On the Acquisition of the Syntax of Romance

Language Acquisition & Language Disorders 62

Edited by
Anna Gavarró

John Benjamins Publishing Company

On the Acquisition of the Syntax of Romance

Language Acquisition and Language Disorders (LALD)
ISSN 2213-428X

Volumes in this series provide a forum for research contributing to theories of language acquisition (first and second, child and adult), language learnability, language attrition and language disorders.

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John Benjamins Publishing Company
Amsterdam / Philadelphia

DOI 10.1075/lald.62

Cataloging-in-Publication Data available from Library of Congress:
LCCN 2018034778 (PRINT) / 2018048813 (E-BOOK)

ISBN 978 90 272 0177 5 (HB)
ISBN 978 90 272 6324 7 (E-BOOK)

John Benjamins Publishing Company · https://benjamins.com

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Introduction

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Most of the papers in this volume were presented at the Romance Turn VIII held at the Universitat Autònoma de Barcelona in September 2016. I am thus following in the footsteps of Vicenç Torrens and Linda Escobar, who edited a volume in this same series, Language Acquisition and Language Disorders, based on the first edition of the Romance Turn in 2004. Like theirs, this book is devoted to the acquisition of the syntax of Romance, an intensely researched topic, which has developed side by side with the study of adult syntax. Here we focus on three broad areas. The first part of the volume consists of several papers on passive sentences and related constructions, one of the longest-standing issues in the study of acquisition. The second part gathers papers on the development of two functional projections in the TP field, namely, pronominal clitics and negation. Finally, papers that explore the CP field and recursion comprise the third part of the volume.

The paper 'French experiencer verbs and the Universal Freezing Hypothesis' by Jason Borga and William Snyder explores the predictions of the UFH, initially proposed to explain delay in the acquisition of the passive. It focuses on Subject-Experiencer (SE) and Object-Experiencer (OE) predicates in French and adopts the analysis by Belletti and Rizzi for OE verbs. Under this analysis, OE derivations involve the additional operation of smuggling and, thus, by the UFH, are predicted to be a late acquisition (in contrast with SE verbs). This prediction is supported.

The paper 'Discrimination of passive predicates by Brazilian Portuguese-speaking children' by João Lima Júnior, Marina Augusto and Letícia Corrêa capitalises on a feature of Brazilian Portuguese: the existence of three different auxiliaries corresponding to verbal passives, resultatives and statives. Their experimental results show that children are able to distinguish these auxiliaries at an early age.

The paper by Jesús Oliva and Ken Wexler 'The acquisition of Spanish passives: The comparison between subject experiencer versus actional verbs and direct aspectual semantic evidence for the adjectival interpretation' considers another language, namely Spanish, with two auxiliaries, one for adjectival, one for verbal passives. They test the comprehension of actional and subject-experiencer verbs

https://doi.org/10.1075/lald.62.01gav

and find delay in the comprehension of passives when compared to actives, and further delay in the comprehension of passives of SE verbs. Furthermore, they show that children's target performance with passives under the standard experimental conditions is in fact the result of the adjectival interpretation of the verbal passive, which emerges in other experimental settings.

In 'Favorable processing conditions in the production of passive sentences by Brazilian Portuguese-speaking children,' João Lima Júnior, Letícia Corrêa and Marina Augusto explore priming as a condition which may facilitate the production of passives. They report two experiments; in one, a character is kept constant throughout, and is the natural discourse topic. In this setting, children produce passive sentences at ages 3–4 and 5–6. In a second experiment, when the discourse topic is not enforced, children still produce passives, although to a lesser extent. These results are at odds with those of previous studies and unexpected under several theories on the acquisition of passive (e.g., by Hyams and Snyder, Hirsch and Wexler, and others) – and thus raise many questions for future research.

In Part II, the chapter by Marina Nardelli and Maria Lobo 'Clitic omission in bilingual Portuguese–Spanish acquisition' considers the acquisition of third person object clitics in bilingual Portuguese–Spanish children. This language comparison is interesting as third person object clitics are very similar in the two languages, but alternate with a null object in one (Portuguese) and not in the other (Spanish). The authors compare the bilinguals to two groups of monolinguals. Even though the bilinguals omit more often than the monolinguals (especially in Spanish), they show sensitivity to the properties of clitics in the two languages, and to the distribution of null objects in Portuguese.

Also dealing with clitics, the paper 'Syntactic awareness of clitic pronouns and articles in French-speaking children with autism, specific language impairment and developmental dyslexia' by Maria Teresa Guasti, Hélène Delage and Stephanie Durrleman considers awareness of pronominal clitics and determiners as measured by grammaticality judgment in three populations. The study reported is part of a larger line of inquiry on the similarities and differences between these populations, since Autism Spectrum Disorder (ASD) has been assimilated to SLI in some respects, and SLI and Developmental Dyslexia (DD) are often comorbid. The results show that ASD children, a subgroup of them in particular, perform worse than all other groups in pronominal clitic and determiner awareness. For the SLI and DD groups, judgments on determiner omission were more accurate than pronominal clitic omission. Two general conclusions can be drawn: determiner and pronoun clitics are affected differently in all these pathologies, and ASD has a deeper effect on grammaticality than previously thought.

The chapter by Shenai Hu, Maria Vender, Gaetano Fiorin and Denis Delfitto 'The comprehension of Italian negation in Mandarin-Italian sequential bilingual

children' measures response time and interpretation of negation in four conditions: true affirmative contexts, true negative contexts, false affirmative contexts and false negative contexts. The authors consider monolingual Italian and sequential bilingual Chinese-Italian children and test the two-step simulation hypothesis, whereby a negative sentence is more difficult to process than an affirmative one. Their results fulfill that prediction, and surprisingly bilinguals sometimes outperform monolinguals.

Starting Part 3, the chapter 'Subject position in Spanish as a heritage language in the Netherlands: External and internal interface factors' by Brechje van Osch and Petra Sleeman deals with subject distribution in heritage speakers of Spanish. The authors find that, while these speakers are able to place subjects just like native speakers in relation to verb type (unergative vs. unaccusative) and topic-hood, they are different from natives with respect to definiteness, a feature not previously investigated. The discrepancy in results between compromised definiteness and target-like topic-hood, both discourse-related features, casts doubt on the Interface Hypothesis.

In 'Acquisition of backward anaphora in European Portuguese by Chinese learners,' Yi Zheng investigates backward anaphora pronoun resolution by native speakers of European Portuguese and L2 learners whose first language is Chinese, in syntactic contexts in which a pronoun appears in an adjunct CP clause. Two strategies are at play in the interpretation of pronouns: the Position of Antecedent Strategy (PAS) and an active search mechanism; each makes different predictions for European Portuguese. The results of a preference experiment show that native speakers contemplate both subjects and objects as antecedents, while advanced learners prefer subjects (resulting from the universal search mechanism), overruling the PAS more often.

In recent years the study of language acquisition has experienced enormous growth in relation to impairment. Silvia Silleresi, Laurie Tuller, Hélène Delage, Stephanie Durrleman, Frédérique Bonnet-Brilhault, Joëlle Malvy and Philippe Prévost report a study of grammar in Autism Spectrum Disorders in their chapter 'Sentence repetition and language impairment in French-speaking children with ASD.' They find that in a sentence repetition task the ASD group splits into two subgroups: the language-impaired, who performed like an SLI group matched on mental age, and the language-normal, who performed like the typically developing. Further associations between non-verbal IQ and performance lead the authors to reflect on the relation between cognition and language development in ASD, a much-debated issue.

In the chapter 'On the comprehension of recursive nominal modifiers in child Romanian' by Anca Sevcenco and Larisa Avram, the authors address the interpretation of recursive PP and relative clause nominal modifiers by 5- and 7-year-olds in

a language, Romanian, in which there is a syntactic recursive marker in both constructions – unlike in the languages previously investigated. They find that, despite this overt marker, children tend to interpret these modifiers differently from adults some of the time, reverting to an interpretation of them as coordinated structures. This is consistent with the findings for other languages, some outside Romance, and suggests that overt recursive marking does not boost adult performance.

One of the hidden pleasures of editing a book is being able to read the reviews, often first-rate academic work in themselves. In the case of this volume, I owe full-hearted acknowledgement to all those who have acted as reviewers: Larisa Avram, Anna Bartra, Anna Cardinaletti, Alejandro Cuza, Kamil Deen, Laura Domínguez, Kleanthes Grohmann, Shenai Hu, João Lima Júnior, Maria Lobo, Silvina Montrul, Magda Oiry, Ana-Teresa Pérez-Leroux, Mihaela Pirvulescu, Philippe Prévost, Ana-Lúcia Santos, Michele Sheehan, Jeannette Schaeffer, Cristina Schmitt, Anna Maria Di Sciullo, Ludovica Serratrice, Carla Soares-Jesel, Imanol Suarez-Palma, Rozz Thornton and Laurie Tuller. My thanks go as well to projects FFI2014-56968-C4-1-P and FFI2017-87699-P, and to Anna Espinal and Ester Boixadera from the Servei d'Estadística Aplicada at the UAB for last-minute help. I am grateful to Kees Vaes, Susan Hendriks and the John Benjamins team for their work in the production of this volume. Finally, I owe an acknowledgment to the series editors, Roumyana Slabakova and Lydia White, for their suggestions and support throughout.

Bellaterra, April 2018

PART I

The acquisition of subjects

Passives, experiencers and other constructions

French experiencer verbs and the Universal Freezing Hypothesis

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The Universal Freezing Hypothesis (UFH) of Snyder and Hyams (2015) predicts that the developmental time course of English *be*-passives follows from younger children's inability to make exceptions to the Freezing Principle, required for smuggling derivations, where mature speakers can. Recent research (Belletti & Rizzi, 2012) indicates that Object-Experiencer (OE) verbs, but not Subject-Experiencer (SE) verbs, require smuggling. We use French to test the resulting prediction of the UFH: mastery of French OE verbs should be late, after age 4, but SE verbs are mastered much earlier. Analysis of longitudinal spontaneous-speech data from 11 children acquiring French indicates that OE verbs are infrequent in children's speech prior to age 4, while SE verbs are present earlier, usually by age 2.

Keywords: French, L1 acquisition, Relativized Minimality, experiencer verbs

1. Introduction

The acquisition of English *be*-passives has been studied extensively, and most researchers report that it occurs quite late. With *be*-passives of actional verbs, children rarely succeed before the age of 4, and with *be*-passives of non-actionals, they seldom achieve full mastery until at least age 6 (e.g. Maratsos et al., 1985; Orfitelli, 2012). In contrast, successful production and comprehension of English *get*-passives has been found as early as age 2 or 3 (Turner & Rommetveit, 1967a, 1967b; Harris & Flora, 1982; Crain & Fodor, 1993; Slobin, 1994).

In part to explain this difference in timing, Snyder and Hyams (2015, S&H) propose the Universal Freezing Hypothesis (UFH). Following Collins (2005a,b), S&H take the English *be*-passive to require smuggling, and according to Collins, smuggling is only possible when an exception can be made to the Freezing Principle (Wexler & Culicover, 1980; Corver, 2006). The UFH, in turn, says that

https://doi.org/10.1075/lald.62.02bor

these exceptions are simply unavailable to children younger than about age 4, on account of a maturational delay.[1] One possibility, according to S&H, is that the intricate syntactic structures created by smuggling (i.e., by violating the Freezing Principle) simply cannot be processed, until the child has the computational resources that become available later in development. In any case, the key difference between *be*-passives and *get*-passives, according to S&H, is that certain types of *get*-passive can be derived without smuggling, and hence without violating the Freezing Principle.[2,3]

Guasti (2016) notes similarities between the English *get*-passive and *be*-passive, on the one hand, and the Romance causative constructions *faire-par* and *faire-à*, respectively. Based on these parallels Guasti speculates that the acquisition of the Romance causatives will pattern with the English passives: that is, *faire-par* will precede *faire-à*. In our work elsewhere (Borga & Snyder 2018; B&S) we tested Guasti's conjecture empirically and found support for it. Then we showed how the UFH can account for the causative findings, provided one assumes a slightly updated version of the Freezing Principle. Finally, we derived and tested the predictions for

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1. A major concern of S&H is to explain why certain studies, exceptionally, find good performance on long *be*-passives, even with non-actional verbs, in children younger than four. As S&H observe, in a number of cases the experimenters introduced a feature such as + Topic (cf. Pinker, Lebeaux, & Frost, 1987) or + WH (cf. Crain, Thornton & Murasugi 2009) on the derived subject. In the version of Relativized Minimality developed in Rizzi (2004), this has the effect of eliminating the minimality violation, and hence the need for the child to use smuggling. Similarly, S&H discuss findings from the Bantu language Sesotho, where Demuth (1989, et seq.) has reported that two-year-olds already use passives. S&H note that Sesotho is a language in which the surface-subject position is obligatorily + Topic; hence, these findings too are fully compatible with the UFH.

2. Here we are focusing on *long be*-passives (i.e., those with a *by*-phrase). In the acquisition literature on English, there is considerable disagreement as to whether short passives cause the same types of difficulties. Guasti (2016) summarizes work on short passives, and notes that some of the discrepancies across studies may be due to differences in whether the experimental materials satisfied pragmatic felicity conditions. One possibility, in keeping with S&H's proposals for long passives, is that efforts to satisfy pragmatic felicity conditions may have introduced a feature of + Topic, + Focus, or + WH, and thereby eliminated the need for smuggling. Another possibility is that children showing early success on the short passive were employing adjectival passives, along the lines first proposed by Borer and Wexler (1987) (see also Fox & Grodzinsky, 1998; but for an argument against an adjectival analysis, see Messenger et al., 2011).

3. To account for the still greater delay seen when the passivized verb is non-actional, S&H propose that *be*-passives of this type require not only smuggling but also semantic coercion, along the lines of Gehrke and Grillo (2008). The idea is that semantic coercion, like smuggling, is subject to a developmental delay, which in this case renders it unavailable until around age 6.

causatives of intransitive verbs, which vary as a function of whether the verb is unergative or unaccusative. Again, the evidence we examined provided clear support.

Another potential application of the UFH is to the acquisition of Object Experiencer (OE) verbs. Under the analysis presented in Belletti and Rizzi (2012), the lower Theme argument must move past the higher Experiencer; hence, smuggling is required in order to avoid an RM violation. By contrast, Subject Experiencer (SE) verbs do not require smuggling, as the Theme does not undergo promotion past another argument. We thus predict that SE verbs will be mastered significantly earlier than OEs. Below we test this prediction, and find considerable support.

To situate the present work, we will begin (in Section 2) by reviewing the B&S paper in considerable detail. Section 3 will go on to present Belletti and Rizzi's (2012) analysis of experiencer verbs in Romance, followed by our test of the resulting predictions of the UFH against evidence from children acquiring French. Section 4 will summarize and conclude the paper.

2. Prior research

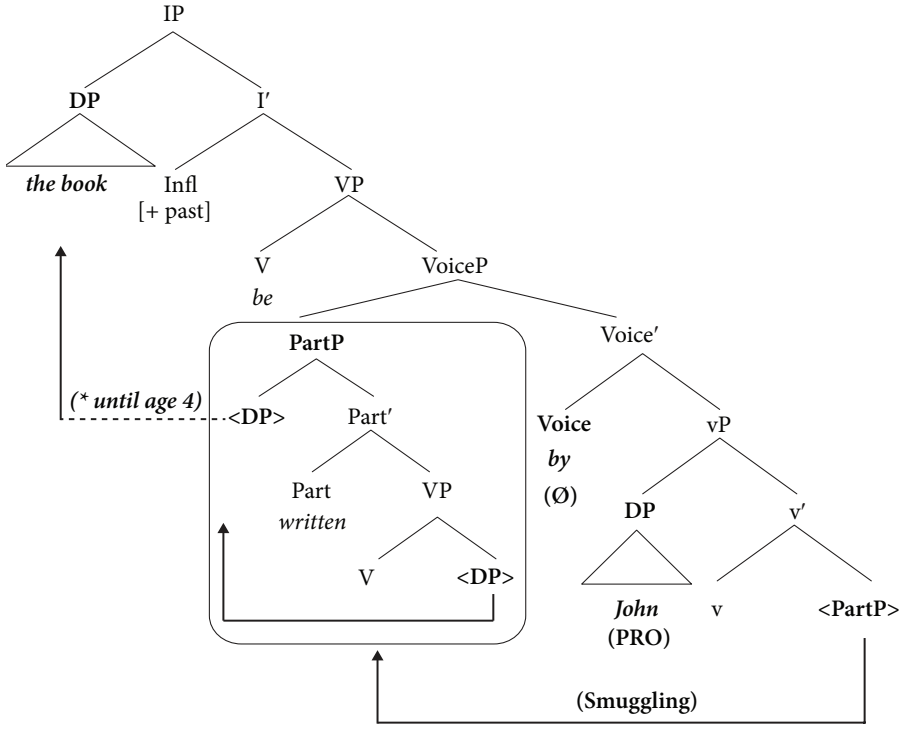
As outlined above, S&H (2015) account for the lateness of English *be*-passives in terms of a freezing effect. For the syntax of the passive, they adopt the analysis of Collins (2005a,b), which is based on a strict interpretation of the Uniformity of Theta-Assignment Hypothesis (UTAH; Baker 1988, p. 46; 1997, p. 74). Under Collins's interpretation, a verb's external θ-role must be assigned in exactly the same way in active and passive sentences, namely to the specifier of *v*P. In a passive the external argument is realized either as a PRO, in the case of a short passive; or as an overt DP (preceded by the overt Voice-head *by*), in the case of a long passive.[4]

Consider the *be*-passive in (1). Given the presence of the external argument *John* in Spec-*v*P, simple argument-movement of the object DP *the book* into Spec-IP would violate Relativized Minimality (Rizzi, 2001, 2004). The solution proposed by Collins is that the object is 'smuggled' past the external argument, inside a larger phrase, after which it raises to surface subject position without a Minimality violation, as shown in (2).

(1) *The book was written by John.*

4. A UTAH-motivated proposal similar in spirit to Collins (2005a,b) is made in Boeckx (1998); additional works along the same lines include Hornstein, Martins and Nunes (2008) and Lima Júnior and Augusto (2015).

(2) (cf. Collins, 2005a, pp. 90, 95)

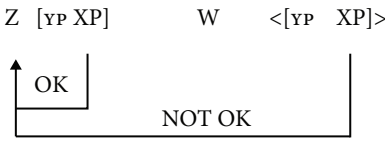


In (2) the V *write* raises to the head of PartP and forms the participle. Smuggling occurs when the entire PartP, including the object, raises past the external argument in Spec-*v*P and lands in the specifier of the passive Voice phrase. From here the object DP can undergo cyclic movement into subject position in a fashion compatible with Minimality.

Collins (2005b, p. 292) defines 'smuggling' in terms of the schematic in (3): Prior to movement, the constituent XP cannot be directly related to Z, due to an intervening element W. Yet, after movement of the larger constituent YP to a position from which it c-commands W, XP can be related to Z. In this case, YP "smuggles" XP past W.[5]

(3) Smuggling: (Collins 2005b, p. 292, example 6)

5. Collins (2005a,b) does not require the movement of YP in (3) to be feature-driven, except insofar as XP may need to enter into a feature-checking relation with Z. Gehrke and Grillo (2008) have worked out a possible feature-driven version of smuggling for the case of English *be*-passives, in which a VP-shell is attracted to Spec-VoiceP by a feature of passive Voice. S&H assume that some version of this feature-based approach can be maintained, and the same assumption will be made here.



In the cases of smuggling discussed in Collins (2005a) and (2005b), the relation between XP and Z is one of movement: the relation created by moving XP to position Z. In principle though, we see no reason to restrict the relation to movement; a relation between Z and XP that is created by AGREE, for example, could likewise be blocked by an intervener W, and could likewise become possible after moving YP. (This idea will play an important role below.)

The entire concept of smuggling hinges on the idea that the Freezing Principle (proposed independently in Ross, 1967/1986 and Wexler & Culicover, 1980), while generally obeyed, allows some exceptions. One formulation of the principle, a modified version of the formulation in Müller (1998), is given in (4). Under (4), the object smuggled within PartP should be frozen to further syntactic operations, and therefore unable to undergo raising into subject position. Collins (2005a,b) concludes that there must be certain situations in which the Freezing Principle fails to apply, although he does not attempt to spell these out.

(4) Freezing Principle (modified): In the following configuration, no operation (such as Move or AGREE) may relate X and Z: * Z … [$_{Y}$ … X …] … <Y>

Note that the Freezing Principle is normally discussed in relation to movement. Yet, in keeping with the idea (above) that smuggling can also have the effect of making AGREEment possible, B&S propose that the Freezing Principle can correspondingly have the effect of blocking AGREEment. (Hence, AGREE is mentioned explicitly in 4). This modification accords with the view, advanced by Chomsky (2000, 2001) and adopted in much of the recent syntax literature, that movement operations are intimately connected to the establishment of an AGREE relation.

2.1 The Universal Freezing Hypothesis and the acquisition of *be*-passives

The role of smuggling in the late acquisition of the *be*-passive, according to S&H (2015), is connected to a difference between adults versus children under 4 in their capacity to make the required exception to the Freezing Principle. In children this young, the Freezing Principle applies in every possible environment, and thereby renders smuggling completely impossible. This blocks the *be*-passive, because without smuggling, the underlying object cannot make it past the intervener to

reach subject position.[6] S&H formulate this hypothesis as the Universal Freezing Hypothesis (UFH), as stated in (5).

(5) The Universal Freezing Hypothesis: For the immature child (until about age 4), the Freezing Principle always applies. No subpart of a moved phrase can ever be extracted.

Thus, under the UFH, the observed delay in acquisition of *be*-passives is accounted for.

2.2 The UFH and the acquisition of *get*-passives

In contrast to *be*-passives, English *get*-passives are produced and understood by the age of 2 to 3 years (Turner & Rommetveit, 1967a, 1967b; Harris & Flora, 1982; Crain & Fodor, 1993; Slobin, 1994). While the underlying structure of *get*-passives is controversial, one influential view is that there are multiple types of *get*-passive, each with its own structure (Reed, 2011, p. 42). S&H (2015) contend that at least the types of *get*-passive that are produced and understood by children younger than 4 do not contain an external argument.

Note that the unacceptability of a purpose clause in a sentence like (6a) is expected, if the type of *get*-passive in (6a) is incompatible with the presence of a silent external argument, because in that case there will be nothing to control PRO. Similarly, we assume that an agent-oriented modifier like *on purpose* requires the predicate that it modifies to assign an Agent theta role, and the problem in (6c) is that no Agent theta role is present.[7]

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6. An alternative proposal regarding the role of smuggling in acquisition can be found in Belletti (2016a).

7. Admittedly the judgments in (6a),(c) are somewhat delicate. As noted in Reed (2011) and Alexiadou (2012), clauses requiring an agent can be grammatical with certain *get*-passives, in appropriate contexts. An explanation is provided by the aforementioned existence of multiple underlying structures associated with the *get*-passive, as in (i)–(iii), taken from Alexiadou (2012: 1088).

(i) $[_{TP}$ *Samantha*$_i$ got $[_{CP/TP}$ PRO$_i$ *hurt*$]]$ causative control *get*
(ii) $[_{TP}$ *Samantha*$_i$ got $[_{PartP}$ *hurt* t$_i$ *by a truck*$]]$ verbal passive
(iii) $[_{TP}$ *Samantha*$_i$ got $[_{PartP}$ t$_i$ *(very) hurt*$]]$ adjectival passive

Alexiadou posits that the role of context in differentiating among (i)–(iii) is related to the underspecification of the non-active Voice head associated with *get*-passives; in addition to a Passive Voice head which selects for an overt agent/PRO, *get* appears with a Middle Voice head lacking an external argument. In terms of the UFH, the *get*-passives of types (i) and (iii), where the main verb (*hurt*) does not assign an external theta-role, are the ones that should be available prior to age 4.

(6) a. **The ship got sunk* [PRO *to collect the insurance*].
b. *The ship was sunk* [PRO *to collect the insurance*].
c. **The book got torn on purpose.*
d. *The book was torn on purpose.* (cf. Fox and Grodzinsky 1998: 327)

Examples (6a) and (6c) contrast minimally with their countarparts (6b) and (6d), where the auxiliary is *be* and the Agent theta role is clearly present. Indeed, in the case of (6b), the people collecting the money must be the same ones who sank the ship.

Thus it appears that there exist certain types of *get*-passive, as in (6a), (6c), that actually cannot have an external argument in their syntactic representation. If so, these types will certainly contain no intervener, and the promotion of an object into subject position will not require smuggling. Accordingly the Freezing Principle will not be violated, and the UFH is fully compatible with children's early success on these *get*-passives, and indeed on any other type in which the external argument either must be, or can be, left syntactically unexpressed.

2.3 Guasti's conjecture for Romance causatives

Within the Generative tradition there exists an extensive literature on French *faire*-causatives, dating to Kayne's (1975) analysis dividing them into two main types, the *faire-infinitif* (referred to here as *faire-à)* and the *faire-par.* In *faire-à* (FA) causatives with a transitive lower verb, the causee is obligatorily realized as either a dative-marked DP following the embedded object, as in (7a), or as a dative clitic preceding *faire*, as in (7b). The causee in the *faire-par* (FP) causative, (7c), instead appears in an optional *par*-phrase, following the object of the lower verb.

(7) a. *Jean a* ***fait*** *laver la voiture* ***à*** *Paul.*
John has made to-wash the car DAT Paul
'John made Paul wash the car.'
b. *Jean lui a* ***fait*** *laver la voiture*
John him-DAT has made to-wash the car
'John made him wash the car.'
c. *Jean a* ***fait*** *laver la voiture (****par*** *Paul).*
John has made to-wash the car (by Paul)
'John had the car washed (by Paul).'

Alongside the difference in causee phrases, there exist a number of semantic differences. Crucially, Guasti (2016) notes that the semantic restrictions on FPs, alongside the (absence of) corresponding restrictions on FAs, closely parallel the semantic restrictions on *get*-passives and *be*-passives, respectively. Stative verbs

(e.g. *loved* and *aimer*, as in 8a and 8b) are rejected in both *get*-passives (e.g. Hirsch & Wexler, 2006) and FPs.

(8) a. ?*John got loved.
b. ?*Ils ont **fait** aimer Jean (**par** Marie).
they have made love John by Mary
(?*) 'They had John loved (by Mary).'

Guasti (2016) also notes that both *get*-passives and FPs require their Patient argument to be "affected" by whatever sort of action the verb describes. In (9a, b) the 'answer' is not in any way affected (i.e. changed) when someone finds it.

(9) a. ?*The answer got found.
b. ?*Ils ont **fait** trouver la solution (**par** le chercheur).
they have made find the answer (by the researcher)
(?*) 'They had the answer found (by the researcher).'

These restrictions are absent in *be*-passives (10a), (10b) and FAs (11a), (11b):

(10) a. John was loved.
b. The answer was found.

(11) a. Ils ont **fait** aimer Jean **à** Marie.
they have made to-love John DAT- Mary
'They made Mary love John.'
b. Ils ont **fait** trouver la solution **au** chercheur.
they have made find the answer DAT-the researcher
'They made the researcher find the answer.'

On the basis of these parallels, Guasti (2016, p. 185) conjectures that the acquisitional time course of French causatives will mirror that of English *get*- and *be*-passives: FPs will be acquired earlier than FAs.

2.4 Acquisition of French causatives

In order to assess Guasti's conjecture, B&S examined 11 longitudinal corpora of spontaneous speech (CHILDES; MacWhinney, 2000) from children acquiring French in France. Each corpus contained regular samples of spontaneous conversation involving the child and at least one of the child's parents. The child's age at the beginning of the corpus ranged from 1 to 2 years (average: 1 year, 7 months); the child's age at the end of the corpus ranged from 3 to 7 years (average: 4 years,

10 months); and the time span covered by the corpus ranged from 1.4 to 5.9 years (average: 3.2). The corpora contained a total of more than 120,000 child utterances.

In order to test the prediction that FAs would not enter the child's linguistic repertoire before the age of 4, B&S located all child utterances containing any form of the verb *faire*; removed all utterances that were not causative; and classified the remaining utterances, on the basis of Guasti's (2016) syntactic and semantic criteria, as either 'clearly FA' or 'potentially FP.' Some details are provided in (12) and (13).

(12) Clearly FA: utterance containing an overt dative argument, and/or a verb that is semantically incompatible with FP.

(13) Potentially FP: utterance with an overt *par*-phrase, or at least a lower verb that is semantically compatible with FP.

(14) *Ils ont fait trouver la solution* (…)

For example, an utterance like (14), where the causee was omitted, would nonetheless have been classified as an FA, because the verb *trouver* does not meet the semantic requirements of the FP construction.

The results of the study matched the prediction: B&S did not find a single instance of a 'clear FA' prior to age 4. The production of FPs, however, began much earlier, with two of the children producing FPs with overt *par*-phrases even before age 3 (15a), (15b).[8] Of the five corpora that extended beyond the child's fourth birthday, two included a point when the child began to use clear FAs, complete with a dative argument, as in (15c).

(15) a. *Elle se fait tirer par la boule comme ça fait*
she self makes pull by the ball as that makes
du bruit.
of-the noise
'She's getting annoyed ['getting herself pulled'] by the ball since it's making noise.' *(Madeleine 2;05,12)*

b. *Il va [se] faire gronder par sa maman et papa.*
he goes-to [self] make scold by his mom and dad
'He's going to get (himself) scolded by his mom and dad.'
(Antoine 2;09,16)

8. The use of reflexive causatives in instances with overt *par*-phrases, as in (15a) and (15b), will be addressed in Section 2.6.

c. *Je faisais faire quoi à mes trois enfants?*
I made do what DAT my three children?
'What did I make my three children do?' *(Madeleine 4;01,27)*

When B&S analyzed their findings statistically, using a binomial test based on the frequency of FAs in the adults' child-directed speech, the observed delay in children's FAs was robustly significant. Therefore, Guasti's conjecture was well supported by the longitudinal corpus data.[9]

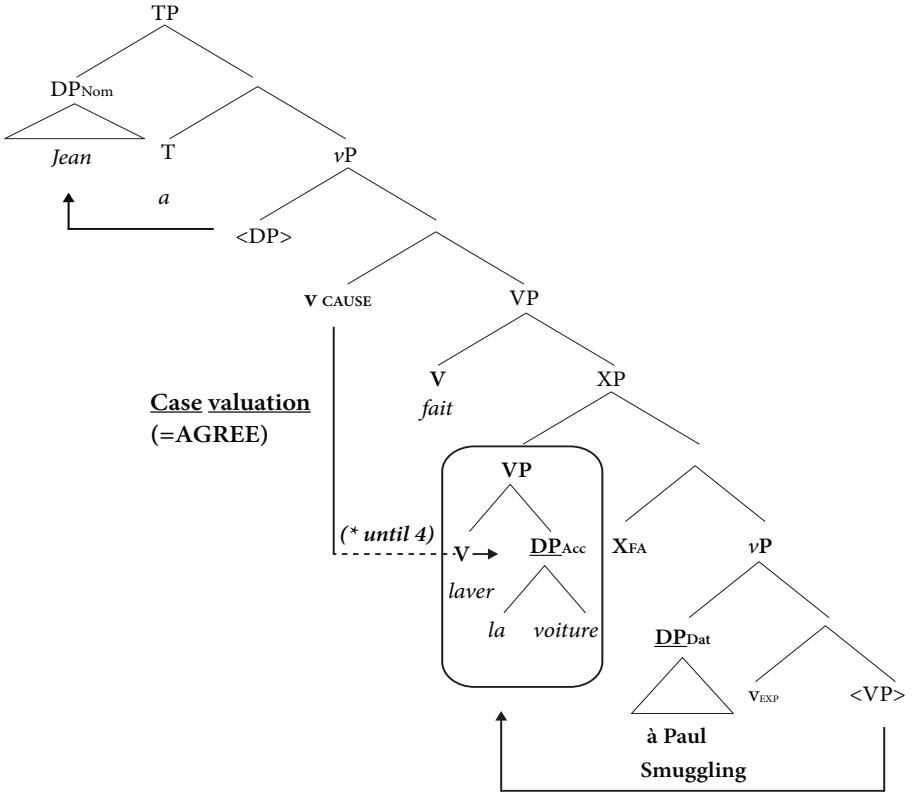
2.5 Romance causatives and the UFH

Despite the existence of parallels between English passives and Romance causatives, it was not immediately clear that the acquisitional timing of French causatives could be accounted for by S&H's freezing-based approach. S&H's account of the delay in *be*-passives was tied to movement, which does not play any comparable role in standard analyses of *faire*-causatives (e.g., Kayne, 1975; Rouveret & Vergnaud, 1980; Burzio, 1986). Yet, recent investigations of Italian syntax suggested that a form of smuggling might indeed be necessary in certain cases.

Bellucci (2015: 105) has advanced the idea that FAs in Italian employ a smuggling-like operation (movement of a "VP chunk"), as illustrated in (17), which has the effect of allowing the main verb's internal argument to be valued for accusative case. Prior to movement, the dative-marked experiencer intervenes between the probe (v_{cause}) and the goal.

9. An anonymous reviewer tells us that, historically, some Spanish and Portuguese varieties lost FPs before FAs. At first glance this appears to conflict with our acquisitional findings. As discussed in Snyder (2007), one of the possible sources of an ordering effect is that the earlier-acquired structure needs only a proper subset of the "pre-requisite" linguistic knowledge (e.g., marked parameter-settings) required for the later-acquired structure. If that were the case for FPs in relation to FAs, the historical findings would indeed by puzzling: it should not have been possible for a language to allow FAs and disallow FPs. Yet, an ordering effect due to the UFH is different. As will become clear in Section 2.6, a UFH-based account does not entail any subset-superset relation in pre-requisite linguistic knowledge. Instead, it is sufficient if the derivation of an FA involves smuggling, and that of an FP does not.

(17) Derivation of FA causative:



The presence of a functional head associated with FAs (which we designate X_{FA}) triggers feature-driven movement of the VP into its specifier position, past the intervening dative causee. At this point, the direct object that is contained within the VP can be case-valued.[10]

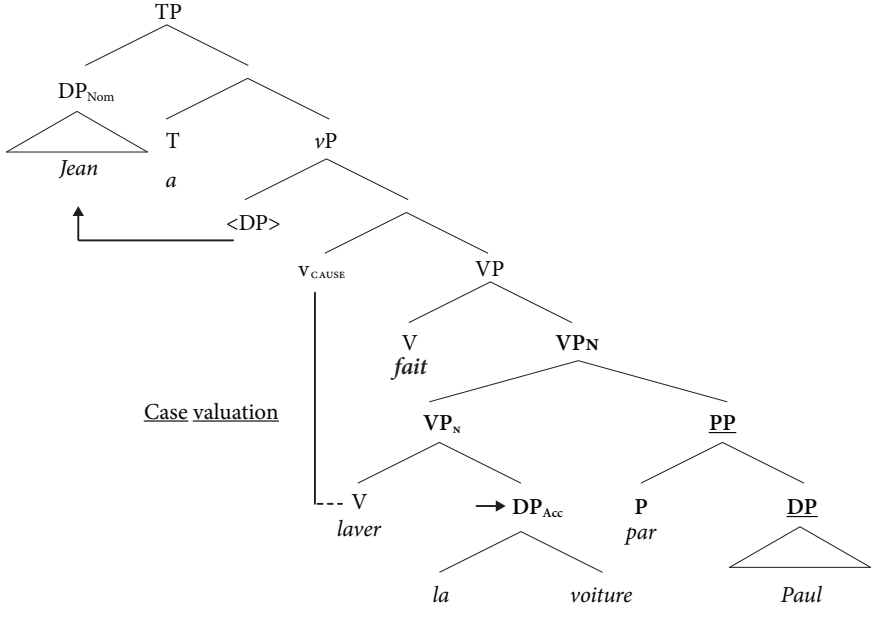
Yet at first glance the role of freezing may still be unclear. This is where B&S's modification to the Freezing Principle comes into play. The modified Freezing Principle given in (4) applies to AGREEment as well as movement. Accordingly, the correct prediction is made by the UFH for FAs with transitive verbs: acquisition will be delayed until after age 4, as the lower verb's direct object cannot be case-valued without making an exception to the Freezing Principle. Exceptions can be made

10. Note that the movement of the VP in (17) is completely independent of the internal argument's need for case-valuation. This can be seen from the fact that the VP undergoes the same type of movement when the lower V is intransitive. For a full discussion of the analysis, including its relation to other accounts in the literature, please see Bellucci (2015).

by adults, but for children younger than 4, case valuation into a frozen constituent such as the smuggled VP in (17) is still impossible.

For the FP, B&S adopted a version of the analyses proposed by Folli and Harley (2007) and Guasti (1996): in the FP, the complement of *faire* is not a *v*P but rather a nominalized VP. The *par*-phrase, when present, is a PP adjunct as shown in (18) similar to the *by*-phrase in English derived nominals (Folli & Harley, 2007) and does not count as an intervener in either movement or case valuation. Accordingly, smuggling and freezing do not play a role in FPs.

(18) Derivation of FP causative:

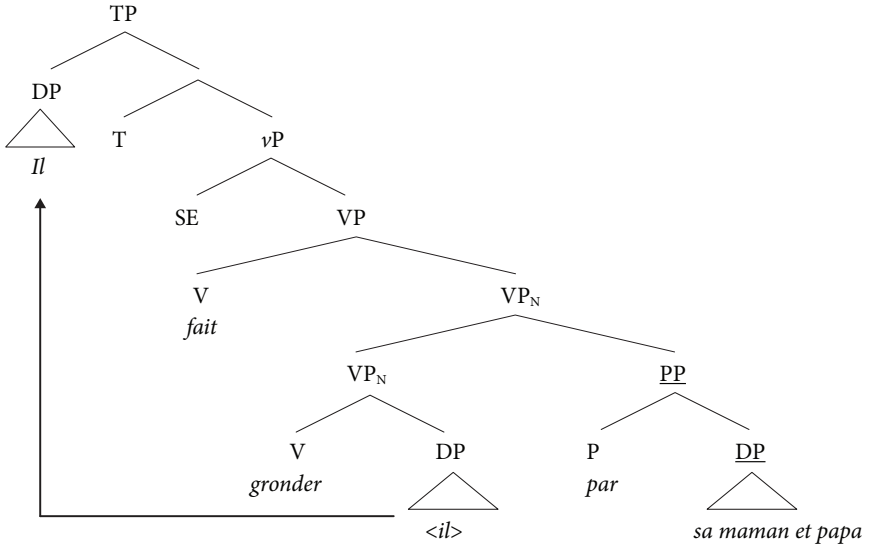


In the child French data examined by B&S, FPs with overt *par*-phrases were already present in the speech of two-year-olds. It should be noted that all of the FPs in the children's speech were reflexive, but interestingly, the same was true in the speech of the children's parents. As discussed by Belletti (2016b) for Italian, these "reflexive causative passives" are intuitively an extremely complex grammatical construction, and the finding that they are nonetheless available to children at age 2 goes to show that people's intuitive ideas about grammatical complexity are a poor predictor of acquisitional timing.

In fact, early mastery is fully consistent with the UFH, for reasons illustrated in (19). Here B&S again followed the approach of Guasti (1996) and Folli and Harley (2007). For the object-to-subject analysis of "formally reflexive" clitic constructions in French, they followed Sportiche (2010). Moreover, S&H (2015) had already

provided extensive evidence for early mastery of reflexive and non-reflexive clitics in children acquiring French or Italian. Also, despite the passive-like interpretation, one can see in (19) that no passive morpheme is present. Hence – once again – there is no need for smuggling.[11]

(19) Derivation of reflexive FP:



In sum, the UFH has so far succeeded in explaining the acquisitional time course of French causatives: a delay for FAs, but not for FPs (not even reflexive FPs). B&S went on to look at further predictions regarding the acquisition of *faire*-causatives with different lower verb-types, namely intransitive verbs of the unaccusative versus unergative classes, and once again found that the specific patterns predicted by UFH were well-supported by the children's data.

11. Belletti (2016b) offers an alternative analysis of the reflexive FP construction, in which the reflexive morpheme represents the external argument of the causative verb, and the lower argument does have to be smuggled past it into surface subject position. Yet, the uses that S&H find in young children's speech are not with semantically reflexive constructions; they are reflexive only in a formal sense. Hence, one possibility is that Belletti's (2016b) analysis is the correct one when a true, semantic reflexive is present (as it often is, in adult speech), while the structure is simpler (and smuggling is not involved) when the construction is only "formally" (not semantically) reflexive.

2.6 The locus of maturational change

The UFH is a maturational hypothesis, but what exactly is the locus of maturational change? One possibility is that UG provides two distinct versions of the Freezing Principle: an initial, more restrictive version; and a second, less restrictive version that replaces it at a certain point (around age 4) on a maturational timetable. Yet, S&H do not commit themselves to this scenario and, for a number of reasons, we are also reluctant to endorse it. First, we are sympathetic to efforts to derive freezing effects, rather than positing an actual Freezing Principle (as such) in UG. For example, Uriagereka (1999) argues that freezing effects follow as a deductive consequence from the mechanisms that are independently needed for cyclic spell-out.[12] Second, we think there is a natural way to interpret the UFH as a change in the computational resources available for language processing, and third we believe there is a growing body of evidence that directly supports a processing-based interpretation of this kind.

To see the conceptual motivation for a processing-based account of children's difficulties with smuggling, consider the grammatical structures that are created by a smuggling-based derivation. These structures are presumably part of the linguistic representations on which language production and comprehension depend. For example, the English *be*-passive (2) is repeated, in schematic form, as (20).

(20) *the book was* [$_{\text{PartP}}$ *written* <the book>] *by John* <PartP>

Here the surface subject (*the book*) heads a chain whose tail is properly contained within the head of another chain (i.e., the participial phrase), whose own tail (in turn) is still lower in the structure. The intuition that we wish to highlight is simple: language processing that involves the type of chain found in (20) demands more than the usual level of computational resources.

Similarly, in the case of a French FA, if the systems involved in language production and comprehension represent information about morphosyntactic agreement, as presumably they must, then an FA like (17), repeated in schematic form as (21), will require the child to represent an AGREE relation between v_{cause} and a proper subpart of the head of a VP chain (which occupies a specifier position within v_{cause}'s complement).

(21) *Jean a* v_{cause} *fait* [$_{\text{XP}}$ [$_{\text{VP}}$ *laver la voiture*] X [[*à Paul*] <VP>]]

12. We thank an anonymous reviewer for bringing this work to our attention.

In other words, our proposal is that the grammatical representations employed in the production or comprehension of smuggling-derived structures are a source of excessive computational demands, and as such are largely beyond the child's processing capabilities until a relatively late point (circa age four) in brain development. Thus, we interpret the UFH as a hypothesis about developmental changes in the brain's computational resources for language processing.

As a final point, we would like mention a study that we think strongly favors this type of processing-based interpretation of UFH. Specifically, Deen et al. (2017) used the Truth Value Judgment Task to examine comprehension of English long *be*-passives with non-actional verbs (e.g., "Monkey was surprised by Elephant") in children of age 3;08 to 4;06. The key findings were that the children's accuracy was little better than chance (56%) in a baseline task on passives of non-actional verbs, as in (22a), but there was dramatic improvement when one of two changes was made: either adding a preamble to the puppet's test sentence, as in (22b), so that the derived subject was [+ Topic] (which yielded 89% accuracy); or adding a one-second pause and then a repetition of the test sentence, as in (22c) (which yielded 83% accuracy).[13]

(22) a. (Baseline)
Narrator: Hey Momo, can you tell us what happened in that story?
Puppet: That was a fun story about A, B and C. Let's see… in that story, <A was verbed by B>

b. (Topicality)
Narrator: Hey Momo, that was a fun story about A, B and C. They made such a mess with those crumbs, didn't they? (or some equivalent) And something interesting happened with A. Could you tell us what happened?
Puppet: Hmm…let's see…in that story…
<A was verbed by B>

c. (Repetition)
Narrator: Hey Momo, can you tell us what happened in that story?
Puppet: That was a fun story about A, B and C. Let's see…In that story, <A was verbed by B> …
[One-second pause] <A was verbed by B>

Under the processing-based interpretation of the UFH that we are advancing, these substantial improvements are expected. According to the theory of RM advanced in Rizzi (2004), adding the feature [+ Topic] to the derived subject in (22b) means that it can move across a [– Topic] argument (i.e., the logical subject) without violating

13. The text in (22) is adapted from the slides presented in Deen et al. (2017). We are grateful to the authors for sharing their slides with us.

RM; hence, there is no need to employ a smuggling-based derivation, and there is no longer any special processing difficulty.[14]

In the case of the repetition condition (22c), the smuggling-based derivation is once again required, but now the increased processing load that it creates is addressed. For example, if the result of the high processing load is an initial misparse, then the second of silence, followed by repetition of the test sentence, may enable the child to re-parse it. Thus, the findings of Deen et al. fit very neatly with a processing-based interpretation of UFH, tied to the special processing challenges that arise when a smuggling derivation is employed.[15]

3. Experiencer verbs and smuggling

The UFH predicts an acquisitional delay for any syntactic structure that requires argument movement past an intervener. Experiencer verbs (or 'psych' verbs) are a case in point. Numerous accounts, across numerous languages, posit at least two basic classes of psych verbs, Subject Experiencer (SE) verbs and Object Experiencer (OE) verbs, as illustrated by the English examples in (23) and (24) respectively (Belletti & Rizzi, 1988; Grimshaw, 1990; White, Brown, Bruhn-Garavito, Chen, Hirakawa, & Montrul, 1998).[16]

(23) *John fears the morning news.* [SE]

(24) *The morning news frightens John.* [OE]

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14. Integrating Rizzi's assumptions with those of Collins is not entirely straightforward. One difficulty (noted by S&H) concerns word order. Collins relies on smuggling to derive a surface word order in which the passive participle precedes *by* and the logical subject. When the logical object bears a feature such as + Topic, if it moves directly to Spec,IP (without any smuggling – as should be possible on Rizzi's account), the expected order in Collins's system becomes (e.g.) *The book was by John written <DP>*. One solution would be to modify Collins's account, and say that *by* is not in fact Voice, but rather an element akin to the dative case-marker *to*. The idea would be move back towards an analysis in which there is a "*by*-phrase" (not a full PP, but more of a DP bearing a "marker" *by*) that is base-generated somewhere to the right of the PartP. Then, regardless of whether the PartP moved, the expected word order would be correct: *The book was [written <DP>] by-John*. (Moreover, for Collins the movement of PartP seems to be optional, except insofar as it is needed to avoid a minimality violation.)

