japanese are not new in themselves, but to a large extent our illustration of them is new, especially that of English. The changes we introduce are not mere terminological formalities but substantial adaptations derived from new developments in PT's feeder disciplines.

Part II addresses some theoretical issues, two of them new to PT xxx

Part III expands the scope of PT to new structures and new conditions. xxx

Part IV xxx

Part V xxx

Part VI xxx

Finally, having taken stock of a dozen years of research within the PT framework since Pienemann (1998) in the introductory part of the book, and having presented some new studies in the following chapters, in the Epilogue suggest some directions for future research. These involve some issues about the development of the theory itself, and others that can be brought into the scope of an expanded theory; some concern areas where PT's hypotheses still need more robust empirical support, others again mention applications to new skills, and conditions.

The ideas presented in this book all build up on previous work on PT by numerous researchers. The editors wish to thank xxx.

Louise Jensen, Barbara Hinger, Elena Nuzzo for comments on the first two chapter

Chapter 1

Processability Theory and its theoretical bases

Camilla Bettoni and Bruno Di Biase

1. Introduction

Processability Theory is now a mature theory of grammatical development of learners' interlanguage. It is cognitively founded (hence applicable to any language), formal and explicit (hence empirically testable), and extended, having not only formulated and tested hypotheses about morphology, syntax and discourse-pragmatics, but having also paved the way for further developments at the interface between grammar and the lexicon and other important modules in SLA. Among the most important SLA theories recently discussed in Van Patten (2007a), no other can accommodate such a variety of phenomena or seems able to offer the basis for so many new directions.[1]

Ten years have gone by since Pienemann's first book-length publication on PT in 1998; and before that, it took almost two decades to mould into PT the initial intuition by the ZISA team that the staged development of German word order could be explained by psycholinguistic constraints universally applicable to all languages (Pienemann 1981; Clahsen, Meisel & Pienemann 1983). In these three decades, the whole field of SLA has grown exponentially. PT has paralleled this growth, and widened its scope in several directions. First, ZISA's intuitions have been applied to English (Pienemann & Johnston 1984; Pienemann, Johnston & Brindley 1988, Pienemann 1989), then PT has expanded its typological validation from German and English to different languages, such as Swedish and other Scandinavian languages (e.g.,

[1] A contender would be the current Minimalist approach, which does include considerations about xxxxx (cf., e.g., Sorace 200?, 200?); the limit of this approach, however, is to derive everything from syntax and neglect the lexicon.

Håkansson 1997, Glahn et al. 2001), Arabic (e.g., Mansouri 1995; 2005), Italian (e.g., Di Biase & Kawaguchi 2002; Di Biase 2007; Bettoni, Di Biase & Nuzzo 2009), French (Ågren 2009), Chinese (e.g., Zhang 2004, 2005), and Japanese (e.g., Di Biase & Kawaguchi 2002, 2005). Secondly, PT's framework has been substantially widened by including Bresnan's (2001) Lexical Mapping Theory, and thus adding a discourse-pragmatically motivated syntactic component (Pienemann, Di Biase & Kawaguchi 2005) to its first syntactically motivated morphological module. Thirdly, developmentally-moderated transfer from L1 (e.g., Pienemann, Di Biase, Kawaguchi & Håkansson 2005a; Pienemann, Di Biase, Kawaguchi & Håkansson 2005b). Fourthly, PT's plausibility has been tested in language situations other than L2 ones, such as monolingual and bilingual language acquisition (e.g., Håkansson 2001, 2005; Itani-Adams 2006), among children with Specific Language Impairment (e.g., Håkansson 2001; 2005), and in the origins of creole languages (Plag 2008a, 2008b). Finally, the range of the original applications of PT to language testing and language teaching has also expanded over the years, involving several new ways of testing and teaching situations (e.g., Iwasaki 2004, 2008, ask Bruno; Pienemann & Keßler 2007), and new languages (e.g. Di Biase 2008; Yamaguchi 2009).

Ensuing publications in all these PT strands during such a long period of growth have had their own agendas and purposes. Furthermore, not only PT itself but also its feeder disciplines have developed in new directions, crucially among them psycholiguistics for language production and theoretical linguistics for language knowlwedge. As a consequence, it is not surprising that readers unfamiliar with PT's history may at times be confused by differences in the presentation of the theory, its use of terminology, and reliance on its theoretical bases.

In this chapter our main general aim is to outline PT in its current state, so as to provide a coherent and updated framework for its many rich strands. This will also make the studies in this book easier to read, and partly avoid repetition in their individual introductions. In presenting PT we will not mention its history except when it can explain some of the incongruities we try to eliminate, or justify our own choices. In particular, we attempt to be as consistent as possible in labelling PT's developmental stages and their structures, so as to make them independent of derivational syntax[2] and more consistent with PT's actual feeder fields, namely Levelt's Model for psycholinguistics, and Lexical Functional Grammar (LFG from now on) for theoretical linguistics. As a matter of fact, prefacing our presentation of PT itself, we will include a focused synthesis of the main points of these two theoretical bases as they bear on PT. A further aim in this chapter is to look beyond the current state of PT, in order to pave the way for suggesting possible directions for future research in the Epilogue of the book.

Even as we write, PT is expanding rapidly, so our presentation must inevitably be partial. But it is partial in three further ways. First, our outline here is not intended as an independent introduction to the theory, in the sense that we will mention only minimally PT's main scope, constructs and processes. These, we assume, will be found by interested readers in the original works by Pienemann and in his numerous shorter

[2] For a discussion on the incompatibility of derivational syntax and language processing, cf. Pickering, Branigan & McLean (2002).

presentations (e.g. 1998, 2003, 2005b, 2005c; 2007a; 2007b) – although with regard to the latter a note of caution should be added to the effect that they are mostly biased towards the acquisition of English, and may rely on older versions of PT. Secondly, although we will mention some problems in the theory and point out some suggestions for further research which will be developed in the Epilogue, we do not intend to solve them here. Nor, thirdly, can this chapter be read as a full review of the rich and varied PT literature. On the more positive side, our ambition here is to offer an outline of PT which is most tightly anchored on its two updated psycholinguistic and theoretical linguistic bases, yet least tied to the history of its contributing strands, and least dependent on the English language for exemplification,[3] and which, on the other hand, is a balanced synthesis: both critical in pointing out PT's weaknesses and enthusiastic in showing how the universal stages it hypothesises can define parallel language-specific schedules widely applicable in all languages, as chapter 2 will show, and in a variety of situations – as indeed the chapters that follow illustrate. Needless to say, our focus here is not so much on the details of PT's developmental schedules as on the reasoning behind them. This explains why the presentation of PT's theoretical psycholinguistic and linguistic bases is given as much space as that reserved to the schedules that derive from them.

In sum, our main focus here is on integration and coherence among what is at times separately and varyingly treated in PT literature: namely,

- between PT itself and its two feeder theoretical bases,
- between the original 1998 version by Pienemann and its 2005 extention by Pienemann, Di Biase & Kawaguchi, and
- among works on different languages basing their work on one or the other of these two versions.

2. Language production and linguistic knowledge

The underlying logic of PT is that at any stage of development learners can produce (and comprehend[4]) only those L2 forms which the current state of their language processor can handle (Pienemann 1998). It is therefore crucial to base our understanding of language development on two formal models, describing – and interfacing – (a) language generation, namely how the processor handles language, and (b) linguistic knowledge, namely what languages are like. Given that the anatomy and physiology of the language processor are universal, if specific languages are described

[3] Of course, we will continue to use English as the main L2 for illustrating PT, because it is the language most familiar to most readers and most studied acquisitionally. Yet when we do so, care is taken to point out its typological peculiarities and present our discussion in such a way as to accommodate the widest possible cross-linguistic variation. Further to English, we use mainly Italian and Japanese because these are languages most familiar to the authors of this chapter, and less configurational than English, albeit in a different way one from the other (i.e., respectively head-marking, and dependent-marking, cf. § 5).

[4] Altough PT's scope certainly inludes comprehension, we do not know of any work done in this area. We will therefore list it among the areas suggested for future research in our Epilogue at the end of the book.

according to the same principles, it is possible to predict the same broad principled course of development of L2 forms across languages.

For language generation, PT relys on Levelt's Model (1989), a dynamic model accounting for language processing in real time and within human psychological constraints, such as word access and human memory. Thus a set of psycholinguistic universal constraints comes to bear on L2 acquisition, and specifies PT's universal hierarchy of processing procedures. This then contributes towards solving for SLA what is known as the 'developmental problem': why do learners follow universal stages of acquisition? For linguistic knowledge, PT relies on Bresnan's LFG (2001), a declarative, explicit and well-defined, formal theory of language, which then contributes towards solving for SLA the so-called 'logical problem': what is the origin of linguistic knowledge? Why do people end up knowing more than they can hear? E.g., how does a learner know that words can be nouns, verbs, etc., or that in the sentence *The boy who loves Therèse is Indonesian*, Therèse may not be Indonesian despite the sequence *Therèse is Indonesian*? The interface between these two formal theories, Levelt's Model and LFG, allows PT to make language specific predictions about L2 development which can be tested empirically.

These two feeder theories of PT interface well not only because LFG intends to be psychologically plausible, but also because it has been demonstrated to be so by its use in psycholinguistic work, including Levelt's.[5] There are two main reasons for this compatibility: LFG's lexicalist approach, and its nonderivational architecture. In particular, albeit LFG is a declarative model, the parallel structures of its architecture can iconically suggest the representation of the dynamic processes temporally modelling language production – at least to a certain extent and in some ways. This seems to be so for the stretch from lexical access to grammatical and phonological encoding.

Needless to say, the next two sections, §§ 2.1-2.3, are only meant to introduce the reader to the main tenets of PT's feeder disciplines that bear most directly on its general architecture, and on some of the issues mentioned in chapter 2 when we will exemplify PT's universal progress with three typologically different languages, or on other specific problems listed in the Epilogue in order to encourage fresh research and suggest some directions. In no way do these two sections dispense the researcher interested in pursueing the finer details of PT from reading the original works by Levelt and Bresnan, and the ongoing updates by their respective teams – anymore than s/he is dispensed by this whole chapter from reading the original works on PT.

2.1. Levelt's Model and PT

The debt to Levelt's Model is already fully acknowledged in the original PT version, when in an extensive presentation of this model Pienemann (1998: §§ 2.4-2.5) stresses issues concerning the storage of grammatical information during language production, and the general psychological constraints that bear on language development. Thus we focus now on elements of language generation that help us understanding the newer

[5] Other psycholinguistic work using LFG is Pinker's (1989).

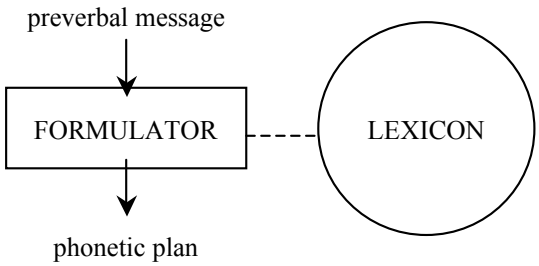
developments of PT. These concern mainly two aspects of Levelt's Model: the lexicon and grammatical encoding. First, following developments in Levelt's Model itself by Levelt, Roelofs & Meyer (1999), a novel look at the lexicon and its richer featuring allows for a more precise characterisation by PT of the acquisition of a wider range of features. If Pienemann's main concern in 1998 was the establishement of the minimal requirements for reaching a stage, PT can now handle the way learners proceed from the emergence of a structure to its mastery, or indeed from the emergence of one or two structures in a stage to the full mastery of all the structures in that same stage, thus discovering the so-called intrastage development. That is, if Pienemann (1998) proposed different modules for handling the complexities within a stage and those concerning the form-function relations, we propose to integrate them into PT. Secondly, we wish to outline that part of Levelt's Model which bears more directly on PT's extension. In fact, Pienemann, Di Biase and Kawaguchi (2005) dealt more extensively with the formalities of LFG than with those of language production. Yet, these can help us understanding better the complex ways in which grammatical encoding depends on the discourse and pragmatic choices available to the speaker.

Levelt's Model assumes that when we intend to say something we select in the conceptualiser[6] the information whose expression may realise our communicative goals. Since any state of affairs can be expressed in many different ways, in the conceptualiser we also plan the form of the message, in the sense that here we select not only the language and register but also the appropriate speech acts, we assign topic and focus, mark the referents as given or new, etc. Thus, although preverbal, the conceptualiser's output already includes information on the relative prominence of its elements. All this presents no problem for the adult learners, who are already competent speakers of an L1, because in order to produce a preverbal message they can rely on the same conceptualiser for either language, as de Bot 1992 maintains in adapting Levelt's Model to language production by bilingual speakers.[7] On the other hand, learning (that is, trouble for learners) begins when the formulator – which is language-specific – receives input from the conceptualiser, and has the task of mapping the preverbal message onto linguistic form, and preparing the phonetic plan, as represented in (1). This task is performed by fishing out of the lexicon the stored entries that best fulfill the conditions required by the preverbal message. Let us then take a look in turn at how lexical entries are stored in the lexicon, and then processed in the formulator.

[6] In Levelt's Model the conceptualiser is the processor where the preverbal message is generated and then fed to the formulator, as the fragments of the preverbal massage become availble.

