Language Acquisition, Processing and Bilingualism

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Selected Papers from the Romance Turn VII

Edited by

Anna Cardinaletti, Chiara Branchini, Giuliana Giusti and Francesca Volpato

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INTRODUCTION

ANNA CARDINALETTI, CHIARA BRANCHINI, GIULIANA GIUSTI AND FRANCESCA VOLPATO

This volume includes selected and adapted papers from *The Romance Turn VII*, held in Venice on October 1-3, 2015. As for previous editions, the conference brought together researchers from across Europe and overseas with the aim of communicating results and developing further research in the acquisition of Romance languages.

The selected papers focus on a broad range of topics which are at the heart of the current debate on language acquisition (clitic pronouns, left-dislocations, passives, relative clauses, *wh*-questions) in a number of different acquisition settings: L1 and L2 acquisition, bilingualism, typical and atypical development. In addition to syntax, the volume covers other modules of grammar: semantics, pragmatics, and phonology, and adds a perspective on language processing to the current discussion on the acquisition of Romance languages. It mainly focuses on Italian, Brazilian Portuguese, and Romanian, in a comparative perspective with other Romance languages (Catalan, European Portuguese, French, Spanish) and languages of other language families (English, German, Persian, Sesotho, Turkish, etc.). One contribution on bilinguals with Greek as one of the two languages opens a perspective on a Balkan non-Romance language which may be interesting to be compared with Romanian.

This book also includes contributions to the debate on atypical language acquisition, in particular the underrepresented research on language development in case of deafness. One contribution also presents a study of language intervention based on formal linguistics.

The book is intended not only for scholars and students interested in the nature and processes behind first, second and bilingual acquisition, and impaired language acquisition focusing on Romance languages in Europe and beyond, but also for language educators and clinicians. It informs on the state of the art in the field of Romance language acquisition, with the aim of inspiring new research and interdisciplinary collaborations.

The volume opens with the chapter by **Marina Nespor** and **Alan Langus**, which discusses processing of rhythm in both L1 and L2 acquisition. In L1 acquisition, rhythm is crucial for bootstrapping into syntactic properties. Phrasal prominence is important for syntactic as well as semantic processing, for instance allowing us to disambiguate potentially ambiguous sentences. As for L2 acquisition in adulthood, Nespor and Langus suggest that the rhythmic cues are not processed in the same way as infants. When adults listen to speech, they do so through the filter of their native language, so-called 'native listening', not only at the segmental level, but also at the phrasal level. Furthermore, the perception of a new language does not only have to overcome the rhythm of the sound system of the L1, but also the rhythm of the visual input of gestures which accompany speech. Nespor and Langus close the chapter with an important suggestion for language education: "for a period just rhythm, not meaning". A rhythmic training might allow adults to process new languages in ways similar to infants. Starting with the acquisition of rhythm would allow second language adult learners to proceed like infants.

In her contribution, **Giulia M. L. Bencini** advocates for convergent theories of language representation and language processing in children and adults. She claims that linguistics should account for both grammar and processing. In other words, a full account of how humans represent, comprehend, and produce language requires an account of both competence and performance. Bencini reviews and discusses many methodological issues in the study of both comprehension and production, and in the last part of her chapter, she focuses on the acquisition of passives. Studies on syntactic priming lead us to conclude that the observed paucity of full passives before age 5 in many languages are not grammatical difficulties, but processing difficulties, which means that children have representations of the passive identical to adults. She also reports on cross-modal priming studies to argue for the existence of abstract representations common to comprehension and production, the One Cognitive System view.

João Claudio de Lima Júnior and **Letícia M. Sicuro Corrêa** also discuss a long-standing issue in the research on language acquisition, namely the comprehension of passive sentences by preschool children, based on the fact that different results are found in the research on different languages. They focus on children acquiring Brazilian Portuguese and use different tasks trying to disentangle the conditions which are claimed to favour passive comprehension, namely Discourse Continuity and Felicity. The results show that Discourse Continuity may

be a relevant factor for the comprehension of passives, at least for children around the age of 4, if the effects of reversibility are controlled for. Reversibility is in fact an independent source of cost that may add up to the burden of the syntactic parsing. Felicity, i.e., the presence of two potential agents, instead, did not turn out to be a facilitating factor for the comprehension of long verbal passives.

Vincenzo Moscati discusses the processing by preschool-age children of sentences containing left-dislocated subjects and focalized objects, coming in the two orders SOV and OSV. Prosody and discourse provide cues that disambiguate the sentence. Moscati tested the sensitivity to these two types of information through a judgment task. Adults and children were asked to judge whether the correction by one of the two characters engaged in a dialogue were correct or not. Results show that both adults and children were much more likely to accept true sentences in the SOV condition; in other words, the preferred parsing strategy is the one that interprets the first DP as the sentential subject. As for the OSV condition, adults dislike this word order in general, but they are sensitive to prosody: with the correct prosodic contour, this interpretation becomes more accessible to them. Children instead showed no visible improvement associated with the correct prosody in the OSV condition.