15. We believe that other studies (e.g., Bencini & Valian, 2008; Manetti, 2013) that find improved performance on passives when processing demands are reduced, for example under conditions of syntactic priming, point in the same direction.

16. Psych verbs of a third type, the *piacere* ('like') class, mark their Experiencer argument with a dative preposition. These verbs will be set aside for present purposes.

Belletti and Rizzi (2012) have argued for a smuggling account of OE predicates. In an example like (24), the basic idea is that the surface subject, [$_{DP}$ *The morning news*], originates lower than the Experiencer.

General support for this view comes from cross-linguistic examples (25)–(27) showing the acceptability of backward-binding with OE verbs (Belletti & Rizzi, 1988, 2012; Cheung & Larson, 2015):

(25) *Pictures of himself$_i$ annoy John$_i$.*

(26) (cf. Cheung & Larson, p. 130, example 11b) (Mandarin)
Ziji$_i$ de fumu de zhichi gandong-le meige e$_i$. cansaizh.
self DE parents DE support touch-PERF every contestant
The support of self$_i$'s parents touched every contestant$_i$.

(27) (cf. B&R, 1988, p. 321, example 77a)
I propri$_i$ sostenitori preoccupano Gianni$_i$. (Italian)
His own supporters worry Gianni.

Equivalent sentences with SE verbs are ungrammatical (see 28), as expected if the Experiencer originates at a higher point in the structure than the Theme.

(28) **I propri$_i$ sostenitori temono Gianni$_i$.*
His own supporters fear Gianni.

On B&R's account, the surface subject originates inside a VP that is asymmetrically c-commanded by the Experiencer, and this is where it receives a theta role of Theme. Yet, as observed by Pesetsky (1995), with EO verbs there is also an element of "causation" by the Theme that is absent in SE verbs. Belletti and Rizzi propose that the VP "chunk" containing the Theme moves to a specifier position just below a causative little v, where it is higher than the Experiencer argument; the Theme then moves out of the VP into the specifier of the causative v, where it acquires its additional causative character; and finally it moves onward to surface subject position. This derivation is shown in (29).[17]

(29) (cf. B&R, p. 134, exs. 15a-b)
a. … v$_{cause}$ [$_{XP}$ X [$_{vP}$ Exp [$_{VP}$ V Theme]]]
b. … v$_{cause}$ [$_{XP}$ [$_{VP}$ V Theme]$_i$ X [$_{vP}$ Exp <VP$_i$>]]
c. Theme$_j$ v$_{cause}$ [$_{XP}$ [$_{VP}$ V <t_j>]$_i$ X[$_{vP}$ Exp <VP$_i$>]]

17. As pointed out to us by an anonymous reviewer, B&R's analysis in (29) does not conform to the same strict version of UTAH assumed in Collins (2005a,b). Yet, for us the crucial part of (29) is simply the fact that the Theme is smuggled past the Experiencer, on its way to surface subject position. Any such analysis should lead to the same acquisitional predictions, when it is combined with the UFH.

In contrast, in the case of SE verbs there is no intervening argument to be concerned about. The Experiencer argument can move directly to the subject position, without any need for smuggling.

3.1 The UFH and the acquisition of French experiencer verbs

Given the above analysis, the application of the UFH to the acquisition of psych verbs in Italian is clear. The UFH predicts that Italian OE verbs, which require a smuggling-based derivation, will not be mastered until sometime after age 4. In contrast, as far as the UFH is concerned, SE verbs can be mastered much earlier. Given the similarity of French psych verbs to their Italian counterparts, we likewise predict that French OE predicates will not be mastered until at least age 4, the same late age range as *be*-passives in English and transitive FAs in French.

Note that we are formulating our predictions concerning OE and SE predicates in terms of "mastery." In the case of FAs, B&S made the stronger prediction that the structure would be entirely absent before age 4. As we will see below, OE verbs are not 100% absent from children's speech before age 4, and perhaps we should not expect them to be. Under a processing-based interpretation of the UFH, the challenge presented by an OE verb may be somewhat less stringent than that of an FA or a *be*-passive, simply because an OE verb will require a smuggling derivation much more consistently; to the extent that the presence of an OE verb reliably "primes" the child for the special characteristics of the associated smuggling derivation, the processing difficulty may be lessened. In contrast, when the main verb of an FA or a *be*-passive is used in other syntactic contexts, it will normally not be associated with a smuggling derivation.

All the same, the UFH does predict a substantial difference in difficulty between OEs and SEs, especially prior to the age of 4. This difficulty should entail a tremendous reduction in the absolute frequency of OEs in the speech of children under 4, when we compare it to the frequency of OEs in the speech of older children. It should also entail a tremendous reduction in the relative frequency of OEs versus SEs in the speech of children under 4, when we consider the relative frequencies of OEs versus SEs in the speech of older children.

To test these predictions we selected from CHILDES (MacWhinney, 2000) the same 11 longitudinal, spontaneous-speech corpora for French that were used in our examination of *faire*-causatives: Anaïs, Marie, Marilyn, Nathan, Théotime (Demuth & Tremblay, 2008); Anaé, Antoine, Léonard, Madeleine, Théophile (Morgenstern & Parisse, 2007); and Anne (Plunkett, 2002). In total these corpora contain over 120,000 child utterances. For each child we first ran the 'FREQ' program (CLAN; MacWhinney, 2000) to create a lexicon of all words the child produced at least once

in the corpus, and then we identified all the SE and OE verbs that were present. Through a COMBO search we located all child utterances in which at least one of these verbs occurred. The resulting utterances were then examined by hand to eliminate all utterances that were an imitation of another speaker, a self-repetition, or a memorized routine. Moreover, utterances were excluded if they involved a special, "formally reflexive" use of the verb, as when the verb *amuser* 'to amuse' becomes the reflexive verb *s'amuser* 'to have fun'. They were also excluded if they involved a non-psychological meaning, as when the verb *gêner* 'to bother' is used in the (physical) sense of 'block' or 'impede.'

3.2 Results

The results strongly supported the predictions of the UFH. In the speech that was recorded before the age of 4;00, the 11 children included in our study produced a total of 111,098 utterances. Within these utterances there were just 13 possible uses of OEs. This is a "liberal" count, in the sense that it includes as OEs some cases that were *arguably* imitative or formulaic. In contrast, for the five children whose corpora extended beyond the age of 4, the recordings during the period from 4;00 onward included a total of 15,106 child utterances. These utterances contained 17 uses of OEs. Thus, the absolute frequency of OEs rose from 1.17 uses per 10,000 utterances, prior to 4;00, up to 11.3 uses per 10,000 utterances during the period from 4;00 onward – roughly a ten-fold increase. In contrast, the absolute frequency of SEs increased far more modestly: from 644/111,098 = 58.0 uses per 10,000 utterances, prior to age 4;00, up to 144/15,106 = 95.3 uses per 10,000 utterances from 4;00 onward – an increase of 64.3%.

When we view the children's use of OEs in relation to their use of SEs, we are led to much the same conclusions. In our sample of speech from children who were at least 4;00, we found a total of 17 OEs and 144 SEs. Thus, on any given occasion when a child of at least age 4 chose to use an experiencer predicate, the likelihood that it would be an OE was approximately 17/(17 + 144) = .1056. Let's consider the null hypothesis that children had OEs available to them at least as early as SEs, and that on any given occasion when the child used an experiencer predicate, it had the same likelihoods of being an OE versus an SE (i.e., $p = .1056$ vs. $p = .8944$) that we see at later ages. Under this null hypothesis, the probability that (just by chance) we would find 13 or fewer uses of OEs (out of 657 experiencer predicates in total) when the children were under 4 can be obtained from a Binomial Test: $p<.0001$ (by two-tailed test). In other words, the contrast in children's usage of OEs before versus after age 4 is robustly significant.

In closing, we provide a few examples of children's SEs and OEs, in (30) and (31).

(30) Examples of SEs

a. *T' as vu la dessin.*
you have seen the drawing
'You saw the drawing.' *(Léonard, 2;04,27)*

b. *Je veux de l' eau.*
I want of the water
'I want some water.' *(Marie, 1;11,25)*

c. *Bah non moi aime pas la banane.*
well no me like not the banana
'Well no, (as for) me, (I) don't like banana.' *(Théotime, 2;01,11)*

(31) Examples of OEs

a. *Ben ils nous embêtaient.*
well they us annoyed
'Well they annoyed us.' *(Anaé, 5;01,20)*

b. *Et puis et puis après elle me elle … ça me gênait.*
and then and then after she me she … that me bothered
'And then and then after she me she … that bothered me.'
(Léonard, 2;11,29)

c. *Ça le dégoûte un peu .*
that him disgusts a bit
'That disgusts him a bit.' *(Madeleine, 6;05,04)*

d. *J 'ai envie de t' embêter.*
I have desire of you to-annoy
'I want to annoy you.' *(Théophile, 4;01,24)*

4. Conclusion

Here we have provided an extended overview of a research program that derives and tests novel predictions of the UFH for children's acquisition of French. In addition to reviewing our past work on the acquisition of French causatives, we have presented our latest findings, which concern children's acquisition of French experiencer verbs. Up to the present all our findings have been consistent: When the derivation of a grammatical structure calls for smuggling, either to permit movement past an intervener or to permit case valuation across an intervener, we find that children younger than age 4 seldom (if ever) produce the structure in their spontaneous speech.

Acknowledgement

The authors are grateful to the audience members at The Romance Turn 8, for their questions and comments; to the anonymous reviewers, for their many helpful suggestions; and especially to Anna Gavarró, for all of her work to make this volume possible. The second author's contributions were supported in part by an NSF grant (IGERT DGE-1144399) to the University of Connecticut.

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Discrimination of passive predicates by Brazilian Portuguese-speaking children

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This paper investigates the discrimination of passive predicates by children acquiring Brazilian Portuguese. A truth-value judgment experiment is reported here which assesses 3–4- and 5–6-year-olds' ability to discriminate eventive/stative and eventive/resultative predicates. The results show an adult-like performance as far as stative and resultative predicates are concerned. As for eventive predicates, children's performance has not reached the adult-standard, though they do discriminate eventive from stative/resultative predicates. These results are discussed in relation to previous ones with children acquiring European Portuguese and Catalan (Estrela, 2013; Gavarró & Parramon, 2017). A developmental account is provided which aims at reconciling the present and previous results.

Keywords: language acquisition, adjectival passives, verbal passives, Brazilian Portuguese

1. Introduction

The acquisition of passive sentences has been at the center of a theoretical debate concerning the maturational agenda of the language faculty. It is traditionally argued that the necessary knowledge pertaining to verbal passives (1) is underdeveloped up to a certain age (cf. Borer & Wexler, 1987, 1992; Wexler, 2002, 2004; Snyder & Hyams, 2015). A maturational turning point would, then, be expected.

(1) *The lion was pushed by the tiger*.

Previous investigations of children's comprehension of passive sentences provided evidence for the difficulty children face in comprehending these structures,

https://doi.org/10.1075/lald.62.03lim

particularly when thematic roles can be reversed (actor-patient) and are equiprobable regarding who behaves as an agent/patient (see 1) (cf. Slobin, 1966; Bever, 1970; DeVilliers & DeVilliers, 1973; Strohner & Nelson, 1974; Maratsos et al., 1979, 1985; Sudhalter & Braine, 1985).

Borer and Wexler (1987) argue that children have difficulty trying to interpret verbal passives and resort to an adjectival reading whenever the participial form of the verb allows for it. In this view, computing an adjectival passive (2) could be a means to circumvent the impossibility of computing a more complex structure (cf. Lima Júnior & Augusto, 2012, 2014). Passive sentences (3) would require, otherwise, a syntactic mechanism that might be dependent on specific maturation, such as non-trivial A-movement (cf. Borer & Wexler, 1987; Wexler, 2002, 2004), theta-role transmission (cf. Fox & Grodzinsky, 1998), or smuggling (Snyder & Hyams, 2015).

(2) *This door is shut.*

(3) a. *This door is shut by every person passing by.*
b. *This door is seen by every person passing by.*

(4) a. *The shut door.*
b. **The seen door.*

In English, adjectival and verbal passives are homophonous (see 2–3). Both structures involve an auxiliary *be* and the participial form of the verb. Hence, if the participle of a verb does not form a good adjective (see the contrast in 4), children are expected to fail the interpretation of passives such as (3b), but not (3a). Consequently, the distinction between adjectival and verbal passives cannot be properly grasped experimentally in English (cf. Crawford, 2012).[1] In Portuguese, however, passive predicates are formed by three different morphosyntactic complexes (cf. Duarte & Oliveira, 2010; Lima Júnior & Augusto, 2017), as illustrated in the examples (5–7).

(5) Eventive Passive
O *copo* *foi* *quebra-do.*
The.MASC.SG glass be.PST.EVENTIVE brok-en.MASC.SG
'The glass was broken.'

(6) Resultative Passive
O *copo* *ficou* *quebrado.*
The.MASC.SG glass get.PST brok-en.MASC.SG
'The glass got broken.'

1. Crawford claims that the "by-phrase" she used in her experiments may not be informational enough for children to distinguish verbal and adjectival passive sentences as the work of Bruening (2013, 2014) suggests (see also McIntyre, 2012).

(7) Stative Passive
O *copo* *está* *quebra-do*.
The.MASC.SG glass be.PRS.STATIVE broken.MASC.SG
'The glass is broken.'

Adjectival passive sentences make use of the auxiliary verbs *estar* and *ficar,* whereas eventive passives involve the auxiliary verb *ser*. There is, therefore, a complex AUX + Part that characterizes passive structures, which children have to identify. The AUX element of this complex has to be further specified, based on the complementary distribution of the verbs (*ser*, *ficar*, *estar*) that may occupy this position, giving rise to the three possible passive structures with their respective syntactic and semantic properties.[2]

This investigation aims to verify whether Brazilian Portuguese-speaking children have the ability to interpret eventive passives as in (5) adequately and discriminate this form of predicate from resultative and stative ones as in (6) and (7). A truth-value judgment task involving the interpretation of the three predicates was then devised. It will be argued here that discriminating the different passive predicates is a fundamental step in the acquisition of verbal passive sentences in Portuguese. The noticeable morphophonological distinction of the passive complexes (see 5–7) would prevent children from attributing an adjectival interpretation to an actual verbal passive. Portuguese is, therefore, an interesting testing ground for actually verifying whether young children do distinguish these complexes.

The paper is organized as follows: in Section 2, the structure of adjectival passive sentences is discussed. Subsequently, two experiments are reviewed which support the adjectival interpretation of verbal passives by children (Estrela, 2013;

2. The verbs *ser*, *estar* and *ficar* can also occur as copula verbs and there are, in Portuguese, copula + participle constructions. Being so, the first element of a structure involving these verbs and a participle can be ambiguous with regard to its auxiliary/copula status.

(i) *O* *exercício* *está* *correto/corrigi-do*.
The.MASC.SG exercise be.COP;AUX correct/correct-ed.MASC.SG
'The exercise is correct/corrected.'

How children solve this ambiguity goes beyond the scope of this paper. It is not clear whether such a distinction is made at an early stage of development. In any case, Caprin & Guasti (2006) show that at least for the Italian *essere* 'be,' more auxiliaries than copulas are omitted by children at around 2 years of age, suggesting that some distinction has already been made at this age. It should also be considered that the predicative/attributive character of an adjective could be extended to participles, in general. It is relevant to point out that temporary/permanent readings of adjectives depend on tense/aspect to a large extent. Therefore, children might initially provide an adjectival reading to all these structures and, later on, the verbal nature of the participle and different values assumed by tense may allow the copula/auxiliary distinction to be made compositionally.

Gavarró & Parramon, 2017). Section 4 presents an experiment making use of a truth-value judgment task, conducted with Brazilian Portuguese-speaking children (3–4- and 5–6-year-old). In Section 4.2, the theoretical approach of this investigation is presented, which assumes a procedural view of language acquisition couched on minimalist assumptions (Corrêa, 2009, 2014). It is argued that within this framework, it may be possible to reconcile the present results with the diversity of data reported in the literature. The possibility of young children's performance on eventive passives to be susceptible to language external factors is discussed. Section 4.2 presents the final remarks.

2. On the structure of adjectival passive sentences and its relation to eventive passives

Portuguese traditional grammar characterizes two major groups of passive sentences: pronominal and periphrastic passives.[3] This paper is concerned with the periphrastic passives, which are morphophonologically composed of an auxiliary verb and the participle of the main verb (see 5). These sentences are similar to English passives in many aspects, presenting a subject, auxiliary, participle, and an optional by-phrase. The major differences between the two languages rely on two facts: (i) Portuguese has different specific auxiliary verbs for verbal and adjectival passives (see 5–7); (ii) Portuguese passive participles exhibit gender and number agreement with the subject.

Regarding syntactic analyses, alternative accounts have been provided to verbal passives (Boeckx, 1998; Collins, 2005; Hornstein, Nunes & Grohmann, 2008; Lima Júnior & Augusto, 2015), and adjectival passives have recently occupied a special chapter in the passive approach debate (Embick, 2004; Duarte & Oliveira, 2010; McIntyre, 2012; Bruening, 2014; Lima Júnior & Augusto, 2017, among others). We briefly review here Embick's (2004) proposal (couched on the Distributed Morphology Paradigm), which has been assumed by Duarte and Oliveira (2010) to account for European Portuguese data. Additionally, we also refer to Lima Júnior and Augusto's (2017) analysis, which, based on Brazilian Portuguese data, departs from Embick's study.

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3. Portuguese pronominal passive is constructed with particle *se* and is very infrequent in colloquial speech in Brazilian Portuguese:

(i) *Compraram-se* *novos livros para* *a biblioteca.*
Buy.3rdP.PL se-PARTICLE new books for the library.
'New books were bought for the library.'

Traditionally, verbal and adjectival passives have been claimed to be derived in different modules. While verbal passives were generated in the syntactic module, adjectival passives were built in the lexicon (Wasow, 1977; among many others), possibly by some kind of verbal feature demotion operation. This dual division has been reconsidered in more recent works (Embick, 2004; Duarte & Oliveira, 2010; Lima Júnior & Augusto, 2017).

Embick's (2004) work has been very influential in proposing not a dual but a tripartite characterization of passive predicates. The ternary distinction lines up morphophonological, syntactic, and interpretive properties of the passive predicates in English. Along these lines, a group of eventive passives and two other types of passive predicates (resultative and stative) are distinguished. In other words, it is the different syntactic structures that give rise to the three distinct interpretable semantic relations at stake.

Passive predicates would thus be formed by two semantic features: [agentivity] and [eventivity]. Stative predicates would not be positively marked for any of these semantic features. When eventivity is positively marked alone, a resultative predicate is obtained. If a predicate is semantically marked for both features, an eventive predicate is thus obtained (see (8) below).

(8) a. [– agentivity; – eventivity] → stative passive
b. [– agentivity; + eventivity] → resultative passive
c. [+ agentivity; + eventivity] → eventive passive

In Embick's analysis, these distinctions reflect the presence of three specific syntactic projections: AspP, *v*P, and VoiceP, which are also assumed by Duarte and Oliveira (2010) for European Portuguese (see Figure 1).

AspP bearing a [stative] feature would be responsible for the stative interpretation of the stative passive predicate. Notice that no *v* is present in the structure of stative predicates (see number 1 in Figure 1).

As stated in Embick (2004), *v* is responsible for bringing eventivity. In resultative predicates (see number 2 in Figure 1), an AspP projection bearing another feature, [Fient], brings eventivity along with *v*, thereby accounting for the contrast between stative and resultative passives. Finally, yet importantly, VoiceP is the projection in charge of inserting the *agent* into the derivation of eventive passives (see number 3 in Figure 1). The presence of an agentive layer accounts for the contrast with resultative passives, and, consequently, with stative passives as well.

In the light of the Minimalist Program (Chomsky, 1995; subsequent work), Lima Júnior and Augusto (2017) point out that Embick's (2004) assumption of

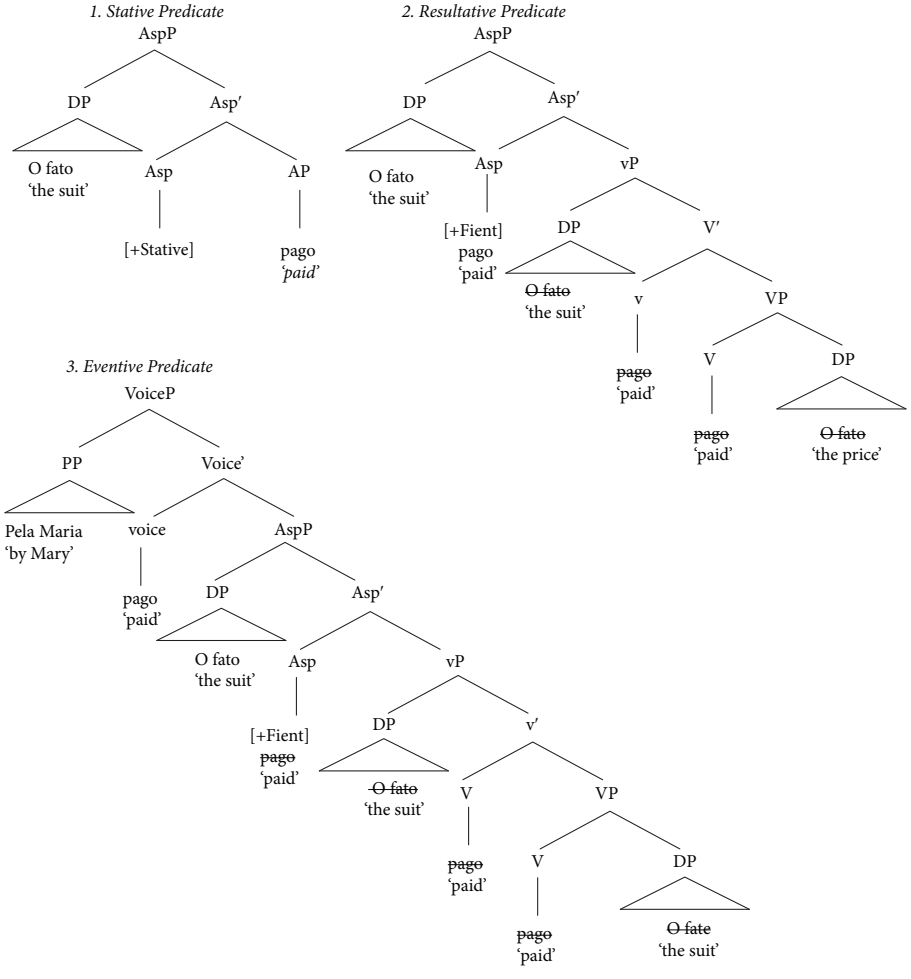

Figure 1. The tripartite division in Duarte & Oliveira (2010) (translation included)

three different syntactic categories for passive predicates seem to be incompatible with some observed data.[4] To overcome this problem, Lima Júnior and Augusto

4. Notice, for example, that an aspectual projection bearing a [Fient/ BECOME] feature is present in both eventive and resultative passives. In this respect, if a participial form of a verb in these languages allows for a resultative reading to be obtained at LF, an eventive passive of the same verb should be allowed as well, contrary to facts (see i).

(i) a. Stative Passive
O João está preocupado com o filho.
The John be.PRS.STATIVE worried with the son
'John is worried with his son.'

further distinguish between stative and resultative passives in the group of adjectival passives. The distinction between eventive and adjectival passives is due to the presence of VoiceP/PassiveP in eventive passives (see Figure 2).

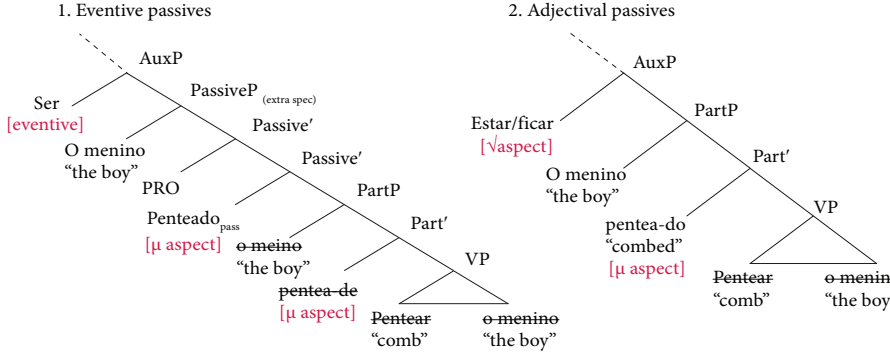

Figure 2. Eventive and adjectival passives in Lima Júnior & Augusto (2017)

b. Resultative Passive
O João ficou preocupado com o filho.
The John get.PST worried with the son
'John got worried with his son.'

c. Eventive Passive
**O João foi preocupado pelo filho.*
The John be.PST.EVENTIVE worried by.the son
'John was worried by the son.'

In the same line of reasoning, if every derivation of eventive passives must exhibit Asp bearing [Fient], it should be the case, then, that every eventive passive also forms resultative passives, once again, contrary to facts (see ii). The perceptual verb *ver* ('see') (and other perceptual verbs), for instance, does not allow a stative/resultative reading, but it does form eventive passives:

(ii) a. Stative Passive
**O João está visto na festa.*
The John be.PRS.STATIVE seen at.the party
'John is seen at the party.'

b. Resultative passive
**O João ficou visto na festa.*
The John get.PST seen at.the party
'John became seen in the party.'

c. Eventive passive
O João foi visto na festa.
The John be.PST.EVENTIVE seen at.the party
'John was seen in the party.'

The passive feature/projection is responsible for the internal merge of the logical object as the subject of the sentence (cf. Collins, 2005; Lima Júnior & Augusto, 2015, 2017). This feature is thus the core information that needs to be represented as syntactic knowledge pertaining to eventive passives. Distinguishing adjectival and eventive passives requires, then, that this particular feature is represented in children's grammar and expressed at the interface levels. In languages such as Portuguese, the auxiliaries *ser* and the others that characterize adjectival passives function as indexes of this distinction at the interface levels. Recent experimental works have been trying to find out when children show an adult competence in differentiating these predicates. In the next section, two of these works are reviewed.

The distinction between stative and resultative predicates, in its turn, is due to the compositional interpretation of the participle and the type of auxiliary selected (see numbers 1 and 2 in Figure 3).

Lima Júnior and Augusto (2017) propose that the auxiliaries *estar* or *ficar* are responsible for valuing the aspectual feature of the participles, giving rise to either a stative or a resultative interpretation of the predicate at LF. Additionally, the authors point out that there are participles in Portuguese which seem to have acquired a plain adjectival nature (see for example the pairs *correto/corrigido* 'corrected,' *tinto/*

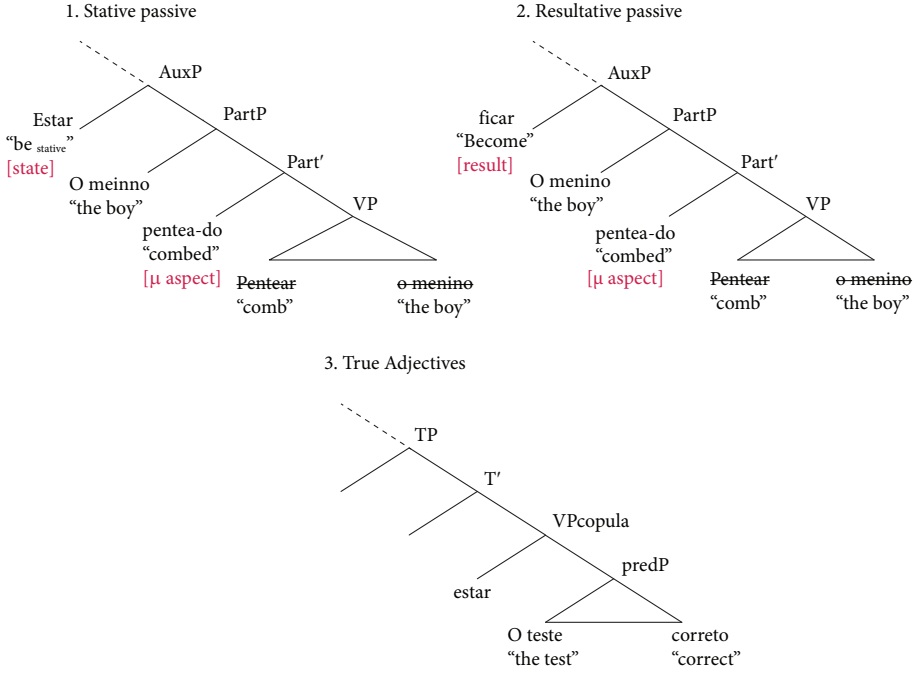

Figure 3. Adjectival passives and small-clause sentences (Lima Júnior & Augusto, 2017)

tingido 'dyed,' *nato/nascido* 'born,' for which a small-clause analysis seems to be appropriate (see number 3 in Figure 3).

In conclusion, the semantic distinction between these predicates is far less strict and more compositional than Embick's (2004) analysis seems to allow.[5] Based on the proposal put forth by Lima Júnior and Augusto (2017), a developmental path can be predicted relating syntactic complexity to semantic distinctions concerning the relation between auxiliaries and participles. The interpretation of participles as states by children may be achieved in comparison to true adjectival constructions.[6] Moreover, the presence of distinct auxiliaries in passive constructions can be a cue to the search for distinct interpretations, ultimately stative, resultative, or eventive readings (see Israel, Johnson & Brooks, 2000; Caprin & Guasti, 2006). It is desirable for any theory of language acquisition to understand how children come to grasp it.

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5. For example, Embick (2004) explicitly states that the structure for the stative predicate should not involve v and its concomitant eventivity (p. 363). However, some data brought by Lima Júnior and Augusto show that (i) agent-oriented adverbs, such as *cuidadosamente* 'carefully,' (ii) instrumental PPs, and (iii) even by-phrases are acceptable in passives with *estar*:

(i) *A cama estava cuidadosamente arrumada.*
The bed be.PST.STATIVE carefully made
'The bed was carefully made.'

(ii) *A avenida está fechada pela polícia.*
The avenue be.PRS.STATIVE closed by.the police
'The avenue is closed by the police.'

(iii) *As paredes estão pintadas com pincel.*
The walls be.PRS.STATIVE painted with paintbrush.
The walls are painted with paintbrush.'

6. An anonymous reviewer provides the following example in Portuguese, corroborating the view that there is a semantic overlap among eventive, resultative, stative, and adjectival constructions:

(i) a. *Esse tapete foi muito escovado pela empregada.*
This rug be.PST very scrubbed by.the maid.
'This rug was very scrubbed by the maid.'

b. Esse tapete foi escovad-íssimo pela empregada.
This rug be.PST scrubbed.SUPERLATIVE by.the maid.
'This rug was very scrubbed by the maid.'

Notice that an eventive reading is obtained in (i), despite the superlative form (*escovadíssimo*) of the participle (*escovado*) (ib), which presupposes an adjectival nature of such participle. It seems that the superlative suffix is used as an intensifier of the event, that is, it has in fact an adverbial character.

3. Previous results in favor of an adjectival interpretation of verbal passives

A number of results demonstrate that children are able to produce and comprehend passives at an early stage of development under certain experimental conditions (cf. Crain, Thornton & Murasugi, 1987/2009; O'Brien, Grolla & Lillo-Martin, 2006; Messenger et al., 2012 for English; Koring, Sangers & Wexler, 2015; Verrips, 1996 (or Dutch; Bencini & Valian, 2008; Manetti, 2012, 2013; Volpato et al., 2013; Volpato, Verin & Cardinalletti, 2014 for Italian; Rubin, 2009; Estrela, 2013 for European and Brazilian Portuguese).[7] Yet, the assumption that children use some sort of adjectival strategy to interpret verbal passives has resisted through time in one way or another (cf. Terzi & Wexler, 2002; Menuzzi, 2002; Hirsch & Wexler, 2006; Gavarró & Parramon, 2017).

An experimental study with Catalan-speaking children, for example, claims to bring direct evidence for the adjectival strategy (Gavarró & Parramon, 2017). In Catalan, the same contrast obtained in Portuguese is observed; unlike English, verbal and adjectival passives are not syntactic homophones. In the most pertinent test of that study for this discussion, the types of sentences contrasted are (9–10).

(9) *La* *nena* *està* *pentinada.*
The.FEM.SG girl be.PRS.STATIVE combed.
'The girl is combed.'

(10) *La* *nena* *és* *pentinada.*
The.FEM.SG girl be.PRS.EVENTIVE combed.
'The girl is combed.'

[Gavarró & Parramon, 2017: 18/19, examples 21 and 22]

The experiment was a sentence-picture matching task. Two pictures, one representing an action performed by one character on another and the other representing only a result state with no action, were displayed, and the child was supposed to choose only one. In Figure 4, the sort of picture used by Gavarró and Parramon (2017) is presented. It corresponds to 'be shaved.'

7. Furthermore, passive sentences seem to be spontaneously produced by very young children (around 2) acquiring Sesotho (cf. Demuth, 1989; Kline & Demuth, 2010). Although there is no adjectival passive in Sesotho, passivization is a very productive phenomenon. Discourse properties of this language seem to favor the use of passives (cf. Demuth, 1990).

Figure 4. Picture used in Gavarró & Parramon's (2017) second test

Gavarró and Parramon's (2017) results reveal that short verbal passives are interpreted as adjectival passives by children between 3 and 6 years of age. The same does not occur, though, in the groups of 7–8–year–olds, nor in the group of adults.

Catalan verbal passives were assumed to be the only adequate match in the test for the type of picture on the right while adjectival passives were the only adequate match available for the type of picture on the left (see Figure 4). The results obtained by Gavarró and Parramon (2017) with a group of adults corroborated it. It can nevertheless be argued that the verbal predicates formed by *és* and *està* plus the participle (aux + part) may also suggest permanent (individual-level predicate) (11) and temporary (stage-level predicate) (12) readings, respectively. The use of the present tense of *ser* may contribute to this predicative interpretation. If this line of reasoning is correct, both picture types in the test (see Figure 4) could be considered an adequate match for the predicate formed by *és*.

(11) Permanent Reading
El nen és callat.
The boy be_PRS;INDIVIDUAL LEVEL quiet
'The boy is quiet.'

(12) Temporary Reading
El nen està callat.
The boy be_PRS;STAGE LEVEL quiet
'The boy is quiet now.'

A similar kind of intricacy holds for Portuguese, particularly if the present tense is used. In (13), the participle *pintado* ('painted,' in English) in (a) and (b) may be interpreted as a temporary or permanent attribute, respectively. Hence, in (13b), either an adjectival or an eventive interpretation may be ascribed to the form of predicate at stake. When past simple is used, as in (13c), in turn, the preferred interpretation available is the eventive one.

(13) a. *O cachorro está pintado.*
The dog be_PRS;STAGE LEVEL stained
'The dog is stained.'
b. *O cachorro é pintado.*
The dog be_PRS;INDIVIDUAL LEVEL stained
'The dog is stained.'
c. *O cachorro foi pintado.*
The dog be_PST;EVENTIVE stained
'The dog was stained.'

In sum, although both Catalan and Portuguese do distinguish verbal and adjectival passives by means of auxiliary-selection, the verb tense chosen may also have relevant implications for the interpretation of passive predicates. Using the simple present tense may enable a predicative reading to be ascribed, which could be the reason why children are led to give the same pattern of answers for *està pentinada* (see (9)) and *és pentinada* (see (10)) in the test conducted in Catalan.

Another recent study aiming at verifying whether children distinguish the different types of passives was conducted in European Portuguese by means of a grammaticality judgment task (Estrela, 2013). It focused on the tripartite typology of participles (Duarte & Oliveira, 2010; Embick, 2004) referring to eventive, resultative, and stative passives (as in (5) to (7) above respectively) and made use of sentential combinations that could be (un)/acceptable with each kind of passive (see Table 1).

Table 1. Estrela's (2013) examples

Pairs	Sentences
1. Eventive vs Stative (instrumental PP)	a. *O castelo foi construído com uma pá.* 'The castle was built with a shovel.'
	b. **O castelo está construído com uma pá.* '*The castle is built with a shovel.'
2. Eventive vs Resultative (purpose clause)	a. *O carro foi lavado para agradar ao pai.* 'The car was washed to please the father.'
	b. **O carro ficou lavado para agradar ao pai.* '*The car got washed to please the father.'
3. Resultative vs Stative (time expression)	a. *O quadro ficou pintado em 5 minutos.* 'The picture became painted in 5 minutes.'
	b. **O quadro está pintado em 5 minutos.* '*The picture is painted in 5 minutes.'

The settings designed for the European Portuguese test were: (i) prepositional phrases with instrumental value, for the eventive and stative contrast (Pair 1); (ii) purpose clauses, for the eventive and resultative contrast (Pair 2); and (iii) the expression *em x tempo* (in x time), for the resultative and stative contrast (Pair 3).

The experimental study evaluated the performance of a group of 40 children aged 5–6 years. The task seemed too difficult for younger children to grasp. Sixty pairs of sentences were tested (with 20 different verbs) contrasting the three types of passives. The results indicate that 5-year-olds are not able to properly distinguish any form of passive predicate. The number of correct responses is around the chance level in the three-sentence pairs. Six-year-olds seem to make a distinction between eventive and stative passives. However, the results are also at the chance level when it comes to eventive versus resultative passives and resultative versus stative passives. The author concluded that the conjugation of different auxiliaries under different contexts is not always easily understood by 5–6-year-olds.

In sum, both experiments reviewed in this section suggest that 3–6- year-olds do not interpret verbal passives adequately, which supports previous results (Slobin, 1966; Bever, 1970; De Villiers & De Villiers, 1973; Maratsos et al., 1979, 1985). Some methodological issues are though called into attention. In Gavarró and Parramon's study, the use of present tense for the eventive passive might have contributed to an attributive reading. In Estrela, the task might have been too demanding even for relatively older children. The experiment to be reported in the next section, a truth-value judgment task conducted with Brazilian-speaking children, is an attempt to test whether young children differentiate passive predicates under supposedly easier experimental conditions.

4. Experimental study

This study aims at evaluating (i) whether young children are sensitive to the form that enables the meaning of stative, eventive, and resultative predicates to be eventually distinguished; (ii) the extent to which children consistently provide an adult interpretation to them.

A truth-value judgment task was then devised in which two types of videos were exhibited. Both video types started with the same event (e.g., someone was combing someone else's hair). In video type 1, the final scene corresponded to the result of the process recorded in the video (compatible ending). In video type 2, the final scene corresponded to the result of an action that undid the effect of the process initially started (incompatible ending). Yes/No-questions involving the three passive predicates (14–16) were formulated. Children were divided into two age groups: A (3–4-year-olds) and B (5–6-year-olds).

(14) Eventive reading
O menino foi penteado?
The boy be_PST;EVENTIVE combed
'Was the boy combed?'

(15) Resultative reading
O menino ficou penteado?
The boy get_PST combed
'Did the boy become combed?'

(16) Stative reading
O menino está penteado?
The boy be_PRS;STATIVE combed
'Is the boy combed?'

In the case of adjectival passives (15–16), a yes/no answer is expected to depend on the ending of the video. Thus, if the ending is compatible with the initial action, the expected answer is "yes". If the ending is incompatible with the initial action, the expected answer is "no". In the case of verbal passives (14), though, the expected answer is always "yes" regardless of the ending of the video. Notice that the initial action (the event) occurs even though it is undone afterward.

The independent variables are: *Age* (3–4 years, 5–6 years), *Video type* (compatible and incompatible ending), and *Type of predicate* (eventive vs. stative, in step 1, and eventive vs. resultative, in step 2). As for the latter, eventive and stative predicates were initially contrasted in a within-subject design. Later, resultative passives were presented to a new group of children, and the results were contrasted with the previously obtained results on eventive passives, in a between-subject design. The results will then be presented in two steps: (i) eventive vs. stative and (ii) eventive vs. resultative passives, making use of the data on eventive passives obtained in (i).

The dependent variable is the number of yes-responses. Adults are expected to give yes-responses to eventive passives, regardless of the video type, and to give these responses to stative and resultative passives in the compatible ending condition only. Hence, the more sensitive children are to the different Aux + part complexes the closer they will be to the adult pattern of responses.

Method

Participants: 48 children were recruited from two private schools of the city of Rio de Janeiro, Brazil. They were separated into two age groups (Group A, 3;4–4;4 [mean age 3;8]; Group B, 5–5;10 [mean age 5;5]). 24 children were initially tested with eventive and stative predicates; 24 children were additionally tested with resultative predicates only. Twenty-four adults formed the control group.

Material and apparatus: Sixteen short-length videos were videotaped (less than 30 seconds in length) depicting actional events (e.g., tie up). A camera (full HD, 12.1 megapixels) was used. Sixteen agentive verbs were used in the trials: *amarrar* 'to tie up,' *amassar* 'to squeeze,' *pentear* 'to comb,' *arrumar* 'to clean up,' *enfeitar* 'to adorn,' *dobrar* 'to fold,' *cobrir* 'to cover,' *enrolar* 'to curl,' *pintar* 'to paint,' *esconder* 'to hide,' *molhar* 'to wet,' *lavar* 'to wash,' *vestir* 'to dress,' *maquiar* 'to put make up on,' *calçar* 'to put on shoes,' and *riscar* 'to scratch'. Eight of these videos were also used to test the resultative sentences with the other 24 children and 12 adults.

The videos were displayed in slides and were presented to children as a game, with each video as one of its phases. A laptop with a 15.5″ screen was used in the presentation. Samples of these videos are exhibited in Figures 5 and 6. It should be noticed that in both the videos, the event at stake was accomplished.

Figure 5. Video type 1–be combed–(compatible ending)

Figure 6. Video type 2–be combed–(incompatible ending)

Procedure: The children were individually taken to a silent room of their school. An assistant teacher with whom the children were familiarized accompanied the experimenter. Before the test began, the experimenter explained to the participants that they would take part in a game. They were instructed to give a simple yes/no answer after watching each video. The final screen was frozen at the end of the video presentation. The experimenter presented the target-question as soon as the video ended. The first two videos were training trials. At the end of the game, all children were rewarded with a bubble maker toy.

Results

The performance of adults was exactly as expected. The means are displayed in Table 2.

Table 2. Mean yes-responses of adults in each condition (maxscore = 4)

Passive	Video ending	Yes-responses
Eventive	Compatible	4
	Incompatible	4
Resultative	Compatible	4
	Incompatible	0
Stative	Compatible	4
	Incompatible	0

With regard to children, the results are presented in two steps. Step 1 is a comparison between eventive and stative passives in a within-subject design. Step 2 compares these data on eventive passives with the additional data on resultative passives in a between-subject design.

Step 1: Table 3 provides the distribution of the yes-responses obtained in each condition for eventive and stative passives.

Table 3. Mean yes-responses in each test condition for step 1

Age groups	Type of passive	Video ending	Yes-responses
Group A	Eventive	Compatible	3.83
		Incompatible	2.67
	Stative	Compatible	4
		Incompatible	0
Group B	Eventive	Compatible	3.75
		Incompatible	2.75
	Stative	Compatible	4
		Incompatible	0.08

The yes-responses of the 24 children tested for eventive and stative passives were analyzed by means of an ANOVA. There was no main effect of Age $F(1,22) = 0.02$, $p = .89$. There was a significant main effect of Video type $F(1,22) = 298$, $p < .000001$, SS = 157.59, MSe = 0.53 (means: 3.895 for compatible ending and 1.375 for incompatible ending). More yes-responses were given to videos with compatible ending. Type of predicate also gave rise to a main effect, $F(1,22) = 79.9$, $p < .000001$, SS = 36.26, MSe = 0.45 (means: 3.25 for eventive passives and 2.02 for stative passives). More yes-responses were given to eventive passives, as expected.

A significant interaction between Type of predicate and Video type was also obtained, $F(1,22) = 102$, $p < .000001$, SS = 49.59, MSe = 0.48. This effect is due to the

higher number of yes-responses for eventive passives in the incompatible ending condition, in contrast with the almost total absence of these responses to stative passives with incompatible ending, $t(22) = 6.71$, $p < .0001$, in a pairwise comparison (see Figure 7). The significant difference between Eventive_Compatible in comparison with Eventive_Incompatible, $t(23) = 3.84$, $p < .0008$ suggests that children had difficulty and/or hesitated to give a yes-response to the eventive questions when, in order to do so, they had to disregard the last scene of the video and rely on the first one only. In any case, the total number of yes-responses to eventive sentences is above chance in both age groups (Group A: $p < .03$; Group B: $p < .01$).

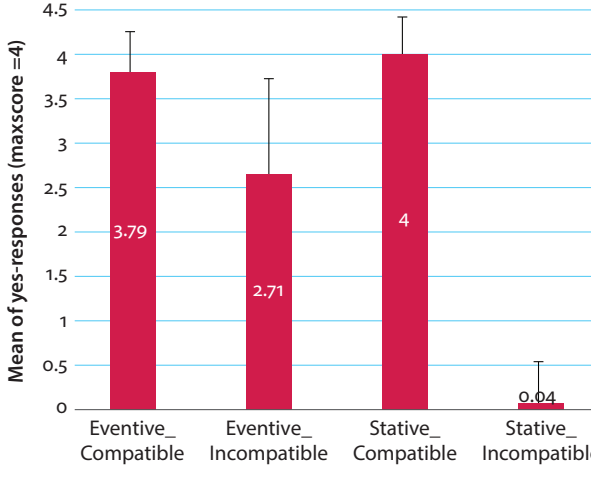

Figure 7. Mean yes-responses showing the interaction between type of predicate and type of video in step 1

Step 2: Table 4 presents the distribution of yes-responses to each condition for eventive and resultative passives. The yes-responses to eventive passives of the former 24 children tested and the yes-responses to resultative passives obtained with the new group of 24 children were analyzed by means of an ANOVA, in which Age and Type of predicate were group factors and Video type a within-subject factor.