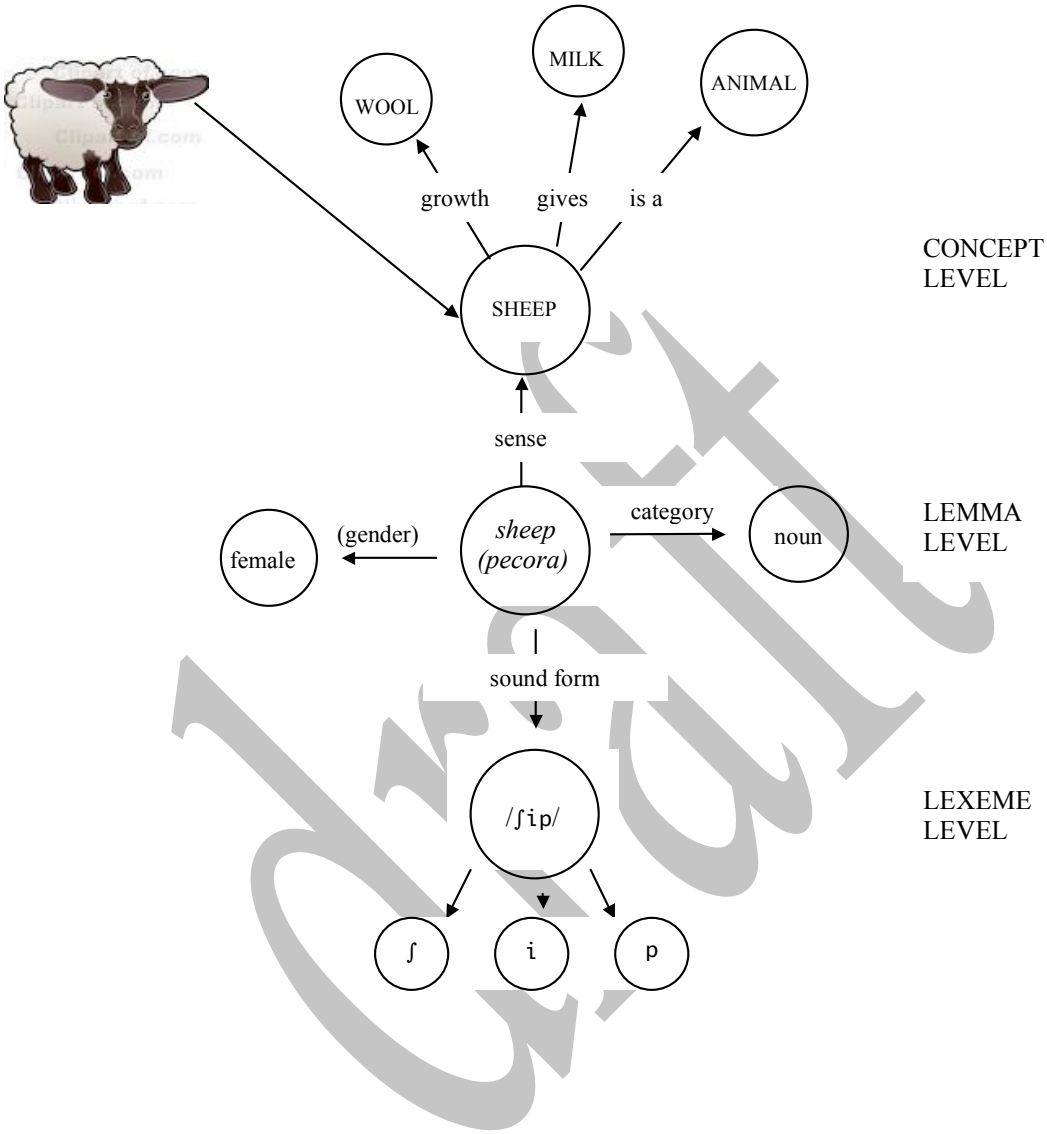
[7] As a matter of fact, in contrast to de Bot (1992), Levelt, Roeleof & Meyer (1999: 8) maintain that the output of the conceptualizer is to a certain extent already language-specific: "Whatever the speaker tends to express, it should ultimately be cast in terms of lexical concepts, that is, concepts for which there exist words in the target language. In this sense, lexical concepts form the terminal vocabulary of the speaker's message construction. That terminal vocabulary is, to some extent, language specific (Levelt 1989; Slobin 1987)." However, these latter authors also comment that their theory, as yet, is not well developed for this initial stage of conceptual preparation. Be as it may, our interest here is distinguishing between a largely universal conceptualiser and a language-specific formulator.

(1) Levelt's Model: Language production from preverbal message to phonetic plan (after Levelt 1989: 9)

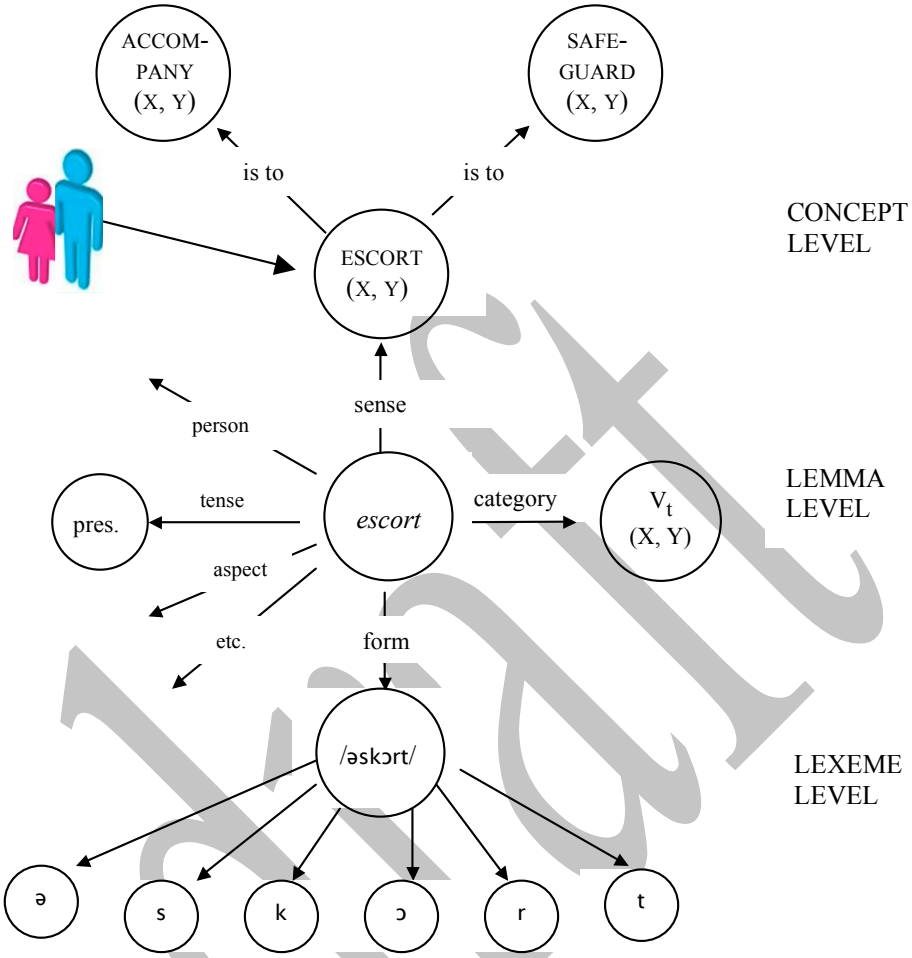


In the lexicon of the adult L1 speaker words are stored with the full bundle of their features involving three types of information, distributed in a three-level system: the conceptual level, the lemma level and the lexeme level. In (2)-(3) we give a simplified representation for two lexical entries, the noun *sheep* and the verb *escort*, following respectively Bock & Levelt (1994: 950-952), and Levelt, Roelofs & Meyer (1999: 3-4).

(2) Levelt's Model: A part of the lexical network for the word sheep (after Bock & Levelt 1994: 951)



(3) Levelt's Model: A fraction of the lexical network for the word escort *(after Levelt, Roelofs & Meyer 1999: 951)*



First, at the conceptual level, knowing a word involves knowing its meaning. About a sheep we know it is a kind of domestic animal that produces milk, etc., and also that it typically de-selects certain other words such as *think* or *smile* typically reserved for humans, etc. About escort we know that it is an action related to accompany, guide, etc., that it requires the two semantic roles of agent and patient, etc. These are properties of our concepts SHEEP and ESCORT.

Secondly, at the lemma level, a word has syntactic properties, a bundle of grammatical features which place it in its syntactic frame. The English word *sheep* is a noun. Its Italian equivalent *pecora* is also a noun, but in addition it has female syntactic gender. The word *escort* is a verb, and verbs are specified for the arguments they command, corresponding to their semantic roles; thus about *escort* we know that it typically takes a subject and an object. Furthermore, many lemmas have so-called diacritic parameters that have to be set. For example, in English verb lemmas have

diacritic features of person, number, tense, and mood, which must be valued for further encoding. Hence the lemma *escort* will be realised phonologically as *escort*, *escorts*, *escorted*, or *escorting* depending on the values of its diacritic features. Some values of these features derive from the conceptual representation, as when English verbs are marked for tense or nouns for number, others are set during grammatical encoding, as we will see soon below.

Thirdly, at the lexeme level, words have formal properties, and knowing them involves knowing their morphological and phonological shape. The word *sheep* is monomorphemic and consists of three phonological segments: /ʃ/, /i/, and /p/, whereas the Italian word *pecora* consists of two morphemes, a stem (*pecor-*) and a suffix (*-a*), and six phonological segments: /p/, /e/, /k/, /o/, /r/, and /a/. Likewise, in (3) nodes at the form level represent phonemic segments.

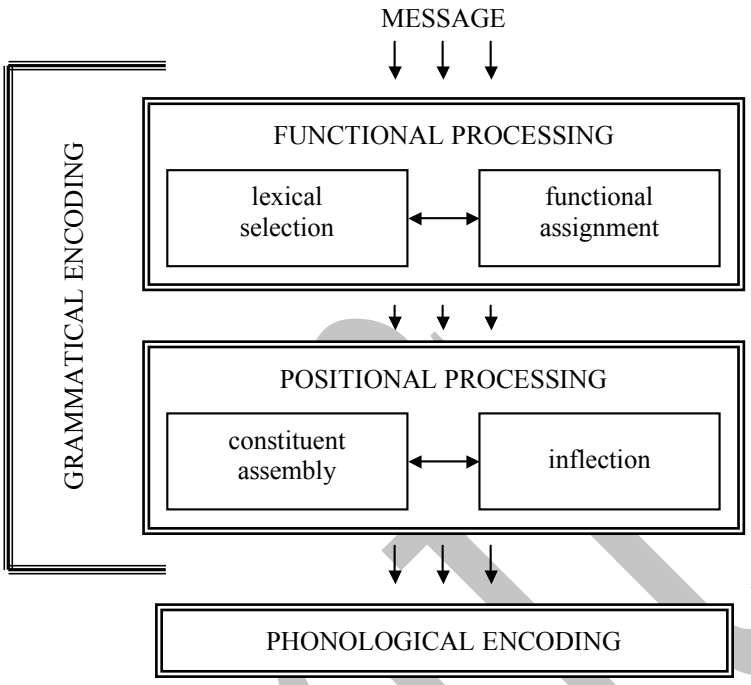
In Levelt's Model, it is the lexicon – with its associated semantic, grammatical and phonological information – that primes the procedures and feeds forward the encoders. In proceeding to grammatical encoding, let us remember that all this information is stored in the mature native speakers' lexicon, but learners must build up their L2 lexicon gradually. If, on acquiring a new word, learners may soon be able to associate a 'meaning' at the conceptual level with a 'form' at the lexeme level, the same is certaintly not true for the lemma level, where features and values may take a long time to emerge[8] and an even longer one to be mastered.

The formulator encodes the utterance first grammatically and then phonologically, as shown in (4). We are interested here in grammar encoding, whose processes create the skeleton of the utterance (Levelt 1989). These processes are grouped into two sets – namely, one functional and the other positional – each set with its own subcomponents.[9]

[8] Emergence can be understood here both as annotation in the lexicon and retrival during production.

[9] Note that, whereas the arrows in (2)-(3) represent types of connections within the network and depict permanent relationships in a store, in (4) they represent the flow of information during production and comprehension and depict activation trajectories.

(4) Levelt's Model: Components of grammatical processing (after Bock & Levelt 1994: 946)



Functional processing has two subcomponents: lexical selection and functional assignment. Lexical selection involves retrieving a word, or more specifically a lemma, from the lexicon given a lexical concept to be expressed. Functional assignment involves creating the appropriate syntactic environment for the words by assigning them their syntactic functions. For example, upon selecting the lemma *escort*, its syntax – it is a transitive verb with two argument positions, corresponding to the semantic arguments – will become available for further grammatical encoding (Levelt, Roelofs & Meyer 1999: 4): which of the two arguments will serve as subject, which as object?

Functional assignment is somehow controlled by two kinds of information represented in the message. First, the eventuality conceived in the conceptualiser is associated with thematic or event roles, such as agent (the instigator of an event), patience or theme (the person or object that is affected o moved). This explains why, in organising an utterance, the verb lemma chosen during lexical selection is central over other lemmas. Secondly, the relative prominence among the participants in the event is associated with discourse or attentional roles. These organise the informational distribution in the utterance so as to direct the listener's attention to its components. As Bock & Levelt (1994: 964; 365) comment, there are seductive correspondences between both thematic and discourse roles and grammatical functions. That is, agents are most often subjects, beneficiaries are objects, etc. as in (5a), although there are violations to these correspondences, as in (5b) or (5c).