Fabrizio Arosio, **Valentina Persici** and **Elena Pagliarini** deal with processing of object clitics in Italian monolingual children. While most previous studies focused on the production of object clitics, they study the comprehension of these elements by Italian children aged 4;6 to 6 years. Using a looking-while-listening task, clitic comprehension was investigated with the clitic pronoun embedded in a discourse fragment, where the gender marking of the clitic should be used to identify the antecedent among different referential expressions previously introduced in the discourse. Results show that Italian-speaking children make use of the gender morphology to identify the antecedents of clitic pronouns in discourse. The syntactic function of the antecedent also influences this process. Comprehension accuracy is highest when the antecedent is the subject of the previous discourse and there is an adjunct competitor. Comprehension accuracy is however the same when the subject has an object competitor and the clitic refers to either the subject or the object. Finally, no difference was found between the comprehension of feminine and masculine clitics, which might be explained by the fact that the subject of the sentence containing the clitic pronoun was a first person singular pronoun, and no interference with the gender feature of the pronoun was found. This study also highlights the impact of memory resources on accuracy in the comprehension of object clitics.

The second part of the volume is devoted to two studies on bilingual acquisition.

Maria Andreou and **Ianthi Tsimpli** study the role of crosslinguistic influence and cognitive skills in measuring syntactic complexity in bilingualism and biliteracy. They focus on syntactic complexity in narrative production as a measure of language ability in bilinguals, analysing the frequency of complex over simple sentences and the types of subordinate clauses produced (i.e., relative, adverbial, and complement clauses). Since they also studied the effect of biliteracy on syntactic complexity, they tested children aged 8 to 12 years. Their findings suggest that bilingual children do not necessarily produce less syntactically complex clauses than monolingual children, provided that they have a rich vocabulary. More balanced literacy in the two languages was responsible for higher production of causal and temporal clauses, i.e., clauses which express cohesion between events in the narrative. This seems to confirm the beneficial role of biliteracy, a fact that requires more attention in education policies.

Elisa Di Domenico discusses the well-known optionality observed in L2 acquisition, e.g., in English speakers who are near-natives of Italian, who also use overt pronouns and preverbal subjects when natives would only use null and postverbal subjects, respectively. Di Domenico suggests that the optionality which characterizes L2 acquisition is evidence for transfer, relying on the idea that parameters are not specified in principles, but are to be conceived of as features on the heads of the functional lexicon. When in L2 acquisition, a given L2 item enters a syntactic derivation, it is possible to transfer or not the grammatical properties of the 'equivalent' L1 item. This produces optionality. The under-specified representation of lexical items is not due to the other language near-native speakers know, but is a general feature of language acquisition, given that in L1 acquisition, too, the acquisition of the [sound / meaning] pair of a lexical item precedes the acquisition of its grammatical properties.

The third part of the volume presents studies on typical and atypical language development.

Giorgia Del Puppo discusses the production of passives by school-age children (from 6;3 to 10;4), with the aim of finding out at what age the use of passive sentences by children becomes adult-like. She tested the very same children in four different tasks with the further aim of determining the conditions that favour the production of passive sentences. In addition to a task aimed at eliciting passive sentences, which contains patient-oriented questions, Del Puppo elicited other types of sentences (object relative clauses, cleft sentences, and wh-questions) in which the use of the

passive voice is possible. Results show that the highest percentage of passives is produced by school-age children in the task eliciting object relative clauses, as a means to turn the object relative into a subject relative. Del Puppo argues that the choice of a passive sentence depends on different factors. The production of passives in relative clauses is favoured because a simpler, canonical alternative is not available. Main clauses in which the passive is uniquely felicitous are instead rare; in these cases, it is always possible to find an acceptable active counterpart. Overall, whenever children until 9-10 years can exploit an active sentence, this is their preferred option, as for younger children. In spite of showing full competence of both the syntactic and the pragmatic properties of passive structures, school-age children are still different from adults, who use (a higher amount of) passive sentences in all tasks.

Larisa Avram and **Anca Sevcenco** deal with another important topic in the current debate on language acquisition, namely wh-questions. Testing preschool-aged Romanian children with a picture-matching task, they aim at identifying the role of number in the comprehension of subject and object wh-questions. Although in the number mismatch task, the children performed worse than in the number match one, number mismatch facilitated the comprehension of object *which*-questions. Furthermore, subject *which*-questions were significantly worse than subject *who*-questions in the number mismatch task, a result which is not predicted by the argument intervention approach, but is predicted by the AGREE intervention approach. The role of the DOM *pe* in Romanian is also discussed. The presence of *pe* enhances the comprehension of object *wh*-questions, but not of object *which*-questions. In spite of the presence of *pe*, *which*-questions feature two dependencies because they contain a resumptive clitic, which makes them more vulnerable.

The chapter by **Marina Augusto**, **Erica Rodrigues** and **Igor Costa** discusses a new construction of Brazilian Portuguese in which PP arguments have become syntactic subjects agreeing with the verb. The construction is also found with weather verbs, which end up being plural if the locative or temporal topic-subject is plural. In an elicited production study, this innovative construction is widely used by both adults and 5-year-old and 7-year-old children in order to exploit the construction of a subject relative instead of a relative clause built on a PP argument. The authors conclude that processing demands may play an important role in language change. An innovative structure, like the one studied here, may be preferred over the conservative competing structure when it implies less cost in the processing of language, subject relative clauses being less demanding than PP relative clauses.

Moving to atypical acquisition in case of deafness, two chapters focus on Italian children with cochlear implants and hearing aids, respectively.