As in the previous test, there was no significant main effect of Age, $F(1,22) = 0.022$, $p = .8$. A significant main effect was obtained for Video type, $F(1,44) = 239$, $p < .000001$, SS = 142.59, MSe = 0.60 (means: 3.85 for compatible ending and 1.42 for incompatible ending). As in the previous test, more yes-responses were given to videos with compatible endings. There was also a main effect for Type of predicate, $F(1,44) = 71.0$, $p < .000001$, SS = 36.26, MSe = 0.51 (means: 3.25 for eventive and 2.02 for resultative passives). More yes-responses were given to eventive than to resultative passives which is also as expected. A significant interaction between

Table 4. Mean yes-responses in each test condition for step 2

Age groups	Type of passive	Video ending	Yes-responses
Group A	Eventive	Compatible	3.83
		Incompatible	2.67
	Resultative	Compatible	3.83
		Incompatible	0.25
Group B	Eventive	Compatible	3.75
		Incompatible	2.75
	Resultative	Compatible	4
		Incompatible	0

Type of predicate and Video type was also obtained, $F(1,44) = 73.7$, $p < .000001$, SS = 44.01, MSe = 0.60 (see Figure 8).

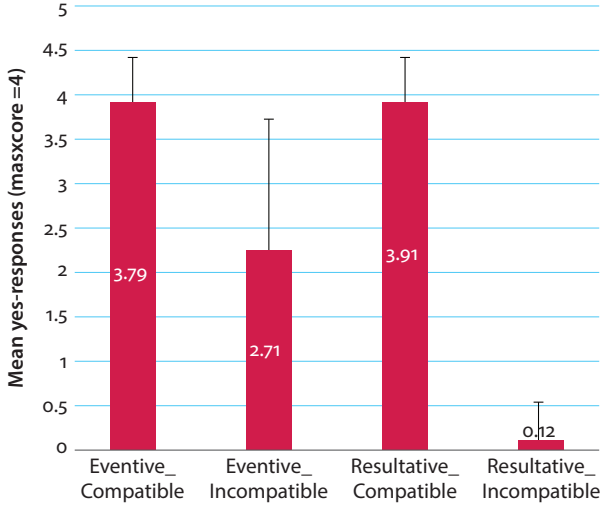

Figure 8. Mean yes-responses showing the interaction between type of predicate and type of video in step 2

For compatible video endings, the number of yes-responses was slightly greater in the resultative condition. For the incompatible ending, on the contrary, more yes-responses were given to eventive passives, thereby suggesting that these types of predicates are distinguished by children. Unlike adults, children did not give a similar number of yes-responses to eventive sentences, regardless of the video ending. In any case, the distinction between the types of predicates has been established.

Contrasting resultative and stative predicates, the results of *t*-tests show that, in the younger age group, the difference between these types of predicates was not significant in both compatible ($t_{df22} = 1.05$, $p = .15$) and incompatible ending

conditions ($t_{df22} = 1.05$, $p = .07$). In the older group, the compatible condition was at ceiling for both types of predicates (cf. Tables 3 and 4), and there was no difference between these predicates in the incompatible ending condition ($t_{df22} = 0.45$, $p = .33$). The difference between these types of predicates does not reveal particular demands for children.

Discussion

As a whole, children's performance is akin to adults' except for eventive passives when the video presented an incompatible ending. At first sight, these results might be claimed to corroborate the view that the acquisition of passives is a late achievement (Borer & Wexler, 1987). Moreover, they may be taken as adding to the findings obtained in Catalan (Gavarró & Parramon, 2017) and European Portuguese (Estrela, 2013). However, given that there is evidence that children distinguish eventive from stative and resultative predicates, it can be argued that their difficulty does not necessarily follow from the inability to conduct the proper syntactic computation but may be restricted to cognitively demanding processing situations.

Children's behavior in video 2 condition (incompatible ending) suggests that some distinction between the forms of passive predicates can be made from the age of 3 years. The fact that children assign a different pattern of yes-responses to eventive vs. stative and eventive vs. resultative predicates indicates that children do not analyze/interpret in the same way the eventive and the adjectival structures presented.

Children appear to differentiate the semantic properties of the verbs occupying the auxiliary position in the AUX + Part complex. The SER + Part complex seems then to provide the sort of interface information that is relevant for the lexical representation of the passive/voice feature that enables the computation (and the production/comprehension) of eventive passives. Being so, the most relevant distinction between verbal and adjectival passives appears to have already been made by 3-year-olds acquiring Brazilian Portuguese, even though children still show a non-adult behavior. What would account for it?

Contrasting videos 1 and 2, it can be noticed that a YES response to the eventive passive in video 2 requires children to ignore the information provided in the subsequent scenes (see Figure 9). Coping with the task in the incompatible ending condition for eventive passives requires, therefore, the ability to refrain from taking into account the more recent information (in fact, the end of the narrative), while retrieving the information in the first scene. This ability may depend on the development of executive functions, which is not complete till late childhood/adolescence (Miyake et al., 2000; Diamond, 2006). Recent studies suggest that the development of executive functions abilities is a factor to be taken into account in the discussion of children's achievements in language tasks (Rodrigues & Marcilese, 2014 and references therein). In the light of these studies, it may be argued that

Figure 9. Inhibitory process to ignore the last scenes in favor of the interpretation involving the initial information in which the eventive predicate is involved

achieving the adult standard of performance in the most demanding condition requires abilities that go beyond grammatical knowledge.

In the next section, the present results will be considered in the broader context of a procedural theory of language acquisition. It will be argued that the acquisition of passives takes place from an early age, even though fully mastering these structures depends on coping with the specific demands of processing them in a variety of conditions.

5. A procedural account of the acquisition of passives

In this section, the acquisition of verbal passive sentences in Portuguese is considered in the light of a procedural model of language acquisition (Corrêa, 2009, 2014) which reconciles the view of an innately guided procedure (Jusczyk & Bertoncini, 1988), the phonological bootstrapping hypothesis (Morgan & Demuth, 1996), and the minimalist conception of language (Chomsky, 1995, subsequent work).

Briefly, this procedural approach to language acquisition starts from the idea that all the grammatically relevant information for the identification of a particular grammar is available at the interface between (internal) language and the so-called performance systems. A universal computational system is assumed to operate upon formal features of the lexicon. These formal features (particularly of functional categories) are expressed in the form of regular patterns at the Phonetic Form (PF). Infants have been shown to detect regularities in the input data since early states of linguistic development. Thus, interpreting children's ability to analyze morphophonological and distributional regularities as the sort of information concerning formal features that is available at the interface levels (innately guided learning) is the distinctive feature of this approach, thereby narrowing the gap between linguistic theory and processing approaches to language acquisition. It is argued then that detecting morphophonological regularities as pertaining to the expression of formal features at the interface levels is crucial for the identification and for the representation of formal features that are accessed in the actual syntactic computation.

As for passive sentences, it is assumed that in a language such as Portuguese, the relevant information to be detected at the interface levels concerns the complex AUX + Part (detectable at the phonetic interface) with the subsequent differentiation of the semantic features of the AUX component of this complex. As a result of this process, the representation of the functional feature/projection (VoiceP (Collins, 2005)/PassiveP (Lima Júnior & Augusto, 2015)) pertaining to eventive passives is achieved.

A procedure for the acquisition of passives in languages such as Portuguese would include:

a. Detecting the phonetic and distributional pattern corresponding to AUX + Part at PF;
b. Differentiating the possible auxiliaries in this complex with the ultimate representation of a distinct feature for eventive passives (Voice/Passive feature);
c. Identifying semantic restrictions associated with main verbs in passive structures;
d. Dealing with the cost of computing/processing passives in different conditions.

In relation to (a), a recent study demonstrated that children at the age of 18 months, unlike 15-month-olds, are able to recognize the pattern corresponding to the discontinuous dependency of verbal passives in Portuguese (Lima Júnior & Corrêa, 2017). In this study, the AUX + Part complex was modified in such a way that the ending of regular Portuguese verbs *-do* was replaced by the imperfective ending *-va* in short stories presented in a Preferential Attention Task.[8] The oldest children listened longer to stories in the non-modified (normal) condition, thereby suggesting that the incompatibility of the verbal ending *-va* with the auxiliary *ser* was noticed. These results corroborate previous ones on the early processing of discontinuous dependencies (Santelman & Jusczyk, 1998; Tincoff, Santelmann & Jusczyk, 2000; Höhle et al., 2006).

The experiment reported in this paper focused on (b). The results suggest that in the process of acquiring passives, children by the age of 3 years make the most fundamental distinctions regarding eventive and adjectival structures, that is, they distinguished eventive from resultative and stative passives, even though adult performance has not been achieved as far as eventive passives in the most demanding condition are concerned.

In relation to (c), the identification of relevant semantic restrictions enables children to tease apart verbs that admit passives in the language or not. In this regard, overgeneralizations have been attested over the age of 4 years (Pinker, Lebeaux

8. The Preferential Attention task is an alternative to the Headturn Preference task, which makes use of the software HABIT. The dependent variable is the amount of time children pay attention to a constant visual stimulus while listening to linguistic material presented in different experimental conditions.

& Frost, 1987). Aspectual/semantic features, such as affectedness for example, also seem to be relevant for the comprehension of verbal passives with psychological verbs in Brazilian Portuguese (see Lima Júnior & Augusto, 2014).

Regarding (d), passive sentences are more costly than actives even for adults (Griffin & Bock, 2000; Ferreira, 2003; Gleitman et al., 2007; Lima Júnior & Corrêa, 2015). Reversibility of theta roles and pragmatic factors have been shown to add to the burden of processing passives (Ferreira, 2003; Richardson, Thomas & Price, 2010; Lima Júnior & Corrêa, 2016). Language external factors such as inhibitory control can also contribute to the development of the ability to cope with these structures, as suggested by the results obtained in the experiment reported here in the incompatible ending condition for eventive passives.

As it can be deduced from the discussion above, this sort of procedural account can bring together a number of results, leading to a comprehensive account of the acquisition/development of passives.

6. Final remarks

This investigation aimed at verifying whether 3–4-year-old children distinguish eventive from resultative and stative passives in a language in which these distinctions are expressed in the auxiliary forms. It also intended to interpret the experimental results obtained here in a theoretical framework that provides a procedural account to the distinct achievements that acquisition of passives requires.

The experiment reported here shows that, around the age of 3 years, children have differentiated the Aux element of the Aux + Part complex. Given the semantic differentiation between passive predicates, it is possible that by that age, the functional category that enables a logical object to be encoded as the subject of the sentence, Voice/PassiveP (cf. Collins, 2005; Lima Júnior & Augusto, 2015), is represented in the lexicon, even though retrieving this knowledge may be hard in particular processing conditions.

In sum, the present results suggest that the development of the ability to distinguish passive predicates takes place around the age of 3 years. However, such an ability may only be fully demonstrated later in childhood. Language-independent development, such as the ability to inhibit an immediate response, as in the video 2 condition of the present experiment, is likely to contribute to achieving an adult performance in the task. In other words, language external factors may account for the difficulty eventive passives present in particular tasks.

Acknowledgements

The authors thank the support of CNPq grant, process PDJ 152661/2016–6, CNPq-PQ 2012–2016.

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The acquisition of Spanish passives

The comparison between subject experiencer versus actional verbs and direct aspectual semantic evidence for the adjectival interpretation

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We test the maturational/adjectival analysis theory of development of passives in Spanish. Children perform less well on psychological passives than on actional passives. Since Borer and Wexler (1987), the most prominent hypothesis is that this difference is due to children's use of an adjectival interpretation of passives. Spanish passives are aux + participle, with different auxiliaries for verbal/adjectival. In Experiment 1, children perform better on actional than on psychological passives. Experiment 2, using the method of Gavarró and Parramon (2017), tests the eventive/stative interpretation of passives directly. As predicted, children often recover an incorrect stative interpretation for verbal passives. Strikingly, the non-commonsensical prediction of the theory that there is a negative correlation between adult-like performance in the theta-role and aspect experiments is confirmed.

Keywords: passive development, passive acquisition, verbal passive, adjectival passive, Spanish passive, acquisition of Spanish passives

1. Introduction

Ever since Borer and Wexler (1987), the standard explanation for the properties of the development of passive structures has been two-fold. First, one of the mechanisms for the derivation of verbal passives is subject to a maturational schedule. This assumption accounts for young children's poor performance on many constructions, in particular verbal passives of subject experiencer verbs. Secondly, children developing English and many other languages do have the grammar of the adjectival passive, interpreting an intended verbal passive as an adjectival passive.

https://doi.org/10.1075/lald.62.04oli

This strategy accounts for good performance when the maturational mechanism rules out the derivation of the correct structure, the verbal passive. Young children perform much better on the passives of "actional" verbs than on subject experiencer verbs, because they can apply the adjectival interpretation to the former, but not to the latter.

Although it was not a term used in Borer and Wexler's (1987) theory, sometimes we will call the child's use of the adjectival passive analysis instead of a verbal passive analysis an "adjectival strategy." Borer and Wexler simply pointed out that young children, who do not command the verbal passive grammar, nevertheless do command the adjectival passive grammar. Therefore, they can understand a sentence intended as a verbal passive as an adjectival passive. Of course, this might result in an interpretation that, although correct in terms of recovering the correct thematic roles of the arguments, nevertheless has a different, stative rather than eventive, semantics. Since classic experiments in the acquisition of passives only measure the capacity to recover thematic roles, the use of the adjectival instead of verbal interpretation will produce good results for a child.[1]

The arguments for this two-fold analysis have been based on its capacity to integrate a large number of developmental phenomena across a range of constructions and languages. In particular, this is the basis for the argument for the adjectival strategy. One might think that there could be an even more direct type of evidence for this assumption, since it makes a particular claim about the aspectual interpretation that children make in experiments when they perform correctly on the verbal passives of actional verbs. Namely, they are predicted to interpret these verbal passives as adjectival, that is, to consider the sentences as having a stative rather than an eventive interpretation. But until recently no such direct experimental evidence (or counter-evidence) had appeared.

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1. Anna Gavarró (pc) points out that, since the adjectival analysis is grammatical in adult English and many other relevant languages, we should not call the use of the adjectival analysis by the child a "strategy." Rather, it is simply a choice of the only grammatical analysis that is available to the child, the verbal passive analysis having been rendered ungrammatical by the maturational mechanism. This is perfectly reasonable and accords with the discussion in Borer and Wexler (1987). Here, we just use the term "strategy" because it has become fairly common, and it might have some rationale. For example, it might be that an adjectival passive with a *by-phrase* is, at least sometimes, ungrammatical in English. Nevertheless, children often use the adjectival strategy to interpret a verbal passive with a *by-phrase*. This is a very subtle question; for example, it's not so clear that the standard assumption that adjectival passives may not take *by-phrases* is correct. We leave the question here, and simply note that the use of the term "strategy" is close to the use of the term "analysis," at least when discussing English and languages with its properties. Spanish, of course, has other properties.

One reason for the lack of experimental evidence on comprehension is that in English the verbal and adjectival passives are homophonous, so that a sentence that is intended as a verbal passive is in fact ambiguous. For simplicity, think of the short passive, without a *by*-phrase. An example is *the boy was shaved*. Of course, this could be a verbal passive. But it could also be a resultant-state adjectival passive (Kratzer, 2000). Such an adjectival passive has the meaning that the boy was in a state that indicates that an event of shaving had taken place on the boy earlier.[2] So if a child took an adjectival interpretation of this sentence, we could just assume that she preferred that particular interpretation; after all, it is a possible interpretation of the sentence. We take it, as in Wexler's earlier work, that children who are using the adjectival strategy are using the resultant-state adjectival meaning as their adjectival interpretation of activity verbs. That is, as Borer and Wexler hypothesized, young children are simply selecting one of two possible interpretations of a sentence that they hear, because the other interpretation is not grammatically available to them. We will later discuss the complications that adding a by-phrase brings.

Recently, however, Gavarró and Parramon (2017) have got around this difficulty by performing an ingenious experiment in Catalan that directly tests the aspectual interpretation that young children take for a verbal passive. They make use of the fact that Catalan verbal and adjectival passives are "almost" homophonous. Both passives use an auxiliary and a participle to indicate the passive but, unlike English, the auxiliary for the verbal and adjectival passives are different. Gavarró and Parramon directly test the interpretation of the verbal and adjectival passives by asking children to select one of 2 pictures, one indicating an eventive (verbal) interpretation and one indicating a stative (adjectival) interpretation. If children perfectly commanded the verbal and adjectival passives, like adults, they would select the eventive reading for the verbal passive and the stative reading for the adjectival passive. However, for both types of sentences, young children from age 3 to 6 mostly select the adjectival (stative) interpretation, indicating most crucially and directly that they are interpreting the verbal passive as adjectival. Only at age 7 do children mostly select the correct eventive picture for the verbal passive. This is striking direct experimental confirmation of the hypothesis of an adjectival strategy invoked by children when they haven't yet developed the mechanisms for deriving the verbal passive.

In order to predict that children will take the adjectival interpretation in the interpretation experiment, we have to assume, as Gavarró and Parramon do, that the different auxiliary is not sufficient to prevent children from using the adjectival

2. As Kratzer points out, context can be a strong help in interpreting these forms as resultant-state adjectival passives. Imagine that it is somebody's job to kick all the tires in a factory. She or he could easily say, while performing this task, "Ok, this tire is kicked, and this one, but not that one."

strategy. That is, children can understand the verbal passive as an adjectival passive when they have no other (in particular, verbal) analysis of the sentence, even though the adjectival passive in the language employs a different auxiliary. This might suggest a true use of "adjectival strategy;" understand a sentence in terms of the analysis of another sentence that you know is grammatical. More precisely, ignore the precise auxiliary in a verbal passive if you don't have an analysis of the verbal passive, and understand it as an analysis of an almost homophonous sentence.

But what does this idea predict about the comprehension experiment? We already know that a strongly different type of verbal passive, very different in structure and derivation and not even using a participle, will result in the lack of an adjectival analysis of verbal passives in comprehension (thematic role) experiments in children. The evidence is that in a language where just such a situation exists (Greek), children perform much worse on the verbal passive of actional verbs than in English (Terzi & Wexler, 2002). With a loosened requirement on homophony, though, we'd expect that children developing Catalan or Spanish would perform much better in the comprehension experiment on the verbal passives of actional verbs than on the verbal passives of subject experiencer verbs. This is because the loosened definition of homophony that allows a change of auxiliary to not interrupt the adjectival strategy in the interpretation experiment should also allow the change of auxiliary to not interrupt the adjectival strategy in the comprehension experiment. To test this prediction, we need to establish that children in languages where the loosened definition of homophony applies (Catalan, Spanish) perform better on the verbal passives of actional verbs than on the verbal passives of subject experiencer verbs. If they do, we can safely accept (following the analysis) that a loosened definition of homophony is at work, allowing the adjectival strategy in such languages.

Gavarró and Parramon did not test subject experiencer verbs in Catalan. In Spanish, we will make that our first experiment, testing the comprehension of the verbal passives of actional and subject experiencer verbs. If children perform better on the actional verbal passives than the subject experiencer verbal passives, then we expect that the adjectival passive strategy is indeed in play (as the Catalan results suggest from the interpretation experiment) and safely predict that the strategy will apply to the interpretation experiment of Gavarró and Parramon, which will be our second experiment in Catalan.

The Catalan evidence that Gavarró and Parramon used to support the claim that children's interpretation of thematic roles in the passive was based on the adjectival interpretation was the fact that the children performed well on short actional passives in a traditional thematic role recovery experiment. This supported the assumption that children were using an adjectival analysis, because in other languages children had to be using such an analysis given that they did poorly on

passives of subject experiencers. However, the paper did not test in Catalan the traditional phenomenon within a language that led to support for the adjectival analysis of verbal passives, namely, the large difference between subject experiencer passives and actional passives.

The maturation and adjectival analysis model predicts that when a passive is ambiguous between an adjectival and verbal analysis, young children will take the adjectival analysis in terms of both thematic roles and the aspectual interpretation. It would be a further test of the model to show that children who develop a language in which the auxiliaries are different in the verbal and adjectival passive perform more poorly on subject experiencer verbal passive than on actional verbal passives.

The first aim of our studies (Experiment 1) is to determine whether this well-established dichotomy in many languages between subject experiencer and actional passives also occurs in Spanish. Spanish has the same relevant properties as Catalan: verbal and adjectival passives are both constructed using an auxiliary and a participle, with the choice of auxiliary differing for verbal and adjectival passives.

If we find the traditional subject experiencer/actional passive distinction in Spanish children, then we have thematic role evidence within the language (not dependent on other languages) that children are using the adjectival interpretation to understand verbal passives.

The second aim of our studies (Experiment 2) is to test children's aspectual interpretation of the passive, by attempting to replicate Gavarró and Parramon's second experiment in Spanish, testing directly whether children interpret verbal passives as adjectival.

There is another aim of our experiments. In addition to their interpretation experiment, Gavarró and Parramon performed a classical four-choice comprehension experiment, in which children had to select the picture corresponding to an action. They found that Catalan-speaking children at the age of 6 had developed excellent behavior on the comprehension (thematic role) experiment, but it was not until age 7 that children developed excellent behavior on the (aspectual) interpretation experiment.[3] They raised the question of why this is, arguing that it doesn't seem to be explained by the bipartite analysis. They raise the possibility that the poorer

3. Of course, both thematic roles and aspect are part of the interpretation of a sentence. However, for simplicity, we will often refer to the traditional thematic role recovery experiment as a "comprehension" experiment and the aspect recovery experiment as an "interpretation" experiment. Our further writing should be understood in these terms. (The terminology is in keeping with the traditional terminology; after all, children were said to comprehend verbal passives well so long as they selected the correct thematic roles in the usual type of experiment. Aspect was not tested. More precisely of course, we can talk about two parts of comprehension, thematic role and aspect.)

behavior in the interpretation experiment is due to a more difficult task, leaving the question open.

However, it seems to us that the standard hypotheses predict the results. The authors used "actional" verbs, the kind that are subject to the adjectival strategy in comprehending the verbal passive. Thus one would expect good behavior on the comprehension experiment so long as the adjectival strategy was in place. The idea of the adjectival strategy is that when a child can't generate the verbal passive, she will attempt to understand the sentence using a different analysis of the sentence, one that has a different derivation, one that she can generate. The child might get the aspectual aspects of the sentence wrong, stative rather than eventive. But she will perform well in an experiment that only asks her to get the thematic roles correct: who did what to whom. *John was shaved* has the property that *John* is the theme, whether the sentence is interpreted as verbal or adjectival. *John* is not the agent in this sentence. When the adjectival interpretation is used for the verbal passive, even with the wrong aspectual interpretation, the thematic roles will be correctly chosen. In the interpretation experiment, the adjectival strategy leads to the wrong (i.e. non-adult) result, the choice of an adjectival rather than verbal interpretation. So the same strategy that leads to a correct result in the comprehension experiment will lead to the wrong result in the interpretation experiment. The interpretation experiment will only show excellent performance when the grammatical mechanism underlying the verbal passive develops, at which point the adjectival strategy will no longer be used. The two-fold theory, maturation of grammatical mechanism plus adjectival analysis before the mechanism develops, predicts good performance on verbal passive of actional verbs before good performance on the interpretation of actional verbs.

The third aim of our experiments, then, is to compare the performance on short actional passives in the thematic role recovery experiment (Experiment 1) and in the aspect interpretation experiment (Experiment 2), predicting that, as children age, they will perform "better" (i.e. correct like an adult) on the thematic role recovery experiment than on the aspect experiment.

Fourth, we have a particularly counter-intuitive and striking prediction to test. The model actually predicts that the better a child performs in Experiment 1 (thematic role) on short actional verbal passives, the worse the child performs in Experiment 2 (aspect) on short actional verbal passives. This is because good performance in Experiment 1 depends on treating the verbal passive as an adjectival passive, and this same strategy will lead to poor performance in Experiment 2. So far as we know, this surprising prediction has not been tested before. In order to test it, we have to use the same participants in both experiments, which we did.

2. Some history

Previous research into children's comprehension of passives shows that children have great difficulties comprehending verbal passive structures, at least before the age of five years. This fact has been assessed across many different languages including English (Bever, 1970; Maratsos, Fox, Becker & Chalkey, 1985), Spanish (Pierce, 1992), Catalan (Gavarró & Parramon, 2017), Greek (Terzi & Wexler 2002), Japanese (Sugisaki, 1998) and Russian (Babyonyshev & Brun, 2003) among many others. In particular, it has been repeatedly found that children perform better with "actional" verbal passives than non-actional verbal passives (Maratsos et al., 1985; Gordon & Chafetz, 1990; Fox & Grodzinsky, 1998; Hirsch & Wexler, 2006a).

The earliest explanation (Bever, 1970) for difficulties with passive pointed to problems in the processing of non-canonical word orders. However, this account seems to be refuted by the fact that children perform better with some kinds of passives. For example, as stated before, children better understand passives derived from actional verbs than those derived from psychological verbs. Young children also understand many non-canonical structures quite well, e.g., those involving A-bar movement such as questions. Some theories argue that the late acquisition of passives is due to the scarcity of some of these structures in child-directed speech (Gordon & Chafetz, 1990). The authors found that psychological passives in children's input were rare. However, Hirsch and Hartman (2006) presented evidence against this fact by counting the frequencies of *wh*-questions with psychological verbs (e.g., *Who did John see?*) in the input to the same children studied by Gordon and Chafetz (1990). The frequencies of those structures were similar to the ones for psychological passives. Therefore, frequency theories predict that children should have problems comprehending *wh*-questions with psychological verbs. However, Hirsch and Hartman (2006) showed that children understood those structures quite well, showing clear data against frequency theories.[4]

The first grammatical explanation for the delay on the acquisition of passives is due to Borer and Wexler (1987). They attribute that delay to the children's inability to compute the movement (A-chain) between the underlying object and the subject position. This inability is due to maturational reasons, so children are able to form A-chains some time after the age of five.[5] This is the A-Chain Deficit

4. It would be good to have similar studies in Spanish, as a reviewer points out. The reviewer also points out that "be-passive" is quite unusual in the present tense in Spanish and Catalan. This would suggest the usefulness of passive studies in those languages using other than the present tense.

5. More detailed recent evidence shows that the age is closer to 8, as we will discuss.

Hypothesis (ACDH). This theory also explains why children perform better with actional passives than with psychological passives. Verbal and adjectival passives are s-homophones (syntactic homophones) (Babyonyshev et al., 2001) in English; that is, they sound alike. However, adjectival passives do not contain an A-chain. Borer and Wexler propose that children can comprehend passives using an adjectival interpretation. As the authors note, actional passive verbs are easily interpreted as adjectives (*The door is closed*) while psychological verbs are not (**The tree is seen*). We will call children's use of an adjectival interpretation to understand verbal passives the *Adjectival Interpretation Strategy* (*AIS*).

Fox and Grodzinsky (1998) proposed instead that children have no problem with verbal passive formation, but that they cannot transmit the thematic role of the underlying subject in a verbal passive to the by-phrase (Theta-role Transmission Deficit) but that there is no difficulty with syntactic verbal passive formation. On their account, there is no AIS. In their experiments they obtained good performance on short psychological passives, which is against ACDH. However, their experiment only had a small number of children and a small number of items per condition (four). Of the 11 children who didn't show adult behavior, 3 conformed to the pattern predicted by Borer and Wexler, and 8 performed differently (good performance on short passives of psychological verbs). As has been pointed out before, the fact that the short passives of psychological verbs were also tested last, perhaps months after the other conditions, means that the children may have learned, and in fact matured. Importantly these results have not been replicated in any experiment while the results predicted by the ACDH, including poor performance on short passives of psychological verbs, have been replicated several times (see for example, Gordon & Chafetz, 1990; Hirsch & Wexler, 2006a), including studies with many more children and randomized conditions of presentation. We therefore cannot attribute children's difficulties with passives to their difficulties with the by-phrase. Hirsch and Wexler (2006b) showed that children at the appropriate age don't understand the nominal *by* that is necessary for such a theory. Gavarró, Parramon and Rallo (2013) note that Majorcan Catalan is like English, in that *de* serves both as the subject theta role marker (transmitter) in a verbal passive and also can assign the Affector theta role, for example, the author of a book. That is, *de* has the properties of English *by.* The Fox and Grodzinsky analysis thus predicts that children speaking Majorcan Catalan should do well on long verbal passives. However Gavarró et al. perform an experiment that finds that these children are quite poor on comprehension of verbal passives of actional verbs, even 6 year-olds, the oldest age studied. To date, then, the great bulk of evidence implies that we need the assumption that some process prevents children from having the correct analysis of verbal passives. Furthermore, for the period in development when performance on verbal passives of actional verbs is much better than on verbal passives of subject experiencer verbs,

we still need to invoke the idea that children use the adjectival interpretation of sentences that were intended as verbal passives.

A well-known problem with the ACDH is that children raise subjects (of transitive and unergative verbs) from the verb phrase to Tense without problem, although the ACDH predicts that such a raising should be difficult for children. On the basis of this difficulty Wexler (2004) proposed an alternative to the ACDH: the Universal Phase Requirement (UPR). This theory assumes that children consider all *v*P, even the *v*Ps with passive participles, to be strong phases, limiting cyclic computation, so that the object of a passive verb, being in the complement of *v*, cannot be raised to T. That is, following the Phase Impenetrability Condition (Chomsky, 2001), children subject to the UPR should consider passive sentences to be ungrammatical. The age at which UPR matures away is determined empirically; according to the detailed studies of Hirsch and Wexler (2006a), the age is about 8 years, though one can imagine that particular methodologies might lead to somewhat different results and that children will vary in the age of maturation.

Borer and Wexler justified their proposal of the AIS by pointing to evidence that children produced adjectival passives at a much younger age than verbal passives. Although this suggestion has been sometimes questioned by non-generative scholars, the evidence has only grown stronger. Even non-generativists (who prefer theories that don't have such grammatical distinctions) have to accept the claim that adjectival passive is in place well before verbal passives. For example, Israel, Johnson and Brooks (2000) provide extensive evidence from natural production data for children's very early use of adjectival passives, and practically non-existent use of verbal passives, stating explicitly that their results confirm Borer and Wexler's proposal concerning the difference in developmental rates of adjectival and verbal passives.

The investigation of the acquisition of passives in other languages with different features can be of great importance in this debate. Of particular interest are those languages in which verbal and adjectival passives are not s-homophones. X is an s(yntactic)-homophone of Y if X and Y have different syntactic structures but have the same phonetic form (Babyonyshev, Ganger, Pesetsky, & Wexler, 2001). E.g., the verbal and adjectival passives in English are s-homophones of each other. On the assumption that children will use Y to understand X (when X is not available to them) only on condition that X and Y are s-homophones, in a language in which the verbal and adjectival passives are not s-homophones, the adjectival strategy (using the adjectival passive to understand the verbal passive in the pre-mature state) will not be available, or not easily available, to the child. Therefore, following ACDH, or UPR, they are expected to perform worse than English children on verbal passives. This hypothesis was first tested in Greek (Terzi & Wexler, 2002). In that work, 30 Greek-speaking children were tested on a picture selection task. The adjectival passive in that language is similar to the familiar English adjectival passive: a copula

and participle. But the verbal passive has no copula and a completely different morphology than the verbal passive. Six actional and four psychological verbs were used to construct the verbal and adjectival passives. The results showed that verbal passives (both actional and psychological) were poorly understood while the performance on adjectival passives was quite good. In particular, the Greek-speaking children performed much worse on the verbal passive than did English-speaking children of the same age. Therefore, the ACDH prediction was confirmed: children seem to use an adjectival strategy to interpret actional passives but they are able to use that strategy only when the verbal and adjectival passives are s-homophones.

More recently, the same prediction was tested in Catalan (Gavarró & Parramon, 2017). In that language, verbal and adjectival passives are not strictly speaking s-homophones either. However, they have quite similar structures. Both use an auxiliary (*ser* for verbal and *estar* for adjectival passives) followed by a past participle. We will return to the question of the grammar of *ser* and *estar* in our section on Spanish passives. In the first two experiments, the authors tested long and short passives of actional verbs. Children performed well on short passives. This fact might be interpreted as being against ACDH and UPR, as children should not be able to use the adjectival interpretation strategy since both passives are not homophones. If that were the case, however, all the other phenomena (e.g., subject experiencer/actional distinction) would be at a loss for an explanation, which is one reason we are testing that in Spanish). Moreover, the great similarity between the verbal and adjectival structures and the fact that they sometimes alternate could be the reason why children can still use the adjectival interpretation. Perhaps the fact that the verbal and adjectival passive both have an auxiliary (although a different one) followed by the same participle, allows a child to mentally substitute the adjectival passive structure for the non-understood verbal passive structure.

It is worth pointing out that, although Babyonyshev et al. (2001) take the homophony of the verbal and adjectival passive as crucial in English in order for the adjectival passive to apply, coining the term of *s-homophone*, taking into account the work of Terzi and Wexler (2002) on Greek, the original analysis of Borer and Wexler (1987) did not explicitly refer to the homophony of the two passive forms as a requirement for the application of a strategy. Rather, they assumed ACDH and wrote (p. 148) that "the acquisition of passives proceeds along the assumption that all participles of actional verbs are well-formed adjectives, whereas participles of non-actional verbs are not. The array of facts described by Maratsos et al. (1985) now follows in its entirety." In particular, Borer and Wexler provided a theory of passives that derived verbal and adjectival passives in a similar but not identical fashion, with ACDH ruling out the verbal passive given this analysis, but not the adjectival. Simplicity conditions (that ACDH is the only relevant maturational mechanism) now implied that the child would have the adjectival analysis of verbal

passives, producing the acquisition results. Terzi and Wexler's results on Greek provided the motivation for the analysis of homophony as necessary for the successful application of the adjectival strategy (that is, the child's ignoring aspectual and other information that distinguish verbal and adjectival passive). That one study is the only relevant one concerning homophony, so it should be no surprise that strict homophony isn't necessary.

In Gavarró and Parramon's comprehension experiment, children showed a poor performance on long passives except for 6-year-olds. Why should children be able to interpret verbal passives as adjectival passives when there is no by-phrase, but have difficulty when there is a by-phrase? We suggest that the reason is that the by-phrase is not compatible with an adjectival interpretation of most passive verbs, as a syntactic fact. Thus, despite the fact that children are able to ignore the auxiliary in short passives, ignoring both the auxiliary and the by-phrase could be too difficult to overcome; a by-phrase indicates a different kind of structure than the adjectival passive and, therefore, children are not able to use the adjectival interpretation.

More precisely, Hirsch and Wexler (2006a) and unpublished work by Jeremy Hartman, Christopher Hirsch and Ken Wexler argue that, when children perform well on verbal passives of actional verbs, it is because they are taking the meaning to be a resultant-state adjectival passive meaning (Kratzer, 2000). A resultant state adjectival-passive such as *the ball is kicked* means that at the reference time *t*, the ball is in a state such that an event of kicking the ball took place before *t*. Resultant-state adjectival passives are still stative, but the state is a more complex, derived, entity than the primitive "target" state of a verb like *break* or *close* (Kratzer, 2000). Kratzer shows that any activity verb can be made into a resultant-state adjectival passive and that, in English, by-phrases are incompatible with resultant-state adjectival passives.

English-speaking children around 5 or 6 years old perform reasonably well (say, 85% or so on a two-choice experiment at age 5) with the typical verbs used in experiments on verbal passives, which turn out to be activity verbs. Thus they can use the resultant-state adjectival passive interpretation to understand the verbal passive. They often perform somewhat better on short actional passives than on long actional passives, indicating that the incompatibility of the by-phrase with this interpretation makes it more difficult to interpret the verb as a resultant-state adjectival passive. However they certainly perform above chance on such verbal passive structures of "actional" (activity) verbs. Thus we can assume that children in English will sometimes ignore the difficulty of interpreting a passive verb with a by-phrase as an adjectival passive. Perhaps this is more difficult in Catalan, since the child has to overcome both the presence of a by-phrase and the presence of the wrong auxiliary.

Alternatively, there might be a structural reason that children in Catalan perform worse than children in English on long verbal passives at age 5. In this paper we would like to extend the Catalan results to Spanish, where there are distinct auxiliaries for the verbal and adjectival passives, as in Catalan. At that point we will return to this question.

In an important second experiment, Gavarró and Parramon (2017) tested the interpretation that children give to passive sentences. Until now, to our knowledge, no experimenter has succeeded in directly testing the interpretation that children provide for the verbal passive. The argument of Borer and Wexler (1987) that children used the adjectival strategy was indirect, based on phenomena like the prediction of the poor performance on psychological verbs.

Gavarró and Parramon's second experiment consisted of a two-choice picture task on short verbal passives of actional verbs, where children had to select between one picture representing an action and a second picture representing the result of the action. The findings indicated that children mostly interpret short verbal passives as results of the action, in other words, as adjectival passives, and this is true also at age 6. All the verbs tested in this experiment were also used in the first two experiments so the results with short passives should be very similar. Therefore, as we pointed out before, a question has been raised by Gavarró and Parramon about the good performance of Catalan-speaking 6-years-old in Experiment 1, and it would be useful to replicate those results in Spanish. According to other findings in the literature, it is quite probable that 6-year-old children are still in the UPR stage (in similar experiments, children perform well on the verbal passives of psychological verbs only around the age of eight).

In this study we try to contribute to the literature investigating the acquisition of actional and psychological passives in Spanish. To our knowledge, the only paper concerning Spanish passive acquisition is the one by Pierce (1992) but that experiment ignored some crucial points that are of special interest. For example, actional and psychological verbs are tested (only two of each kind) but the results are shown without distinguishing between those two categories. Moreover, the adjectival interpretation is not tested at all.

3. Spanish passives

Spanish, like many languages, has two main kinds of passives: verbal and adjectival (Mendikoetxea, 1999). Verbal passives express an event and adjectival passives are used to express a state. Structurally, both passives are very similar but, unlike English, they are not s-homophones.

(1) a. *La niña es peinada.* Verbal
The girl is being combed
b. *La niña está peinada.* Adjectival
The girl is combed

Verbal passives are expressed by means of the auxiliary verb *ser* ('to be') followed by a past participle,[6] while adjectival passives are expressed by means of the auxiliary verb *estar* (also 'to be') followed by a past participle. As in many languages, verbal and adjectival passives differ in their capacity to include a *by*-phrase. Verbal passives easily and generally contain the equivalent of a by-phrase that expresses the underlying subject while adjectival passives can contain such a by-phrase only in more special circumstances. As stated before, these two kinds of passives have a different semantic interpretation related to aspect. Verbal passives refer to the event while adjectival passives refer to the resulting state after that event. Some authors (e.g., Schmitt, 1992; Roby, 2007) suggest that something like this state/event distinction could be the reason for using different copulas in verbal and adjectival passives. However, any attempt to relate the properties of *ser/estar* to lexical semantic properties runs into empirical trouble that has resulted in a large and controversial literature. See Pérez-Jiménez et al. (2015) for a collection of quite varying recent approaches. These are compared and discussed in Leonetti et al. (2015) and in Gutiérrez-Rexach (2017).

Most theoretical approaches depend on the lexical content of the complement to the auxiliary: *ser* or *estar* is chosen depending on this content, expressed in some semantic terms. Zagona (2012) reviews the most prominent of these and shows that there are important phenomena that they mispredict. Interestingly, the verbal passive is one of the structures that the approaches don't seem to predict correctly.

An important phenomenon is that with some predicate adjectives, either *ser* or *estar* may occur.

(2) a. *Juana es linda.* (*ser*)
'J. is beautiful.'
b. *Juana está linda.* (*estar*)
J. is beautiful
'J. looks beautiful/is beautiful.'

There is a semantic difference between (2a) and (2b). In (2a), the statement is that Juana is beautiful in general, over her lifetime, simply a characteristic of hers. In

6. Verbal passives can also be expressed using a non-periphrastic construction built with the clitic pronoun *se* and the finite verb form. However, in this paper we will focus on the periphrastic passives, which are of great interest given their similarity with the adjectival passive structure.

(2b) the attribution of beauty is more limited to a current present time period, a temporary state, e.g. J. looks beautiful tonight, or J. is beautiful tonight. Thus it is natural to take what is perhaps the most common approach to the *ser/estar* distinction, namely that it reflects an individual-level versus stage-level distinction in the predicate, or the intended meaning of the predicate: *ser* is used with individual predicates, *estar* with stage-level predicates. (2a) indicates an individual-level meaning, (2b) a stage-level meaning, hence its possible gloss as *looks beautiful*.

Zagona points out a number of empirical problems for the stage-level/individual-level theory. For one thing, it mispredicts the auxiliary that should be used with verbal passives. These are eventive and "can refer to specific eventualities in 'discrete slices of time'" (Zagona, p. 307). This is pretty much the definition of stage-level predicates. Yet verbal passives occur with *ser*, not *estar*. There are several other problems of this nature. A similar aspectual distinction that is sometimes claimed is that *ser* has an imperfective use and *estar* a perfective one. E.g. (2b) has distinct beginning and end points (J is beautiful in a certain time period, with beginning and ending points) whereas (2a) doesn't. Why should *ser* then occur with verbal passives, which occur at a distinct slice of time, that is, are "perfective?" Furthermore, the progressive in Spanish uses *estar* as its auxiliary. Yet progressives are imperfective, having no beginning and end points. Zagona lays out several such points against the most popular approaches to the lexical content distinction between *ser* and *estar*. She concludes that no approach that explains the difference in the auxiliaries via their 'temporal semantics' can work.

Zagona argues for a theory in which the uses of the two auxiliaries follow from their syntactic properties. In particular, *estar* contains an uninterpretable formal feature, [uP] that *ser* does not contain. The feature is an "uninterpretable prepositional" feature. It is on *estar* itself:

(3) *estar*: [*v* [uP] …]

Since the feature uP is uninterpretable, it must be checked, or agree with the complement of *estar*; that is, there must be an interpretable P feature in that content, that is a preposition of some kind. Otherwise, uP is not deleted, and the derivation crashes by Full Interpretation.

What is this P feature? It may be a location feature, and Zagona suggests that it might have originated that way, but is now more general and abstract, that is, formal. She argues that the complements of *estar* all have a "relational component" to their interpretation. Since this is not semantically defined (as we argued), it must involve an Agree relation with a prepositional complement. She works out a detailed theory of the temporal and aspectual syntax.

Why is *ser* used with verbal passives and *estar* used with adjectival passives? First, Zagona shows that locative complements of *estar* are always states; they may not include a path component. A directional complement does not match the [uP] feature and crashes. Passives are similar. Adjectival passive participles are stative; they do not include a directional component. Thus they match the [uP] probe, eliminating it, deriving a good adjectival passive. Verbal passive participles have a directional component, and will not match [uP], thus causing a derivation with *estar* to crash. *Ser*, having no features, is used when *estar* doesn't derive a grammatical representation.

Like Greek passives, Spanish verbal and adjectival passives are not homophonous. However, in Spanish, both passives share the same structure. The only surface change is the substitution of the copula. This similarity of surface structure could be of great importance in explaining the different patterns of acquisition that children present. Like Catalan, in Spanish the only difference is the auxiliary, while in Greek, adjectival and verbal passive structures are totally different; verbal passives are another form of the verb. Thus, it should be easier to apply the adjectival strategy for Spanish-speaking children than for Greek-speaking children.

In terms of Zagona's theory, the two auxiliaries may be looked at as two versions of BE, differing only by one feature. Their phonetic difference exists in the auxiliaries, but they are extremely similar otherwise. This might help to explain why children might be willing to understand *ser* passives as if they are *estar* passives.

Can we be more precise? Much depends on how well children have developed the correct theory of *ser* and *estar*. Do young Spanish-speaking children know in fact the details of the use of *ser* and *estar*, some of which we have described above? We don't know if any empirical studies have demonstrated this or not. In terms of the theory we are assuming here (from Zagona), it depends on whether children know that the difference is that *estar* contains the (stative) prepositional feature. This is a rather abstract and difficult concept. Linguists haven't thought of it before, instead concentrating on surface temporal semantic distinctions in the complements, that don't seem to work. Of course, we expect children to know the concepts that underlie this. But will Spanish-speaking children have mastered the fact that the distinction exists in their language and which auxiliary is which?

If children haven't mastered this distinction, and if they can't derive a verbal passive grammatically (via a maturational mechanism, e.g. UPR), then the only derivation that they can recover is the adjectival passive one, and they might simply not worry about *ser* or *estar*; the existence of the participle is sufficient to guide them to the adjectival passive interpretation, which is the result we expect.

On the other hand, if children *have* mastered the distinction, depending on the [uP] feature on *estar* (e.g., they use *estar* in progressives, they know that there

is a semantic difference in (2a), (2b), etc.), then they would expect *estar* to be used with an adjectival passive. Why, then, should they be willing to accept an adjectival passive interpretation for a *ser* + *participle* construction, even if they can't derive the construction?

Here is one possibility. *Ser* doesn't contain any [uP] feature. Otherwise it has the same lexical structure as *estar*. *Ser* is used as a kind of default, when *estar* doesn't fit, in a kind of Elsewhere Principle derivation.[7] In a verbal passive, the structure that the child hears (with *ser*) is ungrammatical for them. So since the child knows that *estar* and *ser* are in a kind of lexical competition, the child might decide to mentally put in the other member of the competition pair (*estar*), and understand the sentence in its terms. The child's interpretation of verbal (*ser*) passives as adjectival (*estar*) passives follows.

Much remains to be worked out, including the question of a detailed understanding of what children know about the uses of the two auxiliaries at the relevant ages.

As we have pointed out, given our considerations, two results should follow:

First, immature (i.e., before the UPR has matured away) Spanish- speaking children should perform much better on comprehension of verbal passives of actional verbs than on verbal passives of subject experiencer verbs, since the adjectival strategy applies to the former, but not the latter. (As in English, subject experiencer verbs in Spanish do not make good adjectival passives; in particular they don't make good resultant-state adjectival passives.)

Second, we expect that immature Spanish-speaking children will perform better on the verbal passives of actional verbs than do Greek-speaking children, since the adjectival strategy will be more available in Spanish than in Greek. Since our experiment does not contain Greek-speaking children, we will not comment in any detail on this second prediction except to point out that the Spanish results show a better performance on verbal passives of actional verbs than do the Greek results of Terzi and Wexler. We will concentrate in more detail on the first prediction, the difference between actional and subject experiencer verbal passives.