(5) a. Romeo gives a rose to Juliet
b. Juliet is given a rose by Romeo
c. Juliet receives a rose from Romeo

Likewise, elements expressing given (or topical) information, which is more readily available, appear often early in the sentence and have great affinity with the subject, a function that allows them to lead in the utterance itself. This is shown in (6), where the same eventuality, although expressed with different prominence in (6a) and (6b), in either case assigns the subject function to the topical element:

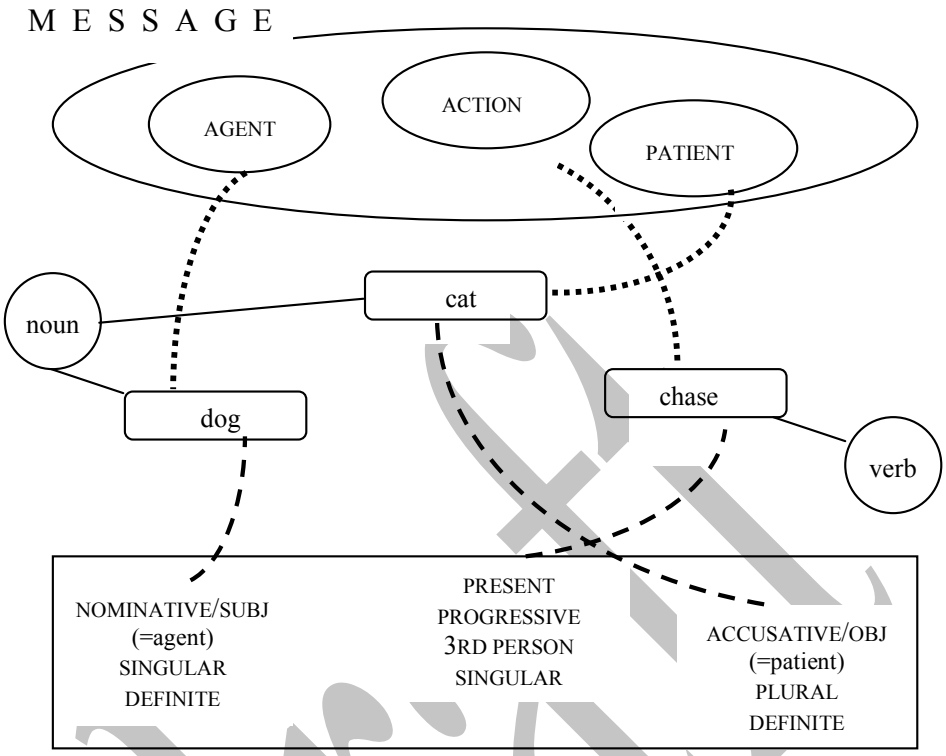
(6) a. [what's going on with the dog?] the dog is chasing the cats
b. [what's going on with the cats?] the cats are being chased by the dog

For the number and type of functions assigned during functional assignment, we refer to their representation by LFG reported in § 2.2 and shown in (20). Suffice to say here that, altough functions are universal, they are marked differently in different languages: morphologically by case markers, clitic pronouns, etc., or structurally by position, as will be mentioned in § 2.2 and shown in (22)-(23). These different ways are not mutually exclusive, and many languages use a combination of morphological and structural means. Even a highly configurational language like English marks the case of personal pronouns morphologically (e.g., by distinguishing between *I* and *me*, *she* and *her*, etc.).

Finally, during functional processing, the combination of lexical selection and functional assignment specifies also the value requirements for the diacritic features of individual lemmas. Let us say, for example, that the speaker intends to produce the sentence in (6a) above. Upon selecting the verb *chase* and the nouns *dog* and *cat* for expressing this eventuality in the present involving *dog* as agent and *cat* as patient, functional assignment will determine not only the grammatical relations between the lemmas (i.e., *dog* is subject and *cat* is object), but also the values of the diacritical features (i.e., *dog*, referring to a single referent, is realised singular as *dog*; *cat*, referring to more than one referent, is realised plural as *cats*; and *chase* is realised as present, progressive and singular).

In sum, functional processing yields an activated set of lemmas and a set of abstract syntactic functions, which are linked together via the argument structure of the lemmas, notably that of the verb (cf. (7) for a schematic illustration of the product of functional processing of the sentence *the dog is chasing the cats*). All this material (i.e., abstract relations or linkages among elements) may contain some indication of the relative prominence assigned to various components, but it is not ordered in any sequence. To convert it into an utterance, the fragments of this partial, incomplete structure cannot go into the phonological encoder straight away as they come out of functional processing, but must be temporarily stored in the memory buffer. The product of functional processing must now be processed positionally.

(7) Levelt's Model: The product of functional processing for the dog is chasing the cats *(after Bock & Levelt 1994: 968)*



Positional processing, like functional processing, also has two subcomponents: constituent assembly and inflection. Both involve the creation of a set of slots which are ordered: the former for lexemes, the latter for morphemes (Bock & Levelt 1994: 946).

Constituent assembly fixes the linear order of word production, and captures dependencies among syntactic functions. Ordering is necessary because the output of functional assignment carries no intrinsic order. This becomes clearest not with English, which is a highly configurational language and marks functions by position, but with less configurational languages, whose constituents can appear in different positions serving the same grammatical functions, often signalled by differences in case. Arabic and Latin are such languages. In (8) for example, by marking the subject (*Paul*) of the verb *amare* ('love') as nominative by means of the *–us* morpheme, and the object (*Mary*) as accusative case by means of the morpheme *–am*, Latin can place either anywhere, as required by discourse or pragmatics, without changing the propositional content of the message:

(8) a. Paulus Mariam amat
b. Mariam Paulus amat

Establishing dependencies among words means organising phrase groupings in a hierarchy. Without them, as Bock & Levelt (1994: 969) point out, there would be no

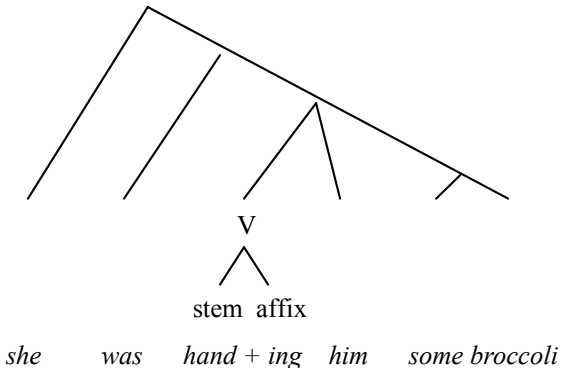
means, for example, to segment sentences such as (9) approriately, where the listener knows that it is not to be understood that it is the boy who blushed, despite the linear sequence showing *the boy blushed*:

(9) the girl who kissed the boy blushed

This hierarchical organisation (namely the phrase structure) is assembled bit by bit under the control of the syntactic functions and the grammatical categories of the lemmas that realise them. That is, for example, given the nominative function and a noun lemma to fill it, adequate information is available to create a subject NP in the proper position in an utterance.

Inflection is the last grammatical encoding process, and involves the generation of fine-grained details at the lowest level of the hierarchy of phrasal constituents, as shown in (10). This is a thorny issue, not yet solved in all its facets in Levelt's Model. The debate is around two questions: first, whether in such cases as the English *handing* or Italian *pecora* the lexicon stores the whole word or its morpheme components; and secondly, whether to consider under inflection not only inflection proper, but also the formulation of function words often associated with grammatical phrases such as determiners for noun phrases, auxiliaries for verb phrases, and prepositions for propositional phrases (Bock & Levelt 1994: 972). Suffice to say here that LFG's principle of lexical integrity considers words as atoms from the point of view of syntax, that is, no further divisible into smaller syntactic units (cf. § 2.2). Furthermore, as mentioned above, certain lemmas carry specifications about diacritic features to be valued inflectionally. In some cases these specifications may be under the control of conceptual elements, as when verbs are specified for tenses. In other cases the control is syntactic, as when there are dependencies among inflectional features. So, in the sentence in (10) speakers say *she **was** handing him some broccoli*, rather than *she **were***, because here two constituents of the sentence reflect a value (i.e., third singular) of some feature (i.e., person) that triggers inflectional variation. These constituents need not be adjacent. What is necessary is that the agreeing constituents stand in appropriate syntactic-functional relationships. In this English example, the agreement operates between the head of the subject noun phrase and the finite verb.

(10) Levelt's Model: Constituent hierarchy of She was handing him some broccoli *(after Bock & Levelt 1994: 946)*



In sum, we can then say that, first, functional processing serves to integrate a set of lemma spefications with a set of syntactic functions. Its output is a set of abstract relations and properties which guides the creation of a framework for positioning words. Then, positional processing serves to place words and their inflections into the framework. Its output is an ordered set of lexems, formally realising the abstract relations of the functional specifications. Why do we need to understand this complex process in order to understand the way PT explains the learner's progress in acquiring L2? Tough the reason will be clear in §§ 3-4, we can anticipate here that, whereas adult L1 speakers are able to activate all the encoder's components effortlessly, L2 learners must build them up gradually. If de Bot (1992) is right in saying that bilingual speakers operate with a different formulator for each language, while the L2 formulator is under construction learners will be able to produce only those structures that depend on the components already in place – as well as on the lexical material already stored. The structures that the native speakers produce by activating the components not yet available to the learners will not be produced.

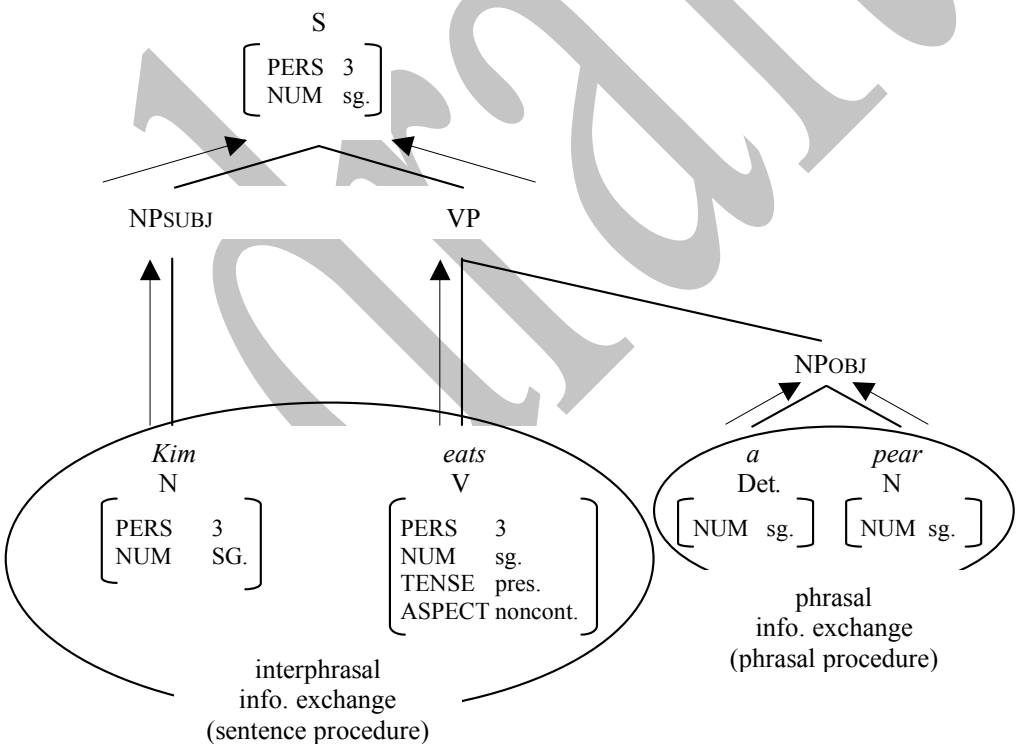
Let us go back to the the native speaker. In Levelt's Model this complex process of grammatical encoding for language generation assumes that grammatical information activated by one procedure needs to be stored temporarily in a memory buffer in order to be used by another procedure, so that the two lots of activated information can then be compared by yet another procedure that builds the output of the first two procedures together. Following the Incremental Procedural Grammar developed by Kempen & Hoencamp (1987), Levelt (1989) maintains that grammatical encoding in mature monolingual speakers unfolds in this sequence:

(11) a. the lemma
b. the category procedure
c. the phrasal procedure
d. the sentence procedure

Thus, upon selecting the lemma, the category procedure is instigated, assigning a lexical category to the lemma. Then the category of the head lemma will instigate a phrasal procedure, resulting in a phrase. By means of the activation of the sentence procedure,

phrases in turn will acquire their functions according to the syntactic frame of their head lemmas. Thus, in *Kims eats a pear* (cf. 12), first the lemma *Kim* needs to be assigned to the lexical category N, and its diacritic features number and person returned with their respective values singular and third person. Then the lemma *eats* needs to be assigned to the lexical category verb, and its diacritic features number, person, tense, and aspect annotated with their respective values singular, third, present, and noncontinuous. Further, in order to achieve the agreement between the two NPs *Kim* and *eats*, information must be exchanged between phrases, and the value of the features they share (i.e., number and person) must be matched. Likewise, in generating the NP *a pear*, the selection of the lemma *a* partly depends on the value (singular) of the diacritic feature of the phrase head lemma *pear*, because the common values they share must be checked againsts each other for agreement. In this case the value of the diacritic feature of *pear* is stored by the categorical procedure until it is checked against that of the modifier *a*. Finally, in order to build up the sentence, a grammatical function must be assigned to the two newly created NPs, that is SUBJ for *Kim* and OBJ for *a pear*.

(12) An illustration of processing hierarchy for Kim eats a pear*: phrasal and interphrasal procedures*



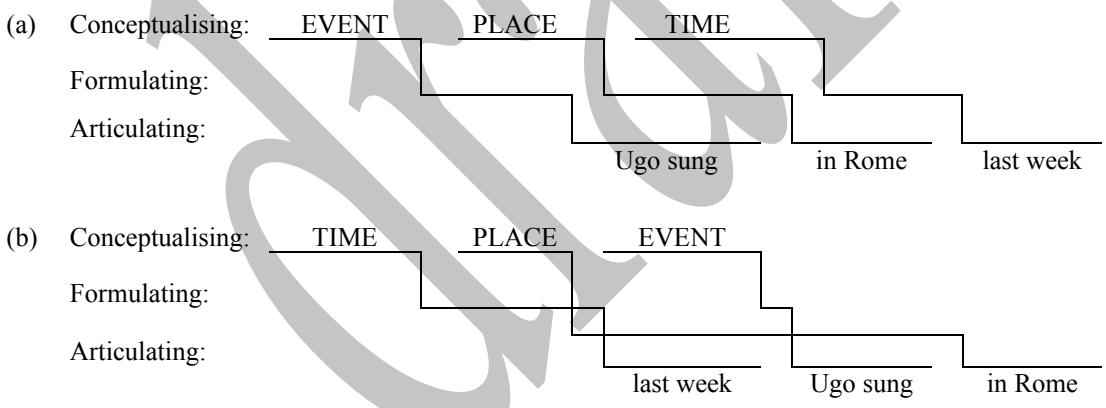
This matching, or exchange, of information regarding the values of shared diacritical features among the elements of a sentence is called 'feature unification' in LFG

terminology (cf. § 2.2). It is a key LFG concept used by Levelt's Model and incoporated into PT for explaining the process of L1 and L2 acquisition respectively.