Silvia D'Ortenzio, **Silvia Montino**, **Alessandro Martini** and **Francesca Volpato** report on two children with cochlear implants who showed weaknesses in the comprehension and production of relative clauses. These children were administered a protocol of language intervention based on formal linguistics and were explicitly taught verb argument structure, the Theta criterion, and syntactic movement used to derive relative clauses. Immediately after the intervention and some months later (2 and 5, respectively), the two children showed better comprehension and production of relative clauses. In addition, generalization effects were found. Non-treated structures and narrative skills (tested in one of the children) also improved, and improvement was maintained some months after the end of the treatment, a very encouraging result for clinical practice.

In the last chapter **Francesca Panzeri** and **Francesca Foppolo** tested the comprehension of metaphor and irony in a group of children with hearing aids, aged 8 to 11, controlling for both their linguistic skills and cognitive abilities related to the Theory of Mind (ToM). It is well-known that the understanding of non-literal language develops late in typically developing children, and that deaf children may show weaknesses in the development of grammar, with negative consequences on the development of cognitive skills and ToM. Results show that deaf children have a good understanding of metaphors, but have more problems in the comprehension of ironic stories. Controlling for age, Panzeri and Foppolo found an influence of both ToM and grammatical skills, with a more prominent role played by syntactic abilities. When children reach good grammatical abilities, their ability to understand the speaker meaning in metaphors and irony increases. The strong asymmetry between ironic criticisms and ironic compliments is explained by the fact that ironic compliments are less common in everyday interactions and that pragmatic factors such as social interaction experiences might facilitate irony comprehension.

In conclusion, the richness of discussed topics, the accuracy as far as methodological aspects of data collection are concerned, the numerous potential applications of the presented results make the volume an important contribution to the study of the acquisition of Romance languages. It will have an impact not only on theoretical research and methodological issues, but also on language education and clinical practice.

PART I:

LANGUAGE PROCESSING IN ACQUISITION

CHAPTER ONE

RHYTHM AND L2 ACQUISITION

MARINA NESPOR AND ALAN LANGUS

1. Introduction

Rhythm is order in movement, according to Plato (*The Laws*): the most general and thus most beautiful definition ever.

In human language, prosody – which includes both intonation and rhythm – is unavoidable: it characterizes all spoken languages, and is also found in sign languages (Nespor & Sandler, 1999), the gestures that accompany speech (Guellaï, Langus & Nespor, 2014), and the movements of the head, as well as the individual parts of the face such as the eyebrows and the mouth (Peña et al., 2016).

In order to understand linguistic rhythm, it is important to determine which elements establish the order in the rhythm of speech. In several papers with a number of colleagues, we have investigated rhythm in language and its role in language acquisition both in infants as well as in adults (Ramus, Nespor & Mehler, 1999; Peña, Bion & Nespor, 2011; Bion, Benavides & Nespor, 2011; Langus & Nespor, 2013, 2015; Toro & Nespor, 2015).

Rhythm, just as prosody, is hierarchical in nature. The lowest level – traditionally associated with rhythmic classes: stress-timed, syllable-timed, and mora-timed – has been proposed to correspond to %V (percentage of time occupied by vowels in the speech stream) and ΔC (standard deviation of consonantal intervals) in a given language (Ramus et al., 1999). Because the variation in consonantal intervals and the amount of vocalic space in continuous speech is at least partially determined by the complexity of the syllables, these cues offer information about the syllabic repertoire of a given language and thus also about the average size of common words. For example, languages with a large syllabic inventory – the so-called stress-timed languages – like Dutch or English (19 and 16 syllable types, respectively) have a low %V and a very high ΔC. At the other extreme of the segmental rhythm spectrum is Japanese – a so-called mora-

timed language (3 syllable types) – that has a very high %V and a very low ΔC. In the middle of the rhythmic spectrum are the so-called syllable timed languages, e.g. Spanish, Italian, and Catalan.

At the phrasal level, rhythm gives cues to word order, specifically to the basic relative order of heads and complements. The phonological phrase (PHPH), in fact, has trochaic (initial) prominence in object-verb (OV) languages and iambic (final) prominence in verb-object (VO) languages (Nespor & Vogel, 1986, 2007; Nespor, Guasti & Christophe, 1996). Importantly, the two prominences are realized in different ways: while prominence is always realized through higher pitch and intensity and longer duration, frequency and intensity are the main cues in trochaic phrases and duration in iambic phrases.

Head initial languages (VO) have PHPH final prominence; head final languages (OV) have PHPH initial prominence, as in the following English and Turkish examples:

(1)	VO	eat **a**pples,	for Gu**i**nevere
(2)	OV	elm**a** ye,	Mehmed**i**n için
		‘eat apple’	‘for Mehmet’

Given the different realizations of phrasal rhythm in OV and VO languages, it is feasible that prominence might be exploited by infants to infer the basic word order of the language to be acquired and thus bootstrap into the syntax of their language of exposure (Nespor, Guasti & Christophe, 1996). However, in order to do so, infants must be sensitive to the different realizations of prosodies of VO and OV languages. To determine infants’ ability to discriminate VO and OV prosody, we tested 6 to 12 weeks old infants with the non-nutritive sucking paradigm and showed that they discriminate French from Turkish. Because these two languages have similar syllabic structures and word primary stress, infants ability to discriminate could only have emerged on the basis of the location of phonological phrase prominence (Christophe et al., 1997). Importantly, the stimuli of the experiment consisted of both branching and non-branching phonological phrases. Since infants could only discriminate the branching, but not the non-branching phonological phrases, their ability could not emerge from different manifestations of prominences in the two languages for reasons independent from syntax.