Experiment 1 tests Spanish-speaking children's performance on short and long verbal passive with actional and psychological verbs.

7. Zagona doesn't put it this way. She argues (p. 324) that *ser* is interpreted in particular ways when its complement has particular properties related to event boundaries. But these are properties of the complements, not related to a formal feature on *ser*. So perhaps what we are saying is compatible with her analysis.

4. Experiment 1: Actional vs. psychological passives

4.1 Method

Participants

The participants in this experiment were 60 children in the age range of 3;0–6;11 years old. They were recruited from a school in Madrid and tested individually at the same school. All of them were native speakers of Spanish and presented no symptoms of language disabilities. We divided them into four groups according to age. The groups tested were 3-year-olds (mean age 3;6), 4-year-olds (mean age 4;7), 5-year-olds (mean age 5;5) and 6-year-olds (mean age 6;6). Each group was composed of fifteen children (see details in Table 1).

Table 1. Participants and age groups in Experiment 1

Group	Number	Age range	Mean age
3 y.o.	15	3;0–3;11	3;6
4 y.o.	15	4;1–4;11	4;7
5 y.o.	15	5;0–5;10	5;5
6 y.o.	15	6;0–6;11	6;6
Total	60	3;0–6;11	5;0

Materials

Experiment 1 tested the effects of voice (active/passive), verb type (actional/psychological)[8] and passive length (short/full) on children's comprehension of passive sentences. We used a set of 16 verbs, 8 actional verbs (*abrazar* 'hug,' *besar* 'kiss,' *empujar* 'push,' *golpear* 'hit,' *lavar* 'wash,' *peinar* 'comb,' *tapar* 'cover' and *tocar* 'touch') and 8 psychological verbs (*amar* 'love,' *escuchar* 'listen,' *mirar* 'watch,' *odiar* 'hate,' *oir* 'hear,' *olvidar* 'forget,' *recordar* 'remember' and *ver* 'see'). We chose these verbs because of their similarity to verbs used in previous research in other languages (hence, facilitating the comparison) and because of the ease with which they could be represented in a picture. The "actional" verbs were all activity verbs, thereby making them capable of a resulting-state adjectival passive derivation (Kratzer, 2000). Each of these 16 verbs was presented in an active sentence, a short passive and a full passive forming a test set of 48 total sentences. All sentences were

8. Subject experiencer is a more accurate term than 'psychological', since there are other types of psychological verbs, e.g. object experiencer verbs (e.g. *frighten*), which present a different type of pattern of development of verbal passives, as expected. But since *psychological* is a term common in the developmental literature, we sometimes resort to that term. We always mean, however, *subject experiencer.*

semantically reversible (one cannot tell from the verb and noun phrases which is the subject and which is the object) so that grammar is essential in comprehending the sentence. The same pictures were used in the active and passive sentences so that the particular items did not influence the understanding of the sentences depending on the condition tested. Some children's difficulties with psychological verbs could be due to the problematic depiction of psychological verbs. Using those same verbs in the active condition, we can test that explanation.

Procedure

The experiment consisted of a two-picture selection task. Children were shown two pictures representing an action and its reverse action, i.e., the same action with the protagonists changing their roles (see Figure 1 in the Appendix). They had to choose the picture that best matched the sentence they were read. Each sentence was read twice before asking the children for the answer. Each child was presented with the full set of 48 sentences in a randomized order. The positions of the correct pictures on the screen were also randomized across the 48 sentences. Before starting the experiment, we conducted a training stage in order to familiarize the children with the characters used in the pictures and the verbs tested. Each child was shown the different characters involved in the experiment performing the 16 actions we used. Finally, a questionnaire was presented to each child in order to check that they knew the characters and the actions involved in the experiment.

In order to make sure that our predictions of the adult behavior were indeed correct, with no odd choices of linguistic material/context, or inappropriate task demands, we repeated the experiment with adults. Fifteen adult participants with ages between 18 and 46 years (mean age 27;6) were tested. All of them were native speakers of Spanish and presented no symptoms of language disabilities. They were asked to perform the same task with a small difference: sentences were shown on the screen below the two images. This way, the experimenter did not have to read the sentences aloud to the participant. The rest of the materials and procedure were exactly the same that we used with children. The results were clear: the adults performed above 95% on all conditions. Therefore, any differences in child performance cannot be attributed to the task or to a flaw in the materials used.

4.2 Results

Results are shown in Table 2. Overall, children perform much better on active sentences than passive sentences. But no difference was found between actional and psychological actives. This fact shows that psychological verbs were not more difficult to understand. On the other hand, actives are better understood by children than short and long passives.

Table 2. Child performance on the different conditions of voice, verb type and passive length

Group	Actional			Psychological		
	Active	Short passive	Full passive	Active	Short passive	Full passive
3 y.o.	88.3%	65.0%	24.2%	87.5%	30.0%	29.2%
4 y.o.	95.8%	68.3%	42.5%	96.7%	28.3%	34.2%
5 y.o.	96.7%	84.2%	48.3%	95.8%	40.8%	47.5%
6 y.o.	99.2%	95.8%	62.5%	98.3%	53.3%	49.2%
Average	95.0%	78.3%	44.4%	94.6%	38.1%	40.0%

We conducted an ANOVA in order to check the effects of each of the conditions tested. We found a significant main effect of voice, active versus passive, ($F(1,56) = 11.926$, $p < 0.001$) while the effect of verb type, actional versus subject experiencer, was also significant ($F(1,56) = 142.348$, $p < 0.001$). There was no significant effect of verb type for active sentences. For passive sentences we found a significant effect of verb type ($F(1,56) = 195.352$, $p < 0.001$) with children understanding actional passives better than psychological passives. There was also a significant effect of length ($F(1,56) = 124.168$, $p < 0.001$) with children understanding short passives better than full passives. Importantly, going through a simple effects analysis, we found no significant differences between full actional and full psychological passives ($F(1,56) = 3.927$, ns.) or between short and full psychological passives ($F(1,56) = 1.150$, ns.)

4.3 Discussion

The results support the UPR and the adjectival interpretation of actional passives. This theory predicts worse performance on short and full passives than on active sentences because the young child does not have the mechanism for deriving verbal passives. In agreement with this prediction, the results of the experiment show a significant difference between actives and both kind of passives. This fact is also clearly against the Theta-role Transmission Deficit (Fox & Grodzinsky, 1998) hypothesis, which predicts bad performance on full psychological passives and very good performance on short psychological passives. The Spanish results are in accord in this regard with many experiments on short and long actional and psychological passives in English (see Hirsch & Wexler 2006b for discussion).

Also, under UPR, children are expected to show better performance on actional passives than psychological passives since they use an adjectival interpretation to understand them. Given the results in Greek, this adjectival strategy might be expected to be applied only when verbal and adjectival passives are homophonous,

which is not strictly the case. Following the results in Gavarró and Parramon (2017) in Catalan, we argued that the small (auxiliary) difference between verbal and adjectival passives in Spanish would allow the adjectival strategy to apply in Spanish. This prediction is confirmed.

Our results show that children perform much better on short actional passives than on full actional passives. Even as late as age 6, where performance on short adjectival passives of actional verbs is at 95.8% (showing strong mastery of the adjectival strategy, since performance on short psychological passives is only 53.3%), performance on full actional passives of actional verbs is only 62.5%. If 6 year-old Spanish children have mastered the adjectival strategy so well, why don't they also apply it in this same masterful way to full actional passives?

First, we should point out that it is a standard result in studies of the development of English passives of actional verbs that children perform better on short than on long passives. (For one example in contemporary results, see Hirsch & Wexler 2006a). This was one of the facts that motivated the original Borer and Wexler analysis of children's use of the adjectival strategy: adjectival passives don't take *by*-phrases nearly so easily as full verbal passives. In contemporary terms, the explanation for this fact usually revolves around the argument that adjectival passives, unlike verbal passives, don't have an external argument slot, or have a less active one in some sense. However, the simple fact that *by*-phrases aren't easily compatible with adjectival passives means that when immature children hear a sentence with a passive and a *by*-phrase, they don't so readily parse it as an adjectival passive. Since they can't analyze it as a verbal passive (by the maturation mechanism, e.g. the UPR), they can't comprehend the sentence. Thus children do less well on full verbal passives of actional verbs than on short verbal passives of actional verbs. Our Spanish results confirm this analysis.

Why do children do better on short actional passives as they age, even though they have not yet matured? Again, this is a standard result. It seems reasonable to assume that their ability to apply the adjectival strategy improves with age. It might be that they understand the adjectival passive better as they age. After all, the resultant-state adjectival passive is not frequent in the input and needs context to make it totally felicitous (see Kratzer, 2000 for the latter point). The children have to supply the context. We make the natural assumption that this property simply develops with time.

Children don't perform better on short psychological passives than on full psychological passives. This result shows that sentence length or complexity, in a simple sense, cannot predict the result that children perform better on short passives of actional verbs than on full passives of actional verbs. Rather, the properties of the adjectival passive predict the results; adjectival passives are not easily compatible with *by*-phrases, at least the type of *by*-phrases that we used in the experiment.

At the same time, children perform much better on short actional passives than on short psychological passives. This is because the activity verbs make good (resultant-state) adjectival passives and the children know this (and they know this better the older they get), but the subject experiencer verbs don't make good adjectival passives.

The results are consistent with previous experiments in languages in which verbal and adjectival passives are not s-homophonous (Terzi & Wexler, 2002; Gavarró & Parramon, 2017). As stated before, as in Greek, the bad performance on long actional passives could be due to the inability of children to apply the adjectival strategy. In Greek, the lack of the adjectival strategy is due to the complete difference in structure of the verbal and adjectival passive, readily apparent to the child by the large surface difference in the two forms. In Catalan (Gavarró & Parramon 2017) and Spanish, the children seem to be able to apply this strategy because of the great similarity of both structures, with only a difference in choice of auxiliary. Thus the Spanish children do well on short verbal passives, though not as well as on actives, showing a development of the ability to use the strategy. At any rate, the results of this experiment and the one of Gavarró and Parramon (2017) are overall quite consistent and show strong evidence for UPR.

The only obvious difference between our results on Spanish and Gavarró and Parramon's (2017) results on Catalan is that we didn't reproduce the results on full actional passives for 6-years-old. In their experiment on Catalan, 6-year-olds show almost adult performance on actional long passives (92%). However, in our experiment, children did not perform much better than chance level. In their second experiment on Catalan, Gavarró and Parramon show that 6-year-olds clearly apply an adjectival interpretation to the passive interpretation, meaning that they have not yet matured in terms of the mechanism that derives verbal passives. It seems that the Catalan children are able to apply the adjectival strategy to full verbal passives at age 6, whereas the Spanish children cannot.

One might attempt to locate the locus of the difference in 6-year-old behavior in Catalan and Spanish to the different methodologies employed. The Catalan study was a four-choice picture experiment, in which the pictures contained extra characters to justify the existence of the *by*-phrase. Could this pragmatic issue have contributed to the better performance in Catalan? It is possible but, in our opinion, doubtful. The younger Catalan children performed quite poorly on the full passive; 5-year-olds only had a mean correctness rate of 29%. If it were a pragmatic issue, why hadn't the younger children performed well?

Moreover, in a language where strict s-homophony between the verbal and adjectival passive holds (English), in general excellent performance on the full verbal passive holds by the age of 6, even with the same two-choice picture methodology employed in our experiment on Spanish. Reviewing similar two-choice

picture experiments on full verbal passives of actional verbs, we see that Maratsos et al. (1985)'s Experiment 2 found correctness rates to be: 85% for age 4, 91% for age 5 and 92% for age 7. Hirsch and Wexler (2006a) found correctness rates to be 69.4% for age 4 and 83.7% for age 5.[9] In unpublished work in preparation on the development of verbal passives in autism and TD controls, Perovic and Wexler have a control group of 26 TD children of mean age 71 months (that is, the mean is just below 6;0). This group shows a correctness rate of 92%.

These numbers in English seem to be quite close to the 92% correctness rate for full verbal passives of actional rates for 6-year-olds in Catalan in Gavarró and Parramon's results (although the 29% correctness rate for 5-year-olds seems well below the pattern in English). The 62.5% correctness rate for full verbal passives of actional verbs in Spanish that our Table 2 shows seems to be the one somewhat anomalous result. Why are Spanish children at age 6 still performing poorly on the full passive of actional verbs compared to English and Catalan children?

Could it be that the different age of good performance on full actional passives in Catalan and Spanish is related to the structure of the two languages? One idea (following Fox & Grodzinsky, 1998) might be asking whether in Catalan (as opposed to Spanish), the form for *by* in the verbal passive is the same as the form for *by* in the nominal, just as in English. We would also have to assume that children know this Catalan form for *by* in nominals (which they don't in English, Hirsch, & Wexler, 2006b). If the *by* forms were the same in Catalan and children knew the nominal form, they might be able to use the nominal form as the basis for a strategy to interpret the *by* of the verbal passive. In Spanish, the forms are different. We would then expect pre-mature Catalan children to perform better than Spanish children on the full verbal passive.

But this does not appear to be the case. In Catalan, the form for the *by* in verbal passives appears to be distinct from the form for *by* in nominals:

(4) a. *un libre de John*
a book by John
b. *El pare és tapat pel germà petit.*
The father is being covered by the small brother

De is the form of *by* in non-passives e.g. in nominals, as (4a) shows. *Per (*pel *before* el) is the form of *by* in the verbal passives as (4b) (from Gavarró & Parramon,

9. Hirsch and Wexler reported data separately for two 4-year-old groups, one group spanning the first half of the 4-year age-range and one group spanning the second half of the age range. Similarly for 5-year-olds. We have averaged these two groups for each age in reporting this data above.

2017) shows. The form of *by* doesn't make it easier to apply the adjectival strategy in Catalan than in Spanish.

Another possibility to explain the difference at age 6 between Spanish and Catalan on short passives is if adjectival passives in Catalan more easily take a *by*-phrase than in Spanish. If that were the case, then the existence of the *by*-phrase wouldn't so readily prevent the use of the adjectival strategy in Catalan. The idea of course is that 6-year-old children, who still have not matured out of the UPR (which prevents the verbal passive derivation), can use the adjectival strategy to answer correctly, by ignoring some of the constraints on *by*-phrases in adjectival passives, although younger children didn't have that capacity. We know that this ability does improve with age, even before maturation out of the UPR, because children perform better on short passives than on long passives of actional verbs, in Catalan, English and Spanish. The ability develops by age 6 in Catalan and English, but not Spanish, given the data we have reviewed.

This proposal is subject to linguistic research that we have not undertaken. It also does not seem all that likely. In general, even with languages that have more distant passive forms, cross-linguistic constraints on *by*-phrases in adjectival passives are similar. Proposals constraining *by*-phrases in adjectival passives include Meltzer-Asscher's (2011) suggestion that they are limited to reference to entities that can be ascertained from the visible result of the action and Alexiadou et al.'s (2014) suggestion that they must refer to *kinds* rather than specific referents. It seems unlikely that Catalan and Spanish would differ so much in the details in the existence of certain types of *by*-phrases with adjectival passives that such a large difference in performance at age 6 would result. Nevertheless, it would be good to do comparative research to test the hypothesis.

We leave the question here, undecided on these options and even on whether any of them might be true. We hope merely to foster further research into the question.

Overall, we can conclude that the results on Spanish and Catalan are mostly in excellent accord, both consistent with the bipartite theory of passive development. The adjectival strategy is at work in the development of both languages. The further data on psychological passives in Spanish shows that the strategy is at work in a thematic role comprehension experiment, so that we would expect better performance on short actional passives than on short psychological passives in an aspect interpretation experiment, to which we turn next.

5. Experiment 2: Adjectival vs. verbal passives

This second experiment investigates whether Spanish children use an adjectival interpretation when understanding verbal passive structures, as predicted by the bipartite theory of passive development, if strict homophony is relaxed to accommodate the auxiliary difference. It is based on one of the experiments designed by Gavarró and Parramon (2017) for Catalan. As stated in the introduction, adjectival and verbal passives are not homophonous in Spanish. However, unlike Greek, both passives share the same structure. The only surface change is the auxiliary substitution (*ser* for verbal passives and *estar* for adjectival passives). As shown by Terzi and Wexler (2002), Greek children were not able to use the adjectival interpretation while Catalan children seem to be able to use it (Gavarró & Parramon, 2017). This difference could be due to the degree of similarity between the verbal and adjectival surface structures. In Catalan, like Spanish, the only difference is the auxiliary while in Greek these two structures are totally different. Thus, it seems to be easier to apply the adjectival strategy for Catalan children. The objective of this experiment is to directly check whether children do or do not take the adjectival interpretation in comprehending verbal passive structures.

5.1 Method

Participants
The participants in this experiment were exactly the same participants as in the first experiment: 60 children in the age range of 3;0–6;11 years old. All of them were native speakers of Spanish and presented no symptoms of language disabilities. See Table 1 for details. All the children were tested a week after the first experiment and all of them were tested in the same room and under the same conditions used in Experiment 1.

Materials
In this experiment we used a set of 8 actional verbs that make good adjectival passives (*afeitar* 'shave,' *besar* 'kiss,' *dibujar* 'draw,' *golpear* 'hit,' *lavar* 'wash,' *mojar* 'wet,' *peinar* 'comb,' *tapar* 'cover'). Once again, we chose these verbs because of their similarity with previous work (hence, facilitating the comparison) and the ease with which they could be depicted in both actional and adjectival interpretations. With each of these 8 verbs we built a short verbal passive and a short adjectival passive forming a test set of 16 total sentences. The pictures for the verbal passive sentences represented an action and the pictures for the adjectival passives represented the result of the action.

Procedure

The experiment consisted of a two-choice picture selection task. Children were presented two pictures representing an action and the result of that action (see Figure 2 in the Appendix). They had to choose the picture that best matched the sentence they were read. Each sentence was read twice before asking the children for the answer. Each child was presented the full set of 16 sentences in a randomized order. The positions of the correct pictures in the screen were randomized across the 16 sentences. Before starting the experiment, we conducted a training stage in order to familiarize the children with the characters used in the pictures and the verbs tested. Each child was shown the different characters involved in the experiment performing the 8 actions we used and also the different final states were shown. Finally, a questionnaire was presented to each child in order to check that they knew the actions and the states involved in the experiment.

As in Experiment 1, we checked that the pictures showing events and resulting states were interpreted correctly, and that eventive pictures were not more difficult to understand. We repeated the experiment with the same adults as in the adult study in Experiment 1. Fifteen participants with ages between 18 and 46 years (mean age 27;6) were tested. All of them were native speakers of Spanish and presented no symptoms of language disabilities. Again, they were asked to perform the same task with a small difference: sentences were shown in the screen below the two images. This way, the experimenter did not have to read the sentences aloud to the participant. The rest of the materials and procedure were exactly the same as we used in Experiment 2 in children. The results were clear: the adults performed above 95% in both conditions. Therefore, any differences in child performance with eventive and resulting state sentences cannot be attributed to a general difficulty in interpreting eventive sentences or to a flaw in the materials used.

5.2 Results

Results are shown in Table 3.

Table 3. Percentage correct interpretation: verbal vs. adjectival passives

Group	Verbal passives	Adjectival passives
3 y.o.	27.5%	68.3%
4 y.o.	37.5%	71.7%
5 y.o.	35.0%	80.8%
6 y.o.	40.8%	83.3%
Average	35.1%	76.0%

The percentages refer to accuracy rates, where the correct interpretation of a verbal passive is the eventive picture, and the correct interpretation of the adjectival passive is the resultant-state interpretation. The results are quite clear: children most often use the adjectival interpretation both for the verbal passives and the adjectival passives. The difference in performance with the two kinds of passives is statistically significant ($F_1(59) = 74.3$, $p < 0.0001$, $F_2(14) = 29.6$, $p < 0.0001$). Even 6-year-old children select the adjectival interpretation about 60% of the times with verbal passives, whereas, as we reported above, adults select the adjectival interpretation less than 5% of the time.

5.3 Discussion

The results support the UPR, and in particular they directly support the strategy of adjectival interpretation. This theory proposes that young children are not able to syntactically compute verbal passives and they are only able to comprehend verbal passives using an adjectival interpretation. The results of this experiment clearly confirm this prediction. Children use the adjectival interpretation in most cases with both verbal and adjectival passives. Also, the maturational account seems to be supported since children do not present much development in this age range on the interpretation of verbal passives (consistent with the results on psychological verbs in Experiment 1). This fact suggests that it is quite probable that 6-year-old children are still in the UPR stage, consistent with other results in the literature, as we have pointed out.

It would be of some interest to check 8-year-old children on this experiment and also on Experiment 1. We expect not only that 8-year-old children in Experiment 1 will do well on verbal passives of psychological verbs but also that in Experiment 2 they will mostly select the eventive interpretation for the verbal passive.

Moreover, the results are consistent with the ones found in Catalan (Gavarró & Parramon, 2017). Given the similarities in the passive structures between Catalan and Spanish, we expected to find similar results, which was the case. In both languages, children mostly apply the adjectival strategy despite the change in the auxiliary between both structures. Comparing the results with the ones obtained in Greek (Terzi & Wexler, 2002), we can confirm the idea suggested by the previous experiment: children do not need strict homophony between verbal and adjectival passives in order to use the adjectival strategy. Children are able to ignore slight differences between those two structures and apply the adjectival interpretation.

This result is actually quite consistent with Borer and Wexler's (1987) original idea that we discussed earlier. Namely, in English (Borer and Wexler) and in Catalan and Spanish, as we discuss, verbal and adjectival passives bear a grammatical

similarity and participles at the immature age can only be adjectival, due to the maturational mechanism (the UPR in our hypothesis). It is this grammatical similarity that induces the adjectival passive reading by immature children even when the sentence is a verbal passive. Greek is different: there is a participle in the adjectival passive, but no participle in the verbal passive. The derivation of verbal passive syntax in Greek is usually considered to be quite different from the derivation in English and Spanish. So, although the idea still holds in Greek that immature children can only give an adjectival reading to the participle, the fact that the verbal passive has no participle means that it will not be comprehended as an adjectival passive, and the particularly poor results of Greek-speaking children on the verbal passive of actional verbs follows. (We are assuming that the UPR will apply to Greek verbal passives; that is, whatever the derivation of this verbal passive, it will involve defective phases, ruled out by the UPR).

One other particularly insightful check on bipartite theory of passive development, and particularly on the Adjectival Interpretation Strategy (AIS) notes that the ability to perform well on short actional passives in Experiment 1, the classical two-choice comprehension experiment, depends on the ability or tendency to invoke the adjectival strategy when not comprehending the verbal passive. (Equivalently, given the foundational discussion in Borer and Wexler that we have just reviewed, the ability to take the only possible grammatical interpretation of participles for immature children, the adjectival interpretation, when there may be parts of the structure, meaning or use of the sentence incompatible with this interpretation). Since children could easily differ on their ability to use this strategy, some children will perform better than others on Experiment 1. The same ability or tendency to use the adjectival strategy when not comprehending the verbal passive would mean that a child would more often respond "incorrectly" in Experiment 2, that is, take the stative rather than eventive reading in Experiment 2. This is a particularly interesting prediction because it suggests that a child who does better (makes more correct choices) in Experiment 1 will do worse (make fewer correct choices, from an adult point of view) in Experiment 2. As we stated, we investigated the same children in both experiments for this very reason, so that we could investigate this prediction.

It seems to us, given many considerations in this paper, that performance on the short actional passive in Experiment 1 is the best measure of the tendency to use the adjectival strategy, since it isn't influenced by properties of the *by*-phrase. For this reason, we decided to compare performance on short actional passives in Experiment 1 with how often children selected the stative interpretation of short verbal passives in Experiment 2. The forms tested are the same: short verbal passive of actional (activity) verbs.

To quantify this test, we performed a Pearson correlation analysis between the % Correct in Experiment 1 on short actional passives and the % of stative interpretations of verbal passives in Experiment 2, for each of the age groups. The results are:

(4)[10] 3 y.o. : 0.4538 ($p < .05$)
4 y.o. : 0.5277 ($p < .025$)
5 y.o. : 0.5402 ($p < .025$)
6 y.o. : 0.6061 ($p < .01$)

These are remarkable results. The more often children selected the "right" answer in Experiment 1, the more often they selected the "wrong" answer in Experiment 2. The tendency or ability to select an adjectival analysis when interpreting a verbal passive leads to "better" (more adult-like) performance in Experiment 1 and to "worse" (less adult-like) performance in Experiment 2. Of course, in general, developmental research finds a positive correlation between performance on different linguistic tasks; some children are more advanced in development than others, so that they should perform in a more adult-like manner across linguistic tests. But here we have a particular hypothesis about what children do with a particular strategy, which leads to a particular prediction that is at variance with the standard, commonsensical result. The prediction is that children who show a better performance on one task on a particular structure will show worse performance on the same structure in a different task, totally unexpected on commonsensical or "general learning theory" grounds. We find this a striking confirmation of the bipartite theory, the UPR (or other maturational mechanism) together with the adjectival strategy.

10. The significance levels were taken from a standard table of significance for the Pearson correlation for N = 15, the number of participants in each experiment. They are significance levels for a one-tailed test, since we predicted that there would be a positive correlation. The actual correlation figures are often close to the next level of significance in the table, so that, for example, the correlation for 5-year-olds would produce a significance level much closer to .01 than to .025. Furthermore, we made the decision to measure the correlations by age group, rather than including all the participants in one large analysis. This was done in order to see if the predicted effects held by age. Nevertheless, it is worth noting that for 60 participants, a correlation of .325 would be sufficient to determine a $p < .005$. Although we didn't perform this overall calculation, we might very well attain this number if we did. Another way to look at the data would say that we should multiply the significance levels for the 4 groups (since they are independent groups) to obtain an upper bound on the chance that the positive correlation was spurious. This would produce an extremely small probability. In short, these are extremely significant results, that must be accounted for. There is an extremely small likelihood that they are due to chance.

6. General discussion

In this work, we tried to shed light on the causes of the delayed acquisition of passive structures. We conducted two experiments with 60 Spanish speaking children. Experiment 1 tested the effects of voice (active/passive), verb type (actional/psychological) and length (short/full) on children's comprehension. Experiment 2 tested the use of an adjectival interpretation to understand passive structures. The results of both experiments show clear evidence for maturational accounts and, in particular, for the Universal Phrase Requirement, or any account that assumes that young children can't compute the syntax of verbal passive and instead use the adjectival interpretation when they can. The worse performance on short and full passives than on active sentences predicted by UPR is confirmed in Experiment 1: there is a significant difference between actives and both kind of passives (which is against the Theta-role Transmission Deficit (Fox & Grodzinsky, 1998)). UPR also predicts better performance on actional passives since children are assumed to use an adjectival interpretation to understand them. However, the application of this adjectival strategy is subject to the possibility that homophony of the two forms makes it easier to apply one form to interpret the other, in particular the adjectival participle to interpret the verbal participle. Our results show that Spanish-speaking children perform similarly to English children on short passives while they perform quite worse on full passives. This fact suggests that children do not need strict homophony to apply the adjectival strategy. They are able to ignore small changes between verbal and adjectival passives (like a simple change in the auxiliary) but they cannot use that strategy when those changes are not so slight (the change in the auxiliary and the presence of the (particular type of) *by*-phrase, which is not compatible with the adjectival reading). Experiment 2 confirms those results and clearly and directly shows that Spanish children do interpret verbal passives like adjectival passives. Moreover, the analysis predicts that children who perform better on short actional passives in Experiment 1 will perform worse on short actional passives in Experiment 2, a rare instance of a prediction and confirmation of inverse behavior within individuals. The result is telling because of its non-commonsensical basis. The prediction depends on a model and shows once again the usefulness of a detailed model of development, rather than some kind of general "learning" model that is incapable of this kind of precision of surprising prediction and empirical testing.

Given the few experiments carried out in Spanish, future work should be focused on expanding the range of this work in order to check other predictions of UPR. For example, as we have pointed out, it would be interesting to repeat the experiments with older children to confirm the maturation point from which they are able to compute passive structures (maybe about 8 years). Also, it would

be important to check the different performance on subject-experiencer and object-experiencer verbs predicted by UPR (since object-experiencer verbs usually make much better adjectival sentences than subject-experiencer verbs – they are generally target-state verbs, which make excellent adjectives without contextual constraints, unlike most activity verbs).

A most important result of this paper (following the earlier work on Catalan) is to test the interpretation that children make of verbal passives when they understand them. The result turns out to be that the interpretation by children is often stative, not verbal, in line with the hypothesis of an adjectival strategy in lieu of an exact syntactic understanding of verbal passives. Moreover, the more a child uses the adjectival analysis to select the correct thematic roles in Experiment 1, the more the child uses the adjectival analysis to make an *error* on the aspectual interpretation in Experiment 2. Only a detailed model would predict such a surprising and non-intuitive result.

Early participles are adjectival. Children have some difficulties with grammar, not being able to compute particular structures, instead assuming tighter constraints on syntax than adults, who allow a wider range of grammars (Wexler, 2004). But the child doesn't provide a wild understanding of grammar, even when certain structures fail to be computed. Rather, the child assimilates a structure into the UG and particular knowledge of her language that she has attained. The result is a UG-constrained grammar (Borer & Wexler, 1987), with tighter constraints on grammar than an adult demands. A stronger UG in the child, not a weaker one (see Wexler, 2004).

Acknowledgements

This work was funded by a JAE Predoctoral Fellowship from CSIC (Spain). We are thankful to the Department of Brain and Cognitive Science of MIT and, in particular, to the people at the Wexler ab/Normal Language Lab who participated in the design of the experiment. We thank Anna Gavarró and two anonymous reviewers for very helpful comments on the paper.

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Appendix. Sample pictures

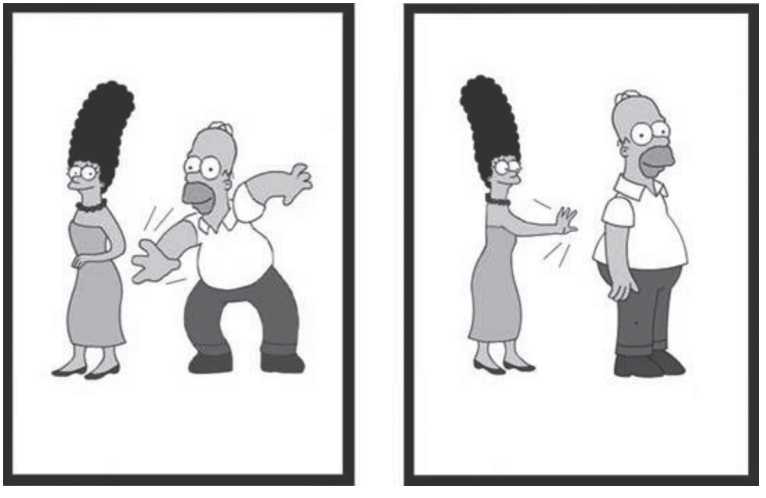

Figure 1. Sample picture used in Experiment 1 for sentence: *Homer es empujado por Marge* (Homer is pushed by Marge)

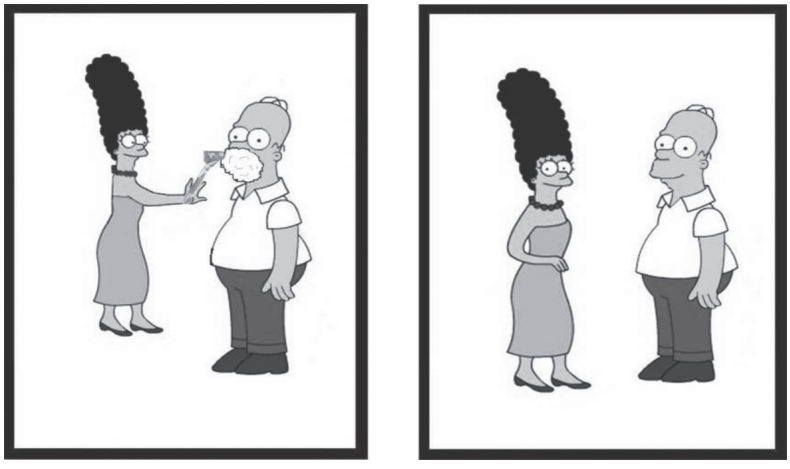

Figure 2. Sample picture used in Experiment 2 for sentence: *Homer es/está afeitado* (Homer is shaved)

Favorable processing conditions in the production of passive sentences by Brazilian Portuguese-speaking children

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This study focuses on the production of passives by children (3–4 and 5–6 years old) under favorable conditions. An experiment is reported in which passives were elicited by priming in a Snap Game, where a central character was the patient of the events depicted in the cards to be described by the children. All children produced at least one passive and their overall number exceeded passives in prior studies; reversed roles were negligible. In a subsequent image description task, passives were elicited in less favorable conditions. Syntactic priming prevailed across tasks. A procedural account of the production of passives and of the effect of priming is provided, which supports the argument for children's early competence to compute verbal passives.

Keywords: favorable processing conditions, discourse continuity, syntactic priming, verbal passives

1. Introduction

Passive sentences are computationally costly. They alter the canonical correspondence between grammatical and logical subjects by having the logical object in the subject position. Consequently, the patient/theme assumes the privileged subject position (c-commander in syntax; topic maintaining position in discourse). This alteration can be formally characterized in terms of syntactic movement (Chomsky, 1965; Baker, Johnson, & Roberts 1989; Boeckx, 1998; Collins, 2005; Lima Júnior & Augusto, 2015; Lima Júnior & Corrêa, 2015a) and its computational cost in terms of the type of movement (Corrêa & Augusto, 2011; Lima Júnior & Augusto, 2014) and/or intervention (Grillo, 2008; Gehrke, & Grillo, 2009; Orfitelli, 2012).

https://doi.org/10.1075/lald.62.05lim

In spite of its computational cost, passivization is a productive phenomenon in a number of languages (Siewierska, 1984; Keenan, 1985). A balance between cost and function, favoring the latter, may account for this fact. A patient/theme in subject position can contribute to discourse cohesion and provides flexibility in the encoding of thematic relations. Producing passives may, therefore, be an optimal solution for the expression of thematic relations in particular discourse contexts. In this case, favorable discourse conditions may be a factor that minimizes processing cost. Would these conditions also enable the early acquisition of these structures?

Early studies on the comprehension of verbal passives by children attested their difficulty in achieving a consistent performance across experimental conditions when the reversibility of the thematic roles, the plausibility of the semantic relations, and the type of verbs were manipulated (Slobin, 1966; Bever, 1970; De Villiers & De Villiers, 1973; Strohner & Nelson, 1974; Maratsos et al., 1979, 1985). The prevailing view was that the ability to compute these sentences solely based on a syntactic rule was beyond the reach of children younger than 5. Evidence for the relevant grammatical knowledge was then equated with the ability to interpret the subject of a passive sentence as the theme of the event presented by the verb, in reversible, equiprobable relations, as in (1).

(1) *The girl was kissed by the granny*.

In the P&P framework, even though the acquisition of passives is not formulated in terms of rule identification, a maturational schedule was suggested, which puts the computation of passives beyond the abilities of children around 4–5 (Borer & Wexler, 1987, 1992; Wexler, 2002, 2004). Recent data have called this into question. There is considerable evidence that children under 4 can comprehend long verbal passives in favorable discourse conditions (O'Brien, Grolla, & Lillo-Martin, 2006; Lima Júnior & Corrêa, 2015b) and produce them under syntactic priming (Huttenlocher, Vasilyeva, & Shimpi, 2004; Bencini & Valian, 2008; Crain, Thornton, & Murasugi, 2009; Messenger et al., 2012a; Manetti, 2012, 2013). It appears therefore that children are sensitive to conditions that favor the encoding of the logical object/theme as the sentence subject and that, contrary to late-acquisition hypotheses, verbal passives can be computed by the age of 4.

It has been argued, nevertheless, that these recent results may not provide unequivocal evidence of children's early computational ability (Snyder & Hyams, 2015). Assuming the *Relativized Minimality* Principle (RM)[1] (Rizzi, 1990), it has been proposed that the syntactic operation of *smuggling* (Collins, 2005) is required as

1. Basically, RM states that a phrase XP endowed with a bundle of features [+F] cannot move past another phrase YP with the same bundle of features [+F]. In this sense, for the movement of XP past YP to be possible, a mismatch of features has to be observed.

a means of promoting the movement of a logical object to the grammatical subject position. The development of the ability to cope with this operation would be achieved after the age of 4 (due to language specific or to language external factors) (cf. Snyder & Hyams, 2008, 2015).

There would be, according to Snyder and Hyam's (2008; 2015) view, other means of carrying out the required movement (internal merge) without contradicting the RM principle. It would involve having a distinctive feature in the element to be displaced, such as a [+ topic] feature. In this case, following this reasoning, *smuggling* would not be necessary. Therefore, pragmatically favorable conditions would not provide, according to this view, the crucial condition for assessing children's ability to compute passives.

Besides, production induced by priming includes passives with the target morphology but the reversed order of thematic roles. In this case, the character performing the action (in a picture) is presented by some children as the subject of the passive sentences rather than the patient of the action, as would be expected (cf. Messenger, Branigan, & McLean, 2012a; Manetti, 2012, 2013). This sort of error brought up the question of whether prime- generated passives actually provide evidence for the availability of the linguistic/other resources for generating passives in the internal language of young children (cf. Snyder & Hyams, 2015). Thus, controversy regarding the state of the internal language of children by the age of 4 still prevails.

Yet, it may be argued that the conditions for producing passives in actual language use involve codifying the logical object with some sort of [+ topic] feature, thereby favoring its placement as the grammatical subject of the sentence.[2] Out of a favorable discourse context, metalinguistic abilities – rather than computational abilities – may be required for passives to be produced.

The aim of this paper is to discuss the extent to which production data induced by priming and discourse-favorable conditions can be taken as evidence of the computation of verbal passives by children. An experiment with Brazilian Portuguese-speaking children is reported in which a discourse topic is introduced and is systematically recovered throughout the test by the experimenter as the subject of passive sentences, thereby priming the production of these structures. The test is thus considered to provide optimal conditions for the production of passives by children. A second task is created in which the production of passives is elicited without the introduction of a discourse topic, its systematic reintroduction along the task, or the use of passives by the experimenter. This second task was presented

2. Notice, that, according to different analyses, the grammatical subject possesses a topic nature, as in functionalist accounts (Givón, 1979; Foley & Van Valin, 1985). From a formalist point of view, the *aboutness* feature (Rizzi, 2006) can also account for the prominence of the subject.

following the first one to those children who took part in the latter experiment and another group was created with children who did not participate in the first task. This was intended to verify whether the effect of priming would linger across tasks, thereby enabling children to produce passives in less favorable conditions.

Three questions are addressed: What does it mean to compute verbal passives in sentence production? What would account for the effect of priming in different production conditions? What can children's prime- induced production of passives in favorable conditions imply?

The text is organized as follows: in Section 2, Portuguese verbal passives are characterized and previous studies on the production of passives by Portuguese-speaking children are briefly reviewed. In Section 3, the psycholinguistic approach adopted here for the production of passives is presented. In Section 4, the elicited production priming experiments are reported. In Section 5, a general discussion resumes the questions initially addressed in the light of the results obtained. The final section contains the final remarks.

2. Portuguese verbal passives and the production of passives by Portuguese-speaking children

There are two types of verbal passives in Portuguese: the pronominal *se*-passive (2) and the periphrastic passive (3). Brazilian and European Portuguese differ with regard to the productivity of (2) in oral language. The focus of this paper is, nevertheless, on (3), which does not differ between the Brazilian and European varieties and is akin to the English passive.

(2) *Vendem-se* *casas.*
sell.PRS.PL-PASSIVE PARTICLE houses.PL
'Someone sells houses.'

(3) *Casas* *foram* *vendi-da-s* *pelo corretor.*
houses.FEM.PL be.PST.EVENTIVE sell-.PRTCP.FEM-PL by.the realtor
'Houses were sold by the realtor.'

As in English, Portuguese has two types of periphrastic passives: verbal and adjectival ones. Unlike English, verbal and adjectival stative passives are not homophonous in Portuguese. Verbal passives are formed by the eventive auxiliary (*ser* 'be') (see (3)), whereas the adjectival ones are formed by the stative (*estar* 'be') (see (4)) or the resultative (*ficar* 'get/become') (see (5)) auxiliaries. In any case, as far as the argument of this paper is concerned, it is the similarities between verbal passives in Portuguese and English (and other languages) that hold (cf. (1) and (3)).

(4) *As* *casas* *estão* *destruí-da-s.*
The.FEM.PL houses be.PRS.STATIVE destroy-PRTCP.FEM-PL
'The houses are destroyed.'

(5) *As* *casas* *ficaram* *destruídas.*
The.FEM.PL houses become.PST destroy-PRTCP.FEM-PL
'The houses become destroyed.'

Few studies focus on the production of passives in the acquisition of Portuguese. Spontaneous production data reveal that passives are infrequent in the speech of both children and adults, either in the European or in the Brazilian variety (Estrela, 2016; Pesirani, 2009; Perotino, 1995). Regarding elicited production, the experiments with Brazilian Portuguese-speaking children reported in Gabriel (2001) provide the only results[3] available in this language (to our knowledge).

In Gabriel's study, Brazilian-speaking children (3–6 years old) watched animations with two characters as the agent and patient of transitive actions. The animation was frozen (by the experimenter) in a particular scene and the prompt "tell me about the agent/non-agent" elicited the child's production. The prediction was that the non-agent condition would be more likely to elicit passive sentences.

Indeed, no passives were produced in the agent-oriented condition. In the non-agent oriented condition, however, the number of passives was really small (7% and 11% of the total sentences produced by 3–4 and 5–6-year-olds) and none of the passives produced in the younger group was a long one (e.g., with an explicit by-phrase). In fact, the non-target responses showed that Brazilian Portuguese-speaking children tended to resort to simpler structures for the encoding of a non-agent entity, such as topical constructions (e.g., *O porco, o gato levou ele* – 'The pig, the cat took him') and sentences derived from verbs that admit the non-agent entity to be at the subject position (for instance, *ganhar* 'gain,' *sentir* 'feel,' *receber* 'receive,' etc.).

According to the author, the high frequency of these alternative syntactic options in the input to which children are exposed would explain the pattern of results obtained. The fact that passives occurred in the production of the younger children suggests, nevertheless, that this structure has been identified as a possible way of expressing a transitive event in which the non-agent entity is prominent. The prompt provided in Gabriel's study, though, may not have been the ideal one for inducing the production of these sentences.

3. Rubin (2004) provides a broad investigation on the comprehension and the production of passives by Brazilian-speaking children focusing on Down syndrome and also provides data of typical developing children older than 5.

In the next sections, the grammatical requirements for the production/comprehension of passive sentences (Section 3) and possible favorable conditions for their production (Section 4) will be considered.

3. Computing verbal passives in a psycholinguistic perspective

The psycholinguistic perspective assumed here incorporates a minimalist concept of language (Chomsky, 1995, subsequent work). Different formal accounts of the syntactic computation of passives have been provided under minimalist assumptions (Boeckx, 1998; Collins, 2005; Lima Júnior & Augusto, 2015). They converge in proposing a functional element (a particle morpheme or a voice/passive feature) whose presence in the numeration entails the computation of a logical subject and triggers the operation that results in the positioning of the logical object (selected by the verb) as the grammatical subject.

Regardless of the analysis that can better account for the adult state of the internal language, computing passives in sentence production/comprehension would require: (i) the possibility of internal merge; (ii) the critical functional element represented in the lexicon; (iii) its retrieval from the lexicon during sentence processing; (iv) the ability to cope with the grammatical encoding of the logical object as the sentence subject in production; (v) the ability to refrain from ascribing the agent/experiencer thematic role to the subject of the sentence in comprehension.

Notice that voice (or the like) is conceived of as a functional element. The formal features of functional elements encode information pertaining to illocutionary force, reference, focus, and discourse continuity, etc. (Corrêa, 2005; Snyder & Hyams, 2008; Gehrke & Grillo, 2009). It can, therefore, be argued that functional elements enable the internal language (the lexicon in particular) to interact with intentional systems, which are crucial for the sentence planning to be in tune with particular discourse demands (Corrêa & Augusto, 2011). The retrieval of functional elements in real time computation thus occurs as a function of the speaker's keeping track of the interlocutor's state of mind, the context of utterance, and the discourse topic. It is thus possible that if children are able to keep track, to some extent, with discourse continuity, the conditions for the retrieval of a voice feature are provided. Once this knowledge is available in the lexicon and the processing requirements for implementing real time computation are satisfied (which may depend on particular processing conditions), it would be expected that the computation of passives can be conducted. The cost–function balance has, nevertheless, to be considered. If the language provides less costly structures for the encoding of a theme as the sentence subject in oral language, it is likely that these alternative structures will be preferred. Priming passive structures may, nevertheless, override or minimize this tendency. The experiment to be reported here was conducted based on this rationale.

3.1 Syntactic priming

Syntactic priming is a tendency speakers have of repeating a syntactic structure previously heard or produced when grammatically encoding a new sentence. This tendency is usually explained as the retrieval of fragments of phrase structures from a "fragment store" which are assembled in similar ways. This sort of account is compatible with the idea of implicit learning as a viable mechanism of language development (Bock et al., 2007; Kidd, 2012).

A priming effect can, nonetheless, be accounted for as a residual activation of the relevant lexical information that causes the target sentence to be processed in a similar way (Pickering & Branigan, 1999; Cleland & Pickering, 2003). This perspective seems to be more compatible with sentence processing models that assume that the relevant grammatical information for the sentence computation is encoded in the formal features of functional elements in the lexicon (Phillips, 1996, 2003; Corrêa & Augusto, 2007, 2011).

A number of experimental studies in the priming paradigm have been successful in eliciting verbal passives from children acquiring different languages (cf. Huttenlocher, Vasilyeva & Shimpi, 2004; Bencini & Valian, 2008; Messenger et al., 2012a for English; Manetti, 2012, 2013 for Italian; Gámez & Shimpi, 2016 for Spanish). Priming passives is therefore more likely to promote the encoding of passive sentences by Portuguese-speaking children than the sort of prompts used in Gabriel's study.