Kempen & Hoencamp's (1987) Incremental Procedural Grammar also assumes that the whole four-step sequence from activating the simple lemma to the sentence procedure is implicational. This means, for example, that in order to activate the phrasal procedure, both the lemma and the category procedures must be activated, but that the sentence procedure need not be active.

Furthermore, the whole process of language generation is incremental. This means that all processors can operate simultaneously in parallel, but they all work independently on different language fragments of the utterance under construction. Implicit in Levelt's Model is the different cognitive cost required by different utterances. If the order of words follows the order of thought, as shown in the first part of (13), the cost of language production in minimal. But words do not always follow thought in a perfect sequence, as shown in the second part of (13). Nor do all grammaticalisation procedures procede linearly. In this case, storage facilities come into play in order to absorb the asynchronies and buffer the intermediate representations as they become available. These facilities operate at a cognitive cost.

(13) Levelt's Model: Incremental production without (a) and with (b) inversion of order (after Kempen & Hoenkamp 1987, as cited in Levelt 1989: 25)



Finally, the theoretical assumption of incremental processing (i.e., of parallel processing activities in the different components of speech generation) hinges on automaticity. Automatic processes have great advantages: they are the only ones that are executed without conscious awareness; they are usually quick; and they run on their own resources, which means that they do not share resources, so they can run in paralell without mutual interference. If each processor were to require acces to attentional resources such as working memory, speaking would not be fluent, and between one articulated fragment and the next there would be long silences devoted to processing. On the other hand, nonautomatic, controlled processing demands attentional resources, as we can only attend to a few things at a time. Attending to the process means a certain

level of awareness of what we are doing. Thus human controlled processing tends to be serial rather than incremental in nature, and is therefore slow. Its advantage is that it is not entirely fixated in memory; in fact, quite flexible and adaptable to the requirement of the task. Here the difference between the native speaker of a language and its learner is crucial. If the native speaker effortlessly generates fluent speech, the learner gradually proceeds from painfully slow retrieval of lexical items towards their ever more complex grammatical encoding in an ever more automatic way. The relevance for SLA of automaticity versus control in speech production will be discussed below in § ?.?, and in Di Biase & Kawaguchi's chapter ?.

This is then, in its basic tenets, Levelt's Model for language generation in the mature native speaker. What about L2 learners? Summing up, as they develop their interlanguage, they need to

(14) a. build up the lexical store, and include in it fully mature lexical items; that is, not only more numerous words with their meanings and sound forms, but also richer lemmas with all their diacritic features (semantic, grammatical and formal, as well as categorical and combinatorial) and specific values;

b. learn to encode these lemmas functionally in LFG's f-structure and positionally in LFG's c-structure (cf. § 2.2 below); and

c. automatise encoding processes for fluent speaking, so as to devote greater attentional resourses to semantic and pragmatic processing.

How learners gradually learn to enrich their lexical storage, activate more grammatical procedures, bottom up, and automatise them is precisely the main concern of PT (cf. § 3). But before describing PT's developmental stages based on implicational procedural skills identified in Levelt's Model, we need to introduce some basic notions of LFG, and integrate them – as far as possible – into this model.

2.2. Lexical Functional Grammar and PT

LFG is committed to the interface between linguistic knowledge and language processing, and is therefore designed to account for linguistic knowledge in a way that is compatible with the architecture of the language processor (Kaplan & Bresnan 1982: 177). Like Levelt's Model, it too takes a lexicalist approach, in the sense that it conceives the lexicon of a language as a lexical store where each entry is associated not just with meanings and forms, but also with the full set of their syntactic information.

Part and parcel with LFG's lexicalist approach to grammar is its principle of lexical integrity. According to this principle, from the point of view of syntax words cannot be divided into smaller units. That is, syntactic rules neither form words, nor do they access their internal structure. In our own discussion, this means that words are stored in the lexicon as integral units: e.g., our English lexical store contains both *cat* and *cats*, then *love*, *loved*, *loves*, *loving*, all of them. Likewise, in our Italian store, we have *bravo*, *brava*, *bravi* and *brave*, and for verbs quite a number of variant forms according to features such as tense, aspect, person, and their values. In Levelt's Model, as we have seen in § 2.1, the choice of the appropriate form is determined partly in the

conceptualiser and partly in the grammatical encoder. For example, whether the speaker intends to refer to one *cat* or to more *cats* is referential information already held in the preverbal message. In other cases, the choice is determined by the syntactic structure of which the lemma is a part. For example, whether in referring to a previously mentioned *Peter* the proper form will be *he* or *him* is information processed by the grammatical encoder according to the function (subject or object) the pronoun is assigned in the sentence of which it is a part.

Another important principle of LFG is its clear distinction between the levels of linguistic representation that a formal model requires in order to describe adequately the complex structure of natural language. Because a sentence is an expression of several types of linguistic information (ie., semantic, pragmatic, syntactic, phonic, etc.), theoretically there can be several distinct structures: semantic structure, information structure, and phonological structure, as well as argument structure, functional structure and constituent structure, which are more closely involved with syntax. So far the former three have been integrated least into LFG's architecture, and not yet applied to PT. They will no longer be mentioned here.[10] We will concentrate instead on the latter three structures: a-structure, f-structure, and c-structure. We will first consider them separately, with their specific properties that make each one different and independent from any other, and then see how they can be linked together, or mapped, one onto another.

A-structure is important to syntax because it determines many of the basic properties of the sentence in which a predicate occurs – the predicate being the word, typically a verb, which names the action, event or state described by that sentence. The a-structure of a predicate encodes information about the number and type of arguments selected by that predicate, as shown in (15). Arguments are thus assigned lexically through the meaning of the verb.

(15) *run* <agent>
eat <agent, patient>
love <experiencer, stimulus>
give <agent, theme, recipient>

Because argumenthood is a semantic concept, it is not always as easy as expected to determine the arguments of a predicate, and many labels have been proposed. Suffice to say here that LFG generally follows Jackendoff (1972), and others, in defining a hierarchy among them which is formally based on two very broad aspects of the way we conceptualise the meaning of verbs: one based on action, the other on space. In the action conceptualisation, an agent has primacy over a beneficiary, because when both are present, the beneficiary is affected by something the agent does. In the space conceptualisation, the instigator has primacy over the theme, which in turn is more prominent than the path, etc. By stipulating also that the action conceptualisation takes over the spatial one, the thematic hierarchy in (16) is derived, typologically validated by

[10] There is little doubt that LFG work in this direction might help further developments in PT, especially concerning information structure (cf., e.g., Mycock's (2007) work applied to the acquisition of Italian constituent questions by Bettoni & Ginelli in chapter ? below) and phonological structure (cf., e.g., the problems in the acquisition of intonation).

Keenan & Comrie (1977) and Hopper & Thompson (1980), among others, and used by Bresnan (2001: 307):[11]

(16) agent > beneficiary > experiencer/goal > instrument > patient/theme > locative

F-structure encodes for every sentence all the grammatical information needed to interpret the sentence semantically. It consists of two types of information about the syntactic elements (namely, words and phrases) of a sentence: first, information about grammatical relationships between them; secondly, information about their grammatical properties, or features. That is, in the f-structure, abstract grammatical functions and diacritic features try to capture universal syntactic principles that vary cross-linguistically at other levels of representation. We are now having a closer look at these two types of information.

In f-structure encoding, let us look first at grammatical functions. The most basic purpose syntactic elements can serve is expressing the arguments of predicates. Hence, the most basic grammatical functions are the argument functions. These are then governed by the predicate, and are SUBJ (subject), OBJ (object), OBJθ (secondary object), the OBLθ (oblique) family of functions, and COMP (complement). Among argument functions, a fundamental distinction is made between core functions, which are SUBJ, and the two objects, OBJ and OBJθ, and noncore functions, which are the OBLθ family ones, and COMP. The core functions are associated with the central participants of the eventuality expressed by the verb, and are usually distinguished formally from noncore functions. In English, for example, core arguments have canonical c-structure positions which are occupied only by NPs and DPs; noncore functions are generally expresssed by other c-structure categories (e.g., OBLs by PPs). For example, in the sentence in (17a), *Consuelo* and *her sentiments*, respectively SUBJ and OBJ, are core functions associated with the verb's arguments, and cannot be placed in any other position than the one they occupy, namely, *Consuelo* before the verb, and *her sentiments* immediately after. On the other hand, *to Pablo*, an OBLθ, is a noncore function associated with an optional PP, as can be seen from the fact that in (17b) it can be left out.

(17) a. Consuelo expressed her sentiments to Pablo quite nicely in writing
b. Consuelo expressed her sentiments quite nicely in writing

Besides argument functions there are also nonargument functions, such as ADJ (adjunct), FOC (focus) and TOP (topic). These bind their expressions to something other than argument roles, and are thus not stricly necessary in building up a sentence. For this very reason, whereas argument functions allow only single instances (i.e., there can be only one SUBJ per sentence), nonargument functions allow multiple instances (i.e. there can be more than one ADJ per sentence). For example, in the sentences in (17) there are two ADJs, namely, *quite nicely* and *in writing*.

[11] Because a thematic hierarchy is not a primitive construct, other rankings have been proposed – all of which, however, almost without exception, rank agent highest. For a discussion of criteria used in constructing a thematic hierarchy and ranking semantic roles, cf. Levin & Rappaport Hovav (2005: ch. 6).

All these functions, whether argument or nonargument ones, represent the clause-internal aspect of syntactic elements. However, they can be also parts of the wider discourse. So, as a secondary function, a syntactic element can also relate to the place its clause has in a larger syntactic structure or in the wider discourse structure. These secondary functions are called discourse (or overlay) functions. They are TOP (topic), expressing the topic of the discourse, old information; FOC (focus), expressing new information; and SUBJ, which is the default discourse topic. The TOP and FOC functions map indirectly to the argument structure in the sense that they must be identified with, or anaphorically linked to, another nondiscourse syntactic function. For example, in (17) *Consuelo* is TOP and SUBJ, whereas in (18) the same propositional content topicalises *in writing*, which is TOP and ADJ:

(18) in writing Consuelo expressed her sentiments quite nicely

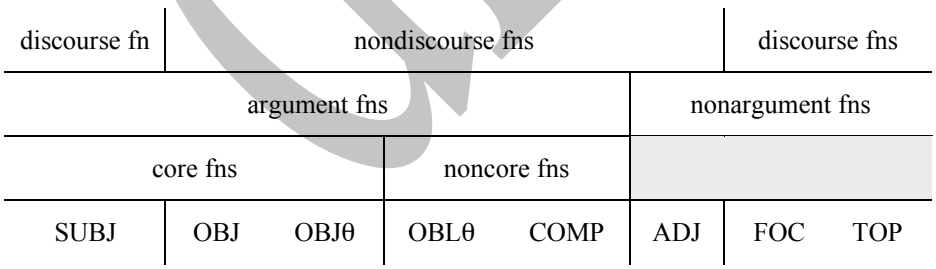
In Bresnan's (2001: 97) example, the preposed NP *Rosie* in (19b) is both FOC and OBJ of its sentence, with FOC relating this sentence to a previous one in (19a):

(19) a. what did you name your cat?
b. Rosie I named her

Note that discourse functions are not part of discourse representation, any more than argument functions are part of lexical semantics. They are syntactic functions expressing relations within the sentence that are relevant for discourse grammar.

In sum, (20) shows how the hierarchy of grammatical (or syntactic) functions can be subdivided into two major dichotomies: argument and non argument functions, and discourse and nondiscourse ones.

(20) LFG: Grammatical functions and their subdivisions (after Falk 2001: §3.1 delle dispense)



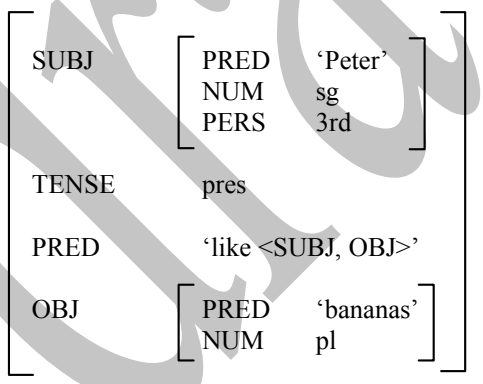
Two connections between these dichotomies are crucial (Pienemann, Di Biase and Kawaguchi 2005: 210). First, SUBJ is the only function participating in both dichotomies, being both argument and discourse function. Secondly, a universal default optionally identifies SUBJ and TOP. We can understand this better if we consider Levelt's Model. As we have already mentioned in § 2.1, there are seductive correspondences between thematic and discourse roles on the one hand, and

grammatical functions on the other. That is, agents tend to be subjects, and elements expressing given (or topical) information tend to appear early in the sentence and have great affinity with the subject, a function that allows them to lead in the utterance itself (Bock & Levelt 1994: 964; 365).

In f-structure encoding, let us now turn to the information conveyed by grammatical properties (or features). As we have seen in § 2.2, these properties are part of the lexical entries, and include diacritic features such as number, person, gender, definiteness, case, and tense, which all have their own values: in English, for example, singular and plural for number (e.g., *cherry*, *cherries*); first, second, etc. for person (e.g., *I*, *you*); masculine and feminine, etc. for gender (e.g., *gentleman/he*, *lady/she*); definite and indefinite for definiteness (e.g., *the banana*, *a banana*); nominative, accusative, etc. for case (e.g., *he*, *him*): and present, past, etc. for tense (e.g., *sing*, *sang*).

Thus in LFG, grammatical information in f-structure is represented by a set of attribute-value pairs; that is, given a particular f-structure, each attribute is always assigned a specific value. There are three types of values: (a) atomic symbols, e.g., sg for singular; (b) semantic forms, e.g., love <x, y>, which stands for a kind of activity involving two arguments; and (c) f-structures, which themselves consist of attribute-value pairs. The f-structure for the sentence *Peter likes bananas* is illustrated in (21).