Because the different realization of phrasal prominence in OV and VO languages could, in principle, also be simply a correlation that has no causal links between phrasal rhythm and the word order, we have tried to find more direct evidence for a link between prosody and word order. To

confirm that it is word order at the basis of the different types of prominence, we analyzed duration, pitch and intensity of the stressed syllable of objects in German, a language where the object can either precede or follow the verb, depending on the complementizer used, as seen in (3) (Nespor et al., 2008):

(3) Der Abend wird gut werden,
a. weil ich **Papa** sehe.
b. denn ich sehe **Papa**.
'It's going to be a nice evening, because I will see papa.'

The results show that stress on *Papa* is more realized trochaically through pitch and intensity in the first (OV) case and more iambically through lengthening in the second (VO) case. These results thus show that in languages where both object-verb and verb-object constructions are allowed, the prosodic prominence in phonological phrases changes between trochaic to iambic. These results would thus support the idea that infants and young children rely on prosody to bootstrap into the syntax of their mother tongue and help to explain why German and Dutch children acquire their native language with the same pace as children of languages with homogeneous prominence.

Because the analysis of speech utterances from German strongly supported a causal link between phrasal rhythm and word order, we returned to investigating how young infants and adults could exploit this relationship. The fact that infants hear the difference in phonological phrase prominence of a head-complement and a complement-head language does not directly mean that they can use it for establishing the relative order of head and complements in the language they are exposed to. The additional assumption has to be made that infants can segment the speech stream into phonological phrases. Otherwise in a sequence in which strong and weak elements alternate, such as ….swswswsw…, they would not know if the strong element is initial or final in its group. This puzzle is solved by the Iambic Trochaic Law (ITL), originally proposed for grouping in music (Bolton, 1894; Woodrow, 1951). According to the original proposal of the ITL, sequences of sounds that differ only in duration are grouped as iambs (weak-strong) and sequences of sounds that differ only in intensity are grouped as trochees (strong-weak).

The ITL has been proposed to account for rhythmic prominence in language on two different levels in the rhythmic hierarchy. The first concerns the prominence in feet where ITL accounts for the allocation of word secondary stress. If a language, in forming feet, systematically puts heavy syl-

lables at the right edge, then the rightmost syllable in the foot will be marked mainly by longer duration, whereas if a language ignores syllable weight in forming feet, then it will form trochaic feet by stressing the leftmost syllable through intensity (Hayes, 1995).

Importantly, the ITL describes the alternation of prominence, but lexical stress does not alternate. For example, both the word *cat* and the word *supercalifragilisticexpialidocious* only have one lexical stress. Because the assignment of secondary stress(es) is dependent on the number of feet within a word, the boundaries of perceptual groups of iambs or trochees do not necessarily correspond to word boundaries (i.e., there can be more than one foot in a word but only one lexical stress). The ITL proposed by Hayes (1995) does thus not define prominence at any unit other than the foot. However, the acoustic realization of prominence in feet occupies the lowest level in the prosodic hierarchy, and the secondary stresses are barely audible and often leveled. The rhythmic alternation of prominence in feet is therefore unlikely to significantly contribute to language perception and acquisition beyond the level of metrical feet.

The second level where the ITL accounts for rhythmic alternation is the level of phonological phrases. Interestingly, in phonological phrases pitch, in addition to intensity, characterizes trochees (Nespor, Shukla, van de Vijver, Avesani, Schraudolf, & Donati, 2008) and experiments in grouping both tones and syllables alternating in pitch in adults suggest that pitch, just as intensity, is predominantly grouped trochaically. This is interesting because phonological phrase level prominence shows that the original description of the ITL is too restrictive in terms of the cues that can cause the rhythmic grouping of elements. Instead, we believe and have carried out experimental work with the following re-formulation of the ITL:

(4) a. Elements alternating in pitch and/or intensity are grouped into trochees with the strong element (with higher pitch/intensity) preceding the weak one.
b. Elements alternating in duration are grouped into iambs with the strong element (with the longer duration) following the weak one.

We have thus shown experimentally that when Italian-speaking adults hear syllable sequences alternating in pitch/intensity, then they perceive trochaic (strong-weak) syllable pairs and when they hear syllable sequences alternating in duration they perceive iambic (weak-strong) pairs instead (Bion, Benavides, & Nespor, 2011). Interestingly, evidence with 7 months

old infants in the same study shows that they show preference for pitch initial but not for duration final groups. It is therefore likely that elements alternating in frequency are grouped according to the ITL earlier than elements alternating in duration. One reason for this asymmetry could be that the SOV order is the marked order for syntax, SVO being the unmarked one (Kayne, 1994). It is thus possible that pre-lexical infants perceive the basic word order in syntax that does not require prosodic bootstrapping, but are highly sensitive to the cue that signals whether the word order parameter has to be changed: i.e., the trochaic prominence that enables the switch from the unmarked VO order to the marked OV order.