The data obtained in priming elicited production tasks, however, have shown that passive sentences can be produced with reversed theta-roles (reversibility effect) (cf. Messenger, Branigan, & McLean, 2012a; Manetti, 2013). Hence, the idea of retrieving a form from a "fragment store" cannot be discarded. This possibility goes in the direction of the view that passive sentences produced due to priming cannot guarantee that their actual syntactic computation was carried out (cf. Snyder & Hyams, 2015).

A decontextualized condition may, nevertheless, favor this sort of error (reversed theta-roles). Recall that, when sentences are spontaneously produced, the way they are encoded is compatible with particular discourse conditions. Therefore, the lexical items that enter syntactic computation are retrieved in such a way that they cannot only enable the content of a message to be linguistically encoded, but the intentional aspects of this encoding can be satisfied. Therefore, in an attempt to provide children with a context that favors the use of a passive, the present experiment introduced primes as a means of maintaining the discourse topic as the subject of each sentence (see also Lima Júnior & Corrêa, 2015b).

3.2 Discourse continuity

Discourse continuity (henceforth, DC) can be viewed as a principle of discursive cohesion. Once particular relevance is ascribed to a given character/referent, making it the discourse topic, the reference to it, in connected prose, tends to be resumed in the highest hierarchical position available in the sentence about to be produced (Clark & Begun, 1968; Bates & Devescovi, 1989; Marchman et al., 1991; Ferreira; 1994; Bates et al., 1995). Notice that even though 3–6-year-olds produced almost no passives in Gabriel's (2001) study, they had a strong tendency to place the prompted entity at the subject position (see also Manetti, 2012 for a similar result in Italian). It appears, therefore, that children tend to abide by DC as a principle of discursive cohesion from an early age (see also Demuth, 1990 for a similar conclusion in Sesotho).

Children's sensitivity to DC could be confirmed in a comprehension task. Brazilian Portuguese-speaking children (4–6-year-olds) performed better on reversible passives presented in a picture-identification task when discourse continuity was maintained (cf. Lima Júnior & Corrêa, 2015b). In this experiment, short narratives were presented in which a given character was introduced as the discourse topic. Reference to it was maintained by having it reintroduced as the subject of the subsequent sentences. At the end of the narrative, a passive sentence was provided and children had to select a picture (out of three) that matched it. The subject of this final sentence was manipulated in such a way that it either maintained the discourse topic or not. The number of errors was greater when the subject of the passive did not coincide with the topical referent. It seems, therefore, that keeping the topical referent in a privileged sentential position helps children's attention to be driven to it and to its thematic role (not agent).

In the encoding of a transitive relation, two referents compete for the subject position, giving rise to processing cost (Richardson, Thomas, & Price, 2010; Lima Júnior & Corrêa, 2016). DC is likely to reduce this cost by favoring a particular referent in this position (Lima Júnior & Corrêa, 2015b). Hence, priming passive sentences by reintroducing the discourse topic as their subject is more likely to promote the retrieval of the relevant residual lexical features than priming this sentence in a decontextualized manner.

4. The experimental study

4.1 First task

The present experiment was intended to verify whether Brazilian Portuguese-speaking children consistently produce verbal passives under favorable discourse conditions. The task was an adaptation of the *Snap Game* presented by Branigan, McLean and Jones (2005). As in the original version, it consisted of an elicited production task that promotes the priming of particular sentences. The key feature of this adaptation is that a single character (a dog named Bob) is introduced and maintained as the topic of the game throughout the experiment.

The task involves a deck of cards, each of which presented the image of Bob together with another character in an actor-action-patient activity. The game consists of a sequence of trials in which both the experimenter and the child draw one card from the deck and take care not to let the other see the image on the card. At issue is to check whether the child's and the experimenter's cards match based on the verbal description each of them provides of their own card. The one who gives the second description scores a point if the two pictures match.

The experimenter and the child alternate going first. Unlike the original *Snap Game*, in each trial, it important to emphasize that both the child and the experimenter provide a verbal description of the image depicted in the card before showing the cards. Figures 1 and 2 illustrate identical and non-identical pairs of

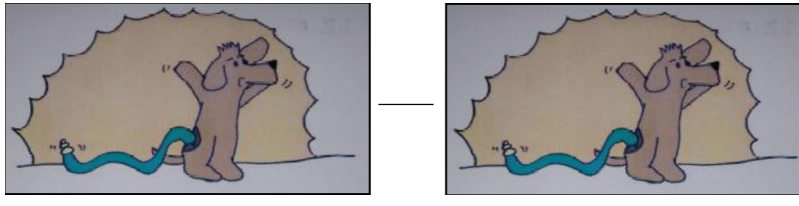

Figure 1. Matching pair for *Bob foi picado pela cobra* 'Bob was bitten by the snake'

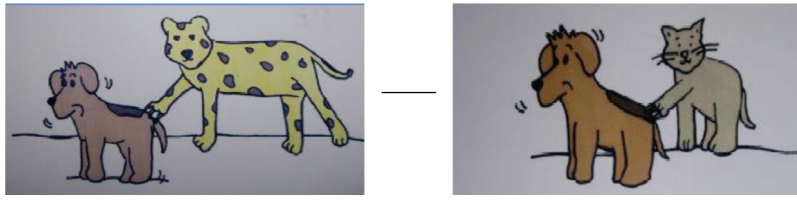

Figure 2. Non-matching pair for *Bob foi arranhado pela(o) onça/gato* 'Bob was scratched by the jaguar/cat'

cards, respectively. In this way, the sentence produced by the experimenter while describing the picture on his/her card serves as a prime for the structure to be produced by the child (see the procedures for a more detailed explanation).

In this particular game, the experimenter's description is always a long verbal passive having Bob as the subject (e.g.: *O Bob foi picado pela cobra* 'Bob was bitten by the snake'). This situation creates the condition named *Direct prime*. When it is the child's turn to go first in describing the card, the structure that is spontaneously used by him/her is in a condition of *Indirect prime*, since it is not immediately primed by a particular sentence but can be influenced by the constant use of passives by the experimenter during the game.

The independent variables were *Age* (Group A: 3–4-year-olds vs Group B 5–6-year-olds), and *Type of priming* (direct vs indirect). There were 8 sentences for each type of priming. The dependent variable was the *Number of verbal passives produced*. An effect of *A*ge was predicted with more sentences produced in the older group. The introduction of the discourse topic is expected to promote a relatively greater number of passives and smaller number of sentences with reversed thematic roles than in prior priming studies. The *Direct prime* condition is expected to give rise to more passives in children's responses than the *Indirect prime* condition due to a possible recency effect.

Method

Participants: 37 children were initially recruited from a nursery school in Rio de Janeiro, but only the data of 28 children were actually used. Nine children were eliminated for remaining silent during different stages of the pre-test/test; for crying or for responding at random. There were 14 participants (9 girls) in each age group. The mean age for Group A (3;0–3; 10) was 3.4 and for Group B (5;0–6;10) the mean was 5.9.

Materials and apparatus: 40 cards (size: 10 × 15 cm) consisting of 20 pairs. The first 4 pairs are part of a pre-test while the next 16 pairs comprise the test. Nine of the pairs (out of 16) are identical, thereby enabling the experimenter's and the child's cards to match (see Figure 1). The remaining 7 pairs of the test do not match (see Figure 2). The pairs are arranged in the deck in such a way that the child is guaranteed to score more points than the experimenter. A recorder was used to register the whole experimental session.

Procedure: each child was invited to play a game in a quiet room of the nursery school. The experimenter (male) and his assistant (female) were introduced to the child. The presence of a female assistant was intended to make the child more at ease with the activity since it is more common for women to be part of the nursery school staff in Brazil. She was introduced to the child as someone who was there

to record the game. It was the experimenter who interacted with the child in the experimental activity.

A pre-test was conducted with the first 8 cards of the deck – 4 for the experimenter and 4 for the child to describe, having Bob as the agent of the event depicted in the cards. Only active sentences were used by the experimenter at this stage.

The remaining 16 pairs of cards had Bob as the patient of the transitive action to be described. Only long passives were produced by the experimenter at this stage.

Participants were told that they should not show his/her card to the experimenter under any circumstances before giving a verbal description of it. This decision was made since a pilot test revealed that 3-year-olds occasionally remained silent, showing the picture to the experimenter instead of providing a description of it.

The experimenter's turn and the child's expected turn are illustrated in (6) and (7), respectively. No feedback was given to the child regarding the correctness of his/her response.

(6) *Experimenter*: In my card, Bob was bitten by the snake. What about your card? Tell me what happens to Bob in your card.
Child: In my card, Bob was bitten by the snake as well.
Experimenter: Oh, really!? So, is that the same? It is! You found the card and scored a point.

(7) *Child*: Bob was kissed by the boy.
Experimenter: Let's see! In my card, Bob was kissed by a girl. Is it the same?
Child: No.
Experimenter: They are different! If they are different I don't score a point.

Coding: the sentences children produced were transcribed by a native speaker of Brazilian Portuguese and checked by another one. Sentences that presented the complex auxiliary-participle (Aux_ser + V_part), such as *foi picado* ('was bitten') were scored as verbal passives, regardless of the presence of the by-phrase.

Results

The data were analyzed by a 2 × 2 ANOVA, in which *Age* produced a significant main effect $F(1,26) = 15.5$, $p < 0.001$, SS = 39.45, MSe = 2.55 (cf. Figure 3). *Type of priming* also provided a significant main effect $F(1,26) = 25.2$, $p < 0.0001$, SS = 62.16, MSe = 2.47 (cf. Figure 4).

The effect of the interaction between the two variables was not significant (Age*Type of priming $F(1,26) = 2.09$, $p = 0.2$). The pairwise comparisons revealed that the age effect was particularly due to an increase in the number of passives in the *Direct prime* condition, since the difference between the number of passives indirectly primed only approached the significance level $t_{df26} = 1.81$, $p = 0.08$.

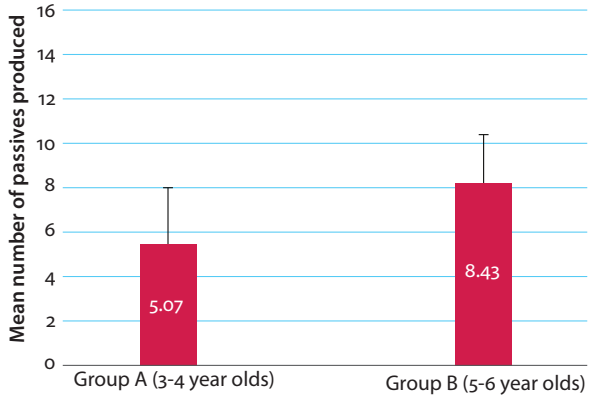

Figure 3. Mean number of passives produced per age group

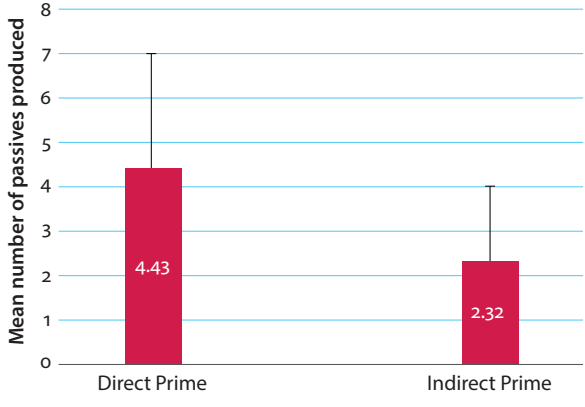

Figure 4. Mean number of passives produced as a function of *Type of priming*

The distribution of the total amount of verbal passives produced by all children is in Table 1.

Table 1. Distribution of passives per each condition in the test

Group	Type of priming	Absolute number/112	%
Group A	Direct prime	46	41.07
	Indirect prime	25	23.31
Group B	Direct prime	78	69.74
	Indirect prime	40	35.71

Although only long passives were primed, short passives were also produced by children. Out of the total number of passives produced in the test (189 verbal passives), 15 were of the short type. Group A (3–4) produced 10 of these passives while Group B (5–6) produced the other 5. All children tested produced, at least, one verbal passive in the experiment.

Alternative responses: Apart from verbal passives, children produced the following types of sentences: actives (8), adjectival passives (9), and topic sentences (10). All the remaining sentences produced were codified as others. These included copula-constructions (11), absolute/ergative structures (12), existential constructions (13) and also utterances missing verbs (14). Sentences with the auxiliary *estar* (stative 'be') produced with a by-phrase, for instance *O cachorrinho está amarrado pelo menino* ('The dog is$_{\text{stative}}$ tied by the boy') were classified as adjectival passives.

(8) *O menino beijou (o cachorro).*
The.MASC.SG boy MASC.SG kiss PST (the dog)
'The boy kissed (the dog).'

(9) a. *O cachorro está amarra-do.*
The.MASC.SG dog be.PRS.STATIVE tie-PRTCP.MASC.SG
'The dog is tied.'
b. *O cachorro ficou amarra-do.*
The.MASC.SG dog become.PST tie-PRTCP.MASC.SG
'The dog got tied.'

(10) *O cachorro, o menino amarrou (ele)/(o cachorro).*
The dog, the boy tie.PST (him.RESUMPTIVE)/(the dog)
'The dog, the boy tied him.'

(11) *O cachorro está em cima do cavalo.*
The.MASC.SG dog be.PRS.COP on.the horse
'The dog is on the horse.'

(12) *O cachorro$_{theme}$ espetou.*
The.MASC.SG dog stick.PST
'The dog got stuck.'

(13) *Tem um cachorrinho com uma abelha.*
Have.PRS a dog with a bee
'There is a dog with a bee.'

(14) *O cachorro todo molhado.*
The.MASC.SG dog all wet.
'The dog all wet.'

As can be seen in Table 2, active and passives were the most frequent responses in the total of responses provided. Together, these two types of sentences constitute 81.2% of the sample obtained for Group A and 89.7% for Group B.

Table 2. Breakdown of responses (total 224 trials per each group)

Groups	Type of structure produced	Absolute number/224	%
A (3–4)	Actives	111	49.55
	Verbal passives	71	31.69
	Adjectival passives	7	3.13
	Topic sentences	11	4.91
	Others	24	10.72
B (5–6)	Actives	83	37.05
	Verbal passives	118	52.67
	Adjectival passives	5	2.23
	Topic sentences	6	2.68
	Others	12	5.37

Adjectival passives and topic sentences constitute a small group, even smaller than the group of sentences codified as others. It is worth noticing, in any case, that the total number of sentences having Bob (non-agent) as the subject/topic corresponded to more than 40% of the responses in Group A and more than 60% in Group B – percentages quite superior to those elicited in prior studies. It appears, therefore, that the conditions were actually more favorable to the production of passives, even though keeping track of them is an incipient ability at the age of 3.

All children tested produced at least one verbal passive in the *Indirect prime* condition in both age groups. Reversed roles occurred in less than 1% of the utterances produced (4 sentences). Three of these errors were identified in group A. Children in this group reversed theta-roles, but of active sentences, not of passives.

Discussion

As predicted, the number of verbal passives produced increases with age and more of these sentences are produced in the *Direct prime* condition. This does not mean, however, that children around 3 years of age are not able to compute verbal passives. Recall that all children tested spontaneously produced at least one verbal passive in the *Indirect prime* condition despite the rarity of these constructions in the input offered to children acquiring Brazilian Portuguese (Perotino, 1995). This is in line with a recent tendency that shows that children have an early abstract representation of verbal passives in their linguistic knowledge (Bencini & Valian, 2008; Messenger et al., 2012a for English; Manetti, 2012, 2013; Volpato, Verin, & Cardinalletti, 2014 for Italian; Gámez & Shimpi, 2016 for Spanish). These findings

add to previous studies of children's spontaneous speech (Pinker, Lebeaux, & Frost, 1987; Kline & Demuth, 2010) and, to a certain extent, contradict the view that the acquisition of passive sentences is late (Borer & Wexler, 1987; Wexler, 2002, 2004; Snyder & Hyams, 2015) and theories based on input frequency as an alternative to the early mastery of passives (Gabriel, 2001; Kline & Demuth, 2010; Gámez & Shimpi, 2016).

The spontaneous production of passives (in the child's turn) is relatively stable between the ages of 3 and 5. It appears therefore that, by the age of 3, the state of the internal language is such that verbal passives can be computed. The spontaneous production of verbal passives is not, in any case, the most natural option for a transitive action to be described even at the age of 5.

As for production in the *Direct prime* condition, it is important to draw attention to the fact that children were not merely repeating the experimenter's sentence. They were recalling the experimenter's description while matching it with their own card. Children realizing that the description just recalled does not match the picture is evidence that they could understand the description provided by the experimenter.

As expected, more passives were produced spontaneously in the younger age group than in Gabriel's study (Gabriel, 2001). In that study, only 3 children in the range of 3–4 years old produced passives. It appears, therefore, that the conditions created in the present study were more favorable to passive sentences than those provided by Gabriel.

Moreover, consistent with the expectations, the number of verbal passives with reversed roles approached zero in this study, in contrast with previous ones (Messenger, Branigan, & McLean, 2012a; Manetti, 2013). Hence, it is unlikely that the prime-induced sentences produced in the present study stem from a "fragment store" rather than from syntactic computation. The present study, by providing favorable conditions for the actual computation of passives, seems to have overcome the vulnerability of the previous investigations making use of syntactic priming. The present results are, therefore, compatible with the claim that only those who have an underlying representation of a syntactic structure can be structurally primed by it (Branigan et al., 1995).

In summary, 3-year-olds produce verbal passives in favorable conditions, though in small numbers. It appears that, as far as the internal language is concerned, the requirements for computing these sentences in such conditions are satisfied. It might be argued, in any case, that this possibility is due to the fact that in this task a topic feature in the subject does not conflict with RM. In this case, these results do not provide counterevidence to the hypothesis that the ability to compute passives in non-favorable discourse conditions is missing, at least in the younger group (cf. Snyder & Hyams, 2015).

4.2 A second task

In order to verify the extent to which the priming of passives in the Snap Game (Branigan, McLean, & Jones, 2005) would promote the retrieval of the relevant residual lexical features for the computation of passives in a subsequent task, a different task was created, which was presented as an activity immediately following the Bob's game.

The possibility of a priming effect lingering across experimental tasks has been attested in a series of experiments with 4–5-year-olds (Huttenlocher, Vasilyeva, & Shimpi, 2004). It would be expected, then, that children would be more prone to spontaneously produce passive sentences in a standard elicited production task after having taken part in the Bob's Snap Game than otherwise.

A picture description task was created in which images depicting a transitive action were presented and sentence production was elicited by a prompt focusing on the non-agent of the event visually presented (What happened to X?, where X was a non-agent). In this task, the discourse conditions are not as favorable for passive sentences to be produced as they were in the first activity. Neither Bob nor any other character is maintained as the discourse topic.

The aim of this investigation was to verify whether the effect of syntactic priming is maintained even if no element in the transitive relation to be grammatically encoded has a topical[4] function. Performance of Group 1 (children who completed Task 1–Bob's Snap Game) was contrasted with a Control (children who came afresh for this task). If the effect of priming in the first task lingers until the second one, more passives should be produced in Group 1 than in Group 2.

Methods

Participants: The same 28 children who participated in the first test plus 20 other children (10 children [3 girls] in the age range A (2; 11–3; 8, mean: 3; 2) and 10 children [6 girls] in the age range B (5; 1–6; 3, mean: 5; 9) were recruited from a nursery school to form the control group. The former were assigned to Group 1 and the latter to Group 2.

Material and Apparatus: 16 slides of a PowerPoint presentation. Eight pairs of slides formed the sets of pictures for the activity. The first slide of the test introduced two different animals. The second slide exhibited a picture, akin to the pictures in Figures 1 and 2, with the two animals performing a transitive action. The characters depicted were not reintroduced in any systematic way.

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4. An anonymous reviewer argued that, since both characters were presented in the slide that precedes each trial, they both can be [+topic], thereby resulting in a condition that can be affected by RM. We are in fact referring to a particular discourse topic, initially introduced and continuously maintained, as in the previous experiment. In any case, both DPs being [+/–topic], RM would apply.

A laptop was used to present the PowerPoint slides to children. A recorder was used to register all of the experimental activity.

Procedure: Children assigned to Group 1 were invited to participate in a new game, which was played on a laptop computer, after they had finished the first task (Bob's Snap Game). They remained, therefore, in the same quiet room of the school. The experimenter asked the child to name the two animals exhibited in the first slide of the pair. If children struggled to name the animal, the experimenter helped them. After naming the two animals, a second slide exhibited the picture in which a transitive action was being performed, for example, a bear washing a bunny. The experimenter elicited children's production with the prompt question: what happened to the non-agent (the bunny, for instance) here? The expected answer was: It/He/The bunny was washed (by the bear).

Children in the control group (Group 2) were invited to play a game on the computer and were taken to a quiet room in the school. The same procedure described above was then applied.

Results

From the total 224 possible utterances in the second task, the 28 children in Group 1 produced 26 passives. Ten verbal passives (all of them long passives) were produced by 3–4-year-olds. The other 16 passives were produced by the 5–6-year-olds (12 long and 4 short passives). Twelve out of the 28 children (5 children in the 3–4-year-old group; 7 children in the 5–6-year-old group) produced at least one clear verbal passive (Aux-Ser + V-part).

In total, 116 active sentences were produced. In Table 3, it is possible to identify all structures produced per each age group in Group 1 of the second task (i.e., children who had first participated in the Snap Game experiment) and their percentage in relation to the total amount of sentences.

Table 3. Breakdown of responses (Group 1)

Groups	Type of structure produced	Absolute number/112	%
A (3–4)	Actives	82	73.2
	Verbal passives	10	8.9
	Adjectival passives	1	0.9
	Topic sentences	9	8.1
	Others	10	8.9
B (5–6)	Actives	88	78.6
	Verbal passives	16	14.3
	Adjectival passives	0	0
	Topic sentences	1	0.9
	Others	7	6.3

The total number of errors produced was a little higher in the second task in comparison with the first one. A total of 12 reversed sentences were produced by children in Group 1. However, only 3 of these sentences were reversed passives.

In the control group, no passive was produced and 108 actives were produced, and 7 of these actives had their theta-roles reversed. The distribution of responses is displayed in Table 4.

Table 4. Breakdown of responses (control group)

Sentences produced	Absolute number (160)	%
Actives	81	50.63
Actives (verb of perspective)	27	16.88
Verbal passives	0	0
Adjectival passives	8	5
Topic sentences	30	18.75
Copula	14	8.75

Among all the actives produced by the control group, 27 utterances involved some sort of "perspective" verbs (Griffin & Bock, 2000) with experiencer subjects, such as *O macaco tomou banho* 'The monkey had a bath' when it was clear that the elephant was showering the monkey, or *O gato ganhou um beijo* 'The cat received a kiss' instead of 'The cat was kissed by the turtle'. When all of the 160 sentences produced were considered, children positioned the non-agent element at the first sentential position available in 79 trials (49.4%).

Discussion

The most relevant fact to be noticed in the data obtained in the second task is that children in the control group produced no passives, as predicted by Snyder and Hyams (2015). The fact that some children in Group 1 did produce passives suggests that they were under the effect of priming. This effect has been shown to linger across tasks (Huttenlocher, Vasilyeva, & Shimpi, 2004). Under such an effect, it is worth noticing that five children in the younger group did produce passives. This would not be expected under the view that the ability to cope with the syntactic requirements for computing this sentence, regardless of particular discourse conditions, develops after the age of 4 (Snyder & Hyams, 2015). Notice that, in this task, the DPs share the same bundle of features (see footnote 4). Consequently, if the analysis in Snyder and Hyams (2015) is assumed, a grammar that allows for *smuggling* (or other means of abiding by RM) is likely to be available at a relatively early age.

The second task favored the production of active sentences. However, interestingly, children seemed to be responsive to the non-agent-oriented question, as

noticed in Gabriel (2001), making it clear that they are sensitive to the discourse condition that the experimental task created. In a more favorable scenario, in which DC and priming are combined, as in the first task, children seemed much more likely to produce passives. This argument grows in strength when the results of the first task are compared to analogous priming tests in the literature.

In the studies of elicitation via priming, a massive preference for the production of actives is commonly obtained despite the fact that more passives are produced after passive sentences are primed (see Table 5). This massive preference was not replicated here.

Table 5. Sentences uttered by children (raw data) in priming studies in different languages

Priming study	Language	Age	Actives	Passives	Total others	% of passives
Messenger, Branigan & McLean (2012a)	English	3;4–4;10	83	34	170 (63)	20
Messenger et al. (2012a) (Example 1)		3;1–4;11	88	60	233 (85)	26
Messenger et al. (2012a) (Example 2)		3;4–4;11	107	55	272 (110)	20
Huttenlocher et al. (2004) (Example 1)		4;5–5;8	107	22	150 (21)	15
Huttenlocher et al. (2004) (Example 2)		4;2–5;7	100	36	150 (14)	24
Huttenlocher et al. (2004) (Example 3)		4;1–5;7	111	24	150 (15)	16
Manetti (2012) (Example 3)	Italian	3;6–4;6	92	31	210 (87)	14
Gámez & Shimpi (2016) (study 2)	Spanish	5;7–6;8	203	52	524 (269)	10
Task 1 in this paper	Portuguese	3–4	111	71	42	32
		5–6	88	118	23	53

As illustrated in Table 5, while the mean number of passives produced in other studies is about 18%, more than 32% of the total production of Brazilian younger children involved verbal passives. This percentage is considerable, given that passive sentences are not the first option to promote the patient in Brazilian Portuguese (cf. Gabriel, 2001).

In comparison with Spanish, the percentage of passives produced by Brazilian Portuguese children is three times larger. This difference is interesting, considering the fact that Spanish *fue*-passives are (i) as rare as verbal passives in Portuguese

(Estrela, 2016; Perotino, 1995) and (ii) never the first option to promote the patient, as they seem to be in English, for instance (cf. Gámez & Shimpi, 2016). The lingering effect in Task 2 (Group 1) gave rise to up to 14.3% of passives (see Table 3), which is similar to the effect of priming in most of the traditional tasks.

5. General discussion

Three questions were addressed here: (i) What does it mean to compute verbal passives in sentence production? (ii) What would account for the effect of priming in different production conditions? (iii) What can children's prime-induced production of passives in favorable conditions imply?

Regarding (i), computing verbal passives in sentence production involves retrieving a voice feature/category from the lexicon and being able to implement the sort of internal merge that this feature requires, namely, placing the logical object in the grammatical subject position. Retrieving this feature is more easily promoted by discourse conditions that favor the maintenance of a discourse topic in subject position. If it is assumed that the retrieving of a feature from the lexicon entails a resting state of activation (Frauenfelder, & Schreuder, 1991), computing verbal passives may also be favored by the recent retrieval of the relevant feature and the corresponding implementation of the relevant operation. These considerations lead to the answer to (ii).

Syntactic priming has been traditionally considered difficult to reconcile with a computational view of sentence processing. The retrieval of phrase-markers from memory or the availability of sentence templates may seem to fit better the effect of a syntactic priming than structure-building processes starting from the selection of lexical items. The discussion of the effect of syntactic priming in children's sentence production, passives in particular, has therefore been belittled due to the occurrence of thematic reversal errors. The fact that children tend to produce passives with reversed DPs has been used to claim that there was not the actual grammatical encoding of a message starting from the thematic relations held by the participants of an event. Rather, children might be relying on a sort of sentence template in which the participants of an event would be inserted (cf. Snyder & Hyams, 2015).

Although some experimental conditions may favor the mere repetition of a sentence pattern without grammatical computation as such, the experiments reported above have shown that, in a favorable discourse condition, priming effects can be attested and reverse errors do not occur. In these conditions, the actual sentence planning is sensitive to discourse continuity, giving rise to a broad non-agent-oriented perspective that can promote the retrieval of [*voice/passive*] (Collins, 2005;

Lima Júnior & Augusto, 2015). As previously discussed, this feature is crucial for the grammatical encoding of passives.

Given that primed structures activate the relevant [*voice/passive*] feature in the lexicon, the production of passives becomes more likely in spite of the cost associated with them. It is important to emphasize that the internal/external merge operations are not sensitive to priming. It is the relevant lexical features that trigger the relevant syntactic operations that can be affected by priming. In this sense, syntactic priming affects the syntactic computation in an indirect way.

Regarding (iii), the results obtained here suggest that children have represented a [voice/passive] feature in the lexicon. As for the ability to satisfy RM, the fact that children younger than 4 produced these structures in relatively unfavorable conditions (Group 1 of task 2) suggests that the availability of this feature in the lexicon may entail that computation can be carried out. The sort of requirement that would have to be satisfied in order for passives to be produced in truly unfavorable conditions (Group 2 in task 2) may involve a cost-benefit balance. In a context as such, young children may resort to less costly alternative structures.

6. Final remarks

The aim of this paper was to discuss the extent to which production data induced by priming and discourse favorable conditions can be taken as evidence of the computation of verbal passives by children. The results obtained here suggest that 3–4-year-olds have a [voice/passive] feature represented in the lexicon, which can be retrieved in favorable conditions for the use of these structures. They also suggest that activating a lexical feature has a resting state of activation effect that may promote the reactivation of [voice/passive] even in less favorable conditions. The fact that in the less favorable condition some 3-year-olds were able to produce verbal passives suggests that achieving the syntactic requirements for deriving eventive passives can occur earlier than the age of 4. The ability to cope with the cost of producing these structures regardless of the processing conditions may, nevertheless, require development that goes beyond strict syntactic competence.

Acknowledgments

The authors thank the support of CNPq grant, process PDJ 152661/2016–6, associated to the project CNPq PQ 309499/2016-0.

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PART II

The TP field

Clitics and negation

Clitic omission in bilingual Portuguese-Spanish acquisition

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This study investigates clitic omission in Portuguese-Spanish bilingual children, comparing them to monolingual children. Children in the target group were simultaneous bilinguals between 3 and 5 years old, living in Portugal and attending a Spanish school. Bilinguals were administered two versions of a production test, which elicited clitics in three different contexts: (i) accusative third person in simple sentences; (ii) accusative third person in adjunct islands; (iii) reflexive third person in simple sentences. Results show that the rates of omission in the bilinguals' Spanish are higher than in Spanish monolinguals, but bilinguals distinguish the two languages and the different contexts: omission is higher in Portuguese than in Spanish, and higher with accusatives in simple sentences than in the other contexts.

Keywords: language acquisition, bilingualism, clitic omission, null object, Portuguese, Spanish, elicited production

1. Introduction

In this paper, we investigate clitic production and omission by European Portuguese/Iberian Spanish bilingual children, comparing them to European Portuguese and Iberian Spanish monolinguals.[1] Portuguese/Spanish bilingual acquisition has seldom been investigated. This language combination is interesting, since the two languages are typologically very close, but differ in crucial aspects related to clitics and null object distribution. Furthermore, clitic production is a phenomenon which should favor crosslinguistic influence according to Müller & Hulk's (2001)

1. From now on, for the sake of simplicity, we also refer to European Portuguese as Portuguese or EP and Iberian Spanish as Spanish or IS. When other varieties of both languages are considered, this will be indicated explicitly. We also use Pt. to indicate Portuguese examples, and Sp. to indicate Spanish examples.

https://doi.org/10.1075/lald.62.06nar

hypothesis: (i) it is a phenomenon at the syntax-pragmatics interface, since using a clitic requires not only syntactic knowledge (clitics as X° categories that move to the functional domain), but also knowledge about the appropriate discourse conditions for the use of a pronominal form; and (ii) it is an area in which there are clear differences between the two languages, but there is some structural overlap between the two grammatical systems.

By considering an additional understudied pair of languages (Portuguese and Spanish), we hope to contribute to the ongoing debate on the developmental path of bilingual acquisition (vs. monolingual acquisition), to the nature of crosslinguistic influence in bilingual language acquisition, and to the source of object omission in language acquisition cross-linguistically.

The paper is organized as follows: in Section 2, we present an overview of the distribution of clitics and null objects in Portuguese and Spanish, in order to identify the similarities and differences between the two grammatical systems; in Section 3, we describe previous studies on clitic production in bilingual language acquisition and we review some well-known hypotheses on crosslinguistic influence in bilingual language acquisition; in Section 4, we present the methodology used in our study; in Section 5, we present the main results; and before concluding, in Section 6, we discuss the relevance of our results for the questions under investigation.

2. Clitics and null objects in Portuguese and Spanish

EP and IS are two typologically related varieties that share many grammatical properties, but differ in crucial grammatical areas, including clitics and null objects. Both EP and IS have object clitic pronouns. However, they differ in clitic placement patterns and in the contexts where the clitic can be dropped. In IS clitics occur after a non-finite verb and before a finite verb (1), while in EP preverbal clitic placement is dependent on several syntactic triggers, including negation, specific preverbal adverbs, moved wh-constituents, among others (2) (Martins, 2013):[2]

(1) a. *Juan me pidió compra-r=lo.*
Juan me asked buy-INF=it
'Juan asked me to buy it.'

2. We have not investigated clitic placement in the present study. This is another topic, which raises interesting questions, considering the typological proximity and differences between EP and IS, and which would allow comparison with previous studies on bilectal speakers of Standard Greek and Cypriot Greek (Agathocleous et al., 2014). We will leave this for future work.

b. *Paco lo ha comprado.*
Paco it has bought
'Paco has bought it.'

(2) a. *O João pediu=me para comprá=lo.*
the João asked=me to buy=it
'João asked me to buy it.'
b. *O Chico comprou=o.*
The Chico bought=it
'Chico bought it.'
c. *O Chico não o comprou.*
The Chico not it bought
'Chico did not buy it.'
d. *O Chico já o comprou.*
The Chico already it bought
'Chico has already bought it.'
e. *Quem o comprou?*
Who it bought
'Who bought it?'

In some contexts, clitics can be dropped and alternate with a null object construction. In Spanish, although there are differences among varieties of the language (Schwenter & Silva, 2002; Schwenter, 2006), null objects are usually restricted to third person inanimate non-specific objects (Campos, 1986):[3]

(3) a. A: *Quieres café?*
want.2SG coffee
'Do you want coffee?'
B: *Sí, quiero.*
yes, want.1SG
'Yes, I do.'
b. A: *Quieres el periódico?*
want.2SG the newspaper
'Do you want the newspaper?'
B: *Sí, *(lo) quiero.*
yes, it want.1SG
'Yes, I want it.'

Null objects in Spanish may thus be analyzed as a special type of null pronominal.

3. In some geographic areas, as is the case of the Spanish variety spoken in the Basque country, omission may be more widespread due to crosslinguistic influence from Basque (García Mouton, 1994).

In contrast, in EP, according to the traditional view, null objects are much less restricted than in Spanish. Null specific definite objects are allowed, provided that the referent is available either through the previous linguistic context (4a) or through pragmatic clues (4b):

(4) a. *Comprei ontem este livro. Já leste?*
bought.1SG yesterday this book. Already read.2SG?
'I bought this book yesterday. Have you read it already?'
b. [pointing to a book] *Já leste?*
already read.2SG
'Have you read it already?'

There are, however, restrictions on null objects in the standard adult grammar: i) null objects seem to be restricted to third person (5a); ii) only non-reflexive null objects are allowed (5b); iii) null objects are not possible in islands (e.g. adverbial clauses, relative clauses, …) (5c):

(5) a. A: *Tens este livro?*
have.2SG this book
'Do you have this book?'
B: *Sim, já (o) comprei.*
Yes, already (it) bought.1SG
'Yes, I have already bought it.'
b. A: *E o João?*
and the João
'What about João?'
B: *Já *(se) barbeou.*
already *(REFL) shaved
'He has already shaved.'
c. *A mãe ficou contente quando a filha *(a) abraçou.*
the mother was happy when the daughter *(her) hugged
'Mommy was happy when her daughter hugged her.'

The fact that null objects are not possible in islands led Raposo (1986) to propose that null objects in EP are a special type of null category – a variable. Since variables have to be A-bar bound, Raposo explained the unavailability of null objects in islands by stating that EP null objects have to be bound by an empty topic operator in the left periphery of the clause.

More recently, some authors have suggested that null objects in EP may be sensitive to animacy features, as described for Brazilian Portuguese (Duarte & Costa, 2013), and have also questioned the ungrammaticality of null objects in islands (Raposo, 2004; Rinke, Flores, & Barbosa, 2018). In general, inanimate null objects

are preferred to animate ones and, at least for some speakers, null objects in islands are acceptable (Raposo, 2004: 46):

(6) ?*Conheço o rapaz que trouxe ∅ agora mesmo da pastelaria*. (topic: este bolo 'this cake')
know.1SG the boy that brought ∅ right now from the bakery
'I know the boy that brought it from the bakery right now.'

Although the exact status of null objects in EP is far from clear, it is obvious that, in Portuguese, they are much more common and less restricted than in Spanish. In fact, the situation is even more complicated in EP, since, beside null objects, there are other types of complement omission constructions, including VP ellipsis, which is not possible in Spanish:

(7) *A Ana tem chegado a horas ultimamente e o marido também tem [-]*.
the Ana has arrived on time lately and the husband also has
'Ana has arrived on time lately and her husband has too.'

Pérez-Leroux, Pirvulescu and Roberge (2008) argue that different types of null objects are available in every language. Null objects obey syntactic conditions on licensing and recoverability and lexical conditions determining which verbs allow null objects. Tuller (2000), for instance, reports that French allows null objects only with some verbs, null objects being lexically restricted:

(8) *Le sac à dos de Luc pèse une tonne le vendredi soir. Ça contient tous ses livres et ses cahiers.*
Luc's bag weighs heavily on Friday evening. It contains all his books and notebooks.
*– *T'as déjà porté? – T'as déjà vu*? (Tuller, 2000, p. 148)
*Have you already taken?/- Have you already seen?

Pérez-Leroux, Pirvulescu and Roberge (2008) also report cases of null objects in English, which can correspond to intransitive uses of transitive verbs or specific null objects in some contexts:

(9) *We have to get rid of all the ugly dishes before your date arrives. Okay, you wash _ and I'll dry _* .
(Goldberg, 2001, apud Pérez-Leroux, Pirvulescu & Roberge, 2008, p. 379)

Following Cummins and Roberge (2005), Pérez-Leroux, Pirvulescu and Roberge (2008) argue that UG allows for different types of null objects, including null pronouns and null nouns. There is thus variation between languages and varieties in what concerns: (i) the syntactic and pragmatic contexts where null objects are

allowed; (ii) the semantic features associated to null objects; and iii) the lexical representation of null objects.

In what concerns EP and Spanish, the two languages that we are considering in this paper, the distribution of null objects in each language is clearly different but there are structural overlaps between the two languages. To produce a clitic, not only does the child have to master the morphosyntax of clitics (deficient pronouns that are dependent on a verbal host and occupy a position within the functional domain), but he/she also has to determine in which context clitics can alternate with null objects.

3. Bilingual acquisition and clitic omission

Clitic and pronoun production and omission in bilingual language acquisition have been studied for different language combinations, considering either spontaneous production data, typically with a reduced number of children, or elicited production data.[4] Most studies focus only on one of the languages of the participants, since usually only one of the pair of languages considered has clitics. Some of them consider both languages, which may be clitic languages or pronoun languages. To our knowledge, no previous study has been conducted with Portuguese/Spanish bilinguals considering the rates of clitic production and omission in both languages.

After reviewing some of the general questions posed by bilingual language acquisition compared to monolingual acquisition, we will consider how different studies on the production of complement pronouns by bilingual children have explained the phenomenon of clitic/pronoun omission.

Studies with bilingual children try to determine whether the developmental path in bilingual language acquisition is similar to monolingual language acquisition, whether there is crosslinguistic influence, and which factors determine it. Although most authors now agree that bilingual children distinguish the two

4. Among the studies that have considered the acquisition of clitics and complement pronouns in bilingual children are: Müller & Hulk (2001), for German/Italian, German/French, and Dutch/French bilinguals; Serratrice, Sorace, & Paoli (2004), for English/Italian bilinguals; Granfeldt & Schlyter (2004), for Swedish/French bilinguals; Yip & Matthews (2005), for English/Cantonese bilinguals; Schmitz & Müller (2008), for French/Italian bilinguals; Stöber & Meisel (2008), for Portuguese/German bilinguals; Karpava & Grohmann (2014), for Russian/Cypriot Greek bilinguals; Pérez-Leroux, Pirvulescu, & Roberge (2009), Pirvulescu, Pérez-Leroux, & Roberge (2012), Pirvulescu, Pérez-Leroux, Roberge, & Strik (2014), and Tuller et al. (2015), for French/English bilinguals; Larrañaga & Guijarro-Fuentes (2012), for Basque/Spanish bilinguals; Costa, Lobo, & Pratas (2016), for Portuguese/Capeverdean bilinguals; and Tomescu & Avram (2016), for Romanian/Hungarian bilinguals.

grammatical systems and attain similar grammatical competence as monolinguals (Genesee, 1989; Genesee, Nicoladis, & Paradis 1995; Meisel, 1989, 2001, 2004; De Houwer, 2009; a.o.), it is also acknowledged that there may be interference processes in bilinguals. According to the influential hypothesis of Müller and Hulk (2001), some areas are more vulnerable in bilingual acquisition. The authors argue that phenomena at the syntax-pragmatics interface, and areas of structural overlap between the two systems being acquired are more vulnerable to crosslinguistic influence. The exact nature of the phenomena subject to crosslinguistic influence is still a matter of debate.

The type of interference that can be found in bilingual acquisition has also been under discussion. According to Paradis and Genesee (1996), crosslinguistic influence may have different manifestations: (i) acceleration – the exposure to a second language triggers a quicker development; (ii) delay – the exposure to a second language causes a slower development. Whether the crosslinguistic influence causes qualitative differences, compared to monolinguals, or only quantitative differences is another debated issue.

Besides language-internal factors, external factors have also shown to be determinant in child development. The situation of linguistic immersion, the age of exposure, the amount of input in each language, and schooling, for instance, as well as child-internal factors, may influence the bilingual acquisition process (Yip & Matthews, 2000; Paradis, 2011). According to other authors (e.g. Pirvulescu et al., 2014), the conditions of bilingual acquisition, which determine reduced input in each language compared to monolingual acquisition, may determine by itself a different path, sometimes referred to as the "bilingual effect."

Whereas, for first language acquisition, the phenomenon of pronoun omission has been explained by the maturation of pragmatic factors (Schaeffer, 1997, 2000), the maturation of grammatical factors (Gavarró, Torrens & Wexler, 2010; Wexler, 2014; Tsakali & Wexler, 2004; Wexler, Gavarró & Torrens, 2004), the complexity of the clitic system (Jakubowicz et al., 1998), or by a generalization of object drop constructions (Costa & Lobo, 2006, 2009, 2010; Silva, 2008; Pérez-Leroux, Pirvulescu, & Roberge, 2008; Castilla & Pérez-Leroux, 2010), for bilingual language acquisition, we can find mainly three types of explanations for the differences between bilinguals and monolinguals in the acquisition of clitics and pronouns: (i) a crosslinguistic influence from a language that has some kind of null object; (ii) a general bilingual (reduced input) effect that favors a default null object representation; (iii) the morphosyntax of clitics vs. pronouns.

Studies with language combinations in which one of the languages allows some kind of object drop have explored crosslinguistic influence, among other factors, as the source for a quantitative difference between bilinguals and monolinguals in the rates of pronoun production. Müller and Hulk (2001) observe that, although

there are no qualitative differences between monolinguals and bilinguals, there are quantitative differences. In the children they investigated, German/Italian, Dutch/French and German/French bilinguals had higher rates of omission in French and Italian compared to monolinguals. They attribute this to the influence of topic-drop of the Germanic languages (German and Dutch). Null objects are an area of structural overlap between the two systems being acquired, which may cause more ambiguous contexts in the input, and they are an interface phenomenon, requiring the integration of the syntactic and pragmatic systems, since the appropriate contexts for object drop are subject to specific discourse constraints. Yip and Matthews (2005) consider 5 bilingual children, who speak Cantonese and English. These two languages differ in the distribution of null objects, which are available in Cantonese, but not in English. The authors observe some transfer from Cantonese to English, since the children had more object omission in English than monolinguals. Larrañaga and Guijarro-Fuentes (2012) observed a higher omission in the spontaneous production of two Spanish/Basque bilingual children, which the authors relate both to a crosslinguistic influence from Basque (that lacks clitics) and to children's use of information recoverability. Similar findings have been reported by Karpava and Grohmann (2014): using elicited production tasks, they also found higher rates of omission in the bilingual acquisition of Cypriot Greek by Russian/Cypriot Greek bilingual children compared to Cypriot Greek monolinguals. The fact that Russian allows some types of null objects may explain these results.

Other studies, however, have not found higher rates of omission in bilinguals, although some other interference processes were reported. Stöber and Meisel (2008), who studied two children acquiring Brazilian Portuguese (BP) and German, did not find topic drop in German in illegitimate contexts. Both languages have some kind of object omission, but with different properties: German is a topic-drop language, where topic drop is restricted to main clauses, whereas BP has null objects, which are allowed both in simple sentences and in in islands. The authors conclude that children distinguish the two systems, and that they develop autonomously. Tomescu and Avram (2016), who investigated Romanian/Hungarian bilinguals, found similar rates of clitic production in Romanian in monolinguals and bilinguals. These languages do not have null objects but they differ in the properties of the pronominal object, which is a strong pronoun in Hungarian and a clitic in Romanian. Although a particular doubling pattern was found only in the bilinguals, the authors report similar rates of clitic production for monolinguals and bilinguals. Serratrice, Sorace, and Paoli (2004) studied one bilingual Italian/English child. Both Italian and English lack null definite objects, and the two languages differ in the morphosyntactic status of the pronoun: object pronouns are clitics in Italian and strong pronouns in English. The authors report that there is some crosslinguistic influence, since the child produces strong pronouns in Italian, but there is no omission in either language.