(21) LFG: F-structure for Peter likes bananas *(after Falk 2001: ch. 1 pag 25)*

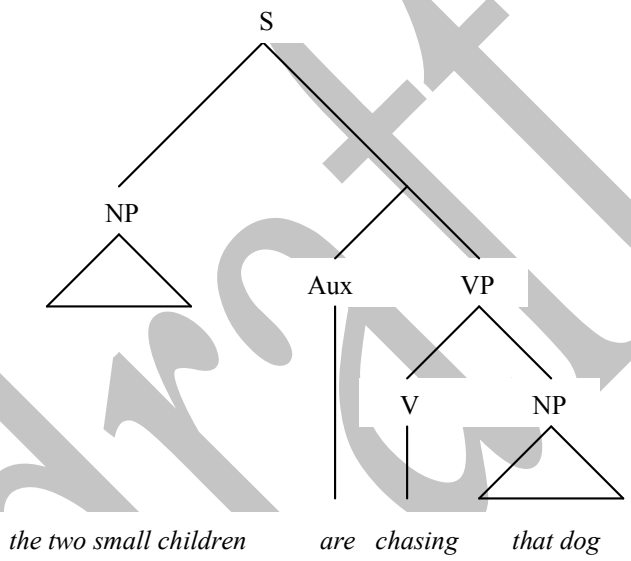


C-structure is the overt expression of the functions and features that make up a syntactic expression (Falk 2001: ch. 2 pag 1). It encodes three types of information: (a) word order, (b) constituent boundaries, and (c) the categories of each word and constituent in the sentence – that is, whether a word is a noun, a verb, an adjective, etc., and whether a phrase is NP, VP, AP, etc. It is the level of representation of phrase-structure trees.

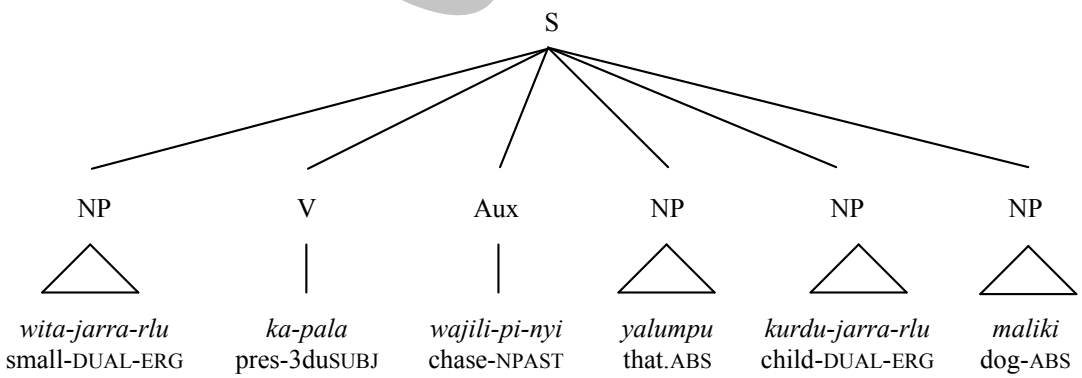
In contrast to f-structure, which encodes the invariant aspects of grammar, c-structure encodes properties that vary a great deal across languages. In this regard compare, for example, English with Warlpiri, an Aboriginal language spoken in northern Australia. In English, c-structure is highly organised, both linearly and hierarchically. A sentence can thus be shown to be made up of identifiable constituents,

such as NP or VP, which are placed in specific positions; and grammatical functions are encoded in c-structure configurations, with SUBJ outside of the VP and OBJ inside. For an example of an English phrase structure, hierarchical and endocentric, see (22). Languages such as English are called configurational languages. On the other hand, in Warlpiri grammatical functions are not encoded in c-structure, c-structure is flat, and all arguments are sisters of the verb. Thus word order is free, and phrases like NP and VP are optional. For an illustration of a Warlpiri phrase structure, flat and exocentric, see in (23) that of same sentence illustrated for English in (22). Languages such as Warlpiri are called nonconfigurational languages.

(22) Phrase structure of the English sentence the two small children are chasing that dog *(after Bresnan 2001: 5)*



(23) Phrase structure of the Walpiri sentence glossed in English as the two small children are chasing that dog *(after Bresnan 2001: 6)*



In the Warlpiri sentence in (23), the actual word order is 'two-small are chasing that two-children dog', with the subject NP split by the verb complex 'are chasing' and 'that', and with 'that' referring to 'dog' rather than to the adjacent 'two children'. So, it is clear that, in Warlpiri as well as in other nonconfigurational languages, the coherence of a conceptual unit is indicated by means of word *shapes* rather than word *groups*. Noncontiguous words that form a conceptual unit must share the same formal endings marking case and number agreements. Indeed it is the richness of the inflectional endings that allows for any permutation of the words in a sentence, according to the speaker's discourse-pragmatic needs. Of course, when words belonging together semantically are further away, this 'sharing' of inflectional features is the basis for the necessary exchange of information that allows for feature unification. In terms of Levelt's Model for language production, the greater the distance (in terms of hierarchical levels) between the words needing feature unification, the higher the cognitve cost of unifying them.

This typological variation between configurational and nonconfigurational languages creates "competition between words and phrases expressing the same f-structure information" (Bresnan 2001: 101-102). This means that morphology and syntax interplay, in the sense that morphology-rich languages show preference for lexical over syntactic expression for grammatical encoding, and vice versa. However, as Bresnan (2001: 132) is quick to remark, along the typological continuum of strictly configurational and strictly nonconfigurational languages, natural languages may freely mix modes of organisation.

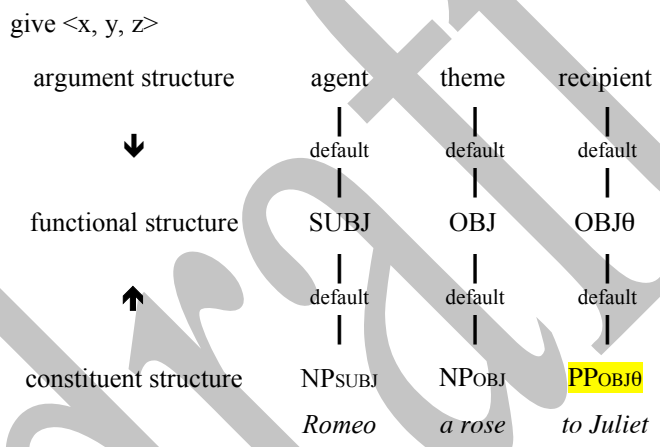
So far we have presented a-structure, f-structure and c-structure separately. This is certainly possible, because each of these levels of representation is independent from the others, in the sense that none is derived from the other, and each corresponds to a different aspect of syntactic structure. However, because each provides only a partial description of a sentence, it is important to specify the mapping, or correspondence, between the elements of these three parallel structures.

According to LFG, the main problem of a syntactic theory is to "characterise the mapping between semantic predicate-argument relationships and surface word- and phrase-configurations by which they are expressed" (Kaplan & Bresnan 1982: 174). Thus grammatical formalism is essentially based on the correspondence with which a sentence maps a- and c- structures onto the grammatical relations and properties in f-structure. Because each structure has its own hierarchy, the mapping between them can align in more than one way (Sells 2001), both across languages and within a specific language. For example, on the one hand, the characteristic correspondences between the SUBJ function and the arguments can vary typologically along several dimensions: onto the semantically most prominent available role in the argument structure, as in accusative languages like Japanese; onto the argument in control of the eventuality, as in active languages like English; or onto the argument most affected by the eventuality, as in ergative languages like Dyirbal, an Aboriginal language on Australia. What all these possibilities have in common is the prominence of the subject argument on the selected dimension compared to other arguments (Bresnan 2001: 95). On the other hand, the SUBJ function takes no single universal form. Expression of SUBJ includes the NP in a certain phrase structure configuration, as in configurational languages like

English; verbal inflection morphology, as in head-marking nonconfigurational languages like Italian; and nominals bearing a specific case, as in dependent-marking nonconfigurational languages like Japanese (cf. § 5).

The mapping is unmarked (or default) when the hierarchical elements of the three structures are aligned in a default correspondence according to their respective hierarchies. This is illustrated in (24) for the sentence *Romeo gives a rose to Juliet*, where the most prominent argument in a-stucture and the first constituent in c-structure, both map onto SUBJ, which is the most prominent function in f-structure; and where a less prominent thematic role links onto a less prominent function, in a less prominent position.

(24) LFG: Default correspondences of a- and c-structures onto f-structure for the sentence Romeo gives a rose to Juliet



However, alignment among the three structures can vary a great deal, and be more or less marked. In any language, for a variety of pragmatic reasons, the same propositional content can be expressed taking different perspectives, as we have seen in § 2.1 when illustrating the sentences in (5)-(6) from the point of view of langage production. These perspectives then require a range of structural realisations. In most languages, sentences may vary between active and passive, between affirmative and question forms, etc. Speakers may also choose to place constituents in prominent positions by topicalising or focusing them, or they may choose not to do so. Many of these structural choices are devices for directing the hearer's attention (Levelt 1989), and contribute to the representation of meaning, making communication more effective. However, how and how often these devices are deployed is language-specific.

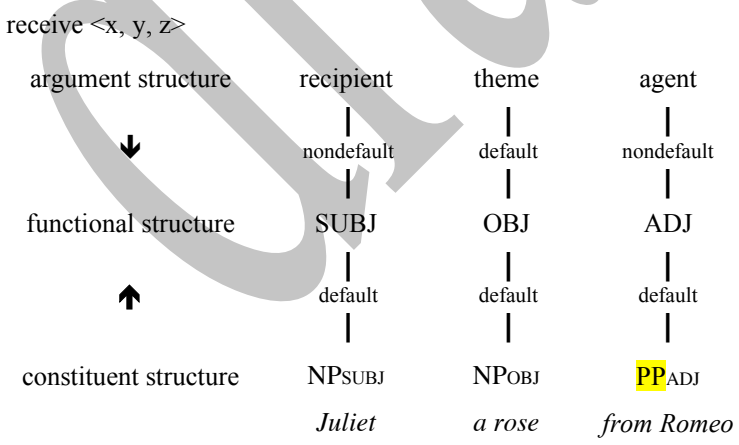
Alignment between the elements of the three levels of representation can be marked in two different ways: between arguments and grammatical functions (mapping of a-structure onto f-structure); and between word order and grammatical functions (mapping of c-structure onto f-structure). The technical, formal details of these linking rules are quite complex, and definetely beyond the scope of this chapter (for their formalisation, cf. Bresnan 2001, Dalrymple 2001). We will illustrate here one example

for each type of markedness in (25)-(26), remembering that grammatical functions are here considered the 'relators' of c-structure to a-structure.

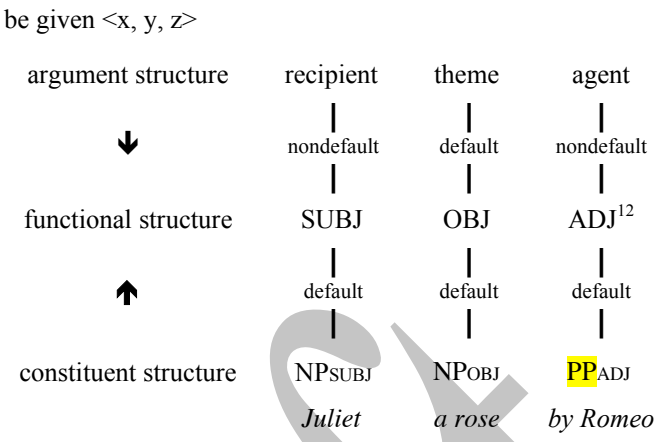
With regards to mapping a-structure onto f-structure, LFG proposes the Lexical Mapping Theory, which systematically explains how the conceptual representation of the thematic roles, mediated by a-structure, is mapped onto grammatical functions. In (24) we have seen an example of how this linking is predictable. But the eventuality described there can be realised differently, if speakers wish to change the relative prominence among the participants. For example, they may wish to express the matter from the recipeint's point of view, and prioritise *Juliet* and demote *Romeo*. This can be done in at least two ways: by using a so-called 'exceptional' verb; or a passive form.

According to Pinker (1984), exceptional verbs are lexical entries with an intrinsic nondefault a-structure. *Receive* is such a verb in relation to its 'normal' equivalent *give*. Other common exceptional verbs describe a psychological state or reaction, and include *please*, *delight*, *bore*, and *bother*. So, the eventuality of Romeo giving a rose to Juliet, as well as canonically by the verb *give* in (24), can be expressed noncanonically by means of the exceptional verb *receive* in (25). On the other hand, it can be expressed also by the passive verb *be given*, as in (26). In either case, noncanonicity is due to the fact that the recipient, a less prominent thematic role than the agent, is linked to SUBJ, the most prominent grammatical function. Yet notice that, in either cases, with regard to c-structure, both sentences exhibit normal, basic word order pattern – which, in the case of English, is SVO.

(25) LFG: Nondefault mapping of a-structure onto f-structure for the sentence Juliet receives a rose from Romeo



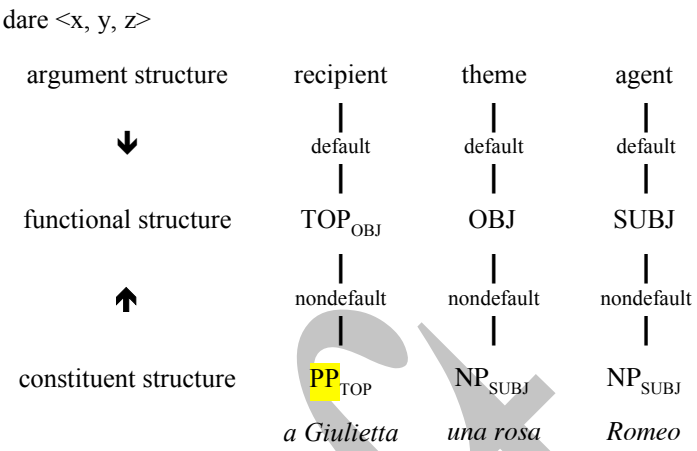
(26) LFG: Nondefault mapping of a-structure onto f-structure for the sentence Juliet is given a rose by Romeo



With regards to mapping c-structure onto f-structure, it is important to note that, whereas f-structure functions are largely universal, c-structure configurations are language-specific. In this regard, language specificity is twofold. First, all languages have their typical (unmarked) canonical word order for core functions. For example, canonical order is SVO for English and Italian, SOV for Japanese, and VSO for Moroccan Arabic. Secondly, languages can be placed in different positions along the typological continuum from configurational to nonconfigurational languages, as we have just seen with the two extreme examples of English and Warlpiri in (22)-(23). Among the better known European languages, Italian is less configurational than English, so we will use this language to illustrate an example of noncanonical word order. Let us go back to the eventuality in (24), for example. If Italian speakers wished to give prominence to *Juliet* (or better, *Giulietta*) over *Romeo*, besides chosing the exceptional verb *ricevere* in a similar way to English, they could also choose to topicalise OBJθ, as in (27). This involves marked alignment between c- and f-structures, with *Juliet* realised as TOPOBJθ preverbally, and *Romeo* as SUBJ postverbally. Thus OVS word order is noncanonical, and the argument function SUBJ is no longer associated by default with the discursive function TOP. On the other hand, notice that mapping of recipient as OBJθ and agent as SUBJ is default.