Young infants are clearly sensitive to some of the prosodic cues signaling rhythmic grouping even before they begin to speak: in addition to being able to discriminate iambic phrasal rhythm in language from trochaic phrasal rhythm, they can also use these cues to group elements alternating in prominence into groups. We are currently thus working on the final link between phrasal rhythm, word order and the possibility that rhythm may help language learners to bootstrap into syntax. Because the ITL can only be useful for acquiring the word order of the language if listeners perceive the grammatical categories of nouns and verbs, it must also be experimentally demonstrated that phrasal rhythm can cause listeners to interpret words that carry phrasal prominence as objects and words that have no phrasal prominence as verbs. The final link in the puzzle of how prosody can bootstrap the word order of the native language is thus the primary focus of our future experiments.

2. Rhythm in second language acquisition

While the evidence for the rhythmic bootstrapping of syntax in infancy is promising, the research also raises the question whether phrasal rhythm could also be used in the acquisition of second languages (L2) in adulthood. The fact that adults are in general not very good in learning new languages appears to indicate that in adulthood, the rhythmic cues are not processed in ways similar to infants. An extensive body of research suggests that when adults listen to speech, they do so through the filter of their native language. For example, when French speakers listen to foreign languages they become stress-deaf, partially because the stress in their native language is so regular that it does not need to be taken into consideration when processing spoken language (Dupoux et al., 1997; Peperkamp & Dupoux, 2002). These effects, which are collectively called native listening, show that the experience we have with the sound of our native lan-

guage affects the perception of foreign languages. We thus listen to all language related signals natively.

While research on how and why native listening occurs has primarily been carried out at the segmental level of sound (Cutler, 2012), we have tried to investigate it at the phrasal level. We asked how Italian, Turkish, and Persian speakers group syllables alternating in pitch, duration or intensity (Langus et al., 2016). When Italian speakers listened to syllable sequences alternating in pitch and intensity, they perceived trochaic (strong-weak) groups, and when they listened to syllable sequences alternating in duration, they perceived iambic (weak-strong) pairs. These findings replicate the original grouping preferences with Italians. However, when Persian and Turkish speakers listened to the same syllable sequences, they always perceived trochaic (strong-weak) groups, regardless of whether the prominence was signaled with pitch, intensity, or duration. Because Italian (VO) marks phrasal prominence iambically and Persian (OV) as well as Turkish (OV) do so trochaically, the results suggest that the phrasal prominence in our native language can also selectively shape the way we perceive rhythm in foreign languages.

The native listening effects in phrasal rhythm perception make strong predictions about second language acquisition. Because Italian speakers succeed in grouping speech units both iambically as well as trochaically, they should have less problems in acquiring the prosody of new languages than speakers of Persian and Turkish, who only group speech elements trochaically. Because Italian is a verb-object language and Turkish and Persian are both object-verb languages, the results suggest that the word order of our native language can help us determine the specific problems we may face when learning the sound of new languages.

It is presently unknown how strong the native listening effects are and how persistent they can be when we learn a new language. Humans begin to lose sensitivity to the sounds that are not used in their native language starting from the first year of life (Werker & Tees, 1984; Maurer & Werker, 2013), suggesting that the norms of processing of sound in our native language become stronger and more resistant to change as we become older. We have no evidence that would indicate how much training it would take to over-come these preferences, or in fact whether it is possible to overcome them at all. However, our results from the native listening study do suggest that the differences between Italian speakers on the one hand, and Turkish and Persian speakers on the other hand, only occur with linguistic stimuli. When listening to tone sequences and looking at visual events alternating in pitch, intensity, and duration, participants from all languages followed the ITL without violations (Langus et al., 2016). This

suggests that the sensitivity to iambic rhythm is not entirely lost in speakers of OV languages – it can still be found in perceptual domains other than spoken language (i.e., the tones of music and the visually alternating events).

This may mean that training that exploits the differences between different perceptual domains – for example by comparing and contrasting spoken language and music – could be used to resensitize adult listeners to rhythmic grouping principles that are lost in language acquisition during development.

Furthermore, phrasal prominence is not only important for discriminating between rhythmically different languages, it is also directly related to the syntactic processing of spoken language (Nespor & Vogel, 1986; 2007). This is best shown by experiments where listeners have to disambiguate sentences that have two meanings. For example, in Italian, the sentences shown below have exactly the same words, but have two different meanings according to the way phrasal prominence is realized. We have shown that when Italian listeners can rely on the prosodic cues when listening to these sentences, they are very good at indicating which of the two meanings is intended – performance that declines when prosodic cues are eliminated or switched (Guellaï, Langus, & Nespor, 2014). This means that the phrasal prominence of our native language is important for syntactic as well as semantic processing. Native listening effects that cause listeners problems in correctly perceiving the grouping of elements alternating in duration can therefore also systematically hinder listeners' ability to process the syntax of new languages and understand what is said:

(5) ambiguous sentences can be disambiguated using phrasal prominence:

a. [[Come hai visto]$_{PP}$]$_{IP}$ [[la vecchia]$_{PP}$ [legge]$_{PP}$ [la regola]$_{PP}$]$_{IP}$
'As you saw, the old woman reads the rule.'
b. [[Come hai visto]$_{PP}$]$_{IP}$ [[la vecchia legge]$_{PP}$ [la regola]$_{PP}$]$_{IP}$
'As you saw, the old law rules it.'