Other studies have explored the fact that object omission might be a kind of default representation that is preferred in bilingual language acquisition. Costa, Lobo, and Pratas (2013, 2016) elicited accusative clitics in simple sentences and in islands by Cape Verdean/European Portuguese bilingual children living in Portugal, and compared them to Cape Verdean monolinguals living in Cape Verde and EP monolinguals. Cape Verdean has obligatory clitics and does not allow object omission, differently from Portuguese. The authors found that Cape Verdean monolinguals rarely omitted clitics, whereas bilinguals omitted clitics both in Portuguese, as expected, and in Cape Verdean. This may be seen as transfer from Portuguese: bilinguals choose the null form, which has lower computational costs, more often. Pirvulescu et al. (2014) also investigated pronoun production by French/English bilingual children, using an elicited production task. Bilingual children omitted the object pronoun more often than monolinguals both in French and in English. The authors argue that this is a "bilingual effect" that is not clearly explained by cross-linguistic influence, and attribute object omission in bilinguals to the retention of a default null object representation. Different types of null objects are made available by Universal Grammar (UG) but identifying the types of null objects available in the language takes more time in bilingual acquisition, due to reduced input.

Finally, some studies have considered the role of the morphosyntactic status of the pronoun on its acquisition, considering not only object pronouns, but also subject pronouns. Both Granfeldt and Schlyter (2004) and Schmitz and Müller (2008) considered how the status of different types of pronouns (as strong, weak or clitic pronouns) impacts their acquisition. Granfeldt and Schlyter (2004), taking into account the framework of Cardinaletti and Starke (1999), compare subject and object pronoun production by Swedish/French bilingual children and L2 learners. The bilingual children exhibited target-like pronoun production from an early age, unlike the L2 speakers. Contrary to other studies, Schmitz and Müller (2008) did not find differences between the emergence and frequency of accusative and reflexive clitics. They argue that strong pronouns and subject clitic pronouns are acquired earlier than accusative and reflexive clitics due to differences in their internal and external syntax. According to the authors, strong pronouns and subject clitics, which contain an N-layer, are acquired earlier than reflexive and accusative clitics, which lack the N-layer. Tuller et al. (2015) studied several phenomena in the production of French by English/French bilinguals living in France, comparing them to SLI children. One of the linguistic properties they considered, which is generally taken as a marker of SLI, was the production of clitics through an elicited production task. The authors found that bilinguals omitted clitics more than monolinguals and that both nominative and reflexive clitics were produced more often than accusative clitics. Similar asymmetries between types of clitic are reported in Jakubowicz et al. (1998) for French monolingual acquisition, and in Silva (2008) for Portuguese monolingual acquisition, for instance.

Although clitic production seems to be a vulnerable area in bilingual acquisition, results reported in the literature are not always unanimous, and the nature of clitic omission in child language is still a debated issue. In our study, we wish to contribute to the ongoing debate by considering the acquisition of clitics by bilingual Portuguese/Spanish children. Our study is innovative not only in what concerns the language combination, with two typologically related languages, but also because: (i) it considers clitic production in both languages, which enables us to investigate whether the bilinguals distinguish each language and whether they differ from monolinguals in both languages; (ii) it considers not only accusative clitics in simple sentences, but also accusative clitics in islands and reflexive clitics, which enables us to investigate whether the developmental pattern is similar across different clitics and clitic contexts.

4. Experimental design

4.1 Research questions and hypotheses

As we have seen, Portuguese and Spanish are two typologically close languages, which differ, however, in the distribution of null objects and therefore in the contexts where clitic omission is allowed. According to Hulk and Müller (2000) and Müller and Hulk (2001), crosslinguistic influence in bilingual acquisition is mostly found with interface phenomena where there is some structural overlap between the two grammatical systems. Clitic production (and the possibility of using a null object instead of the clitic) qualifies as an interface phenomenon, since using a clitic requires integrating syntactic computation with pragmatic knowledge, including the saliency of the referent. Furthermore, it is an area where there is structural overlap between Portuguese and Spanish: in Spanish null objects are allowed in a subset of the contexts in which they are allowed in EP. Therefore, clitic production by Portuguese/Spanish bilinguals is a relevant domain to test hypotheses on crosslinguistic influence in bilingual language acquisition.

The sociolinguistic context of Portuguese/Spanish bilinguals living in Portugal differs from other more numerous bilingual populations living in the same country, like the Portuguese/Cape Verdean bilinguals, considered in Costa, Lobo, and Pratas (2013, 2016). Cape Verdean is a minority language that is not an official language in Cape Verde and is considered to be a low-prestige language. Spanish, on the contrary, is spoken by a group of speakers usually with a higher socio-economic status, and is the language of schooling at the Spanish school.

Taking into account that we considered a different population and different language combinations, we formulated the following research questions:

a. Is the developmental path of Portuguese/Spanish bilinguals similar to that of Portuguese and Spanish monolinguals?
b. Do Spanish/Portuguese bilinguals distinguish the two grammatical systems?
c. Is there crosslinguistic influence in the clitic production of Portuguese/Spanish bilinguals? And if so, in which direction? Is there less omission in Portuguese compared to Portuguese monolinguals (accelerated development) or more omission in Spanish compared to Spanish monolinguals (delayed development)?
d. Are bilingual children sensitive to the morphosyntactic contexts where null objects are allowed? Are there differences in the rates of clitic production for reflexive clitics, accusative clitics in simple sentences, and accusative clitics in islands?

4.2 Participants

The target group included Portuguese/Spanish bilingual children living in Portugal, in the Lisbon area, who were attending a Spanish school (Instituto Español "Giner de los Ríos"), where teaching is in Spanish and in accordance with the Spanish curriculum.[5] Portuguese is taught as a subject, since it is the language spoken in the country. The children were simultaneous bilinguals, who had one Spanish-speaking parent and one Portuguese-speaking parent. In some cases, one of the parents or both were bilingual. In all the cases, both languages were spoken at home from birth. We also tested a group of bilingual adults living in Portugal and two groups of monolingual Portuguese and Spanish speakers. The Portuguese monolingual children were living in the greater Lisbon area and attended pre-school in different private schools supported by the State. Spanish monolinguals were living in Spain, in Madrid, and attended a private school. These children and their parents were born in Madrid.

183 participants took part in our study (details are given in Table 1).[6,7] Bilinguals were tested in the two versions (Portuguese and Spanish) by a native speaker of each

5. Most of the children who attend this school either have Spanish parents currently living in Portugal, or are descendants of Spanish families.

6. In Table 1, the standard deviation has been calculated in months for the children and in years for the adults.

7. Initially we had data from 187 participants, since we also tested 4 early bilingual children who were exposed to the second language before pre-school, two of them in the 3-year-old group, one in the 4-year-old group and one in the 5-year-old group. Following a reviewer's suggestion, the data from these 4 children were excluded and all the data from the bilinguals were recalculated. Although this did not have a significant impact on the results, we now have data only from simultaneous bilinguals.

language. In total we obtained results from 249 applications of the experimental task considering both languages.

Table 1. Participants

	Monolinguals EP				Monolinguals IS				Bilinguals EP/IS			
	N	Age range	Mean age	SD	N	Age range	Mean age	SD	N	Age range	Mean age	SD
3 y.-o.	–	–	–		15	3;2–3;11	3;5	2.93	19	3;0–3;11	3;5	3.33
4 y.-o.	20	4;1–4;11	4;6	3.12	14	4;0–4;10	4;5	3.30	20	4;0–4;11	4;4	4.09
5 y.-o.	20	5;0–5;10	5;4	3.05	15	5;0–5;11	5;4	3.27	16	5;1–5;10	5;6	3.07
Adults	21	18–38	21;1	6.62	12	25–60	42;6	12.26	11	25–32	28;8	2.69

4.3 Task and procedure

We used an elicited production task with the help of pictures shown on a computer screen, following a methodology used in previous studies (e.g., Varlokosta et al., 2016). The researcher introduced the picture and asked a question about it. The test included three different conditions, corresponding to three different syntactic contexts, with a total of 34 test items, in addition to training items:

a. accusative third person clitic in a simple sentence – 12 items
b. accusative third person clitic in an adjunct island (adverbial reason clause) – 12 items
c. reflexive third person clitic in a simple sentence – 10 items

The three contexts that we considered allow us to distinguish contexts where null objects are allowed in Portuguese (accusative in simple sentences) from contexts where clitic omission is ungrammatical for most adult speakers (reflexive clitics and accusative clitics in islands). Clitic production is obligatory in all those contexts in Spanish, since we only included definite object contexts. The order of presentation of the items was randomized.

There were two versions: a Portuguese one and a Spanish one. We included verbs with similar syntactic properties in both languages, which selected direct objects in both cases. Portuguese monolinguals were administered the Portuguese version, Spanish monolinguals were administered the Spanish version, and bilinguals were administered both versions. To avoid influence of object omission in Spanish due to previous exposure to the Portuguese version, bilinguals were tested first in the Spanish version and later in the Portuguese version, following the methodology used in Costa, Lobo and Pratas (2013, 2016).

Examples of test items for each condition are given below.

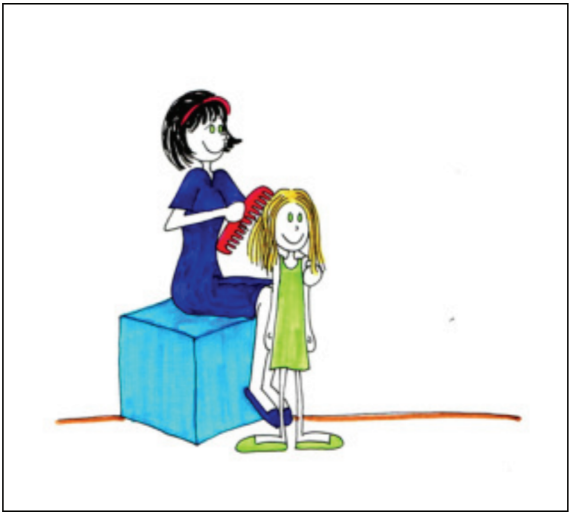

Figure 1. Picture used in Condition 1 – Accusative clitic in simple sentence

(10) Portuguese version:

Investigator:	*Temos aqui uma mãe e uma filha.*
	'We have have here a mother and a daughter.'
	O que é que a mãe está a fazer à filha?
	'What is the mother doing to the daughter?'
Expected answer:	*Está a penteá=la./Está a pentear Ø.*
	is combing=her/ is combing Ø.
	'She is combing her.'

Spanish version:

Investigator:	*Aquí tenemos a una mamá y a una hija.*
	'Here we have a mother and a daughter.'
	¿Qué le está haciendo la mamá a la hija?
	'What is the mother doing to the daughter?'
Expected answer:	*La = está peinando.*
	her=is combing
	'She is combing her.'

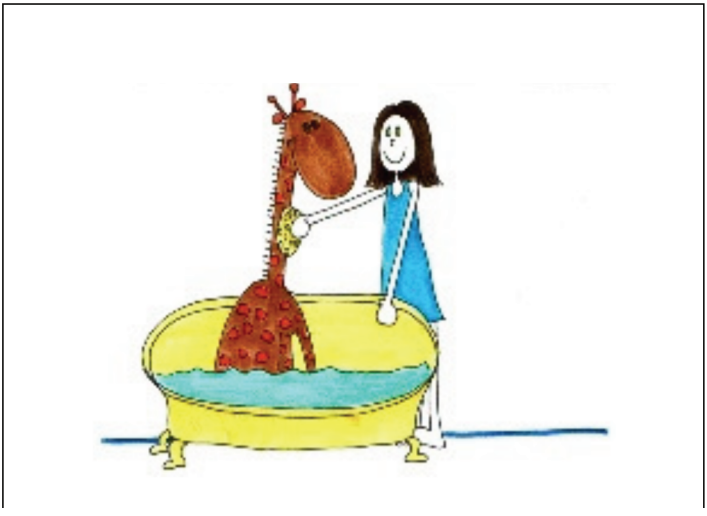

Figure 2. Picture used in Condition 2 – Accusative clitic in island

(11) Portuguese version:

Investigator:	*A menina lavou a girafa e a girafa ficou limpa.*
	'The girl washed the giraffe and the giraffe became clean.'
	Porque é que a girafa ficou limpa?
	'Why did the giraffe become clean?'
	A girafa ficou limpa porque a menina….
	'The giraffe became clean because the girl…'
Expected answer:	*…a=limpou.*
	…her=cleaned
	'cleaned her.'

Spanish version:

Investigator:	*La niña ha lavado a la jirafa y la jirafa se ha quedado limpia.*
	'The girl has washed the giraffe and the giraffe became clean.'
	¿Por qué se ha quedado limpia la jirafa?
	'Why did the giraffe become clean?'
	La jirafa se ha quedado limpia porque la niña…
	'The giraffe became clean because the girl…'
Expected answer:	*…la=ha limpiado/la=limpió.*
	…her = has cleaned/…her = cleaned
	'cleaned her.'

Figure 3. Picture used in Condition 3 – Reflexive clitic

(12) Portuguese version:
Investigator: *Temos aqui uma girafa.*
'We have here a giraffe.'
O que é que a girafa está a fazer?
'What is the giraffe doing?'
Expected answer: *Está a lamber=se.*
is licking=REFL
'It is licking itself.'
Spanish version:
Investigator: *Aquí tenemos una jirafa.*
'Here we have a giraffe.'
¿Qué está haciendo la jirafa?
'What is the giraffe doing?'
Expected answer: *Se=está lamiendo.*
REFL=is licking
'It is licking itself.'

4.4 Coding

The answers were coded according to the following categories:

a. Target clitic
Clitic production was considered target when the participant produced an accusative (Pt. *o/a*; Sp. *lo/la*) or dative clitic (Sp. *le*) typical from "leísmo" in the accusative conditions[8] and when the participant produced a reflexive clitic (Pt./Sp. *se*) in the reflexive condition.

Ex: Sp.	*la=limpió*	Pt. *lavou=a*
	3SG.FEM=cleaned	washed=3SG.FEM
Sp.	*se=está mirando*	Pt. *sujou=se*
	REFL=is watching	dirtened=REFL

b. Omission

Ex: Sp.	*limpió*	Pt. *limpou*
	cleaned	cleaned

c. Strong pronoun

Ex: Sp.	*ha pintado ella*	Pt. *molhou ele*
	has painted her	wetted him

d. DP

Ex: Sp.	*ha pintado la casa*	Pt. *está a pintar a casa*
	has painted the house	is painting the house

e. Other

We included in "other" the production of a non-target clitic (e.g. a reflexive clitic in the accusative conditions) or the production of a structure that did not require the intended clitic (e.g. use of an intransitive verb or use of a transitive structure with a full object in the reflexive condition, e.g. *ficou sujo de lama* 'became dirty with mud' instead of *sujou-se* 'dirtied himself').

Only clitics (and, for Portuguese, also omission in simple sentences) are both grammatical and appropriate answers in the context. Strong pronouns in object position are not grammatical in Spanish and European Portuguese; omissions are ungrammatical in Spanish in all contexts, and are not allowed with reflexives and in island contexts in Portuguese; DP answers, although not ungrammatical, are pragmatically inappropriate in the context.

8. See Fernández-Ordóñez (1999, 2012) for the phenomenon of *leísmo*.

5. Results

In Tables 2, 3 and 4, we present the results obtained in each condition for each group. Table 2 corresponds to the condition eliciting accusative clitics in simple sentences. Remember that clitics are optional in EP in this context, but obligatory in Spanish.

Table 2. Results for the Condition Accusative clitic in simple sentences

	Portuguese monolinguals					**Bilinguals (Portuguese)**				
	Clitic	**Null**	**Pron.**	**DP**	**Other**	**Clitic**	**Null**	**Pron**	**DP**	**Other**
3 y.-o.	–	–	–	–	–	21.9%	**51.3%**	0	4.8%	21.9%
4 y.-o.	22%	**54.2%**	1.7%	8.3%	13.8%	25.4%	**52.1%**	0	5%	17.5%
5 y.-o.	42.9%	**45%**	2.9%	2%	7%	17.7%	**55.2%**	1.6%	7.8%	17.7%
adults	73.8%	**4.8%**	0	20.2%	1.2%	81.8%	**10.6%**	0	5.3%	2.3%
	Spanish monolinguals					**Bilinguals (Spanish)**				
	Clitic	**Null**	**Pron**	**DP**	**Other**	**Clitic**	**Null**	**Pron**	**DP**	**Other**
3 y.-o.	56.7%	**23.9%**	0	1.1%	18.3%	19.9%	**52.6%**	0	5.2%	22.3%
4 y.-o.	78.6%	**8.3%**	0.6%	2.3%	10.1%	22.9%	**57.9%**	0.4%	3.3%	15.4%
5 y.-o.	72.8%	**18.9%**	0	1.1%	7.2%	52.1%	**28.1%**	3.1%	3.1%	13.5%
adults	86.1%	**7.2%**	0	0.7%	6.9%	91.6%	**5.3%**	0	1.5%	1.5%

In this condition, as expected, there are high rates of omission in Portuguese monolingual children, similar to the ones found in previous studies (Costa & Lobo, 2006; Silva, 2008). Spanish monolinguals also have some omission but with lower rates. This rate of omission is higher than the one found in previous studies with Spanish monolinguals using elicited production tasks (Gavarró, Torrens, & Wexler, 2010) and closer to the rates found for Colombian Spanish (Castilla & Pérez-Leroux, 2010). This may have been triggered by the high rate of non-finite verb forms that seemed to allow more easily for bare verb forms without a complement. In Table 5 below, we consider how this may have affected the rate of omission in every group. As for our target group, there was clitic omission both in Portuguese and in Spanish. The rates of omission for the bilinguals in Portuguese were comparable to Portuguese monolinguals; however, their rates of omission in Spanish were higher than the ones found in Spanish monolinguals, with a clear decrease in object omission in the 5-year-old group. Rates of omission for monolingual and bilingual adults were very low.

In Table 3, we present the results from each group for the accusative in island condition.

Table 3. Results for the Condition Accusative clitic in islands

	Portuguese monolinguals					**Bilinguals (Portuguese)**				
	Clitic	**Null**	**Pron**	**DP**	**Other**	**Clitic**	**Null**	**Pron**	**DP**	**Other**
3 y.-o.	–	–	–	–	–	21.1%	**64.5%**	0.4%	1.3%	12.7%
4 y.-o.	15.4%	**42%**	4.2%	2.5%	35.9	36.6%	**50.0%**	0.8%	2.5%	10.0%
5 y.-o.	33.8%	**35%**	2.9%	3.8%	24.6%	37.5%	**42.2%**	4.1%	4.7%	11.5%
adults	61.9%	**0**	0	16.3%	21.8%	91.7%	**3.85**	0	3.8%	0.7%
	Spanish monolinguals					**Bilinguals (Spanish)**				
	Clitic	**Null**	**Pron**	**DP**	**Other**	**Clitic**	**Null**	**Pron**	**DP**	**Other**
3 y.-o.	86.1%	**3.3%**	0	0.6%	10%	61.8%	**21.5%**	0.4%	0.4%	15.8%
4 y.-o.	92.9%	**3%**	0	0	4.1%	60%	**25.8%**	0.4%	1.7%	12.1%
5 y.-o.	93.3%	**2.8%**	0	0.6%	3.3%	74.5%	**12.5%**	3.6%	0	9.4%
adults	96.5%	**0**	0	1.4%	2.1%	99.2%	**0.8%**	0	0	0

In this condition, both Portuguese monolinguals and bilinguals tested in Portuguese show high rates of omission. This contrasts with the rates of omission in Spanish. Spanish monolinguals rarely omit clitics in this condition. Bilinguals tested in Spanish show higher rates of omission than Spanish monolinguals, but clearly less omission than in Portuguese, with a clear drop in the 5-year-olds (only 12.5%). Results from the bilinguals in this condition are interesting because they clearly show that bilinguals behave distinctly in Spanish and in Portuguese, although their development is still behind the one of Spanish monolinguals.

Table 4 presents the results from the reflexive condition.

Table 4. Results for the Condition Reflexive clitic

	Portuguese monolinguals					**Bilinguals (Portuguese)**				
	Clitic	**Null**	**Pron**	**DP**	**Other**	**Clitic**	**Null**	**Pron**	**DP**	**Other**
3 y.-o.	--	--	--	--	--	50.5%	**20.0%**	0	0	29.5%
4 y.-o.	41.5%	**27%**	1%	1%	29.5%	49.5%	**22.5%**	0	0	28.0%
5 y.-o.	68.5%	**14%**	0.5%	1%	16%	51.3%	**26.2%**	0.6%	0	21.9%
adults	91.4%	**0.95%**	0	0.95%	6.7%	96.4%	**0**	0	0	3.6%
	Spanish monolinguals					**Bilinguals (Spanish)**				
	Clitic	**Null**	**Pron**	**DP**	**Other**	**Clitic**	**Null**	**Pron**	**DP**	**Other**
3 y.-o.	74%	**6%**	0	0	20%	51.6%	**21.6%**	0	0	26.8%
4 y.-o.	89.3%	**2.9%**	0	0	7.9%	45.0%	**29.5%**	0	0	25.5%
5 y.-o.	85.3%	**5.3%**	0	0	9.3%	70.6%	**13.7%**	0	0	15.6%
adults	95%	**0**	0	0	5%	98.2%	**0**	0	0	1.8%

In the reflexive condition, there is less omission in every group. Portuguese monolinguals have lower rates of omission than in the other conditions, confirming previous

studies (Costa & Lobo, 2007; Silva, 2008) that show that this is the context where clitic production becomes stable earlier in Portuguese. Spanish monolinguals only have residual omission (below 7%). Bilinguals omit in both languages, with lower rates than in the accusative in simple sentence condition. Spanish bilinguals have higher rates of omission than Spanish monolinguals, although the rates of omission drop in the 5-year-olds. The rates of clitic production are not as high as expected, but this is due to the rate of other responses, which was higher in the reflexive condition. Children used non-reflexive structures (e.g. *he is washing his body* or *he became dirty*) instead.

The comparison of the rates of omission for the target group of bilinguals in each language and in each condition (Figure 4) reveals that, although bilinguals omit in both languages, there are clear differences in the rates of omission in each language: the rates of omission in Portuguese are usually higher than in Spanish. This is especially visible in the accusative in island context, and in the 5-year-old group.

Since the rates of omission that we obtained for Spanish monolinguals were higher than the ones found in previous studies using a similar methodology (Gavarró, Torrens, & Wexler, 2010), we decided to investigate whether this was an effect of the finiteness of the verb. Gavarró and Fortón (2014: 106) report that omission of first and second person clitics in Catalan was higher with non-finite verbs. The use of the present progressive in the accusative in the simple sentence condition and in the reflexive condition, instead of the simple past, which is odd in Portuguese to describe an ongoing action, had as a result that sometimes participants only produced the non-finite verb form, omitting the auxiliary (e.g. *lavar* 'to wash' or *lavando* 'washing'). Therefore, we calculated the rates of omission again considering only sentences with finite verb forms (e.g. *está lavando* 'is washing' or *lavou* 'washed'). The results are presented in Table 5.

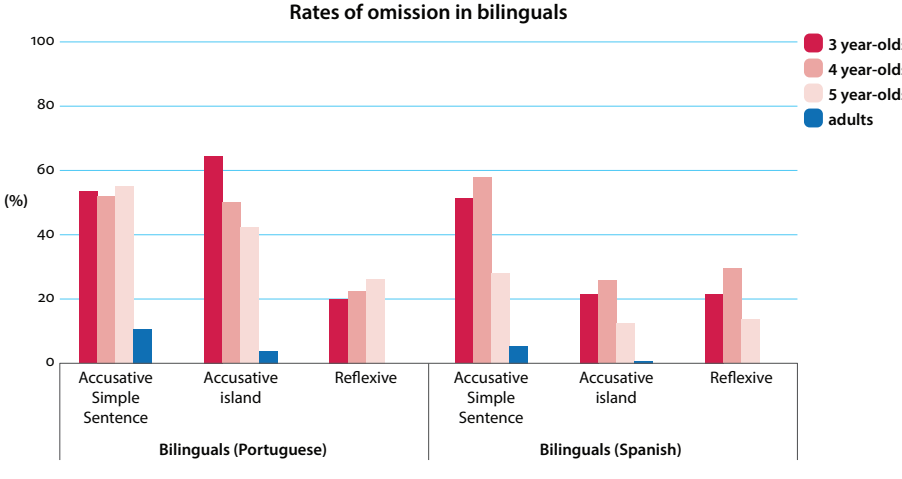

Figure 4. Rates of omission in bilinguals

Table 5. Rates of omission considering only sentences with finite verb forms

	Portuguese monolinguals			Bilinguals Portuguese		
	Acc. simple sentence	Acc. island	Refl.	Acc. simple sentence	Acc. island	Refl.
3 y.-o.	--	--	--	32.9%	64.5%	8.4%
4 y.-o.	22.5%	41.7%	11%	12.9%	50.0%	4.0%
5 y.-o.	25.4%	33.8%	7.5%	20.3%	42.2%	5.6%
adults	1.2%	0	0	2.3%	3.8%	0
	Spanish monolinguals			**Bilinguals Spanish**		
	Acc. simple sentence	Acc. Island	Refl.	Acc. simple sentence	Acc. Island	Refl.
3 y.-o.	3.9%	2.8%	1.3%	17.5%	19.3%	11.0%
4 y.-o.	2.4%	3%	0%	17.5%	24.6%	9.0%
5 y.-o.	0	1.4 %	0	8.3%	11.5%	5.6%
adults	0.7%	0	0	1.3%	0.6%	0

As we can see, rates of omission in finite sentences are lower than when we consider both finite and non-finite sentences. Spanish monolinguals rarely omit clitics in finite sentences (omission is below 4%), having thus results that are comparable to those of previous studies. There still is some omission in the bilinguals tested in Spanish, though, which confirms that the rates of clitic omission are higher in the bilinguals compared to monolinguals. The rates of omission are lower in the reflexive condition, compared to the conditions that elicited accusative non-reflexive clitics. The distinction between Spanish and Portuguese in the bilinguals is now clearer: bilinguals omit more in Portuguese than they do in Spanish. These results show that the verbal tense used in the experiment must be taken into account when considering clitic production and clitic omission.

6. Discussion and conclusions

There is still a lot of debate on whether bilingual development resembles monolingual development or shows a different developmental path. Crosslinguistic influence has been argued to affect mainly interface phenomena and areas of structural overlap between the two languages being acquired, since the input is more ambiguous. This paper has addressed clitic omission in Spanish/Portuguese bilingual acquisition. This pair of languages is understudied in bilingual studies. By considering different clitics (accusative and reflexive) and different syntactic contexts for accusative clitics (simple sentences and adjunct islands), we were able to determine whether bilingual children are sensitive to the morphosyntactic nature of the clitic

and the distribution of null objects in each language. Since we tested bilinguals both in Portuguese and in Spanish, we were able to determine whether bilinguals had different behaviors in each language and developed each grammatical system separately. By comparing bilinguals and monolinguals we were able to determine similarities and differences between monolingual and bilingual development.

Let us return to our main research questions. Our study aimed at investigating whether there is crosslinguistic influence on the production of clitics by Portuguese/Spanish bilinguals, and, if so, in which direction. The fact that we elicited clitics in both languages also allowed us to compare the rates of omission and clitic production in each language and see if the bilingual children distinguish the two systems.

According to Müller and Hulk's (2001) hypothesis, clitic production/omission in bilingual Portuguese/Spanish acquisition is an interface area: as described in Section 2, there is some overlap between the two systems (both languages allow some type of object omission), and clitic production requires the integration of syntactic and discourse knowledge. Thus, taking into account the properties of the pair of languages under consideration, we expected to find crosslinguistic influence, with more omission in the bilinguals. The results we obtained confirmed this prediction: they show that there is crosslinguistic influence in the acquisition of clitics by Spanish/Portuguese bilingual children. Since Portuguese is a null object language, which allows object omission in a wider number of contexts than Spanish does, the children's input will be more ambiguous than for Spanish monolinguals in what concerns null objects. Spanish/Portuguese bilingual children seem to extend the null object construction to Spanish in the same way they do in Portuguese. As reported in the literature, monolingual Portuguese children also take some time to determine the contexts where null objects are allowed, and clitic omission is found until later ages than in other languages (Costa & Lobo, 2006; Silva, 2008; Varlokosta et al., 2016). The exposure to Spanish, which has less object omission, could have an accelerating effect in the bilingual children. However, this was not confirmed. Instead, the bilinguals showed only crosslinguistic influence from Portuguese to Spanish. This preference for a null form is presumably attributable to the fact that it is a default form, as claimed by Pirvulescu et al. (2014), which is less costly for the computational system (Costa, Lobo, & Pratas, 2013; Varlokosta et al., 2016). Hence, it is not the case that crosslinguistic influence is not grammatically constrained. It is highly sensitive to the specific grammatical structure and it seems to be unidirectional: in this case, the grammar with a less restricted null form influences the grammar where the null form is highly constrained.

We have also seen that the rates of omission are lower and the differences between EP and IS become more evident when we consider only finite sentences. It may be the case that when the child uses a non-finite verbal form he/she is not producing a full sentence, but he/she is just describing a generic event. As

acknowledged in Castilla and Pérez-Leroux (2010), there is variation across studies in the optionality of object omission. In our case, the methodology was closer to the one used in Castilla and Pérez-Leroux (2010). Therefore, it may also be the case that different rates of omission are due to methodological issues.

Despite the crosslinguistic influence, our data show that bilingual children distinguish the two grammatical systems. The fact that bilinguals have different rates of omission in each language gives support for an independent development of each system, as defended in Genesee (1989) and Meisel (1989), among many others. Bilinguals omit more in Portuguese than in Spanish, and the rates of omission drop earlier in Spanish than in Portuguese; 5-year-olds already have lower rates of omission in Spanish. Thus, although clitic production takes some time to develop, ultimately bilinguals will attain full grammatical competence in both systems.

Furthermore, we have shown that, similarly to monolinguals, bilinguals are sensitive to the different grammatical contexts: there is more omission with accusatives than with reflexives. Similar results have been found for monolingual children in Portuguese and in other languages (Costa & Lobo, 2007; Silva, 2008; Tuller et al., 2015; Jakubowicz et al., 1998). Although Schmitz and Müller (2008) do not find differences between accusative and reflexive clitics in monolingual and bilingual acquisition, a higher rate of reflexive clitics has been found in several languages, including Portuguese and French. Our results are thus in line with Tuller et al.'s (2015) results. Besides the fact that only accusative clitics are dropped in adult grammars, it may be that morphological features of the clitic also play a role. Reflexive clitics in Portuguese and Spanish are only specified for person, whereas accusative non-reflexive clitics are also specified for gender and number. Although not frequent, there were some gender errors in the accusative clitics produced by the bilinguals both in Spanish and in Portuguese. So, besides the effect of null objects, the grammatical properties of the clitic are also determining factors for language acquisition, as has been argued by Delage, Durrleman, & Frauenfelder (2016).

It must be underlined that it is not the case that bilinguals have problems with the clitic status of the pronoun. All the children produce clitics in a target-like way and show knowledge of the properties of clitics. The difference between bilinguals and monolinguals is that the former exhibit higher rates of omission. Moreover, unlike monolingual children, bilinguals occasionally use the allomorphs *lo* and *la*, instead of *o* and *a*, in inappropriate contexts in Portuguese (e.g., *secou-lo* instead of *secou-o* or *o artista pintou-la* instead of *o artista pintou-a*). This seems to be due to an influence from Spanish, which does not have these morphophonological variants. The Portuguese system is more complex, since the form of the clitic in postverbal position may be *o* or *lo* depending on the verb ending (cf. *comeu-o* 'ate it' vs. *está a comê-lo* 'is eating it').

We can thus conclude that bilinguals' development converges with the target grammar and follows a path which is globally similar to the one found with monolinguals, but this particular grammatical area apparently takes more time to develop in bilinguals than in monolinguals. Clitic production develops more slowly in bilinguals, which may be seen as a "bilingual effect," as defended in Pirvulescu et al. (2014). Our results are thus in line with previous studies that show that the differences between monolingual and bilingual acquisition, at least as far as clitic production is concerned, are mostly quantitative in nature (cf. Müller & Hulk, 2001, among others), although some particular patterns may show up in bilinguals, as reported also in Tomescu & Avram (2016) for Romanian/Hungarian bilinguals.

Since we did not test bilinguals living in Spain, we cannot determine whether the crosslinguistic influence is the result of the linguistic environment and more exposure to Portuguese. We would have to test Portuguese/Spanish bilinguals living in Spain to see whether the linguistic environment is a relevant variable or whether the developmental path is the same.

Acknowledgments

We would like to thank the children, schools and adults who participated in the experiment, Stéphanie Vaz and Margarida Tomaz for their help collecting data from the Portuguese monolinguals, two anonymous reviewers for their useful comments on an earlier version of this work, and Ana Madeira and Alexandra Fiéis for their suggestions, which helped us to improve our paper.

This research has been funded partially by Portuguese National Funding through the FCT Fundação para a Ciência e Tecnologia as part of the project of the Centro de Linguística da Universidade Nova de Lisboa – UID/LIN/03213/2013.

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Syntactic awareness of clitic pronouns and articles in French-speaking children with autism, specific language impairment and developmental dyslexia

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The performance of 122 children on syntactic awareness of clitics and articles in French was examined. Three clinical groups (21 children with ASD, 22 children with SLI, 23 children with DD) and a group of 56 younger children with TD were studied. On the article task, children with ASD obtained lower scores than all the other groups and on the clitic task they performed worse than children with DD. In addition, children with ASD and low expressive language displayed more difficulty than children with SLI on the clitic task. Thus, a subgroup of children with ASD is taxed in an area that is critical to identify children with SLI.

Keywords: clitics, article, syntactic awareness, ASD, SLI, DD

1. Introduction

Difficulties with language, and in particular grammar, are a characteristic feature of children with Specific Language Impairment (SLI) or "developmental language disorders" (DLD). Although SLI is a heterogeneous disorder and subtypes have been identified (Conti-Ramsden & Botting, 1999; Friedmann & Novogrodsky, 2011), children with SLI are generally delayed in the onset of language and display persistent problems in phonology, lexicon, morphosyntax and syntax. Children with Autism Spectrum Disorder (ASD) display poor spoken communication skills (DSM-V, American Psychiatric Association [APA] 2013), although much individual variation is also evident in this condition (Lord et al., 2006). One of the components most investigated in children with ASD is pragmatics (Tager-Flusberg, 1996), where they

https://doi.org/10.1075/lald.62.07gua

generally perform poorly (Happé, 1995; Baron-Cohen, 1997; Chin & Bernard-Opitz, 2000; Reddy, Williams, & Vaughan, 2002). However, in the last fifteen years, growing interest in the grammatical abilities of children with ASD has uncovered weaknesses similar to those observed in children with SLI (Roberts et al., 2004; Kjelgaard & Tager-Flusberg, 2010; Zebib et al., 2013; Durrleman & Delage, 2016). This has led some authors to distinguish between at least two subgroups, one including children with ASD and language impairment (LI), termed ALI, and one including children with ASD without LI (Roberts et al., 2004; Modyanova et al., 2017).[1]

Developmental Dyslexia (DD) is a persistent problem in learning to read adequately. It is widely accepted that DD has, in most cases, a linguistic origin, related to phonology (a.o., Ramus et al., 2003). Beyond phonology or phonological related processes, other domains of language such as morphosyntax and syntax may also be affected in children with DD (Barshalom et al., 1993; Robertson & Joanisse, 2010; Rispens et al., 2004; Cantiani et al., 2013). In some work, these language problems have been observed in particular when verbal working memory load increases (Robertson & Joanisse, 2010). While SLI and DD have often been studied separately, interest in the overlap between these conditions has been growing over the years (Bishop & Snowling, 2004). Co-occurrence of SLI and DD is regarded as a case of comorbidity, but often subtle language problems are observed through ERP measures in children and adults with DD who do not fail in standardized language measures (Cantiani et al., 2013; Cantiani et al., 2015). Thus, as in the case of ASD, we find unexpected language difficulties in children with DD. This raises the question of whether there are some commonalities among the language problems in these different populations.

In this paper, we examine the syntactic awareness of 3rd person accusative clitic pronouns (clitics, henceforth) and articles in French-speaking children with SLI, ASD, and DD. Clitics and articles are homophonous in French, but, it has been found that in production, the latter are less challenging than the former for children with SLI (Jakubowicz et al., 1998). In fact, clitic production is claimed to be a clinical marker of SLI in French (e.g., Paradis et al., 2003; Parisse & Maillard, 2004; Jakubowicz & Tuller, 2008; Tuller et al., 2011). While production has been extensively investigated in children with SLI, their receptive sensitivity has often been neglected. A study on production and comprehension of clitics by Grüter (2005) has revealed that children with SLI have problems in production, but less

1. The first author acknowledges the LACA project for feedback on the issues discussed in the paper. LACA is a NWO Internationalization in the Humanities grant for collaboration among 12 teams in 8 countries from the universities of Amsterdam, Groningen, Potsdam, Milano-Bicocca, Bruxelles, Reading, CNRS Lyon, Haifa, UCL London, Tours, TEI Patras, Cambridge.

in comprehension. In contrast, Leonard et al. (1992) found that Italian-speaking children with SLI are impaired in both comprehension and production of clitics.

The receptive sensitivity to grammatical entities can be examined through comprehension or through metalinguistic tasks that tap into children's awareness of specific linguistic expressions. In this study, we investigate the latter aspect of receptive sensitivity, as metalinguistic tasks may be more effective with older children and our participants have all been in school for some years.

In line with these premises, our goals in this study are to establish

1. whether syntactic awareness of clitics is impaired in children with SLI,
2. whether there is indeed a group of children with ASD that displays language problems in the area of morphosyntax reminiscent of SLI,
3. whether, among the children with DD, there are some that meet the criteria for SLI and
4. whether there are similarities between the language problems of children with ASD and DD.

We do that through two different grammaticality judgment tasks. We assessed children's sensitivity to articles by presenting them with pictures and sentences and asking whether the sentence was appropriate or not. For sensitivity to clitics, we asked children to decide which sentence was better among two sentences, one grammatical and one ungrammatical.

2. Morphosyntax in children with ASD and children with DD

2.1 Morphosyntax in children with ASD

In contrast to previous work (e.g., Bartak et al., 1975), recent studies have detected the presence of language deficits in children with ASD. These studies focusing on specific aspects of morphosyntax have established that the deficits are not attributable to general cognitive abilities (Roberts et al., 2004; Terzi et al., 2012; Perovic et al., 2013; Zebib et al., 2013). These studies have established that a group of children with ASD displays a language profile similar to that associated with SLI (e.g., Kjelgaard & Tager-Flusberg, 2010; Modyanova et al., 2017; Tager-Flusberg, 2006; Riches et al., 2010). Some authors point out that adolescents with ASD (with mean age 14 years) have milder language problems than adolescents with SLI (Riches et al., 2010) in the repetition of complex sentences (subject and object relative clauses). Other authors find that children and adolescents with ASD are more impaired than children with SLI in the marking of finiteness in English (Roberts et al., 2004, based

on children aged 8–9; Modyanova et al., 2017, based on children aged from 4;3 to 16;3). The difference in reports may stem from the different ages of children in the various studies (the rate of development in the two syndromes may be different), the different structural aspects tested, or the different IQ levels. Indeed, some studies report correlations between linguistic skills and nonverbal IQ (e.g., Howlin, 1984; Tager-Flusberg et al., 1990; Modayanova et al., 2017).

However, other studies have claimed that IQ does not explain language abilities in children with ASD, such as Terzi et al. (2012). These authors showed that 5–8-years old Greek-speaking children with ASD (IQ above 80) had poorer syntactic awareness of object clitic pronouns than their chronologically age-matched peers with typical development (TD). A subset of these children with ASD was further tested and displayed difficulties in the production of clitics as well (Terzi et al., 2014). Similarly, Zebib et al. (2013) reported that, regardless of IQ levels, several children with ASD had weaknesses in morphosyntax as established through standardized tests and elicited production of wh-questions. Durrleman and Delage (2016) showed that 5- to 16-year old French-speaking participants with ASD performed as poorly as children with SLI in the production of clitics, but their impairment was not related to nonverbal IQ, instead it was related to working memory. They also detected some differences in error types: children with ASD mainly omitted clitics, while children with SLI made mostly gender errors. Finally, Modyanova et al. (2017) distinguished two groups of children with ASD, one with language impairment (ALI) and with severe deficits in marking finiteness in English (i.e., using past tense, third person –s, auxiliaries and copula) and one without such deficits (ALN). In spite of presenting a language profile similar to that of children with SLI, ALI children behaved differently from them in making commission errors or producing irrelevant sentences. In addition, children with ALI had low nonverbal IQ levels. They concluded that "the disorder of ALI causes a range of deficits in the development of different aspects of language."

In sum, when we look at specific aspects of language, it is clear that children with ASD, or at least a subgroup, have language problems that go beyond pragmatics and resemble those evident in children with SLI. It is a matter of debate whether these problems can be accounted for by low nonverbal IQ and to what extent the linguistic profile of these children is indeed reminiscent of the language profile of children with SLI.

In order to gain further insight, we carried out a study in French on areas that are particularly vulnerable in children with SLI, namely 3rd person accusative clitic pronouns. The production of these pronouns is held to be a clinical marker of SLI in French and other Romance languages (Bortolini et al., 2002; Hamann et al., 1996; Paradis et al., 2003; Parisse & Maillard, 2004; Gavarró, 2012; Avram et al., 2013; Arosio et al., 2014). Along with clitic pronouns, we also investigate articles, which

are homophonous to clitic pronouns. We should point out that a direct comparison between the sensitivity to clitics and articles cannot be performed, because we used two different methods and the material used was not the same in the two tasks. Most of the studies on clinical markers are based on production. Here we concentrate on syntactic awareness, i.e., children's ability to judge critical sentences, which is more related to the receptive side of the grammar. Comprehension seems particularly appealing to analyse in ASD because some authors have claimed that comprehension may be worse than production in this clinical group (e.g., Cohen & Volkmar, 1997; Tager-Flusberg et al., 2005; Goodwin et al., 2012) thus in striking contrast to TD language development. However, a recent meta-analysis reveals that both for vocabulary and grammar, the overall pattern attested in ASD is that of a normative production-comprehension lag (Kwok et al., 2015). Still, as both comprehension and production can be affected in ASD, both warrant close investigation. Our tests are not directly on comprehension, but certainly on the receptive side of the grammar, as previously explained.

2.2 Morphosyntax in children with DD

Although children with DD have a phonological deficit, which may be responsible for their reading problem, mounting evidence demonstrates that their oral language is not intact. In addition, it is known that about half of the pre-school children with SLI turn out to have dyslexia during school years (McArthur et al., 2000; Bishop & Snowling, 2004). But beyond that, some children have not had a previous diagnosis of SLI and yet have language problems, often not detected by standardized testing.

Rispens et al. (2006) report reduced sensitivity to subject-verb agreement violations in Dutch-speaking children and adults with DD. Similarly, Cantiani et al. (2013) found that Italian-speaking adults with DD, who performed adequately on a standardized test of grammatical comprehension, displayed an anomalous processing of subject-verb agreement violations as evidenced by ERP measurements. The same atypical pattern of ERP responses was also found in 8-year-old children with DD (Cantiani et al., 2015). Poor auditory comprehension of complex syntactic constructions, such as relative clauses or passive sentences, was pointed out in several studies in children and adults with reading problems (Barshalom et al., 1993; Waltzman & Cairns, 2000; Arosio et al., 2017). This was especially found in conditions of high verbal working memory demands (manipulated through the simultaneous or successive presentations of the test sentence and the pictures) (Robertson & Joanisse, 2010). Not only comprehension is affected but also production. Guasti et al. (2015) found that 9-year-old Italian-speaking children with DD perform worse than chronological age-matched controls in the production of wh-questions and relative clauses. They are also weaker than control children in the

production of clitics (Arosio et al., 2016). As a group, 9-year-old Italian-speaking children with DD produce only 65% clitic pronouns, which is less than 5-year-old typically developing children, who produce 84% clitics (Arosio et al., 2014). Age-matched controls produced 90% clitics. Interestingly, not all children with DD were severely impaired, as only 25% were 1.5 SD from the mean of the chronological age-matched children in the production of clitics.

In sum, these findings suggest that some children with DD have language problems, similarly to those observed in children with SLI. Whether these are children with DD and SLI or not is a matter of debate. For our purposes, it is interesting to establish whether, in our group of children with DD, there is a subset of children with linguistic difficulties and how they compare to children with ASD and language impairment.

In line with these observations, we adopted a cross-syndrome comparison approach to investigate the syntactic awareness of sentences including or not clitics and articles. If children with DD only have a phonological problem, their sensitivity to these elements should not differ, as they are phonologically identical. If the same holds for children with ASD, we could argue that the problem these children face is phonological. Alternatively, if the language difficulties of children with DD and ASD turn out to be different, we will have evidence that language can be impaired in different ways.

3. Our study

3.1 Participants

One hundred and thirty children participated in the study. Eight children were excluded (2 ASD, 5 SLI, 1 DD) because they failed to complete tasks. This left 122 children: 21 children with ASD (2 girls), 22 children with SLI (7 girls), 23 children with DD (8 girls) and a control group of 56 younger children with TD (28 girls). The chronological age of the three pathological groups did not differ, but the age of SLI children and DD children differed from that of the control group ($F(3, 118) = 6.34$, $\eta^2 = 0.13$, $p < 0.001$, Post hoc Bonferroni $p < 0.05$ and $p < 0.01$, respectively). Clinical groups differed in nonverbal abilities as measured by Raven $F(2, 63) = 5.68$, $\eta^2 = 0.15$, $p < 0.001$. This is because children with ASD were not restricted to the high-functioning end of the spectrum, and thus obtained lower scores than children with DD (Post hoc Bonferroni $p < 0.01$). In fact, among the 21 children with ASD, 9 obtained scores at or below the 5 centile; in the SLI group, only one child was below the 5 centile. If we remove these 9 children with low scores on Raven, we do not obtain the group effect anymore. This suggests that the former

difference in Raven scores is due to the children with ASD obtaining scores below the 5 centile (and one SLI child). Clinical groups did not differ in the standardized test assessing expressive grammar (BILO-3C). Table 1 reports demographic information for all groups, including their chronological age, scores on a standardized measure of expressive grammar (Bilan Informatisé de Langage Oral 3C (BILO 3C), Khomsi et al., 2007), and scores on nonverbal abilities (Raven, 1998). All children with ASD had verbal communication skills and met the clinical *DSM–IV* criteria for the autism spectrum (APA, 2000). They were recruited via parent associations in French-speaking Switzerland and a specialized network in developmental disorders in Lyon, France. Children with SLI and children with DD met the criteria for these diagnoses, which were given by qualified speech and language pathologists. The Ethic Committee of the University of Geneva approved the project.