[12] Despite the presence of three arguments in the a-structure, one is suppressed by the feature of the passive lexical entry, and is thus marked as ADJ in f-structure. For a theoretical explanation, Cf. Bresnan (2001: ch. 14).

(27) LFG: Marked alignment of c-structure onto f-structure for the Italian sentence a Giulietta dà una rosa Romeo.



In concluding this brief presentation of LFG, we further summarise that it is a lexically driven, pschycologically plausible grammatical theory which provides an architecture for describing typologically diverse languages in a formal way. LFG provides PT with two fundamental concepts, ensuring that the different parts of a sentence actually do fit together:

(28) a. the different syntactic levels – i.e., lexical level, phrasal level or sentence level – within or across which their elements require unification of diacritc features and values; and

b. the different kinds of correspondences among a-, c- and f-strutures; or more precisely, the canonical or noncanonical mapping of a-structure onto f-structure, and the unmarked and marked alignment of c-structure onto f-structure.

3. PT's key concepts

In tune with its feeder disciplines, PT describes, explains and predicts the development of morphology and syntax for any typologically different L2 by focusing on the development of the processing procedures (described by Levelt's Model) required by the production of L2 structures (described by LFG).

One of PT's greatest claims is that the sequence with which learners develop their grammar follows the sequence with which grammatical encoding of the lexicon unfolds in Levelt's Model. Hence the language processing sequence described for L1 mature speakers in (11) above predicts the developmental progress described for L2 learners in § 4 below (cf. (30)-(31)). That is, the sequential activation of the processing procedures allows for the production of language structures which at first do not require any

exchange of information among constituents, and later on do require it at phrasal level, and finally at sentence level. Exchange of information is a key concept here.

PT, then, spells out the hypotheses for the developmental sequences of L2 morphology and syntax in learners' interlanguage. That is, if learners are able to apply processing procedure x, they will be able to produce morphological or syntactic structure y using procedure x. Implicational hierarchy is a key concept here.

Based on the activation of implicational processing procedures, PT conceives L2 acquisition in terms of sequential progression through a series of stages. These stages are characterised by an increasingly lower degree of linguistic linearity in surface structure. Linguistic linearity is thus a key concept. It derives from two main sources. For morphology, it is operationalised in terms of feature unification, and measured by the syntactic level on which lie the elements needing features unification in the target language (Pienemann 1998). For syntax, it is operationalised in terms of the mapping of a-structure onto f-structure, and alignment of c-structure onto f-structure, and measured by the canonical vs noncanonical, and unmarked vs marked types of correspondence among these structures (Pienemann, Di Biase & Kawaguchi 2005).

Implicit in the mismatch between the order in which lexical items are first retrieved from the lexicon and grammatically encoded, and then finally produced linearly, is the cognitive cost of temporarily storing in a syntactic buffer partially encoded information that will later need further encoding. Processing cost is here a key concept. The more information needs to be exchanged, and the further afield, that is, the longer it needs to be kept active in the short-term memory store, the greater the processing cost. Crucially, the more costly the encoding of the structures, the later these develop in the learners' interlanguage.

The cost of grammatical encoding to learners decreases as processing procedures are ever more automatised through frequent activation. Thus the learners' progress depends on both the ability to activate new procedures along their implicational sequence, and the gradual automatisation of the already acquired ones. Automatisation is another key concept here (cf. Di Biase & Kawaguchi's chapter ? below).

In the meantime, while more advanced procedures are not yet available and earlier ones not yet automatised, the least costly solution for learners is to resort to default (or unmarked) structures of the simplest one-to-one relationship between form and function. In other words, because learners do not know in advance what the relevant structures of the target language will be, they tend to map conceptual structures directly onto surface form, as long as there are words in the lexicon that match the conceptually conceived message. Defaultness – (un)markedness, or canonicity – is yet another key concept in understanding PT.

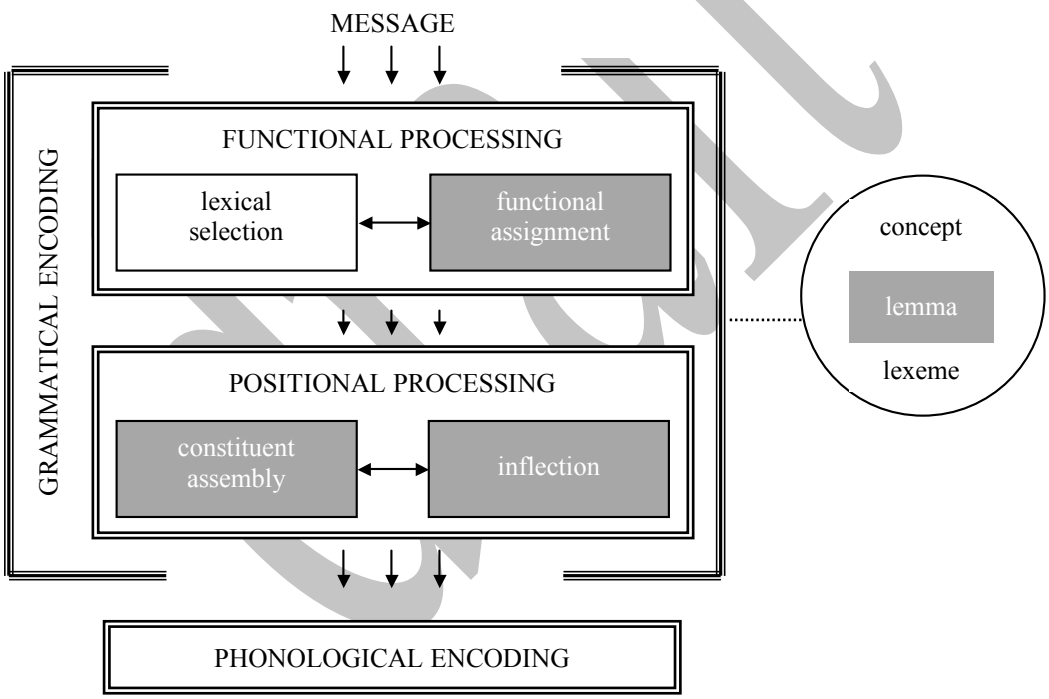
4. The learner's progress

Having briefly summarised PT's theoretical bases in §§ 1-2 and key concepts in § 3, let us now look at how they shape the learner's progress along the development path.

Briefly stated, PT hypotheses that L2 learning starts with an initial stage when words and formulas are not yet encoded grammatically. That is, they are produced in strings organised only pragmatically, in the order in which they are conceptualised.

When grammatical encoding begins, learning proceeds with words exhibiting minimal diacritic features and values, and rigidly organised in c-structure according to the canonical order of the target language. Subsequently, thanks to the gradual building up of f-structure, lemmas acquire richer features (inflectional morphology), and costituents can be placed in a freer linear order. In (29) we reproduce the components of grammatical processing, already illustrated in (4), where they were all shown as fully activated in mature native speakers. Here, the learners' limited annotations in the lexicon and their limited ability to assign functions to thematic roles and constituents, and values to features are shown graphically with a grey shadow in the relevant components. As learning progresses, an L2 formulator is built up (cf. de Bot 1992), and these areas become gradually clearer.

(29) Levelt's Model: Components of grammatical processing at an early stage of L2 acquisition (after Bock & Levelt 1994: 946)



The task of building up an L2 formulator – or indeed the very existence of a totally different Formaulator for each language – may vary according to the learners' L1, as de Bot (1992) notes. That is, if the two languages are typologically unrelated the task is more arduous and the learning slower. If they are closely related, it may even be doubtful that a whole new formulator is needed, and in any case many of the categories and procedures needed for speech may already be in place and oparative. This would result in faster learning.

Although the two sequences in the learning of morphology and syntax certainly interface in important ways (cf. § 4.3), we keep them separate in our initial presentation in §§ 4.1 and 4.2 respectively). The reason for doing so is is that the two developmental sequences depend on two different sets of motivations. On the one hand, we have the original psycholinguistic procedures of Kempen & Hoenkamp (1987) and Levelt (1989) modelled in LFG by the mechanisms of feature unification, and adopted by PT in Pienemann (1998). On the other hand, we have the different kinds of correspondences among the three LFG a-, c-, and f-structures, adopted by PT in Pienemann, Di Biase & Kawaguchi (2005).

4.1. Morphological development

PT hypothesises that the availability of increasingly more demanding processing procedures defines the learners' progress through a sequence of stages which depend on the increasingly greater syntactic distance (in terms of hierarchical levels) between the linguistic elements requiring exchange of information for their approriate grammatical production. This sequence is shown in (30).[13]

[13] Unlike most tables presenting PT sequences in the considerable volume of PT literature since Pienemann (1998), we prefer to avoid the use of numbers for identifying stages. Two reasons guide us in this decision. First, although conveniently synthetic, numbers are not used consistently, especially whenever authors feel the need to highlight stages within a stage. This is particularly evident when, in languages such as English, the activation of phrasal procedure includes the emergence of both NP morphology and VP morphology, with the former clearly emerging before the latter (cf. the table in (2), ch. 2). This may not be relevant in languages without a VP. Secondly, as well as the sequence for morphological development, PT has now added two other sequences for syntactic development, as we shall see in (34) and (39) in § 4.2 below. Because, the correspondences among these three staged developments are not yet fully clear and should not be pre-empted, each sequence would require its own separate numbering. Thus the conveniently synthetic use of numbers would become problematic if you needed to specify which of the three sequences you are actually referring to.

(30) PT: Hierarchy of processing procedures – Morphological development (after Pienemann 2005: 14)

STAGE	t1	t2	t3	t4	t5
S-BAR PROCEDURE	–	–	–	–	interclausal information exchange
SENTENCE PROCEDURE	–	–	–	interphrasal information exchange	interphrasal information exchange
PHRASAL PROCEDURE	–	–	phrasal information exchange	phrasal information exchange	phrasal information exchange
CATEGORY PROCEDURE	–	lexical form variation	lexical form variation	lexical form variation	lexical form variation
LEMMA ACCESS	invariant forms & formulas	invariant forms & formulas	invariant forms & formulas	invariant forms & formulas	invariant forms & formulas

Initially, the only procedure L2 learners can activate is the access to the lemma. With regard to morphology, they are unable to activate any procedure, and thus can produce only single words without formal variation and formulas. The main reason for this inability is that at this earliest stage the L2 lexicon is hardly annotated. In other words, the three-level system of the mature L1 speaker's lexicon, represented in (2)-(3) above, is reduced to the two levels of the concept (semantics) and the lexeme (sound).

At the next stage, learners begin to annotate their lexicon, and develop a system of lemmas whereby lexical concepts acquire first a syntactic category and later its subcategorisation diacritic features. This feeds the process of syntactisation, thus activating the category procedure. The first categorical distinction is usually between nouns and verbs. And the early values to be distinguished are usually those of diacritical features that express conceptual representation – such as singular and plural for number, and present and past for tense, where the L2 uses them – rather than those required by the grammar – such as the values expessing class, gender, or case. At this category-procedure stage, then, formal variation begins to emerge. However, whatever grammatical information is thus annotated, it does not carry across lexical level. In the verb lemma, for example, the information about tense is contained with the value 'past' for the diacritic feature 'tense', and in turn this type of marking characterises the verb and differentiates it for example from the noun. This means that the diacritic feature in question is available in the same location where the morpheme for the marking of the past (i.e., *-ed* in English) must occur. Because there is no exchange of information taking place, nothing is stored for further use somewhere else in the sentence. For those

lexical entries which are not yet fully annotated, the learner will likely use default forms, the least marked and the most available in the input, namely, the singular form in languages that mark number, the nominative form in those that mark case, non-past forms for tense, etc. These default forms will of course be used also wherever the target language would require feature unification somewhere else in the sentence. (For more examples, cf. ch. 2, §§ 2.1, 3.1 and 4.1, respectively for the development of English, Italian, and Japanese morphology).

With the next step forward learners reach the phrasal-procedure stage. As the lexicon grows and annotations become richer, they add diacritical features to their entries, and begin to distinguish categorically also adjectives and determiners from nouns, auxiliaries from lexical verbs, etc. Furthermore, word strings become longer. Parallel to when in Levelt's Model the lemma's category information calls up the phrasal procedure, also learners are now able to distinguish the phrasal head from other elements within it. For example, if the category of the lemma is N, then the NP procedure can be called up in order to produce an NP. If a determiner or modifier is added, the value of the head plays a key role. That is, the grammatical information of the head lemma N must be deposited in the NP-procedure and temporarily stored there in order to be checked against that of the other constituent(s) within the phrase. In order to do this, information must be exchanged among the words that in the target language require feature unification. For example, in the English phrase *a pear* in (12) above, the determiner and the noun share the feature 'number', and require feature unification, which in this case concerns the value singular. In chapter 2 (cf. §§ 2.1, 3.1 and 4.1) we will illustrate some English, Italian, and Japanese examples respectively.