The way listeners use phrasal rhythm for syntax processing is also interesting because prosody is not only carried by the sound but is conveyed also by various body parts, including the face and the hands. In fact, in the above mentioned study, Italian listeners were also shown videos of a person uttering these ambiguous sentences (Guellaï, Langus, & Nespor, 2014). Crucially, in half of the videos the sound and the video (that included the hand movements that accompany our speech utterances) matched, and in

the other half the sound was accompanied by the video of the opposite meaning. While participants were very good at indicating the intended meaning of the sentence when the gestures matched the speech, they began to choose more often the meaning of the sentence indicated by gestures when the sound and the video mismatched. These findings suggest that phrasal rhythm is not only present in the spontaneous gestures we produce when we speak, they are also actively used when we perceive spoken language. This means that the perception of a new language does not only have to overcome the rhythmic regularities we are accustomed to perceiving in the sound of language but also in the visual input of speech we receive.

The accumulating evidence of how phrasal rhythm is manifested in speech thus suggests that the prosody of our spoken utterances is automatically mapped not only to the sound of spoken language, but also to the motor-programs responsible for hand movements. This may suggest that learning a new language may, additionally to learning how to pronounce its sound, also entail learning how to map prosody to the bodily movements typical of a foreign tongue. Almost nothing is known about how the acquisition of new languages in adulthood affects the way we produce the bodily gestures that usually accompany speech. Yet the difficulties adults show in learning how to master the vocal production in a second language acquired late in life, suggests that also acquiring the co-ordination of motor-activity of the limbs with the rhythm of speech may require experience as well as training.

The last question we want to pose is: once rhythm is set for the native language, how hard is it to reset it in different ways? And if so, is a rhythmic training possible to allow adults to process new languages in ways similar to infants? We would like to propose that second language learners in adulthood should start with rhythm. What usually happens instead is that they try to memorize words. Thus, our proposal is that adults should be made to proceed as infants: for a period just rhythm, not meaning.

Given the word order mistakes people make in a foreign language learned in adulthood, they do not appear to use phonological phrase prominence to deduce the relative order of V and O. How to train them to connect prominence to the object, independently of its location with respect to the verb? How to make them proceed as in L1, i.e., concentrate on rhythm before concentrating on word meaning? In current work, we propose a training with rhythm to acquire the syntax of a new language in adulthood (Saksida et al., in progress).

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CHAPTER TWO

DEVELOPING CONVERGENCE: TOWARDS AN INTEGRATED DEVELOPMENTAL MODEL OF LANGUAGE PROCESSING IN CHILDREN AND ADULTS

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1. Introduction

This paper presents arguments for the benefits of convergent theories of language representation and language processing in children and adults. I use the term *convergence* to encompass both the theoretical, methodological, and educational aspects of this enterprise. Theoretically, convergence boils down to the claim that linguistics should account for *both* grammar and processing; methodologically the claim entails considering a broader range of data in addition to acceptability data; educationally, it entails forming linguists within the broader scope of cognitive science and neuroscience.

The core of the paper deals with the theoretical and methodological points that support the benefits of convergence. I find it useful to adopt the theory neutral definitions of the International Classification of Disability Functioning and Health (World Health Organization 2001; WHO-ICF for short) to ground the claim within the broader context of all of the disciplines that study language and communication from different perspectives. I will introduce the ICF framework in section 1.2 and situate the contributions of basic research in linguistics and psycholinguistics with reference to ICF domains. Section 2 outlines some open areas of inquiry at the interface between linguistics and psycholinguistics, organized around three general questions. Section 3 provides the psycholinguistic background to begin to provide answers to these questions, which is attempted in section 4.

Arguably, a theory that accounts for language competence and language processing is more complete and more useful than a theory of competence alone. Language comprehension and language production are *one* cognitive activity that humans engage in with language, and although not necessarily of interest to all linguists, comprehension and production are of interest to many. In this paper, I also aim to demonstrate that language processing can help resolve open research questions even when the primary interest is in grammatical competence and its development. Processing considerations must be taken into account whenever data obtained from language processing tasks – comprehension and/or production – are used to understand linguistic competence. I address some of the educational considerations with respect to the training linguistics students receive in the remainder of this introduction.

The claim that linguistics should deal with both competence and processing is, of course, not unique. In practice, the broadening of the scientific domain of linguistics is well on its way, at least in some countries, as evidenced by the number of linguistics programs that offer psycholinguistics specializations. In the US, many linguistics departments are training linguists to work as psycholinguists. To get a quick sense of these trends, we can eyeball the data provided by the Linguistics Society of America (LSA) Annual Reports concerning training and specialization areas offered by Linguistics Departments with doctoral programs. Among the Linguistics Departments with doctoral programs, the number of departments offering a psycholinguistics concentration area was 32 in 2013 and 37 in 2018. These estimates are to be compared with those for the more widespread classic concentration areas in syntax, semantics, and phonology. Estimates for syntax are: 49 in 2013 and 52 in 2018; phonology: 45 in 2013 and 45 in 2018; semantics: 42 in 2013 and 46 in 2018. A useful comparison is also with computational linguistics, another non-classic concentration area with a high appeal for its broader occupational outlooks: 20 programs in 2013 vs. 28 in 2018 (Linguistic Society of America, 2014, 2019). Specializing in processing (psycholinguistics) isn't any different than specializing in syntax, semantics, or phonology.