Table 1. Demographic information concerning our groups

	ASD (N = 21)	**SLI (N = 22)**	**DD (N = 23)**	**TD (N = 56)**
Age range in months, M, SD	69–200 M = 114, SD = 33.7	70–194 M = 115, SD = 35.7	102–135 M = 120, SD = 10	48–144 M = 95, SD = 26
Raven	M = 21, SD = 9	M = 26.7, SD = 5.5	M = 29.9, SD = 3.8	–
Z-score BILO 3C	M = −2.7, SD = 2.4	M = −2, SD = 1.8	M = −1.18, SD = 1.7	–

3.2 Experimental procedure and materials

Syntactic awareness of articles

A grammaticality judgment task was used to test syntactic awareness of definite articles modeled after Zachou (2013). Children were shown pictures displaying animals performing transitive actions and were presented with prerecorded sentences describing what was happening. Sentences were uttered by a female voice. We used grammatical sentences including definite articles and ungrammatical sentences in which definite articles were omitted. Omission of the definite article could be in subject or in object DPs. After having heard the sentence, children were asked to judge whether it was correct or not. We used 24 experimental items, 8 for each article (*la*, *le*, *les,* the-FEM-SG, the-MASC-SG, the-PL). There were 16 grammatical sentences and 16 ungrammatical sentences, with 8 sentences lacking the article in subject position and 8 in object position. Items were presented in a pseudo-randomized order. Before starting the experimental session, children received an instructional training with 3 items during which they were guided in order to select a smiley face if they considered the sentence to be correct or a sad face if they detected errors. When

children performed correctly during this familiarisation phase, the experimenter responded with praise (Well done! You understand!) and when they performed incorrectly, the item was repeated and the child was asked: would you say that sounded right or wrong? If the child did not respond, the experiment provided the answer. The task was administered through a PowerPoint presentation. Below we report examples of grammatical and ungrammatical sentences.

(1) **Phoques regardent la girafe.*
Seal.FEM.PL look-3rd.PL.PRES the.FEM.SING giraffe.FEM.SING
'*Seals are looking at the giraffe.' (instead of *les phoques*)

(2) **La chèvre regarde phoques.*
The goat.FEM.SING look.3rd.SING.PRES seal.FEM.PL
'*The goat is looking at seals.' (instead of *les phoques*)

Syntactic awareness of 3rd person direct object clitic pronouns

A grammaticality preference task was used to assess the sensitivity to direct object clitic pronouns (*la*, *le, les* lit. 'her', 'him', 'them'). Notice that clitic pronouns are homophonous with articles in French, as in other Romance languages. Children were presented a picture that was described as in (3a). Then a question was asked about the picture as in (3b). Two cartoon characters appeared on the lower part of the screen and uttered two alternative answers to the question: one with a sentence including the clitic as in (3c) and one with an ungrammatical sentence lacking the clitic, as in (3d). One character was a male and uttered a sentence with a pre-recorded male voice, and one was a female and uttered a sentence with a pre-recorded female voice.

(3) Probe:
a. *Le chat lave le chien.*
The cat wash-3rd-SING.PRES the MASC.SING dog-MASC.SING
'The cat is washing the dog.'
b. *Qu' est-ce qu'il fait le chat au chien?*
what is-it that he does the cat to+the dog
'What is the cat doing to the dog?'
Cartoon Character A:
c. *Il le lave.*
He him.CL wash.3rd.SING.PRES
'He is washing him.'
Cartoon Character B:
d. **Il lave.*
he wash.3rd.SING.PRES
'He is washing.'

Children had to choose which character gave the best answer. Material included 16 items and 5 fillers. Fillers included reflexive clitics. Items were presented through a PowerPoint presentation in a pseudorandomized order, and the cartoon characters appeared on different sides of the screen also in a pseudo-randomized order. Ungrammatical sentences were produced by both characters in a balanced way. Before starting the experimental session, children received an instructional training during which they were guided in order to detect the errors.

Children were tested individually by an experimenter in school for children with TD and their own homes or their speech therapist's offices for the clinical populations.

3.3 Results

Sensitivity to articles was quite good in all groups, but the ASD group was lower than the other groups, as can be seen in Figure 1.

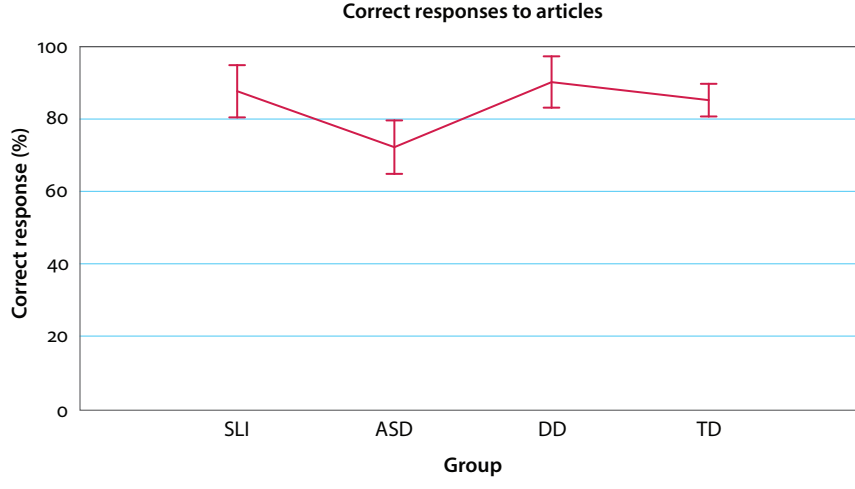

Figure 1. Percentages of correct responses on articles by the three clinical groups and by the younger TD group. Vertical bars indicate confidence intervals at 0.95

We performed a generalized linear model analysis with group as independent variable and percentages of correct responses as dependent variable. The analysis revealed a significant effect of group: ($F(1, 118) = 4.7$, $\eta^2 = 0.10$, $p < 0.001$); through Bonferroni Post hoc, we established that the ASD group differed from all the other groups (SLI $p < 0.05$, DD $p < 0.01$, TD $p < 0.05$). This indicates that children with ASD performed lower than the other clinical groups and the TD children, although the latter were more than 1 year and half younger.

Consider now the sensitivity to clitics. Figure 2 reports the accuracy of the four groups of children. An effect of group is found ($F(1, 188) = 3.46$, $\eta^2 = 0.018$, $p = 0.02$), due to the fact that the ASD group differs from the DD group (Bonferroni Post hoc: $p < 0.05$).

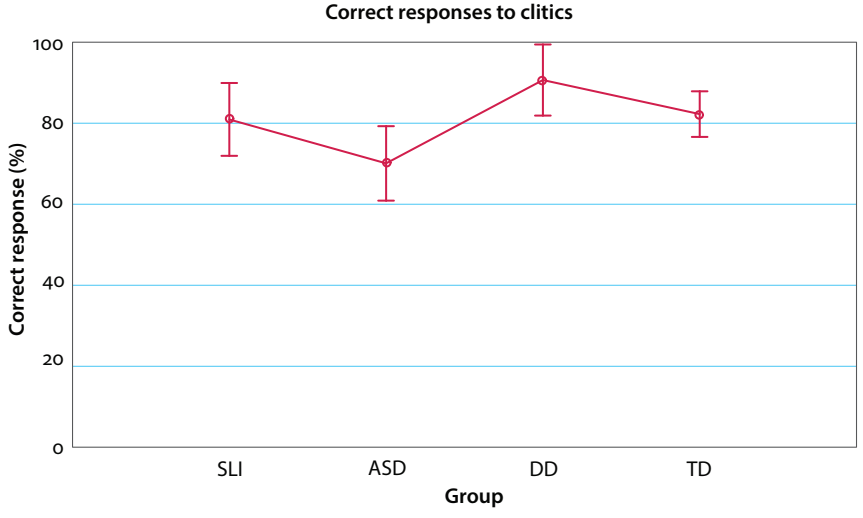

Figure 2. Percentages of correct responses on clitics by the three clinical groups and by the younger TD group. Vertical bars indicate confidence intervals at 0.95

The ASD group obtained lower scores on nonverbal reasoning (Raven's), as we said earlier (see Table 1). In fact, in the ASD group, 9 children scored at or below the 5 centile; while 1 did so in the SLI group[2] and none in the DD group. Therefore, to further investigate the performance of children with ASD and determine whether the impairment in their sensitivity to articles and clitics could be ascribed to the lower nonverbal IQ, we performed a new analysis adding Raven scores as covariate. In this analysis, we only considered the SLI and ASD groups, because our interest was to find out whether children with ASD have language problems and how this compares to that of children with SLI. In addition, to establish whether the language problem characterizes the whole group or only a subset of the ASD children,

2. Children with SLI and with DD have generally an IQ that is within normal range. It is possible that when these children were given the diagnosis they had higher IQ and that at the time of testing their IQ lowered (Conti-Ramsden & Botting, 1999), due to the Matthew effect, i.e., the tendency of getting worse when you are in a vulnerable situation and getting better when you are in a favorable situation (Stanovich, 1986). Our measure of IQ here was based on Raven. For diagnostic purposes, a more comprehensive battery of tests may have been administered.

we decided to split the group based on individual z-scores of the expressive language test BILO-3C. One group included children with an expressive z-score ≤ −2 (ASD_LOW) and the other comprised children with an expressive z-score > −2 (ASD_HIGH). Among the 9 children with Raven scores at or below the 5 centile, 6 were in the group ASD_LOW and 3 in the group ASD_HIGH. We extended the division in terms of z-scores to children with SLI as well (SLI_LOW, SLI_HIGH) and compared the performance of these new groups (the single child with a Raven score below the 5 centile was in the group SLI_LOW). While it is true that children with SLI have received a diagnosis, it is known that the term "SLI" is an umbrella term for quite heterogeneous language disorders. Since our interest is to establish whether a subset of children with ASD have formal language problems, we tried to isolate among the children with SLI those that were more comparable to those with ASD. In the literature, different cut-offs are adopted to individuate language impairment, all of which are to certain extent arbitrary. Tomblin et al. (1997) used −1.25 in two language tests and Marshall et al. (2009) used −1.5 in one language test. We adopted a restrictive cut-off of −2SD below the mean in one language test (as we only have one language test). This is not an unusual choice and is motivated by the fact that we wanted to select children that had severe language problems (see Arosio et al., 2014). Table 2 reports the information of these new groups.

Table 2. Demographic information about the groups of children with ASD and SLI with high and low performance on the standardized test of expressive grammar

	ASD_HIGH (N = 10)	**ASD_LOW (N = 11)**	**SLI_HIGH (N = 13)**	**SLI_LOW (N = 9)**
Age M, SD	M = 113, SD = 44	M = 114, SD = 23	M = 123, SD = 44	M = 106, SD = 14
Raven	M = 25, SD = 8.6	M = 22, SD = 9.5	M = 26, SD = 5.8	M = 27, SD = 5.3
Z-score BILO-3C	M = 0.69, SD = 0.99	M = −4.6, SD = 1.7	M = −0.9, SD = 0.7	M = −3.72, SD = 1.67

These new groups do not differ in chronological age, nor in Raven scores, but they differ as to their scores in the language standardized test BILO-3C (and this is expected given that language performance scores were the critical element for forming the groups), even controlling for the Raven level: $F(3, 38) = 24.4$, $\eta^2 = 0.66$, $p < 0.001$. This is because children with ASD_LOW and children with SLI_LOW obtained lower scores than the other two groups. In fact, children with ASD_LOW differ from children with ASD_HIGH ($p < 0.001$) and from children with SLI_HIGH ($p < 0.001$); children with ASD_HIGH differ from children with SLI_LOW ($p < 0.001$); children with SLI_HIGH differ from children with SLI_LOW

($p < 0.001$). Thus, this new analysis has Group (ASD_LOW, ASD_HIGH, SLI_LOW, SLI_HIGH), as an independent factor, Raven scores as covariate and percentage of correct responses as a dependent variable. Figure 3 reports the correct responses to sentences used in the task assessing sensitivity to articles. It is evident that only one group of children with ASD is weak, the one with lower z-scores on expressive grammar. Statistical analysis confirms this observation ($F(3, 38) = 2.97$, $\eta^2 = 0.19$, $p = 0.04$); Bonferroni Post hoc confirms that the ASD_LOW differs from SLI_HIGH ($p < 0.01$). However, they do not differ from ASD_HIGH. While the two ASD groups differ in language production, they do not differ in their sensitivity to articles. We also found an effect of nonverbal IQ ($F(1,38) = 16.19$, $\eta^2 = 0.29$, $p < 0.01$). This means that the Raven score partially explains the variability. The linguistic performance and the Raven score correlate in the ASD group ($r = 0.66$, $p < 0.01$), but this correlation is no longer significant if the children with the Raven score at or below the 5 centile are removed. No correlation was found in the SLI group. At the individual level, we found that all SLI children, but one (in the SLI_LOW group), were above chance in responding to the task. In addition, 8 (out of 10) children in the ASD_HIGH group and 5 (out of 11) children in the ASD_LOW were above chance. The individual analysis confirms that the language abilities of children with ASD_LOW are affected.

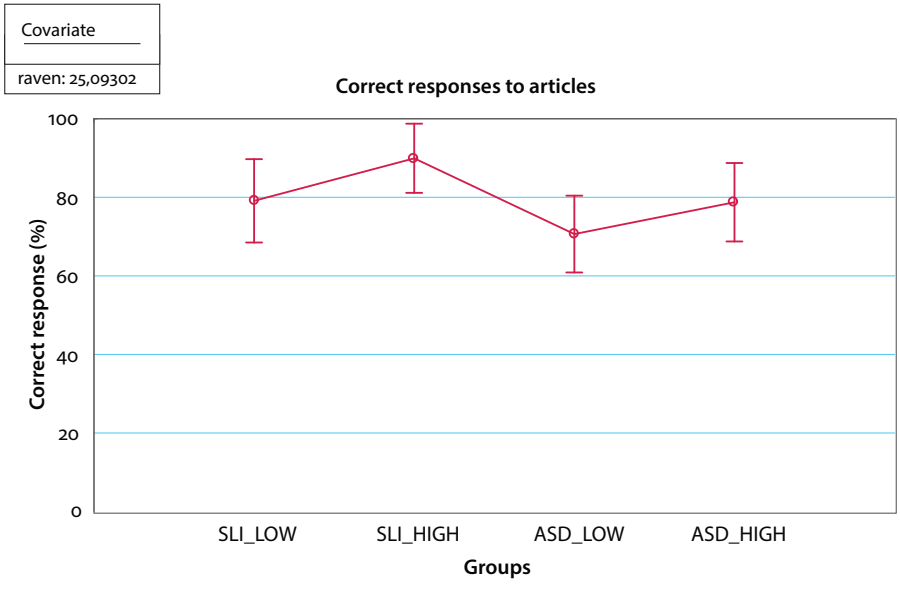

Figure 3. Percentages of correct responses on articles by children with SLI and children with ASD. Each group was divided into two based on their z-scores on BILO-3C. Vertical bars indicate confidence intervals at 0.95

Let us now turn to the sensitivity to clitic pronouns. Figure 4 displays the performance of the four groups of children. Children with ASD_LOW have more problems to judge sentences including or not clitics than all the other groups. We found an effect of Group: $F(3, 38) = 2.9$, $\eta^2 = 0.18$, $p = 0.04$. Bonferroni Post hoc shows children with ASD_LOW had poorer performance than the other groups: ASD_LOW differs from SLI_HIGH ($p = 0.02$) and ASD_HIGH, SLI_LOW ($p < 0.01$). We also found an effect of Raven $F(3,38) = 17.1$, $\eta^2 = 0.31$, $p < 0.01$. The linguistic performance correlates with the Raven score for the ASD group ($r = 0.57$, $p < 0.01$), but failed to do so when the ASD children with the Raven score at or below the 5 centile were removed. The same correlation was significant for the SLI group ($r = 0.54$, $p < 0.01$), whether or not the single children with the low Raven score was removed. The individual analysis shows that 7 (out of 13) children in the SLI_HIGH group and 8 children (out of 9) in the SLI_LOW perform above chance. Only 2 (out of 11) children in the ASD_LOW and 5 (out of 10) in the ASD_HIGH perform above chance. Thus, the individual performance confirms that the children with ASD_LOW are the most affected.

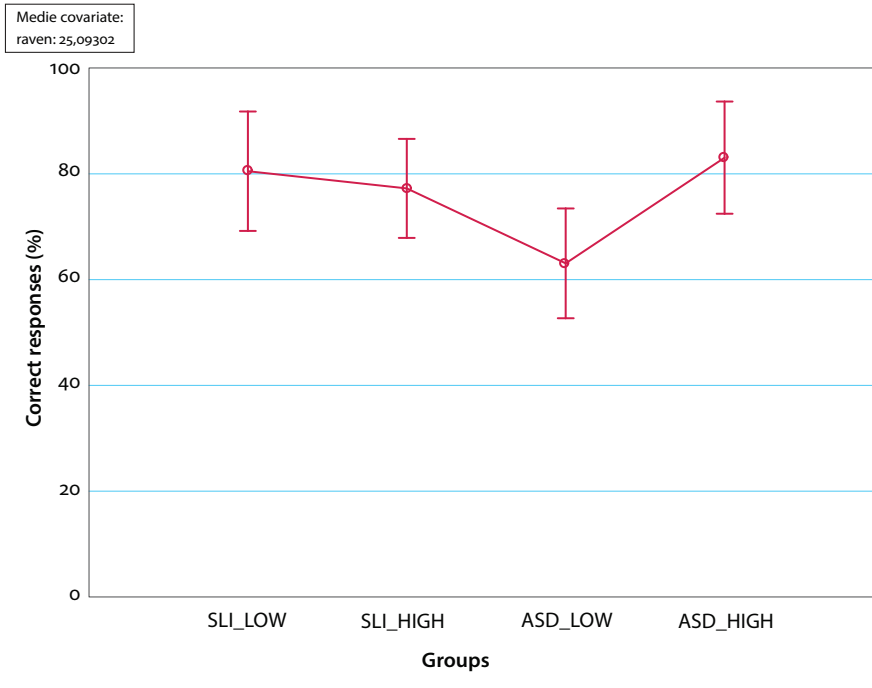

Figure 4. Percentages of correct responses on clitics by children with SLI and children with ASD. Each group was divided into two based on their z-scores on a standardized language expressive test. Vertical bars indicate confidence intervals at 0.95

We extended the same analysis to children with DD and compared their performance to that of children with SLI. The demographic information about the new groups of DD obtained on the basis of their z-scores on BILO-3C are reported in Table 3, where for convenience we have repeated the data concerning children with SLI.

Table 3. Demographic information about the group of children with DD and SLI with high and low performance the BILO-3C

	DD_HIGH (N = 16)	**DD_LOW (N = 7)**	**SLI_HIGH (N = 13)**	**SLI_LOW (N = 9)**
Age M, SD	M = 124, SD = 8.6	M = 111, SD = 10	M = 123, SD = 44	M = 106, SD = 14
Raven	M = 30, SD = 3.05	M = 29, SD = 5.4	M = 26, SD = 5.8	M = 27, SD = 5.3
Z-score BILO 3C	M = −0.25, SD = 1.07	M = −3.32, SD = 1.1	M = −0.9, SD = 0.7	M = −3.72, SD = 1.67

These new groups do not differ in chronological age, nor in Raven, but they differ on their scores in the BILO-3C-, even controlling for Raven level: $F(3, 40) = 24.5$, $\eta^2 = 0.64$, $p < 0.001$. This is due to the fact that children with DD_LOW and children with SLI_LOW obtained lower scores than the other two groups. In fact, children with DD_LOW differ from children with DD_HIGH ($p < 0.001$) and from children with SLI_HIGH ($p < 0.001$). Children with DD_HIGH differ from children with SLI_LOW ($p < 0.001$), and children with SLI_HIGH differ from children with SLI_LOW ($p < 0.001$), as we have already seen. The analysis of the performance of these four groups in judging sentences including or not articles only yielded an effect of nonverbal IQ ($F(3,40) = 6.95$, $\eta^2 = 0.14$, $p < 0.05$). The linguistic performance of DD children in judging sentences including or not an article correlated with their Raven scores ($r = 0.52$, $p < 0.01$). At the individual level, all children with DD, but one in the DD_LOW group, were above chance. Similarly, in the case of clitics, we also found an effect of nonverbal IQ ($F(3,40) = 14.45$, $\eta^2 = 0.26$, $p < 0.01$. The linguistic performance of DD children in judging sentences including or omitting clitics correlated with their Raven scores ($r = 0.48$, $p < 0.05$). At the individual level, we found that 5 (out of 7) children with DD_LOW and 15 (out of 16) children in the DD_HIGH were above chance.

Taking all the clinical groups together, we found some correlations among our descriptors (Age, Raven scores, Expressive scores-BILO-3C and accuracy in syntactic awareness to articles and clitics). Significant correlations ($p < 0.05$) are reported in Table 4.

Table 4. Correlations among Age, Raven scores, Expressive scores on BILO-3C and accuracy in judging sentences assessing articles and clitics

	BILO	RAVEN	Age	Acc ART	Acc CL
BILO					
Raven				0.59	0.62
Age		0.37			
Acc ART	0.37	0.59			0.58
Acc CL	0.47	0.62	0.37		

The accuracy in judging sentences assessing articles is correlated with expressive scores, Raven, and accuracy in judging sentences assessing clitics. The accuracy in judging sentences assessing clitics is also correlated with expressive scores, Raven, and age.

4. Discussion

This study examined the syntactic awareness of two grammatical morphemes, clitics and articles in children with ASD, with SLI and DD. We chose these morphemes because they are homophonous. Previous studies with children with SLI have found clitics to be more challenging than articles. In fact, difficulty with clitic production is taken to be a clinical marker of SLI in French and other Romance languages. Our goals were to establish whether a subgroup of children with ASD displays impairment with clitics similar to that of children with SLI and whether this impairment could be explained by their cognitive level. We aimed at establishing whether children with DD displayed difficulties with clitics since it is known that about 50% of children with DD have had a previous history of SLI and children with DD may have language problems that remain unidentified in preschool years (Arosio et al., 2016). We also wanted to establish whether the linguistic difficulties of children with ASD were similar to those of children with SLI and DD. Our results show that, as a group, children with ASD performed worse on the syntactic awareness of articles than all the other groups and on the syntactic awareness of clitics they performed worse than children with DD, but not than children with SLI. It is noteworthy that children with ASD performed below the levels of the TD children, who were one year and half younger. However, the overall results conceal the fact that only a subgroup of children with ASD was particularly affected in their syntactic awareness. In a subsequent analysis, children were divided according to their scores on a standardized, expressive language test (BILO-3C). We found that children with ASD and an expressive score lower than 2 SD (ASD_LOW) and children with SLI_LOW performed lower

than the other two groups. Specifically, the results on syntactic awareness of sentences including articles revealed that ASD_LOW performed below children with SLI_HIGH, but not different from children ASD_HIGH. We also found that Raven scores contributed to explain the variance in ASD children' sensitivity to articles (see also Jensen de López et al., 2018 for the contribution from nonverbal IQ on language abilities). ASD children with low IQ performed worse than ASD children with normal IQ (the IQ effect disappeared when ASD children with low IQ were removed from the analysis). In other words, sensitivity to sentences with articles does not differentiate the two ASD groups nor ASD from SLI_LOW children. Children with ASD_LOW performed below all the other groups in judging sentences including clitics or not and notably worse than children with SLI_LOW. Again performance on Raven contributed to explain the variance in their sensitivity to clitics, likely due to children with low IQ, as said earlier. A similar correlation was also found in SLI children. Thus, although at the level of morpho-syntactic production (BILO-3C) children with ASD_LOW and SLI_LOW do not differ, they differ at the level of their sensitivity to clitics. This finding is in line with results showing worse performance in children with ASD compared to children with SLI. Modyanova et al. (2017) found that English-speaking children with ASD performed worse than children with SLI in marking finiteness (in production), a clinical marker of SLI in English. It is interesting that here we find the same result in their syntactic awareness concerning a clinical marker of SLI in French. For articles, children with ASD_LOW were not different from children with SLI_LOW, for clitics they were. Our results indicate that articles and clitics, although homophonous, are not equally difficult for children with ASD or SLI: clitics are more challenging for both populations. This finding is at odds with theories that attribute problems with clitics to their phonological status of weak elements (Bortolini et al., 2006). Articles are phonologically as weak as clitics and, just like clitics, they also occur in front of a lexical item that may start with a strong syllable. All in all, our results show that children with ASD_LOW are vulnerable in an area in which children with SLI also are, namely clitics; however, they perform worse than them.[3] These findings bear on the question of whether the language disorder in ASD is similar to that of children with SLI (Kjelgaard & Tager-Flusberg, 2010; Roberts et al., 2004; Tager-Flusberg, 2006; Zebib et al., 2013) or rather resembles that of other children with a low nonverbal IQ (Tager-Flusberg et al., 1990). Our

3. One reviewer raised the question of whether poor performance in the ASD group may be due to failure to understand the task. Although children practiced the task before the experimental session began, this possibility cannot be completely discarded, especially for the ASD_LOW group who may indeed be affected not only by linguistic difficulties but also by other difficulties related to their general level of functioning, potentially leading to miscomprehension of task instructions, inability to consistently attend to the task at hand, etc.

results show that nonverbal IQ scores are involved in the syntactic awareness of our two morphemes, especially clitics. These results are at odds with other findings based on production in which a dissociation between grammatical abilities and nonverbal skills is reported (Durrleman & Delage, 2016; Tuller et al., 2017). It is possible that the different results are due to the different modality tested: receptive or productive side. One of our tasks was a grammaticality judgment, which includes a metalinguistic component. The child had to decide whether a sentence was grammatically correct or not. The other task required the child to decide between two sentences, which one was better. This also includes a metalinguistic component. In other words, children had to comprehend the sentences, but also to decide whether it was the right way to express a given concept. It is thus possible that the link to nonverbal abilities, which we find here, originates from the metalinguistic skill consisting in reflecting on correctness. In this respect, it is not surprising that the effect of non-verbal IQ were found in all three clinical groups. It is interesting to notice that children with DD_LOW did not differ from children with SLI_LOW in the expressive text nor in their syntactic sensitivity to sentences with articles or clitics, that is, unlike the children with ASD, the language problems were not aggravated in this population. Thus, we can infer that children with ASD display a unique (meta)-linguistic profile. At the same time, we can conclude that non-verbal IQ contributes to explain the variability among the three groups in the syntactic sensitivity tasks. It is noteworthy that Raven did not correlate with the expressive language test and this is in line with the previous findings in the literature that production scores do not correlate with non-verbal IQ. These observations notwithstanding, it remains interesting to notice that the locus of major difficulties was clitic syntactic awareness. Future work would need to examine both syntactic awareness and production in the same children and to determine the relation of both with nonverbal abilities. From previous literature and our findings, we conjecture that non-verbal IQ will contribute to syntactic awareness, but not production. In turn, this could suggest that if we want to pin down the linguistic problems of children with ASD, we need to examine production. Syntactic awareness is likely to result from the combination of linguistic competence (hence, tasks involving clitics elicit lower performance than tasks involving articles, regardless of the type of task) and non-verbal skills, which are used to compensate for linguistic deficits. Thus, one group of children with ASD has language problems in production and in syntactic awareness, with the latter being related to nonverbal abilities, while the former does not seem to have such problems, a point that deserves further investigation. Children with ASD seem to obtain lower scores in some linguistic areas than children with SLI and, in this respect, their profile is different from that of children with SLI. The profile of children with DD is also distinct from that of ASD children, as DD children seem to be less impaired than ASD children. Finally, a group of DD children is similar to children with

SLI_LOW as far as expressive language is concerned. However, when we turn to syntactic awareness the differences among the groups with low or high expressive scores disappear. Regardless of the expressive score, all children with DD and all children with SLI behave similarly. This is a hint that the language problems experienced by children with SLI (and a subgroup of children with DD) is mostly evident in production. In fact, few studies have investigated the syntactic awareness of clinical markers such as clitics, and these have yielded mixed results. Future investigation should address the question of whether syntactic awareness and production are aligned or not in children with SLI.

In conclusion, our children with ASD performed worse than children with SLI on the syntactic awareness of clitics. In the comparison between children with SLI and children with DD, we observed that syntactic awareness of clitics (and articles) did not differ as a function of scores in production. Studies on both syntactic awareness and production may be relevant to better profile children who show a superficial resemblance.

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The comprehension of Italian negation in Mandarin-Italian sequential bilingual children

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This study investigates how sequential bilingual Mandarin-speaking children who had more than three years of exposure to Italian comprehended Italian negative sentences in comparison with affirmative ones. Sixteen bilingual children and 16 Italian monolingual peers were tested using a truth-value judgment task. All children showed greater difficulties in the comprehension of True negatives, indicating that the difficulties in the processing of negation, in the relevant experimental conditions, have a general validity across the two groups. This result can be readily interpreted in the light of the "experiential" theories of negation processing, by means of the two-step simulation hypothesis. In addition, it should be emphasized that bilingual children were more accurate in the comprehension of True negatives than monolingual children, a finding that deserves further investigation.

Keywords: Italian sentential negation, bilingual children, comprehension, two-step simulation hypothesis

1. Introduction

It has been well documented that negation is hard to acquire for typically developing children as well as for atypically developing children (e.g., Bloom, 1970, 1993; Fan, 2007; Hu, Vender, Fiorin, & Delfitto, 2018; Nordmeyer & Frank, 2014; Vender & Delfitto, 2010). However, still very little is known about how bilingual children acquire negative sentences. In this paper, we present a study on the comprehension of sentential negation in sequential bilingual Mandarin-speaking children with more than three years of exposure to Italian. In particular, the study aims at investigating: (i) how bilingual children comprehend Italian negative sentences

https://doi.org/10.1075/lald.62.08hu

as compared to their comprehension of affirmative sentences; and (ii) how the comprehension pattern of bilingual children relates to the comprehension pattern of their monolingual peers. In the next sections, we offer a brief review of previous studies on children's acquisition of negation, followed by a short introduction to the two-step simulation hypothesis (Kaup, Lüdtke, & Zwaan, 2005, 2006, 2007), which represents the model of negation processing that we basically assume in this study.

Previous studies on children's acquisition of negation

Negation is a key element of human language, and instances of negative formatives have been reported to be one of the most important classes of words that children learn at early ages (e.g., Bloom, 1970, 1993; Fan, 2007; Pea, 1980). However, the actual use and interpretation of negative sentences in natural language are far from simple to acquire. To be able to capture all nuances of negation (e.g., denying, contradicting, correcting wrong inferences, lying and speaking ironically), children need several more years, since a complex interplay of linguistic, conceptual and pragmatic/contextual factors is arguably involved in children's acquisition of negation (see Nordmeyer & Frank, 2014).

The central finding in the literature regarding children's comprehension of negation is that negative sentences are harder to interpret than affirmative ones. This result parallels the findings from the study of adult's processing of negation, which hold across different experimental tasks (e.g., Clark & Chase, 1972; Horn, 1989; Kaup et al., 2005, 2006, 2007; Wason, 1959, 1961). One of the most typical experimental designs adopted in the studies on negation processing is the sentence-picture verification task. In this task, subjects are asked to verify the truth-value of a sentence against a picture in four experimental conditions, namely, (i) True affirmative, as when the affirmative sentence *The window is open* is associated with a picture of an open window, (ii) False affirmative, as when the sentence *The window is open* yields a mismatch with the picture of a closed window, (iii) True negative, as when the negative sentence *The window is not open* is associated with a picture of a closed window, and (iv) False negative, as when the sentence *The window is not open* enforces a mismatch with the picture of an open window. Results from the majority of previous studies show that negative sentences are difficult to process as compared to affirmative ones, and that True negative sentences (corresponding to the experimental condition in which the image matches the negative sentence) are the most difficult to process. The very same processing pattern has been recently found in a study concerning the comprehension of Mandarin affirmative and negative sentences (Hu et al., 2018). This study compared Chinese young poor readers with a mean age of 9 years 8 months with their age-matched typical readers and

showed that negative sentences as in (1a) were harder to process than affirmative ones as in (1b), irrespective of the distinction between poor and typical readers.

(1) a. *Muniu mei zai ti luotuo.*
cow not be kick camel
'The cow is not kicking the camel.'
b. *Muniu zai ti luotuo.*
cow be kick camel
'The cow is kicking the camel.'

For what concerns the acquisition of sentential negation in bilingual children, comprehension studies are quite limited. In fact, the available studies focus on children's early production, e.g., the production of anaphoric negative formatives as in yes-no questions (Chen, 1925; Choi, 2014; Madrid & Garcia, 1981; Paradis & Genesee, 1996). These studies generally indicate that negative formatives are hard to acquire also for bilinguals. Crucially, however, they do not discuss the performance of bilingual children in the comprehension of sentential negation, especially with respect to the aforementioned four conditions. Moreover, the available literature essentially discusses bilingual children who speak English as one of their two languages. More particularly, as far as we are aware, the acquisition of negation in Italian has not been studied in bilingual children who acquire Italian as their L2. Negation often interacts with other grammatical phenomena, e.g., tense, agreement and aspect, and is an area of great interest for general syntactic and pragmatic theories (e.g., for Italian see Cardinaletti & Guasti, 1993; Delfitto, 2018; and for Chinese, see Ernst, 1995). From these perspectives, the current study is innovative, since it explores sequential bilingual children's performance in the four experimental conditions presented above, focusing on their comprehension pattern of Italian sentential negation.

The two-step simulation hypothesis

Several theoretical perspectives on negation have been proposed in the literature, such as the "propositional" account of negation (Carpenter & Just, 1975; Clark & Chase, 1972; among others) and the "contextual" account of negation, focusing on the role played by pragmatic constraints and situational simulation on negation processing (Kaup et al., 2005, 2006, 2007; Nieuwland & Kuperberg, 2008; Zwaan & Radvansky, 1998; among others). In this paper, we essentially adopt the two-step simulation proposed by Kaup et al. (2005, 2006, 2007), based on the so-called "experiential" view of negation processing.

As Wason (1965) pointed out, the interpretation of a negative sentence depends on its context of utterance, and in particular on the presence of a specific

expectation to be denied, which Wason dubs "context of plausible denial." This is precisely what renders (2) more difficult or "odd" to process than (3): whereas it seems indeed reasonable to wonder if a whale is a fish (under the plausible expectation that it is), it sounds cognitively awkward to wonder if it is a bird (since there is no plausible expectation that it is).

(2) *The whale is not a bird.*

(3) *The whale is not a fish.*

The pragmatic felicity of a negative sentence is thus determined by the implicit or explicit presence of a prior expectation that is being denied. On these conceptual grounds, Kaup et al. (2005, 2006, 2007) proposed a view of negation processing according to which negation is not processed incrementally. Rather, a negative sentence is evaluated only after its affirmative counterpart, corresponding to the negated state of affairs, has been evaluated. This is the so-called two-step simulation hypothesis.

This hypothesis roughly presupposes an embodied cognition framework, according to which the described state of affairs is mentally simulated in a representational format which is grounded in perception and action (Glenberg, 1997; Zwaan, Stanfield, & Yaxley, 2002; among others). In the context of the two-step simulation hypothesis, negation processing involves two temporally distinct stages. For negative sentences such as *the window is not open*, comprehenders would first construct a mental simulation of the negated state of affairs, namely, *an open window*, and then switch to a simulation of the actual state of affairs, namely *a closed window*. By contrast, for affirmative sentences such as *the window is open*, the simulation of the state of affairs expressed by the sentence (the actual state) is directly constructed. As a consequence, the interpretation of negative sentences is necessarily more costly in terms of processing resources, in comparison to that of affirmative sentences, since two steps (instead of one) are required.

This hypothesis is supported by empirical evidence from a large number of processing studies on adults (e.g., Hasson & Glucksberg, 2006; Kaup et al., 2005, 2006, 2007; Scappini, 2015), as well as from studies concerning children's comprehension (Hu et al., 2018; Vender, 2017). All these studies confirm that negative sentences are harder to process than affirmative sentences, as is particularly clear from behavioral data such as lower accuracy or longer latencies.

In line with the two-step simulation hypothesis, Vender and Delfitto (2010) found a higher difficulty of True negatives as compared to False negatives in a standard sentence-picture verification task. They suggest that when the picture does not provide a simulation of the negated state of affairs (as in the case of True negatives), the comprehender has first to construct it from scratch before switching

to the simulation of the actual state of affairs, as expressed by the negative sentence. The first stage of processing is arguably easier in the case of False negatives, since the picture already provides a simulation of the negated state of affairs, which need not be constructed from scratch. This arguably results in lower processing costs (i.e. higher accuracy and/or shorter latencies) for False negatives as compared to True negatives.

The main goal of the present study is to investigate how Mandarin-Italian sequential bilingual children comprehended Italian negative sentences in comparison with affirmative ones. If the two-step simulation hypothesis is essentially correct, the processing of negative sentences is expected to lead to less accurate answers and to involve longer reaction times than the processing of affirmative sentences, both in monolingual and in bilingual children.

The current study offers interesting contributions at three levels: first, it addresses a gap in the bilingual literature, by focusing on comprehension rather than production; second, it assesses the performance of Mandarin-Italian bilingual children in the four experimental conditions presented above, concerning the comprehension of sentential negation, therefore testing the predictions of the two-step simulation hypothesis both with respect to monolinguals and with respect to bilinguals; and third, it extends empirical coverage to a language still poorly studied in this field, i.e. Italian.

2. Method

Participants

Thirty-two children participated in the study: sixteen bilingual children (from 8;4 to 11;5, M = 9;5, SD = 1.06) and 16 Italian monolingual children controls (from 8;4 to 11;1, M = 9;7, SD = 0.98). A one-way ANOVA revealed no difference in the ages between the bilingual and the monolingual groups, $F(1, 30) = 1.45$, $p = .24$. The bilingual children were from the Chinese community in Milan and were recruited from Chinese schools which were only opened on weekends. The monolingual children resided in Trento and Verona, Italy. All the bilingual and the monolingual children attended Italian primary school regularly. No history of language impairment or hearing loss were reported by the parents.

Parents of the bilingual children were all Chinese born and had moved to Italy more than five years earlier. The bilingual children were either Italian or Chinese born, but as an inclusion criterion the language spoken at home had to be Mandarin Chinese and the onset of systematic exposure to Italian had to be three years or older. According to parental questionnaires, the children used both languages on

a daily basis, and they had been systematically exposed to Italian for at least 3 consecutive years (M = 4.25, SD = 0.77). In order to satisfy this criterion, we started with a sample of 25 children and trimmed it to 16.

The children's vocabulary knowledge of Italian was measured using the Italian version of the *Peabody Picture Vocabulary Test* (Dunn & Dunn, 1981; Stella, Pizzioli, & Tressoldi, 2000). The mean scores of the bilinguals and the monolinguals were roughly equivalent (M = 111.56, SD = 22.8; M = 107.56, SD = 6.31, respectively), and a one-way ANOVA confirmed no significant difference between them, $F(1, 30) = 0.45$, $p = .50$, indicating that the bilingual children participating in the study had a good competence in their L2.

Materials and procedure

To measure the children's comprehension of affirmative and negative sentences in pragmatically supportive contexts, we adopted the truth-value judgment task that was used in another recent study (Hu et al., 2018). A list of 12 sets of experimental sentences were constructed, as illustrated in (4). We manipulated two factors, i.e. Sentence Polarity (affirmative vs. negative) and Truth-value (true vs. false). Accordingly, four conditions were generated, namely, True affirmative, False affirmative, True negative and False negative. Twelve pairs of pictures were created for the task. Each pair of pictures involved the same action as exemplified in Figure 1, which is associated with a set of four sentences as in (4). An example of the experimental task, with all four conditions referring to the left picture in Figure 1, is provided in (4).

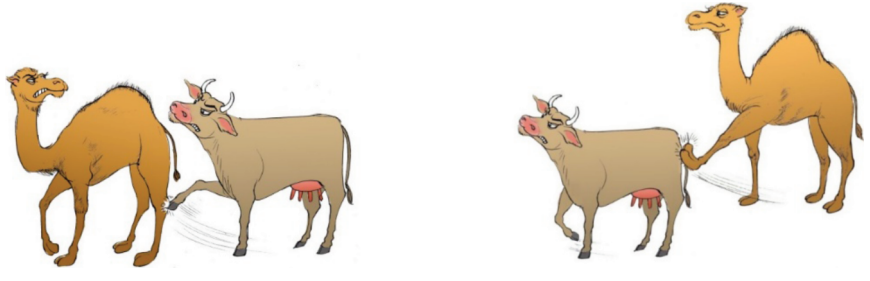

Figure 1. Example of a pair of pictures

(4) a. *La mucca sta colpendo il cammello.* (True Affirmative)
cow be kick camel
'The cow is kicking the camel.'

b. *Il cammello sta colpendo la mucca.* (False Affirmative)
camel be kick cow
'The camel is kicking the cow.'

c. *Il cammello non sta colpendo la mucca.* (True Negative)
camel not be kick cow
'The camel is not kicking the cow.'

d. *La mucca non sta colpendo il cammello.* (False Negative)
cow not be kick camel
'The cow is not kicking the camel.'

In total, there were 48 target sentences and 24 pictures, including 12 different transitive verbs, namely, *seguire* 'follow,' *spingere* 'push,' *tirare* 'pull,' *disegnare* 'draw,' *abbracciare* 'hug,' *mordere* 'bite,' *colpire* 'kick,' *inseguire* 'chase,' *imboccare* 'feed,' *toccare* 'touch,' *picchiare* 'hit' and *baciare* 'kiss.'

We used a Latin-square design, creating 8 lists with counterbalanced items; each list included 12 experimental sentences with 12 different verbs, each of which was paired with a picture that depicted the action; each participant saw one of these eight lists. Additionally, there were 3 practice sentences and 6 filler sentences. Regarding filler sentences, they were not reversible, as in *coniglio* 'rabbit' and *lettera* 'letter' in *Il coniglio sta scrivendo una lettera* 'The rabbit is writing a letter.'

The task was created with E-Prime 2.0 software, recording accuracy and response latency (Schneider, Eschman, & Zuccolotto, 2012). In the warm-up sessions, children were instructed to listen to a sentence produced by a puppet (*l'orsetto* 'the small Bear'), who was going to play a "true" or "false" game with them. The child was told that the puppet would look at a picture and try to describe it by producing a sentence. The child was also told that the puppet was not always able to describe correctly the picture and that the child's task was to judge if the sentence that it uttered corresponded to the picture or if this was not the case. The child first heard the sentence and successively, after 1000 ms, saw the same picture previously seen by the puppet. The child was then instructed to press a button if the sentence was true and another button if the sentence was false. The interval time between the sentence and the picture of 1000 ms was chosen since it is considered as minimally necessary for children to carry out the task (Hu et al., 2018; Scappini, 2015).

Data analysis

Statistical analyses of response accuracy and response latency were performed with a mixed-effects model, using the *lme4* and *lmerTest* packages in the R environment (Baayen, Davidson, & Bates, 2008; R Development Core Team, 2015). The analysis of response latency was performed only on correct responses and response latency was logarithmically transformed. Response latencies faster than 200 ms or slower than 10000 ms were considered as outliers, hence 2.6 % of the data were excluded from the analysis.

In the analyses, Group (bilinguals vs. monolinguals), Sentence Polarity (affirmative vs. negative) and Truth-value (true vs. false) were introduced as potentially significant fixed factors, and subjects and items as random factors. We used the monolingual controls as the reference category for the Group factor, the affirmative for the Sentence Polarity factor, and the false for the Truth-value factor. Effects were evaluated one by one on the basis of likelihood ratio tests; both first-level effects and the interactions between the fixed factors were tested.

3. Results

The percentage of response accuracy and response latency for all the conditions are shown in Figures 2 and 3. First, the bilingual children's performance was more accurate than that of monolingual control children in True affirmatives, False affirmatives and True negatives, but not in False negatives (see Figure 2). Secondly, their response latency was slightly slower than that of monolingual children in True affirmatives, False affirmatives and False negatives, but not in True negatives (see Figure 3). Finally, in both groups, True negatives were the most difficult.

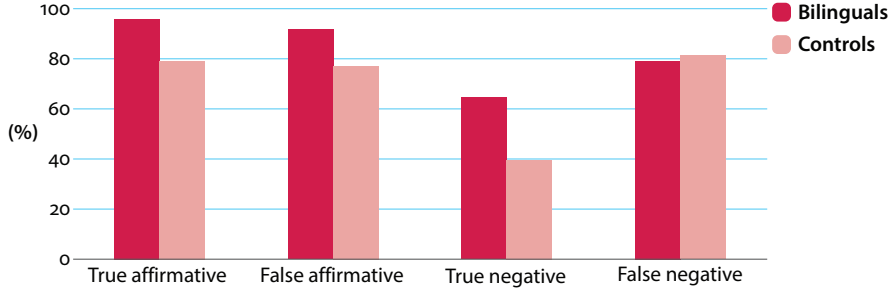

Figure 2. Mean of response accuracy for the bilingual and the control groups

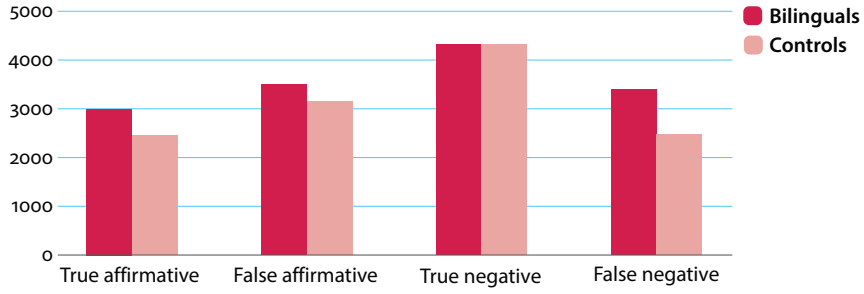

Figure 3. Mean of response latency (in ms) for the bilingual and the control groups

The analysis of response accuracy

We fit the data of response accuracy to a generalized mixed-effects model. We observed a main effect of Group (ß = 1.50, z = 2.80, $p < .01$) and Sentence Polarity (ß = −0.91, z = −2.71, $p < .01$), but no interaction between them (ß = −0.93, z = −1.58, $p = .11$). These results suggest that the bilingual children tended to be more accurate than the monolingual children irrespective of Sentence Polarity, while negative sentences were less accurately processed than affirmative sentences, irrespective of group. Besides, an interaction between Sentence Polarity and Truth-value was observed (ß = 2.30, z = 3.14, $p < .01$).