At the sentence-procedure stage, learners begin to assign a syntactic function to their phrases by establishing a relation between them. In order to achieve this, the phrase needs to be attached to the S(entence)-node (that is, the mother node in the tree structure), with the sentence procedure determining the functional destination of the NP associated with the argument roles of the verb, such as NP$_{SUBJ}$ or NP$_{OBJ}$. Here again, the necessary information relating to a phrase's values must be stored until the diacritic feature is assigned to the appropriate place in the other part of the sentence and the values checked for unification. For example, in the English sentence *Kim eats a pear* in (12) above, the NP$_{SUBJ}$'s value 'number' (i.e., singular) and 'person' (i.e., third person) are kept in the syntactic buffer (i.e., short-term memory store) until the bound morpheme *–s* is assigned to the verb *eat*. The S-procedure then checks the compatibility of the information coming from different phrases, in this example, number and person coming from NP$_{SUBJ}$ and NP$_{OBJ}$. This requires interphrasal exchange of information. (For more examples in English, Italian and Japanese, cf. ch. 2, §§ 2.1, 3.1 and 4.1 respectively).

Further along the morphological developmental path, at the last stage, learners activate the S-BAR procedure and are thus able to exchange information about the values of relevant diacritical features between elements in different clauses. For example, in English, interclausal information exchange is required in a sentence such as (31). Here the information exchanged between the two clauses is that, on the one hand, the main clause requires feature unification between SUBJ and verb (i.e., *he suggests*), and on the other, the subordinate clause does not (i.e., *she sleep*). For more, and other

language-specific examples, cf. §§ 2.1, and 3.1 in ch. 2, respectively for English, Italian and Japanese.

(31) he suggests she sleep more

4.2. Syntactic development

Like for morphology (cf. § 4.1), also for syntax PT hypothesises staged development (Pienemann, Di Biase & Kawagychi 2005). These syntactic stages come about as learners gradually learn to go beyond default solutions in linking functions to arguments and constituents towards freer word orders motivated by discourse and pragmatic options. So, after a common initial stage, spelled out in PT by the Unmarked Alignment Hypothesis, there are two paths ahead: one developing marked alignment of c-structure onto f-structure, linking constituents to syntactic functions, which is spelled by the Topic Hypothesis; and the other developing noncanonical mapping of a-structure onto f-structure, linking arguments to syntactic functions, which is spelled out by the Lexical Mapping Hypothesis. We present the three hypotheses in the following three sub-sections, spelling them out in (32), (33) and (38), and illustrating the two sequences beyond the common stage in (34) and (39).

The Unmarked Alignment Hypothesis
At the very beginning of the developmental path, as we have already seen in the case of morphology, there is no L2 grammatical marking in the learner's interlanguage. There being no lemma level in the lexicon to guide grammatical encoding, in multiword strings words are juxtaposed in the order in which conceptual fragments become available for further processing. Word order is then entirely dictated by semantics, that is, by the prevailing relations between lexical concepts (cf. Pienemann 1998: 84). This conceptual ordering places the most prominent arguments earlier in the string; the others follow. One popular choice is 'agent first', another one is 'location last' in SVO languages, as with children learning their L1 (Levelt, Roelofs & Meyer 1999: 2).

When the activation of the category procedure takes place and distinguishes at least verbs from nouns, verbs can begin to acquire their pivotal role in the sentence. This means that learners can start organising their sentences no longer entirely by prevailing relations between lexical concepts but by sequencing their a-structure elements by default and mapping them directly onto linguistic form in c-structure (e.g., agent or experiencer in first position). However, because functional assignment is not in place yet, both f-structure and c-structure are underspecified, resulting by default in the order which is prevalent in the input, that is the L2 canonical word order.

Canonical word order is language specific. It is the prevailing order with which a language organises its basic constituents in the c-structure of the prevalent type of strings, namely, simple, active, affirmative, declarative, minimally presuppositional, and pragmatically neutral sentences. However, even at this early level of lexico-grammatical representation, there are dominant, optimal, tendencies cross-linguistically, such as the relative ordering of SUBJ and OBJ. That is, once we discount the place of the verb, SUBJ preceeds OBJ in by far the greatest majority of the languages in the world (Lee

2001), and in any case the ubiquity of canonical word order in the target language makes it easy for learners to discover it even at this early stage. Be it as it may, initial reliance on canonical word order of the target language is a well attested SLA result from a large number of corpus-based studies on typologically different languages – albeit all exhibiting the SUBJ+OBJ order – both without the PT framework (e.g., Pinker 1984; Sasaki 1998), and within (e.g., Di Biase 2007; Kawaguchi 2005; Mansouri 2005; Zhang 2005; cf. Pienemann, Di Biase & Kawaguchi 2005: 227).

Reliance on canonical order is the basis for PT's Unmarked Alignment Hypothesis, which is spelled out in (32) adapted with minor terminological adjustments from Pienemann, Di Biase and Kawaguchi (2005: 229). This hypothesis explains how with default mapping of a-structure directly onto c-structure, learners can produce canonical order without functional assignment – thanks to the very predictability of canonical order. That is, learners will initially organise syntax on the basis of fixed alignment of semantic roles with the specific position in c-structure, because such alignment universally results in entirely linear structures that require no internal re-arrangement of linguistic material, and thus a minimal language-specific processor and memory store. Given the learner's limited state of L2 linguistic knowledge, the still immature L2 processor is unable to hold and exchange the linguistic information that would be required for the unification of lexical features (even if the lexicon were thus annotated). So, these one-to-one default links, entirely relying on aspects of the syntactic processing which is largely not language-specific (NP$_{AGENT}$ in first position), are the computationally least costly manner of organising L2 syntax. The default solution is to make the first NP$_{AGENT}$ the SUBJ.

(32) In second language acquisition learners will initially organise syntax by mapping the most prominent semantic role available onto the subject (i.e. the most prominent grammatical role). The structural expression of the subject, in turn, will occupy the most prominent linear position in c-structure, namely the initial position.

The very fact that canonical word order is all the learners produce at this stage can explain how learners can produce SUBJ+OBJ with a minimal S-procedure being operative. Pienemann (1998: 87) calls this S-procedure 'simplified', but this terminology seems confusing if at this stage learners have yet to built a sufficiently robust formulator to assign grammatical functions in the L2. SUBJ and OBJ are very much underspecified and must rely on semantic roles and their position in c-structure, strictly as specified by canonical order.

Functional assignment, then, marks the critical difference between early and intermediate-advanced learners. As learners begin to assign syntactic functions to c-structure and a-structure components, further progress becomes possible. That is, whenever for a variety of pragmatic reasons, learners wish to express the same propositional content by taking a different perspective, functional assignment opens up for them a whole range of new structures, in two important ways. One way is that of directing the listener's attention to particular participants in the current eventuality by giving them prominence through position in c-structure; for example, by placing in first position something other than SUBJ, so that the two hierarchies of c- and f- structures are no longer aligned in a default way (cf. 24 above, and the Topic Hypothesis in the next section below). Another important way is by giving participants prominence

through mapping semantic roles on syntactic functions in ways that do not follow the canonical hierarchies of a- and f-structures; for example, by assigning SUBJ function to roles other than agent (cf. 25 above, and the Lexical Mapping Hypothesis in the section after the next below).

The Topic Hypothesis

The speakers' need to enhance their expressiveness, and their wish to give prominence to a particular participant in the eventuality they are communicating to the listeners can result in marked alignment between the order of constituents and the universal hierarchy of grammatical functions. The way learners progress through the staged development of syntax, away from the rigidity of the unmarked alignment to the full freedom of optional choices in word order allowed by their L2, is spelled out by Pienemann, Di Biase & Kawaguchi's (2005: 239) in their Topic Hypothesis, quoted in (33), and is illustrated in (34).

(33) In second language acquisition learners will initially not differentiate between SUBJ and TOP. The addition of an XP to a canonical string will trigger a differentiation of TOP and SUBJ which first extends to non-arguments and successively to arguments thus causing further structural consequences.

(34) PT: Syntactic development based on the Topic Hypothesis (after Pienemann, Di Biase & Kawaguchi 2005: 239)

STAGE	t1	t2	t3	t4
MARKED ALIGNMENT	–	–	–	topicalisation of core argument other than SUBJ
XP + UNMARKED ALIGNMENT	–	–	ADJ + canonical word order	ADJ + canonical word order
UNMARKED ALIGNMENT	–	canonical word order	canonical word order	canonical word order
LEMMA ACCESS	single words; formulas	single words; formulas	single words; formulas	single words; formulas

The two initial stages in (34) have already been dealt with in presenting the Unmarked Alignment Hypothesis in the previous sub-section. At the next stage up, learners bring about a first innovation away from strict and simple canonical word order. This innovation takes place parallel to a general development of the learner's interlanguage in two important directions: first, the lexicon expands, in the sense that

more word categories are annotated and can build up their phrases; and secondly, utterances become longer, adding constituents other than those mapped onto the as-yet-underspecified canonical word order. Typical additions to canonical order at this stage are time and place specifications, as in (35a). More crucially, however, if for discourse or pragmatic reasons learners wish to give prominence to this new information, they now become able to place it in first position before the SUBJ, as in (35b). This will bring about a differentiation between the grammatical functions of TOP and SUBJ, because the TOP function will now be assigned to this new constituent rather than by default to the SUBJ. The less costly choice is that this new constituent be ADJ rather than an argument of the verb. And indeed Pienemann, Di Biase & Kawaguchi (2005: 232) report that empirical studies of the development of a range of languages identify ADJ among the first nonSUBJ constituents to occur in sentence-initial position. What matters most, at this XP + unmarked alignment stage, is that, whereas before direct mapping does not allow for the differentiation of SUBJ and TOP – and indeed there is no need to distinguish between them; i.e., if there is only canonical order, TOP is SUBJ –, now the appearance of an XP in first position triggers a dislocation of the SUBJ in its canonical first position and disturbs the close connection between SUBJ and TOP: the TOP function is assigned to the first constituent, and the SUBJ follows together with canonical order.

(35) a. I ow(n) my s(h)op in Sydney
b. in Vietmam no(t) no(t) the people not ow(n) s(h)op(s)

So far we have said that the adjunction of XP in first position, typically a time or space specification, triggers the differentiation between SUBJ and the discourse function TOP. This is why Pienemann, Di Biase & Kawaguchi (2005) call this the Topic Hypothesis. However, we can be more precise, and say that 'Topic' here, in (33)-(34), is used as a cover term for any discourse function, namely also for the function Focus. FOC in first position typically occurs with constituent questions in languages like English that front the question word, as shown in (36b, d). And, indeed, it is a well attested fact in English interlanguage that learners can front their question word at this stage. What, of course, they still cannot do is disrupting canonical word order, as shown in (37).

(36) a. Carmen is licking AN ICECREAM-FOC=OBJ in the garden
b. WHAT-FOC=OBJ is Carmen licking in the garden?

c. Carmen is licking an icecream IN THE GARDEN-FOC=ADJ
d. WHERE-FOC=ADJ is Carmen licking an icecream?

(37) *where you go?

Interesting as the development of interrogative sentences may be, in order to keep the matter simpler, we do not deal with them further here, and continue our discussion of the development of syntax by dealing only with topicalisation in declarative sentences. However, for a discussion of constituent question formation and the discursive function Focus within the LFG approach in a typological perspective, we refer to Mycock (2007); for an interpretation of learners' questions in English, see briefly § 2.2 in

chapter 2; and for an account of constituent question acquisition in Italian L2, see Bettoni & Ginelli's chapter ?.

At the next stage, a further innovation away from the Unmarked Alignment Hypothesis takes place. The crucial step forward here is no longer just the addition of a new topical constituent linked to a nonargument function in first position, but the fact that topicalisation assigns the TOP function to core functions other than SUBJ, typically to OBJ. What enables this to happen is that the learner can now specify the elements of canonical order by clear functional assignment to all costituents. The OBJ function as well as the SUBJ is now identified and appropriately assigned. This makes argument functions other than SUBJ sufficiently independent as to receive, by themselves, the assignment of a discourse function such as TOP. The placing in first position of a core grammatical function relating to arguments listed in the lexical entry frees up the canonical word order. All this obviously needs the S-procedure to be firmly in place. If no functional assignment marking were to signal to listeners that the first constituent is not SUBJ, they might take it as SUBJ, and misunderstand the message. Likewise, if the functional assignment of SUBJ is not clearly marked, the listener may confuse, in a topicalised structure, a focalised SUBJ with an OBJ.

In sum, in order to capture the learner' syntactic progress from a simple and strict canonical word order to a richer and looser one, PT's Topic Hypothesis predicts the three stages from t2 to t4 illustrated in (34): first, when word order is canonical, the alignment of c-structure onto f-structure is unmarked, and TOP and SUBJ coincide by default, with the latter underspecified. Then, when word order is still canonical, but an XP is added as TOP, the alignment is still unmarked, but TOP and SUBJ are differentiated. Finally, with the topicalisation of a core argument, the alignment is marked, and TOP is assigned to OBJ.

Empirical evidence for the Topic Hypothesis is reported in several studies across different languages and situations, such as Kawaguchi (2005) for Japanese, Di Biase (2007) for Italian, Zahn (2005) for Chinese, Yamaguchi (2008) for English, and Itani-Adams (2009) for Japanese-English bilingual acquisition, all of them within the PT framework.

The Lexical Mapping Hypothesis

The wish of the speakers to give prominence to a particular participant in the eventuality they are communicating to the listeners can result, on the one hand, in marked alignment between constituents and grammatical functions, as we have just seen in dealing with the Topic Hypothesis. On the other hand, it can result in nondefault mapping between thematic roles and grammatical functions. Notice, in fact, that topicalisation preserves the semantic role mapping to grammatical function; so, if agent is mapped on SUBJ, topicalisation does not affect their relationship, as we have seen in the Italian sentence in (27). In a parallel way, canonical word order can be unaffected by a change in the grammatical functions assigned to the thematic roles, as we have seen in the sentences in (25)-(26).

The way learners progress through the staged development of syntax, away from the rigidity of defaultness to the full freedom of optional choices allowed by their L2 in assigning functions to thematic roles, is dealt with by Pienemann, Di Biase & Kawaguchi's (2005: § 3.8) in their Lexical Mapping Hypothesis. These authors,

however, do not formulate it in a synthetic form, so we give our own formulation of this hypothesis in (38), and illustrate it in (39).