Everyone will agree that good science relies on good theories and solid methods. Despite lingering debates about linguistics as an empirical science (e.g., Gibson & Federenko, 2010, 2013), theoretical linguistics employs empirical methods just as much as psycholinguistics does, and conversely, psycholinguistics produces theories just as much as theoretical linguistics does. Linguists conduct experiments and collect behavioral measures obtained from live human participants (unlike, say, historical

linguists), typically in the form of speaker judgments. They rely on a linking hypothesis made explicit by linguistic theory that speakers' competence (a property of the underlying cognitive system) can be accessed this way. The cognitive construct (linguistic competence) will be reflected in the behavior (acceptability judgment) with a certain signal to noise ratio. This is just like any other area of cognition, as in, for example, the linking hypothesis that uses gaze-duration to reflect underlying attentive processes.

Decades of linguistic research have proven that experiments with acceptability judgments as their primary dependent variable yield good signal to noise ratios in many domains, especially in the domain of syntax, where most of the research using this method has been done. Recent large-scale studies have confirmed that the empirical base with respect to judgment data is solid and sound. Effects are reliable, replicable, and typically large (Sprouse, 2011; Sprouse & Almeida, 2012; 2017; Sprouse, Schütze & Almeida, 2013; see also Phillips, 2009; Phillips & Lasnik, 2003). Acceptability judgments are alive and well – there is every reason to be happy – especially at a time when other areas of science, ranging from the life sciences to medicine and the social sciences are challenged by replication failure (Marantz, 2019).

However, my claim is that a full account of how humans represent, comprehend, and produce language requires an account of both competence *and* performance. So if the linguist's interest is in processing, then, in addition to representational questions, questions about time-course, cognitive architecture, processing style, interaction with other cognitive domains such as long and short-term memory, etc. are no longer part of the "noise" part of the equation, they become directly part of the object of inquiry, and the methods used to study processing also become part of the tools of the trade.

In this paper, I present the argument that knowledge about language processing in adults and knowledge about the development of the language processing systems in young children, apart from being interesting topics in their own right, are relevant to competence theories, and especially to language acquisition theory and theories of language impairments. Take the case of language production data: what children or individuals with language impairments say (or do not say) may be the effect of missing/developing competence (immature/impaired grammars) but also of immature/impaired processing systems. Section 4.2 will illustrate this point using the acquisition of the passive to argue for a processing account of delayed passive acquisition, against a grammatical competence account. This one case will also bear on an important ongoing more general debate

in language acquisition: the early abstraction versus item-specificity account of young children's early sentence representations.

To conclude this section, acceptability is neither surpassed nor under attack, quite to the contrary. The success of acceptability should, however, not come at the expense of other measures such as reaction times, eye-gaze, response probabilities and error patterns, pausing and dysfluencies, hemodynamic or electrophysiological responses. Depending on the question and the linking hypothesis – how the measure reflects underlying cognitive activity, these measures are also part of the linguist's tool kit.

In order to carry out good experiments (robust, generalizable, replicable), linguistics students must be trained as cognitive scientists and be held to the same standards as in any domain of cognitive science/neuroscience. Research methods and data analysis courses are just as important as classic core areas (syntax, phonology, semantics, and pragmatics), and Linguistics Programs must include them in their common core.

1.1 Linguistics, psycholinguistics and speech language pathology in the ICF framework

The International Classification of Functioning, Disability and Health (ICF-WHO, or ICF for short) is a classification system that belongs to World Health Organization (WHO) family of international classifications and is the current international standard to describe and measure health and disability. [1] The ICF is a complementary bio-psycho-social classification system to the more widely known medical classification system called the International Classification of Diseases (ICD) which allows users to classify diseases by diagnosis through the use of an alphanumeric coding system (e.g, F81.0, *specific reading disorder*; F81.81, *disorder of written expression*). The ICF offers a broader and conceptually different classification system to the ICD. Like the ICD, the ICF is grounded in the body with a list of body *functions* and *structures* (e.g., The structures and functions of the nervous system), but, unlike the ICD, the ICF also includes lists of domains of *activity* and domains of *participation*.

I suggest that ICF is highly relevant to linguistics, psycholinguistics and speech-language pathology, and, conversely, advances in these disciplines contribute to the ICF. The ICF is a classification system, not a

[1] It was officially endorsed by all 191 WHO Member States in the Fifty-fourth World Health Assembly in 2001 (World Health Assembly, resolution 54.21).

theory.[2] Although the ICF is still primarily used in clinical settings, I believe that knowledge of the ICF is also useful outside of clinical contexts.[3] Because the ICF is neutral with respect to theory, uses simple descriptive labels and does not resort to specialized terminology or excessive jargon, it allows researchers and practitioners working in different disciplines and with different goals (e.g., linguistics, psychology, neurolinguistics, neuropsychology, conversational analysis, speech-language pathology; language technology) to situate their theories and findings in the relevant ICF domains. Familiarity with and use of the ICF is a common framework that also facilitates transfer of knowledge from more basic science (linguistics, psycholinguistics) to clinical practice (speech-language pathology). The ICF can also be used as a general framework across the curriculum in speech-language pathology where students must receive training in both basic and applied aspects of language, communication, hearing and speech (e.g., Bencini, Galletta & Cascella, 2013).

In the ICF, the term *functioning* is a neutral term and it refers to all body functions, activities and participation. Similarly, the term *disability* is a neutral cover term that applies to impairments, activity limitations and participation restrictions. Central to the ICF is also the recognition of the role of environmental variables on human functions, activities and participation so the ICF also includes lists of *environments*. Because the ICF adopts a person-centered view, environments are broadly defined as consisting not just of the physical environment but also including the social, relational and cultural environments. Just like the ICD, the ICF uses an alphanumeric coding system with letter codes to identify the major domains for human functions (**b** stands for body functions; **s** stands for body structures), activities (**d**) and environments (**e**). In addition to the major codes the ICF uses Qualifiers following the codes: numbers 0-4 indicate level of impairment (0=none, 4=complete problem). Further qualifiers have different meanings: In the Activity/Participation domains there is a distinction between a person's ability to perform a skill (e.g., carry out a conversation) in his/her natural environment (performance

[2] One could argue that the ICF *does* reflect theoretical approaches, for example in making the distinction between language as a mental function and communication as an activity. I will not pursue this issue further in this paper, but it does have consequences with respect to how one approaches assessment and treatment of language and communication disorders.

[3] The ICF framework can be adopted outside of medical or clinical settings, such as education (see Bencini, Garofolo & Arenghi, 2018 for an application to the contexts and environments of Higher Education).

qualifier) vs. performing the skill in a standard setting, such as a clinic (capacity qualifier). The capacity qualifier in turn consists of 2 digits, indicating a person's capacity to carry out the activity without assistance and capacity with assistance (e.g., a speech-language therapist's use of picture prompts, cueing, etc).

There are several chapters in the ICF that are relevant to linguistics and psycholinguistics. Both linguistics and psycholinguistics are mentalist approaches in that they view language primarily as a mental function. The relevant ICF chapter is a "b" chapter, indicating that it belongs to body structures and functions. The body structures relevant to language are primarily in the central nervous system, whereas speech and hearing involves the peripheral nervous system and the anatomy and physiology of speech/sign. The body functions related to language in the ICF are listed in their own macro-chapter called *Mental Functions of Language*, which is itself embedded under *Special Mental Functions*. The *Mental functions of Language* chapter has its unique identifying alphanumeric code (b167). It, too, is a macro-chapter containing additional chapters: b1670 indicates all of the chapters having to do with language comprehension (the ICF uses the term "reception"). These include separate chapters for spoken, written, and sign. Everything having to do with language production ("expression" in the ICF) is coded b167, and likewise includes chapter for spoken, written and sign.

In summary: within the ICF, all of the chapters in b167 are in the domain of linguistics and psycholinguistics. If the interest is also in communication (for example within more functionally oriented linguistic approaches including conversational analysis or discourse-pragmatic approaches; but also psycholinguist approaches to dialogue) all of the relevant chapters are included in a separate domain, called activities. Communication has its own large macro-chapter: d3. The alphanumeric code indicates that communication is an activity (not a core mental function) and this chapter encompasses everything that concerns communication, whether via language or other means.

To give a simple illustration of how the coding system works, consider the case of a person with language impairment – who, as the result of their language impairment, also has difficulties carrying out a conversation. The ICD does not have diagnostic codes for seemingly mundane things like "impaired conversation". The ICF does. The relevant ICF macro-chapter is d3 (Communication), specifically 3501 *sustaining a conversation* which is defined as "Continuing and shaping a dialogue or interchange by taking turns in vocalizing, speaking or signing, by adding ideas, introducing a new topic or retrieving a topic that has been previously mentioned" (ICF

2001). She/he would therefore receive a 3 (indicating severe impairment) on the corresponding activity, followed by a 2 code for capacity qualifier without assistance (indicating moderate impairment) in a standardized environment such as a speech-language therapy clinic and a 1 score for capacity with assistance. To summarize, the corresponding ICF code would be: d350.3.2.1. The code reads: severe impairment in conducting a conversation in a natural environment, moderate impairment in a standardized setting without assistance, mild impairment with assistance (example adapted from Bencini, Galletta & Cascella, 2013).

2. Open questions at the interface between linguistics and psycholinguistics

Research in linguistics and psycholinguistics has often been conducted independently, leaving several outstanding questions unanswered (e.g., Bencini, 2013, 2017; Marantz, 2005; Lewis & Phillips, 2015; Phillips & Eherenhofer, 2015). These questions are listed in (1) – (3):

1) *What is the nature of the relationship between the grammar and the processing systems? Specifically, are the grammar and the processing systems part of one or more cognitive systems?*

This question is foundational and has consequences both for studies of grammar and language processing, but very little research has addressed it directly. Lewis & Phillips (2015) discuss two alternatives: "One-System Hypothesis" vs. "Two-System-Hypothesis". They define a cognitive system as "a collection of cognitive mechanisms with a distinct purpose, operating over representations of a distinct kind" (p. 28). If the representations employed by the processing system(s) are qualitatively distinct from the representations employed by the grammar, the relevance of grammatical theories to understanding how humans comprehend and produce language would be seriously limited. In section 4.1, I argue that language production errors provide strong evidence that the units in production are always linguistic in nature and obey linguistic constraints at some level, even when what is produced is an error. Lewis & Phillips make a similar point for errors in comprehension, discussing the case of grammatical illusions. Another facet of the Two Systems Hypothesis concerns the relationship between language comprehension and language production. This important question is addressed separately as question 3.