(38) In second language acquisition, as learners begin to use verbs with one or more arguments, they will initially map the most prominent role available onto the most prominent grammatical function, i.e., SUBJ, and henceforth use this default mapping until they learn to attribute prominence to other thematic roles by mapping, for example, the patient role (rather than the agent role) to SUBJ. Nondefault mapping of roles onto functions will occurr first with some lexical verbs, available in the target language input, which require it because of their intrinsic lexical features (e.g., exceptional verbs such as English 'receive'). Later on, learners will also be able to respond to discourse-pragmatic motivations expressed through nondefault mapping in a language-specific way (e.g., passives, causatives, benefactives).

(39) PT: Syntactic development based on the Lexical Mapping Hypothesis (after Pienemann, Di Biase & Kawaguchi 2005: 246)

STAGE	t1	t2	t3	t4
NONDEFAULT MAPPING	–	–	–	passives, causatives, benefactives
LEXICALLY NONDEFAULT MAPPING	–	–	exceptional verbs	exceptional verbs
DEFAULT MAPPING	–	default mapping & canonical word order	default mapping & canonical word order	default mapping & canonical word order
LEMMA ACCESS	single words; formulas	single words; formulas	single words; formulas	single words; formulas

As we have seen above with the Unmarked Alignment Hypothesis (cf. 32), initially learners will analyse the first NP as the highest thematic role available in the eventuality they are describing, and functionally assign it to SUBJ. However, for enhancing expressiveness, as their interlanguage develops, besides topicalising a constituent, learners may wish to attribute prominence to a thematic role such as recepient or theme by mapping it onto SUBJ. Or they may wish to de-focus a thematic role such as agent by encoding it as ADJ rather than SUBJ, or even suppress it altogether. In either case, this results in marked alignment brought about by lexical entries with nondefault a-structure. Among these, there are the so-called exceptional verbs, and passive verbs, as we have seen in (25)-(26).

Parallel to the path predicted by the Topic Hypothesis – i.e, that learners will proceed from unmarked to marked alignment, the Lexical Mapping Hypothesis predicts

that they will procede from default to nondefault mapping. This does not necessarily imply that learners will first use only nonexceptional and active verbs, and later on also exceptional and passive ones, althouth it is true that initially they may tend to avoid them. It means that, should these verbs be used, their partially known features will not allow for target-like functional encoding. Until S-procedure is firmly in place and assigns clear functions to constituents, canonical mapping can obviously mislead the hearer, as in (40a), where the speaker means to say what is said in (40b) – especially when both participants are animate, as in (41).

(40) a. *they don't interest that film
b. that film doesn't interest them

(41) a. * [call your Mother,] she worries you
b. you worry her

In (39), we hypothesise that learners will acquire exceptional verbs before passive verbs. This is because, in the case of exceptional verbs, the motivation for the Lexical Mapping Hypothesis is triggered exclusively by the intrinsic lexical nature of the verb, whereas in the case of passive verbs, the motivation is triggered by the lexical features of the verbs in interaction with the discourse-pragmatic attribution of TOP and FOC functions.

Empirical evidence for the Lexical Mapping Hypothesis comes mainly from Kawaguchi's study of Japanese L2 (cf. Kawaguchi 2005, 2007, 2009), two studies on the acquisition of passive voice in English, namely Keatinge & Keßler (2009b) and Wang (2009), and one by Bettoni, Di Biase & Nuzzo (2009) on the acquisition of postverbal subject. Less robustly supported by empirical evidence than the Topic Hypothesis, this Hypothesis needs further testing across different languages and situations, as will be mentioned in the Epilogue.

4.3. Interfacing developmental schedules

Interfacing morphological and syntactic development

As we have seen, with regards to morphology, PT claims that progress is determined by the syntactic level of the constituents whose features require unification (cf. § 4.1). This means that learners develop first lexical then phrasal and finally interphrasal morphology. With regards to syntax, PT claims that progress is determined by the way in which argument roles and constituents align with syntactic functions (cf. § 4.2). This means that learners develop from a rigid canonical word order to a freer order. How then do these two parallel developments interface? When in 2005 Pienemann, Di Biase & Kawaguchi add their extension to the original Pienemann's PT version of 1998, the interfacing between them is often mentioned, but not worked out in any detail. This is not the place to do so. We only state the problem in its broader form, in order to encourage further research (cf. the Epilogue).

The key issue here is functional assignment. As long as argument roles are mapped directly onto c-structure, canonical word order ensues by default, and there is no need to identify their grammatical functions: functions are assigned by default, and f-

structure is underspecified. However, expressivity may prompt discourse and pragmatic choices, which in turn may require to topicalise or focus constituents in ways other than the default ones, and hence displace them from their canonical place. When speakers wish to do so, constituents cannot remain underspecified, and functions must be assigned. This can happen only at the S-node, when the sentence procedure is in place, as clearly stated in Kawaguchi (2005; 2008: 92-93).

How syntactic functions are assigned formally is language-specific, with language typology playing an important role. A configurational language like English will do it mainly by means of position; a case language like Walpiri by means of case morphology. Chapter 2 will illustrate how three different languages develop their morphology and their syntax according to the general outline illustrated here above in (30), (34) and (37). In general terms, we can expect to find that, in L2 acquisition, morphology is harder to acquire than syntax. DeKeyser (2005: 7) reports the results of several SLA studies, such as Lardiere (1998), Prévost & White (2000), and Sprouse (1998); although they use formal approaches other than PT's, they provide evidence that morphological and syntactic features that are closely related in syntactic theory (i.e., verb raising and inflection) are not acquired together. He suggests that one way out of this problem, from the point of view of a theory in which such a link is seen as crucial, is the view that learners acquire the syntactic features easily but continue to have problems with their morphological instantiation, as shown in Sorace (2003), and Lardiere's summary of several of her own articles in Long (2003). Some evidence of this will be provided in chapter 2, other in the following chapters, other still will have to wait for further reasearch (cf. the Epilogue).

Interfacing Topic Hypothesis and Lexical Mapping Hypothesis

Beyond the common stage spelled out by the Unmarked Alignment Hypothesis, the Topic Hypothesis and the Lexical Mapping Hypothesis account for how learners develop beyond unmarked alignment and default mapping. Do these two developments occur in a parallel fashion? Empirical evidence will show the sequence in which structures such as those in (42b-d) will be learned (cf. the Epilogue). Suffice to mention here three set of factors.

(42)	a.	[unmarked alignment]	I named her Rosie
	b.	[topicalisaton]	Rosie I named her
	c.	[passive verb]	Rosie she was named / she was named Rosie
	d.	[exceptional verb]	she reveived the name Rosie

First, the Topic Hypothesis is triggered only by discourse-pragmatic factors, and motivates noncanonical word order in c-structure (and/or particular prosodic stress, depending on language typology) without reference to the feature structure of the verb lemma. In fact, the topic and/or focus in a sentence is established by the speaker at the conceptual level and is already present in the preverbal message, that is, before the lexical items are retrieved (cf. Levelt 1989). On the other hand, the motivation for the Lexical Mapping Hypothesis is triggered either exclusively by the intrinsic lexical nature of the verb (in the case of, e.g., exceptional verbs), or by the lexical features of the verb in interaction with discourse-pragmatic attribution of topic or focus (in the case of, e.g., passive verbs).

Secondly, although the Lexical Mapping Hypothesis predicts the acquisition of exceptional verbs before passive verbs, some of the verbs requiring 'only' intrinsically nondefault mapping seem very hard to acquire. This may be related to the complexity of their lexical features, which need to be learned verb by verb. This requires what Skehan (1998) calls "exemplar-based knowledge" (rather than "rule-based knowledge"). Since exemplar-based knowledge occupies a larger memory storage than rule-based knowledge, it is less economical for online language production, especially when responding to new situations.

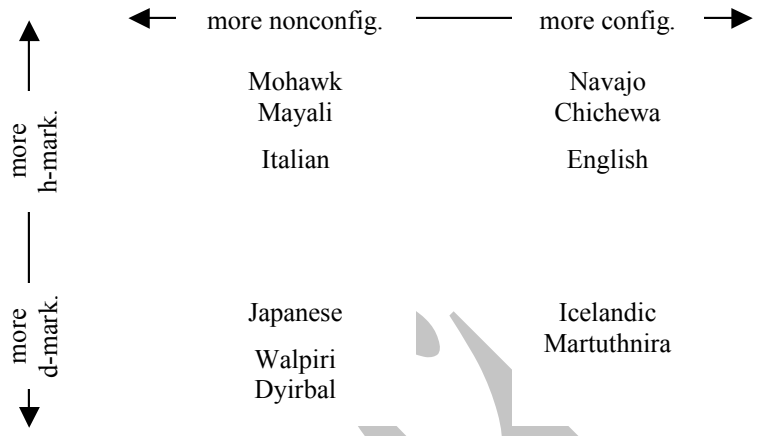
Thirdly, not only not all options in (42) are equally available in all languages, but different languages show a preference among them – as the akwardness of some of the English ones imply. So, regarding the interfaces between these two hypotheses, what is acquired first may be language-specific rather than universal. This matter is mentioned with reference to Italian L2 in Bettoni & Nuzzo's chapter ? below.

5. Language specificity

There are two sources of language specificity that the learner must acquire: the lexicon and c-structure.[14] They are linked via f-structure, which, although largely universal, is expressed in a language-specific way. In this regard, there are two important typological distinctions – or rather two typological continuums, because natural languages may freely mix their modes of organisation (Bresnan 2001:132). The first – as we have already seen with the two extreme cases of English and Warlpiri (cf. § 4.2) – is syntactic, and distinguishes among configurational and noncofigurational languages, that is, among those expressing f-structure information by position, and those expressing it by morphology. The second important distinction is morphological. Somewhere between the nonconfigurational and configurational ends of the continuum (Bresnan 2001: 113-114), it distinguishes among languages that are head-marking and those that are dependent-marking. These names indicate whether grammatical relations are marked inflectionally on the head element or on the depending element. For example, in order to indicate the SUBJ function in an NP$_{SUBJ}$-Verb sequence, if a language marks the verb by its agreement with SUBJ it is head-marking (assuming that the verb heads the sentence); on the other hand, if a language marks the NP by case-feature it is dependent-marking. Following Nordlinger (1998), the horizontal continuum in (43) concerns syntax (i.e., more or less configurational languages), and the vertical one concerns morphology (i.e., more head-marking or more dependent-marking languages).

[14] There is also prosody, which is an important issue, but we do not discuss it here, because it is just beginning to receive attention by LFG, and has not yet been dealt with by PT.

(43) LFG: Basic typology of expressing grammatical relations (after Nordlinger 1998:49)



With regard to configurationality, represented on the horizontal continuum in (43) here, we have shown in (22) above how a highly configurational language like English uses hierarchical phrase structure to encode grammatical functions such as SUBJ and OBJ. English in fact is one of those languages where OBJ belongs under VP, and SUBJ is outside VP. As a result English SVO word order is fairly fixed, to the extent that, if the two NPs before and after the verb are swapped, the meaning changes, as in (44).

(44) a. Jane hits Tarzan
b. Tarzan hits Jane

At the other end of the continuum, we have shown in (23) how a nonconfigurational language like Warlpiri uses morphological case marking on NPs, rather than syntactic phrases, to encode grammatical functions. This type of marking allows for a highly flexible word order.

With regard to morphology, represented in the vertical continuum (43), inflection can contribute to encoding grammatical relations in various ways. Like Warlpiri, also Italian and Japanese are a nonconfigurational language, albeit the latter two are less extreme, in so far as they do have a canonical word order (which is SVO in Italian and SOV in Japanese), and they do not allow elements belonging to the same NP to be broken up. This means that both these languages allow for some flexibility in word order. However, they differ from each other because they represent a case of head-marking and dependent marking languages respectively. We illustrate this difference by looking at their morphological encoding of the two core functions SUBJ and OBJ by means of agreement marking on the verb in the case of Italian, the more head marking language, and case marking on NPs in the case of Japanese, the more dependent marking. For example, in the two Italian sentences in (45), word orders are SVO and OVS; yet their referential meaning is the same. This is so because, when OBJ topicalisation disrupts canonical word order, the functions of both NP$_{SUBJ}$ and NP$_{OBJ}$ are

identified morphologically by two inflections of the verb: the former, which marks SUBJ, is identified by the verbal morpheme *–a*, agreeing with postverbal SUBJ; the latter, which marks OBJ, is identified by *lo*, the clitic marker coreferential with preverbal TOPOBJ (cf. § ?, ch. ?).

(45) a. Desdemona picchia Otello
Desdemona hits-3.SG Otello-MASC.SG
[Desdemona hits Otello]

b. Otello lo picchia Desdemona
Otello-MASC.SG him-MASC.SG hits-3.SG Desdemona
[Desdemona hits Otello]

Likewise, in the two Japanese sentences in (46), taken from Kawaguchi (2008: 96), word orders are SOV and OSV respectively; yet their referential meaning is the same. However, unlike in Italian, this is so because, irrespectively of their position, the function of the NPSUBJ is identified morphologically by the case-marking *–ga* for NOM, and the function of the NPOBJ by the case-marking *–o* for ACC:

(46) a. Mari-ga Takashi-o nagutta
Mari-NOM Takashi-ACC hit-PAST
[Mari hit Takashi]
b. Takashi-o Mari-ga nagutta
Takashi-ACC Mari-NOM hit-PAST
[Mari hit Takashi]

In sum, there are different devices for encoding grammatical relations in different languages. English, a configurational language, does it mainly through syntax. Italian and Japanese, two nonconfigurational languages, do it mainly through morphology: the former mainly by head-marking, the latter mainly by dependent-marking. PT claims that the learner's morphological and syntactic development can be predicted, by

(47) a. interpreting the different means by which a target language specifies its grammatical information, as indicated by an LFG-based description; and

b. identifying the procedural skills required for a particular linguistic operation, as indicated by Levelt's Model.

We will illustrate the relationship between language typology and PT by exemplifying the L2 developmental stages of English, Italian and Japanese in chapter 2.