Accordingly, we analyzed the accuracy data to a mixed-effects model including Group (bilinguals vs. controls) and Condition (True affirmative vs. False affirmative vs. True negative vs. False negative) as fixed factors, and subjects and items as random factors. We used the controls as the reference category for the Group factor and the True negative as the reference category for the Condition factor. A summary of the results of the statistical analysis is given in Table 1. The main effect of Group and Condition were found, and so did the interaction between Group and Condition. Taken together, these results reveal that True negatives were less accurate than all the other conditions both for the bilinguals and the controls, and that the bilingual children were more accurate in True negatives than the controls.

We further performed individual analysis by comparing the mean scores of the bilingual children to the mean scores of the monolinguals. The monolingual children comprehended True affirmatives with a mean accuracy of 0.79 (SD = 0.36), False negatives with a mean accuracy of 0.77 (SD = 0.23), True negatives with a mean accuracy of 0.40 (SD = 0.39), and False negatives with a mean accuracy of 0.81 (SD = 0.32). By using these as the reference mean score for each condition, we compared children by group. In True affirmatives, 6.3% (1 out of 16 participants) monolingual children scored less than 1 SD below the mean, and none of the bilingual children did so. In False affirmatives, 12.5% (2 out of 16 participants)

Table 1. Summary of the fixed effects in the mixed-effects model for response accuracy

	Estimate	SE	*z*	*Sig.*
(Intercept)	−0.48	0.002	−222.1	< .001
Group	1.15	0.002	535.5	< .001
TN vs. TA	1.99	0.002	924.2	< .001
TN vs. FA	1.81	0.002	841.8	< .001
TN vs. FN	2.12	0.002	984.3	< .001
Group × Condition (TN vs. TA)	0.81	0.002	376.5	< .001
Group × Condition (TN vs. FA)	0.05	0.002	23.9	< .001
Group × Condition (TN vs. FN)	−1.24	0.002	−577.8	< .001

Note: TA = True affirmative, FA = False affirmative, TN = True negative, FN = False negative.

monolingual children scored less than 1 SD below the mean, and 6.3% (1 out of 16 participants) bilingual children did so. In True negatives, 37.5% (6 out of 16 participants) monolingual children scored less than 1 SD below the mean, and 12.5% (2 out of 16) bilingual children did so. In True affirmatives, 18.3% (3 out of 16) monolingual children scored less than 1 SD below the mean, and 12.5% (2 out of 16) bilingual children did so. It is clear that there were descriptively fewer bilingual children who scored less than 1 SD below the mean than monolinguals, and this is particularly evident in True negatives. This result confirms that bilingual children performed better as compared to monolinguals at the individual level.

To sum up, the analyses of the accuracy prompt the following conclusions. First, negative sentences were harder to comprehend than affirmative ones, resulting in more errors. Second, True negatives were more difficult than all the other conditions for both groups. Third, the bilingual children tended to be significantly more accurate than the monolinguals in the processing of True negatives, whereas they did not significantly differ from the monolinguals in terms of accuracy with respect to the other conditions. This result also clearly emerged from the individual analysis.

The analysis of response latency

The log-transformed data for response latency were fit to mixed-effects models with Group (bilinguals vs. controls), Sentence Polarity (affirmative vs. negative) and Truth-value (true vs. false) as fixed factors and subject and item as random factors. We did not observe the main effect of Group (ß = −0.07, $t = 1.40$, $p = .17$), but we observed the main effect of Sentence Polarity (ß = −0.08, $t = -2.26$, $p < .05$), three-way interaction among Group, Sentence Polarity and Truth-value (ß = −0.18, $t = -2.50$, $p < .05$) and the interaction between Sentence Polarity and Truth-value (ß = −0.35, $t = -6.60$, $p < .001$).

Accordingly, we analyzed the data to a mixed-effects model including Group (bilinguals vs. controls) and Condition (True affirmative vs. False affirmative vs. True negative vs. False negative) as fixed factors, and subjects and items as random factors. Table 2 summarizes the output of the statistical analysis. The main effect of Group was not significant, and the differences between True negatives and other conditions (i.e. True affirmative, False affirmative and False negative) were significant. Crucially, the interaction between Group and Condition (i.e. True negative vs. False negative) was found, reflecting the fact that bilingual children were slower than the controls when interpreting False negatives, but was not so when interpreting True negatives. These results reveal that bilingual children's response latency did not significantly differ from their monolingual peers', and True negatives took longer time to process than all the other conditions in both groups.

Table 2. Summary of the fixed effects in the mixed-effects model for response latency

	Estimate	**SE**	***t***	***Sig.***
(Intercept)	3.59	0.05	73.75	< .001
Group	−0.003	0.05	−0.06	= .95
TN vs. TA	−0.28	0.04	−6.73	< .001
TN vs. FA	−0.15	0.04	−3.47	< .001
TN vs. FN	−0.22	0.04	−5.21	< .001
Group × Condition (TN vs. TA)	0.10	0.05	1.95	= .053
Group × Condition (TN vs. FA)	0.07	0.05	1.33	= .18
Group × Condition (TN vs. FN)	0.15	0.06	2.62	< .01

Note: TA = True affirmative, FA = False affirmative, TN = True negative, FN = False negative.

Summarizing, the first and second findings from the analyses of the accuracy data were confirmed in the analyses of the response latency data. That is, negative sentences were harder to comprehend than affirmative ones, resulting in slower response latency, and True negatives were more difficult than all the other conditions in both groups. By contrast, the third finding reported in the accuracy analysis was not confirmed, as the bilinguals did not show significant differences in response latency with respect to the monolinguals.

4. Discussion

The aim of this study was to explore how Mandarin-Italian sequential bilingual children comprehended Italian negative sentences as compared to affirmative ones. Bilingual and monolingual children's accuracy and response latency in the comprehension of affirmative and negative sentences were examined. We found that

both groups showed a similar pattern, displaying greater processing difficulties in negative sentences with respect to affirmative ones, with True negative sentences being the most difficult to process.

In this sense, the present study fully supports previous research findings to the effect that the greater difficulty of negation processing has a general validity, in accordance with the predictions made by the two-step simulation hypothesis, both for monolinguals and for bilinguals. According to this hypothesis, as discussed above, the interpretation of negation requires two steps: in the first step, comprehenders simulate the "negated state of affairs;" in the second step, comprehenders shift their attention to a simulation of the "actual state of affairs," as expressed by the negative sentence. Thus, negative sentences are expected to be more costly in terms of processing than affirmative sentences.

The greater difficulties detected in the processing of True negatives can also be explained by adopting the two-step simulation hypothesis in agreement with Vender and Delfitto (2010), as discussed above. In the False negative condition, indeed, a sort of priming effect occurs in the first step of negation comprehension, arguably due to the fact that comprehenders can take advantage of the state of affairs illustrated by the picture while constructing a simulation of the negated state of affairs. Conversely, this facilitation effect is absent in the True negative condition, as the picture does not match the simulation of the negated state of affairs in the first step of negation comprehension. From this perspective, the present study adds to the existing evidence supporting a non-incremental account of negation, confirming that comprehending negative sentences is a more demanding process for both bilingual and monolingual children than comprehending affirmative sentences.

Another notable result of this study is that the young bilinguals appear to perform better than the age-matched monolinguals, especially in the True negative condition, in spite of the fact that Italian was their L2. Note that this was only evident in accuracy, but not in response latency. At first sight, the better performance seems to contrast with the findings of some studies on bilingual adults (e.g., Ćoso & Bogunović, 2017; Hasegawa, Carpenter, & Just, 2002). For instance, Hasegawa et al. (2002) reports fMRI measures of cortical activation from Japanese native speakers (from age 21 to age 38, M = 26.9, SD = 4.8), when they listened to auditory affirmative and negative sentences in Japanese and English. All the participants had started to learn English as their L2 during adolescence and had acquired moderate fluency in English. The authors found that negative sentences elicited, especially for English, greater activation than affirmative sentences. They interpreted these results as suggesting that the difficulties arising in the processing of negation have a significant impact on cortical activation especially in the context of the second language, which may thus be considered as an additional source

of difficulty. By contrast, the result of our study showed a higher accuracy in the bilingual children as compared to the monolinguals. A possible interpretation of this contrast is that behavioral methods are too coarse to allow us to detect the relevant qualitative differences in sentence processing, and that on-line methods are required to single them out. However, we should also notice that most of the participants in Hasegawa's et al. study were Japanese adults who started to learn their L2 relatively late (during adolescence), whereas the participants in our study were Chinese young children who had learned their L2 in the preschool or school years. It might thus be the case that early vs. late bilingualism is the relevant factor for explaining these conflicting results. Clearly, further research is needed to assess the correctness of this statement. In general, our findings raise the question about the differential factors affecting the comprehension of negation in bilinguals, possibly related to early vs. late exposure and level of proficiency in L2, or to the role played by diverse L1 backgrounds.

Alternatively, the better performance of bilinguals on the True negative condition could be interpreted as an experimental artifact of the truth-value judgment task that we employed, which requires a different, and higher, processing cost in comparison to that conducted by Hasegawa and colleagues. Indeed, the task that we administered was based on a sentence-picture evaluation, which is likely to introduce a significant processing load for children, as discussed above. In this sense, the advantage shown by the bilinguals in True negatives could be seen as a positive effect of bilingualism on language processing. As a matter of fact, bilingualism has been extensively reported to provide a positive boost to cognitive functioning, with bilingual children reported to outperform monolinguals on a variety of executive control and linguistic tasks (Barac, Moreno, & Bialystok, 2016; Bialystok, Peets, & Moreno, 2014; Valian, 2015; Vender et al., 2018; however, see Paap, Johnson, & Sawi, 2015, 2016 for proponents). As suggested by these studies, bilinguals seem to benefit from a higher cognitive flexibility and metalinguistic awareness, leading them to outperform monolinguals in tasks imposing non-trivial attentional and processing requirements.

Following this line of reasoning, bilingual children's more accurate performance with True negatives could be explained by executive function enhancement or higher cognitive flexibility and awareness while satisfying the cognitive demands of the task, that is, in constructing and comparing with each other two different representations. In fact, although True negative sentences are the most difficult ones for both groups of children, the bilinguals seem to be more efficient than the monolinguals in successfully performing the two steps required, by hypothesis, to verify this class of sentences. Of course, this line of explanation also remains speculative and needs to be tested in further appropriately designed studies and with a larger sample of subjects.

To conclude, in this paper we have reported an experimental study on Mandarin-Italian sequential bilingual children's comprehension of Italian negation. In line with the findings emerging from the literature on monolingual children, we observed that negative sentences were harder to comprehend than affirmative sentences, and that True negatives were the most difficult to comprehend, as predicted by the two-step simulation hypothesis. Interestingly, we also found that bilingual children outperform their Italian monolingual peers while processing True negatives. Although a fine-grained interpretation of this finding would clearly require non-trivial extensions of the present study, crucially including a concomitant analysis of the performance of bilinguals in their L1, i.e. Mandarin Chinese, we think it is already appropriate to highlight the positive effect of bilingualism in cases where negation processing is expected to be particularly difficult.

Acknowledgements

We are grateful to all the children, adults and teachers who participated in the study, to SHAN Wei and Benedetta Rubino who helped us out with the data collection, to HUANG Guoli, LI Qunlai, XU Jun, ZHANG Wenjun and ZHAO Tongyu for their help in obtaining permission to work in schools, and to Maria Teresa Guasti who kindly made figures available for us. Our sincere thanks also go to Anna Gavarró, Maria Teresa Guasti, Chiara Melloni, Anne Reboul, and the two anonymous reviewers for helpful insights and suggestions. The research leading to these results has received funding from the Fundamental Research Funds for the Central Universities under grant agreement no. 20720171054 and the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no. 613465.

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PART III

The CP field and recursion

Subject position in Spanish as a heritage language in the Netherlands

External and internal interface factors

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This study investigates Spanish heritage speakers in the Netherlands concerning their knowledge of three factors influencing subject position in Spanish: verb type, focus and definiteness. The results of a scalar acceptability judgment task show that heritage speakers have monolingual-like knowledge of the effects of verb type and focus, but not of the effect of definiteness of the subject. We interpret the vulnerability of the definiteness factor as partial support for the second version of the Interface Hypothesis, which predicts the syntax-discourse/pragmatics interface to be particularly vulnerable compared to the syntax-semantics interface. The heritage speakers moreover overgeneralize postverbal subjects, a finding that we tentatively attribute to cross-linguistic influence from Dutch.

Keywords: heritage speakers, Spanish, subject position, word order, Interface Hypothesis, unaccusativity, focus, definiteness, Dutch, cross-linguistic influence

1. Introduction

One of the main questions in research on bilingualism is why some phenomena are robust in situations of language contact, whereas others are more vulnerable and sensitive to cross-linguistic influence. About two decades ago, scholars started noting that phenomena located in the C-domain are particularly problematic in bilingual acquisition (Hulk & Müller, 2000) as well as in early L1 acquisition, children with specific language impairment, adult L2 speakers and aphasics (Platzack, 2001). This idea has been developed further in the Interface Hypothesis (Sorace & Filiaci, 2006; Tsimpli et al., 2004), which predicts linguistic interfaces, and especially the external interfaces between syntax and discourse or pragmatics to be more vulnerable in bilingual populations.

https://doi.org/10.1075/lald.62.09osc

In the present paper we test the Interface Hypothesis with a specific group of bilinguals, namely heritage speakers. Heritage speakers are adult speakers of a minority language, which was acquired in childhood through naturalistic exposure within a majority language environment, either simultaneously with, or before the onset of the dominant language, in the case of early sequential bilingualism. The important characteristic that sets apart this group of bilinguals is that there is a dominance shift: from the moment children start going to school the relative input in their heritage language decreases, often leading to an end-state of acquisition that diverges in several ways from monolingual speakers of the same language.

The phenomenon under investigation in the present paper is subject position with respect to the intransitive verb in Spanish, which is conditioned by several factors, including verb type (located at the syntax-semantics interface) and focus (located at the syntax-discourse interface), two determinants that have been investigated for heritage speakers and L2 speakers of Spanish with English as their dominant language (Montrul, 2005, 2006; Hinch Nava, 2007; Zapata, Sánchez & Toribio, 2005; de Prada Pérez & Pascual y Cabo, 2012). Our contribution to the existing literature consists of the inclusion of a third factor determining word order, namely definiteness of the subject, which has so far not received much attention in research on word order patterns in bilinguals. We show that definiteness is a vulnerable factor in heritage Spanish. Moreover, this study includes a thus far unstudied dominant language, Dutch, which will offer new insights into the role of cross-linguistic influence.

The paper is organized as follows. In the following section we briefly present the Interface Hypothesis and its general predictions. In Section 3, the theoretical literature regarding the constraints on subject position is discussed. Section 4 offers a brief summary of the previous literature on the knowledge of subject position in monolingual and heritage speakers of Spanish, leading to the formulation of our research questions and hypotheses in Section 5. The methodology is described in Section 6, followed by the results (Section 7), a discussion (Section 8) and some concluding remarks (Section 9).

2. The Interface Hypothesis

The Interface Hypothesis was proposed by Sorace and colleagues to account for differential vulnerability between different kinds of phenomena in bilingual populations (Sorace & Filiaci, 2006; Tsimpli, Sorace, Heycock, & Filiaci, 2004). The first version of the hypothesis predicts increased vulnerability in phenomena where syntax interacts with other modules of language, i.e. the interfaces. Purely syntactic phenomena on the other hand are predicted to be problem-free. A second version

(Sorace & Serratrice, 2009) makes a further distinction between internal and external interfaces. While internal interfaces integrate modules pertaining to formal grammar, like syntax, semantics and morphology, external interfaces combine the former linguistic modules with elements of language outside of formal grammar that are more related to general cognition and/or world knowledge, such as discourse and pragmatics. In this second version, the external interfaces are predicted to be particularly vulnerable, given that they integrate domains at different levels of language (i.e. inside and outside formal grammar), thus provoking a higher processing load. Phenomena located at these interfaces are expected to be problematic in bilingual populations, either because of bilinguals' less detailed knowledge or less automatic access to computational constraints within the language module, or because they have fewer cognitive resources available than monolingual speakers (Sorace, 2011).

The Interface Hypothesis has been widely tested in different bilingual populations (bilingual acquisition (e.g. Serratrice, Sorace, & Paoli, 2004), L2 acquisition (e.g. Sorace & Filiaci, 2006), L1 attrition in adult L2 speakers (e.g. Tsimpli et al., 2004) and heritage speakers (van Osch, Aalberse, Hulk, & Sleeman, 2017), with different language combinations[1] and looking at different phenomena.[2] Where some studies indeed find evidence for increased vulnerability of discourse/pragmatics related phenomena (Hulk & Müller, 2000; Montrul, 2008; Iverson, Kempchinksy & Rothman, 2008), other studies contradict it, either by showing robust knowledge of phenomena located at an external interface (e.g. Rothman, 2008; Hopp, 2009, Slabakova, Rothman & Kempchinsky, 2012) or conversely, by attesting vulnerability in purely syntactic phenomena (Cuza, 2012).

In the following section, we present a theoretical description of the factors that determine subject position in Spanish and the predictions for each of these factors based on the Interface Hypothesis.

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1. Such as Russian-Greek (Tsimpli & Sorace, 2006), English-Italian, Spanish-Italian (Sorace & Serratrice, 2009), English-Spanish, English-Greek (Lozano, 2006), English/Russian/Dutch-German (Hopp, 2009); English-Japanese, English-Korean (Laleko & Polinksy, 2016), English-Bulgarian (Ivanov, 2012), Spanish-Dutch (van Osch et al., 2017).

2. Such as anaphora resolution (e.g. Sorace & Filiaci, 2006); subject position (e.g. Parafita Couto, Müller Gathercole & Stadthagen-González, 2015); mood (e.g. van Osch et al., 2017); clitic left dislocation (e.g. Slabakova et al., 2012).

3. Subject position in Spanish

Within the generative framework, the theoretical literature on subject position with intransitive predicates discusses two factors constraining word order: verb type and focus. Verb type refers to the distinction between unergative and unaccusative predicates, also commonly termed unaccusativity. Whereas unergative verbs like *gritar* 'to shout' are more likely to follow the subject, unaccusative verbs like *llegar* 'to arrive', are more likely to precede it:

(1) *Juan gritó.*
Juan shouted

(2) *Llegó Juan.*
Arrived John

Most scholars agree that the two verb types have different syntactic configurations: with unergative verbs, the subject is base-generated in [Spec,*v*P] (Chomsky, 1995) and then usually moves to [Spec,IP], whereas for unaccusative predicates, the subject is base-generated in complement position within VP (e.g. Perlmutter, 1978; Rosen, 1984) and generally remains in situ in Spanish.

Unaccusativity is assumed to be universal; where languages differ is the way in which it is reflected syntactically. In Spanish, word order is just one of the diagnostics of unaccusativity. Another example in Spanish is the participial absolutive construction, which is possible with unaccusative, but not unergative predicates, as examples (3) and (4) illustrate (Montrul, 2005).

(3) *Muerto el perro, se acabó la rabia.* (unaccusative)
Dead the dog, the rabies were finished
'With the dog dead, the rabies were finished.'

(4) **Nadado Juan, se sintió mejor.* (unergative)
Swam John, he felt better
'With John swam, he felt better.'

In English, unaccusativity surfaces, among other structures, in the (un)grammaticality of the resultative construction, a small clause which describes an effect of the event expressed by the verb (Montrul, 2006), as can be seen in examples (5) and (6).

(5) *The book broke apart.* (unaccusative)

(6) **At his wedding, Peter sang sore.* (unergative)

In Dutch, the most notable difference between the verb types is reflected in the choice of the auxiliary: *hebben* 'to have' with unergative predicates (example 7) and *zijn* 'to be' with unaccusative predicates (example 8):

(7) *Ik heb geschreeuwd.*
I HAVE.1SG shouted
'I have shouted.'

(8) *Ik ben aangekomen.*
I BE.1SG arrived
'I have arrived.'

The second factor that is extensively discussed in the generative theoretical literature is focus. In broad focus, as in the answer to the question *¿Qué pasó*? ('What happened?'), the pattern is as described above: unergative predicates follow the subject and unaccusative predicates precede it. But in narrow presentational focus,[3] i.e. focus with the purpose of highlighting information, for instance as an answer to the question *¿Quién gritó/llegó*? ('Who shouted/arrived?'), the distinction between verb types is overridden and both predicate types have a postverbal subject (Ordóñez, 1997, Zubizarreta, 1998), as shown in examples (9) and (10).

(9) *Quién gritó? Gritó Juan.*
Who shouted? Shouted Juan

(10) *Quién llegó? Llegó Juan.*
Who arrived? Arrived Juan

Following Belletti (2001) and Lozano (2006), we assume that in this case, regardless of verb type, the subject moves to the specifier of a Focus position, located in between IP and vP, and the verb moves to I.

These two factors combined – predicate type and focus – thus yield four conditions. In all conditions postverbal subjects are expected to be preferred, except for subjects with unergative predicates in broad focus contexts. This pattern is depicted in Table 1:

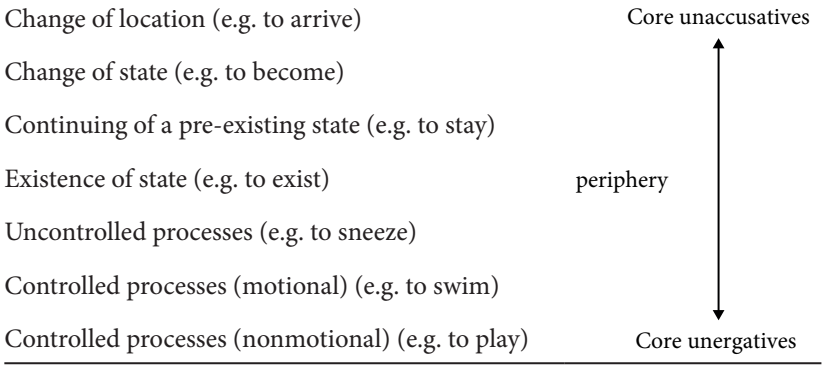
Table 1. Expected pattern based on the theoretical literature

	Broad focus	**Narrow focus**
Unergative predicates	SV	VS
Unaccusative predicates	VS	VS

3. Presentational focus should be distinguished from *contrastive* focus, which indicates a contrast w.r.t. another antecedent and can receive stress in situ (Domínguez, 2007), e.g. *Gritó Juan? – No, MARÍA gritó* ('Did Juan shout? – No, María shouted').

Now, what does the Interface Hypothesis predict for each of these two factors? In this paper, we adopt the second version of the Interface Hypothesis, which makes a distinction between internal and external interfaces and predicts the latter type to be particularly problematic for bilingual populations. The first factor we look at, verb type, has both a syntactic and a semantic component. As mentioned above, there is a syntactic difference regarding the position and movement of the subject with each verb type. But the different verb types also have different semantic properties. Unergative verbs are generally non-telic and agentive, whereas unaccusative verbs are telic and non-agentive. The difference between these verb classes is not categorical; we find differences within verb classes, too (Sorace, 2000, 2004). Some unaccusative verbs behave more consistently unaccusative-like than others, and the same goes for the unergative predicates. This has led Sorace (2000, 2004) to propose the Split Intransitivy Hierarchy, a universal continuum of semantic categories, with core unaccusatives and core unergative categories on the two extremes of the continuum and peripheral categories in the middle. The verbs pertaining to the two extreme categories are those that behave most prototypically according to their predicate type. The peripheral verbs are less consistent in their behaviour.

(11) Split Intransitivy Hierarchy (Sorace 2000, 2004)



Since both syntactic and semantic features are involved, we assume, following previous studies (i.a. Hertel, 2003; Roggia, 2011; de Prada Pérez & Pascual y Cabo, 2012; Parafita Couto et al., 2015), that the difference between unaccusative and unergative predicates is located at the internal interface between syntax and (lexico-)semantics.

The second factor, focus, is by most accounts considered to pertain to the external interface between syntax and discourse, given that it is related to the information structure of the sentence. Therefore, the Interface Hypothesis predicts focus to be more vulnerable for bilingual populations than verb type, which is located at the internal interface between syntax and (lexico-)semantics. Some previous studies have tested this prediction, for various bilingual populations (Hertel, 2003; Zapata

et al., 2005; Lozano, 2006; de Prada Pérez & Pascual y Cabo, 2012; Domínguez & Arche, 2014; Parafita Couto et al., 2015). The following section offers an overview of those studies that have looked at heritage speakers of Spanish.

4. Previous research on word order patterns in monolingual and heritage Spanish

To our knowledge, all previous studies investigating heritage speakers of Spanish regarding their knowledge of the effects of verb type and focus concern English-dominant heritage speakers of Spanish. One robust finding arising from these studies is an overall overgeneralization of preverbal subjects compared to monolingual speakers (Montrul, 2005; Zapata et al., 2005; Hinch Nava, 2007; de Prada Pérez & Pascual y Cabo, 2012). This overgeneralization seems to be stronger in lower proficiency speakers (Montrul, 2006) and increases with each succeeding generation of heritage speakers (Silva-Corvalán, 2001).[4] The explanation offered by most scholars is cross-linguistic influence from English, which almost exclusively has preverbal subjects.

As for the question whether heritage speakers have knowledge about verb type and/or focus, the findings from previous studies are less consistent. Montrul (2005, 2006) compared heritage speakers and L2 speakers of Spanish regarding their knowledge of the difference between unergative and unaccusative predicates with regards to subject position. The heritage speakers showed robust knowledge of the distinction: they rated postverbal subjects higher when the verb was unaccusative than when the verb was unergative. Moreover, they were sensitive to other reflexes of unaccusativity, such as word order with bare plurals and the (im)possibility of the absolutive construction. Focus was not taken into consideration in this study. Some studies with heritage speakers also included focus as a factor. Based on the Interface Hypothesis, the prediction in these studies is that focus, given its external interface status, would be more vulnerable than verb type. Zapata et al. (2005) found that heritage speakers in the U.S. did not behave according to the expected pattern with respect to both factors. Whereas they preferred SV with unergative predicates in broad focus contexts and VS with unaccusative predicates in narrow presentational focus contexts, as predicted by the theory, they did not show a significant preference for either order in the other two contexts, where a preference for VS was expected. The pattern is summarized in Table 2:

4. The overgeneralization of preverbal subjects is however not attested in simultaneous Spanish-English bilingual acquisition, as discussed in Villa-García and Suárez-Palma (2016) and references there.

Table 2. Attested pattern in Zapata et al. (2005)

	Broad focus	**Narrow focus**
Unergative	SV	No preference
Unaccusative	No preference	VS

The authors take these findings as evidence for lack of knowledge of either factor. However, these data could be interpreted in a different way: the fact that heritage speakers prefer postverbal subjects more for unaccusative verbs than unergative verbs in broad focus may be taken as evidence that they do distinguish between the two verb types. Similarly, the fact that, for both verb types, they have a relatively higher preference for postverbal subjects in narrow focus than in broad focus could be interpreted as evidence of knowledge of the effect of focus. We would also like to note that no control group was included in this study. Since different studies have reported quite different preference patterns for monolingual speakers of Spanish as well (as will be discussed below), it is difficult to draw strong conclusions from a study that does not include a monolingual control group.

A more recent study by de Prada Pérez and Pascual y Cabo (2012) looked at both verb type and focus as factors determining word order in heritage speakers with different proficiency levels as well as a monolingual control group. The results showed that only the monolingual controls and the low proficiency group distinguished between unergative and unaccusative verbs in broad focus. As for focus, the data demonstrated that all heritage speaker groups preferred postverbal subjects more in narrow focus than in broad focus. The authors conclude based on these results that predicate type is more vulnerable than focus, contradicting the Interface Hypothesis. Interestingly, however, the control group in this study did not show the expected pattern either: they failed to prefer VS in the conditions where it was expected. This could be due to the fact that the control group was a group of Spanish-speaking immigrants who spoke English as an L2 and may have suffered from attrition, as suggested by the authors. Unfortunately, there is no report of their proficiency in English. In any case, the fact that the control group shows a non-target-like pattern, makes it more difficult to draw strong conclusions about the results for the heritage speakers.

In fact, when we look at monolingual control groups in other (mostly L2) studies, even though they consistently show knowledge of the two factors, they often do not behave completely according to the expected pattern in Table 1. The native speaker control groups in both Parafita Couto et al. (2015) and Sánchez-Alvarado (2016), for instance, fail to show a preference for postverbal subjects with unaccusative predicates in broad focus in an acceptability judgment task. Hertel (2003), who compared L2 speakers to native speakers of Spanish on a written production

task, found that the native speaker control group preferred preverbal subjects in all four conditions.

Aside from methodological differences, a reason why such contradicting results with monolinguals are attested may be the overlooked influence of confounding factors. First of all, we do not always know whether these studies tested *core* or *peripheral* unaccusative and unergative verbs in Sorace's Split Intransitivy Hierarchy. Moreover, some studies have shown effects of additional factors, that have been largely ignored in the generative literature on the topic. One of these factors is the animacy of the subject, which has been shown to affect subject position, at least in written Spanish: inanimate subjects follow the verb more often than animate subjects (Rivas, 2008; Roggia, 2011), as illustrated in examples (12) and (13), taken from López Meirama (1997: 118, cited in Rivas, 2008):

(12) *Mis hijos han salido.*
My children have left

(13) *Han salido setas en el jardín.*
Have grown mushrooms in the garden
'Mushrooms have grown in the garden.'

Another influential factor is the presence and location of adverbial phrases. With a preverbal adverbial phrase, the subject is more likely to be postverbal, and with a postverbal adverbial phrase, preverbal subjects become more felicitous (Kahane & Kahane, 1950; Roggia, 2011), which, as noted by an anonymous reviewer, may be evidence for the fact that these two types of constituents compete for the same structural position. Third, the length (or heaviness) of the subject has an effect on word order. This is because longer constituents tend to occur last in the sentence in Spanish (Fernández Soriano, 1993; De Miguel Aparicio, 1993). Roggia (2011) confirmed this effect specifically for subjects of intransitive verbs in monolingual Mexican Spanish: longer/heavier subjects (i.e. longer than determiner + noun + adjective) were preferred in postverbal position and shorter subjects in preverbal position. Finally, and most relevant to the present study, the definiteness of the subject also influences its position in the sentence: whereas definite subjects are more often preverbal, indefinite subjects are preferred in postverbal position (Rivas, 2008; Roggia, 2011).[5] The definiteness effect has been attested for Italian (Belletti et al., 2007; Tsimpli et al., 2004), but is not generally discussed in the generative literature on Spanish. Hertel (2003) does mention definiteness, but denies that the effect exists in Spanish:

5. An anonymous reviewer wondered whether the effect of definiteness occurs independently of verb type. In the literature reviewed here, nothing is mentioned about differential effects of definiteness in unergative and unaccusative predicates.

> Example [*Llegó mi nieto* 'My grandson arrived'] also illustrates that in Spanish, unlike languages such as Italian, the appearance of postverbal subjects is not regulated by the Definiteness Effect (Belletti, 1988) (…) (Hertel, 2003: 274)

The definiteness effect on subject position in Spanish has, to our knowledge, not been tested for heritage speakers or other bilingual populations.

To sum up, most previous studies on word order in heritage speakers of Spanish have been carried out in the US, and have looked either at verb type only, or have compared verb type and focus. These studies do not provide a consistent answer to the question which of these two factors is more vulnerable. An additional problem is that many of these studies fail to mention whether they took any other factors into consideration.

In the present study, we introduce Dutch as a new dominant language, and we control for possibly confounding factors by restricting ourselves to sentences with only core unaccusative and unergative verbs in preterite aspect, and by including only animate and short subjects. Moreover, we include definiteness of the subject as an additional explanatory variable. In the following section, we present our research questions and hypotheses.

5. Research questions and hypotheses

In this study, we investigate the effects of verb type, focus and definiteness on subject position in Spanish. Given the inconsistent results for monolinguals in previous studies, which may not have controlled for confounding factors, our first aim is to establish the monolingual pattern in order to have a solid basis for comparison for the heritage speakers. Therefore, our first research question is:

RQ1: Do monolingual native speakers of Spanish show evidence of the effects of verb type, focus and definiteness on word order?

We hypothesize that monolingual native speakers of Spanish will show knowledge of these three factors. That is, we expect them to prefer postverbal subjects more with unaccusative verbs than unergative verbs. In narrow focus, we expect this distinction to be overridden and postverbal subject to be preferred for both verb types. Finally, we expect a higher preference for VS with indefinite subjects than with definite subjects.

Once we establish the monolingual pattern we can use this as a basis for comparison with the heritage speakers. Our second research question is:

RQ2: Do heritage speakers of Spanish show knowledge of the same factors as monolingual speakers? If not, which of the factors is/are more vulnerable?

Following the Interface Hypothesis we predict the heritage speakers to deviate more from the monolingual speakers with focus than with verb type, given that the former pertains to the external interface between syntax and discourse, whereas the latter is located at the internal interface between syntax and semantics. This study also includes definiteness as an explanatory variable. We assume definiteness, just as focus, to be located at the external interface between syntax and discourse-pragmatics. After all, the definite determiner is usually used to refer to previously mentioned antecedents and/or to antecedents known to both interlocutors, whereas the indefinite determiner is used to introduce new referents into the discourse. We thus expect heritage speakers to show more difficulties with the effects of both definiteness and focus than with the distinction between verb types.

6. Method

Participants

27 second generation heritage speakers participated in the study. To reduce heterogeneity within the group, a selection was made based on the participants' general proficiency in Spanish, which was measured in two ways: the cloze part and the vocabulary part of the DELE (*Diploma Español de Lengua Extranjera*, a standardized proficiency task for Spanish) and a lexical decision task. Only those speakers were included who (1) scored 36 or higher on the DELE (corresponding to high-intermediate and advanced) and (2) had an accuracy score of 100 or more out of 149 on the lexical decision task (as a point of reference: the lowest score for the monolinguals was 110 out of 149). After these selection criteria, 21 heritage speakers remained. Their mean age was 24.0 years old (Range: 19–36, SD: 4.8). All of them (17 female, 4 male) were university students or graduates. Two were raised in families where both parents spoke Spanish, the others were raised in bilingual households, usually the mother being the Spanish-speaking parent. The heritage speakers' parents spoke a range of different varieties of Spanish: peninsular (8), Mexican (5), Colombian (3), Uruguayan (2), Chilean (1), Panamanian (1), and Ecuadorian (1). Crucially, none of the heritage speakers spoke a Caribbean variety of Spanish.[6] Apart from one heritage speaker who arrived to the Netherlands at age 2, all heritage speakers were born in the Netherlands. Given that most participants used Spanish almost exclusively at home to speak with their parent(s), we see a

6. Caribbean dialects have been shown to have different preferences with respect to subject position in questions (e.g. see Alba, 2004; Lipski, 1977; Ordóñez & Olarrea, 2006). We know of no other dialectal differences regarding subject position with intransitives predicates.

decrease in Spanish input and use from school age onward. However, most participants did report a strong emotional connection with their home language and culture. Most of them had visited their home country multiple times in childhood and some even lived there for a couple of months. Many participants indicated that they had received some type of instruction in Spanish, for instance at Saturday or Sunday schools, or as a subject in high school or university. Given the presence of English in the Dutch educational system as well as in Dutch media, all heritage speakers also had knowledge of English. Self reported proficiency in English ranged from high-intermediate to near-native.

As for their current language use, most heritage speakers indicated that they spoke predominantly Dutch at home, but some also spoke (some) Spanish. In 5 cases Spanish was even the dominant language at home. At work or school, as well as during free time spent outside of the house, the main language was generally Dutch.

The descriptive statistics for the relevant variables are illustrated in Table 3:

Table 3. Age and proficiency scores for all participants

Group	DELE score	Accuracy lexical decision task	Self-reported proficiency
Heritage speakers (N = 17)	Mean: 40.9	Mean: 109.5	Mean: 5.1
	Range: 37–45	Range: 101–122	Range: 3.5–6
	SD: 2.2	SD: 6.2	SD: 0.7
Monolinguals (N = 18)	Mean: 45.2	Mean: 130.7	Mean: 5.9
	Range: 40–48	Range: 110–140	Range: 5–6
	SD: 2.1	SD: 8.7	SD: 0.2

The control group consisted of 18 native speakers (5 male, 13 female) of Spanish who had moved to the Netherlands less than 6 months before the time of testing. The group was similar in age to the heritage speaker group (mean 26.4, range: 21–38, SD: 4.5). All participants grew up acquiring only Spanish in childhood, however, they had learned English in adulthood (self-reported proficiency levels ranging from intermediate to highly advanced). However, they had no knowledge of Dutch whatsoever. The group included a mix of varieties of Spanish: Spain, Mexico, Colombia, Argentina, Nicaragua and Venezuela. Again, no Caribbean dialects were included in the sample.

Task and procedure

A contextualized scalar acceptability judgment task was used, containing 24 items targeting word order. Since the task was part of a bigger project which also tested mood in Spanish (van Osch & Sleeman, 2016; van Osch et al., 2017), it also

contained 54 items about mood. This way, each of the two phenomena served as fillers for the other. The project also tested production; however, in the present paper we only report on the judgment task. In this task participants were presented with short stories followed by two sentences, which they were asked to evaluate on a scale ranging from minus two to two. Minus two meant: 'This sentence sounds very strange and I would not say it this way' and two meant: 'This sentence is perfect and I would say it this way.' Zero was interpreted as a neutral rating, falling right in the middle between 'completely acceptable' and 'completely unacceptable.'[7] Three practice items preceded the actual experiment. As mentioned above, general proficiency in Spanish was measured using the DELE and a lexical decision task. The lexical decision task consisted of aurally presented Spanish words and non-words for which the participants had to indicate as quickly as possible whether they thought it was a word or not, by pressing either a green or a red button.

The procedure was as follows: the participants would start by filling out an extensive background questionnaire about their previous and current amount of input and use of Spanish. All experimental tasks were carried out on a laptop. The first task was the lexical decision task, which took about 10 minutes, followed immediately by the production task (more or less 30 minutes), after which there was a short break. The first task after the break was the acceptability judgment task. The duration of this task varied greatly per person, but the average duration was around 45 minutes. At the very end of the session followed two paper-and-pencil tasks: the DELE and a morphological recognition task, which was part of the study on mood. In total, the whole test lasted around 2 hours. The reward for participation was 10 euros.

Items

Each item consisted of a short introductory story that always ended in a question asked by one of the characters in the story. Below the story two possible answers were given, one with a preverbal subject and one with a postverbal subject. In some of the items, a second short sentence followed the critical sentence, to make the answer more natural, as in example (14).

7. It has been suggested that using a Likert scale including a zero value might be problematic given that participants might interpret the zero as meaning 'I don't know.' We think our instructions made it sufficiently clear that the zero should not be taken to mean 'I don't know,' but a value in between the two extremes of the scale.

(14) *Mi compañero de casa, Pepe, nunca quiere que haya fiesta en nuestra casa. Este fin de semana se fue de vacaciones. Yo aproveché y planeé una fiesta para el sábado, pero el sábado en la mañana veo que Pepe ha regresado inesperadamente. Tengo que cancelar la fiesta. Hablando con mi mamá, me nota un poco malhumorado, así que me pregunta: "¿Qué pasó?" Le contesto:*

My housemate Pepe never wants to have parties in our house. This weekend he went on a holiday. I took advantage and planned a party on Saturday, but Saturday morning I see that Pepe returned unexpectedly. I have to cancel the party. Talking to my mom, she notices that I'm a little cranky, so she asks me: "What happened?". I answer her:

Mi compañero regresó. Tuve que cancelar la fiesta.

My housemate came back. I had to cancel the party.

○	○	○	○	○
−2	−1	0	1	2

Regresó mi compañero. Tuve que cancelar la fiesta.
Came back my housemate. I had to cancel the party.

○	○	○	○	○
−2	−1	0	1	2

Given the fact that heritage speakers often experience difficulties with the written form of their heritage language, all stories and sentences were presented both written (on the screen) and aurally. The recordings were made by a native speaker of Colombian Spanish, who was instructed to speak slowly and clearly. None of the participants reported having any problems understanding the recordings. To minimize possible effects of prosody,[8] a linguist who is native speaker of Spanish listened to the sentences and confirmed their neutral prosody. The order of the two sentences as well as the order of the items was randomized for each participant. The items differed with respect to three factors: verb type, type of focus and definiteness of the subject. All other possible confounding factors we were aware of were largely controlled for: all verbs were in preterite, and all subjects were human[9] and light (i.e. less than 3 words).[10] Two items contained an adverbial phrase, such as *en la*

8. For transitive sentences, some studies (e.g. Gabriel, 2010; Muntendam, 2009; Hoot, 2012) have shown that narrow focus on the subject can also be expressed using prosodic stress on the (preverbal) subject.

9. For one item, the subject was *un fantasma* 'a ghost', but this was not considered a problem, given that ghosts are usually depicted as having human-like properties.

10. Except for one item, for which the subject was *una hermana de la novia* 'a sister of the bride.' However, this item did not deviate from the other items in the same condition.

calle 'in the streets' or *de repente* 'suddenly.' An analysis of these items showed no different patterns compared to other items in the same condition.

Half of the items contained unaccusative predicates and the other half contained unergative predicates. The specific verbs used in the task were selected based on their frequent use in previous literature, to facilitate comparisons across studies. The other criterion for the selection of the verbs was that they pertained to the two most extreme categories on the unaccusativity hierarchy (Sorace, 2000, 2004). For the unaccusative verbs, this means change of location verbs and change of state verbs: *venir* 'to come,' *llegar* 'to arrive,' *regresar* 'to come back,' *entrar* 'to enter,' *irse* 'to leave,' *desaparecerse* 'to disappear,' *morirse* 'to die,' and *escaparse* 'to escape.' For the unergative verbs the categories were controlled motional processes and controlled non-motional processes: *bailar* 'to dance,' *correr* 'to run,' *llamar* 'to call,' *llorar* 'to cry,' *reirse* 'to laugh,' *cantar* 'to sing,' *gritar* 'to shout,' *limpiar* 'to clean,' *tocar* 'to play (music).' A possible issue with some of the unergative verbs, such as *llamar* 'to call,' *limpiar* 'to clean' and *tocar* 'to play (music),' is that they can be transitive verbs as well, even though they are used as intransitive verbs in this study. However, no deviating pattern could be revealed for the items containing these particular verbs.

The type of focus was determined by means of the introductory story, which either ended in the question *¿Qué pasó?* ('What happened?'), prompting broad focus on the entire sentence, or *¿Quién + V?* ('Who V-ed?'), targeting narrow focus on the subject. These two different conditions were evenly distributed across conditions.

Finally, half of the subjects were definite and half were indefinite. The *definite* category included subjects with possessive determiners (e.g. *mi mamá* 'my mom,' *nuestro professor* 'our teacher'), given names (e.g. *Susana*) and, in one case, a definite determiner (*el vecino* 'the neighbor'). All *indefinite* subjects were accompanied by the indefinite determiner *un/una* or the plural form *unos/unas*. Both subject types were evenly distributed across the other conditions.

7. Results

Monolingual controls

First, the results for the monolingual controls were analysed, to check whether this group showed the expected pattern. A linear mixed-effects model analysis was run, using the lme4 package (Bates & Sarkar, 2006) in the R environment (R Development Core Team, 2017). The dependent variable was the relative preference for postverbal subjects, which was calculated by subtracting the rating for the sentence with a preverbal subject from the rating for the sentence with the postverbal subject, for each item. The fixed factors were verb type (unergative vs. unaccusative verbs), focus (broad vs. narrow focus) and definiteness (definite vs. indefinite subjects), as well

as all possible interactions between these factors. Subject and item were specified as random factors. P-values were obtained using the Kenward-Roger approximation, as implemented in the pbkrtest package (Halekoh & Højsgaard, 2014).

For the monolingual speakers there were significant main effects for all three factors, and no significant interactions between factors. The main effect of verb type (Estimate = 0.52, SE = 0.20, $t = 2.56$, $p = 0.015$) indicates that monolingual speakers have a stronger relative preference for postverbal subjects on unaccusative verbs than on unergative verbs, as illustrated in Figure 1.

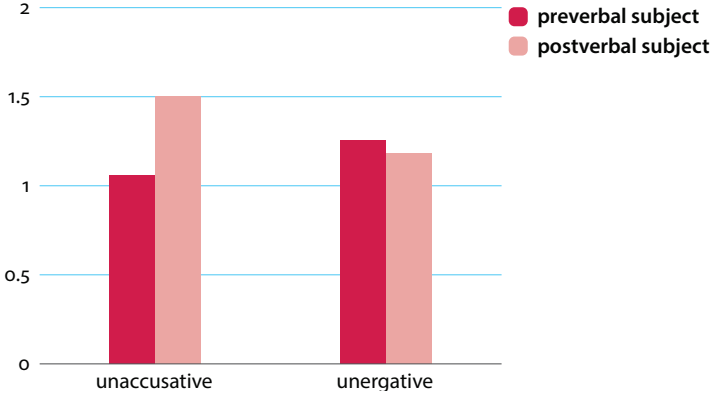


Figure 1. Main effect of verb type in monolingual speakers

The effect of focus (Estimate = 1.18, SE = 0.20, $t = 5.81$, $p = 1.5\text{^}{-6}$) means that monolingual speakers rate postverbal subject relatively higher when there is narrow focus on the subject than when there is broad focus on the entire sentence. This effect is depicted in Figure 2.

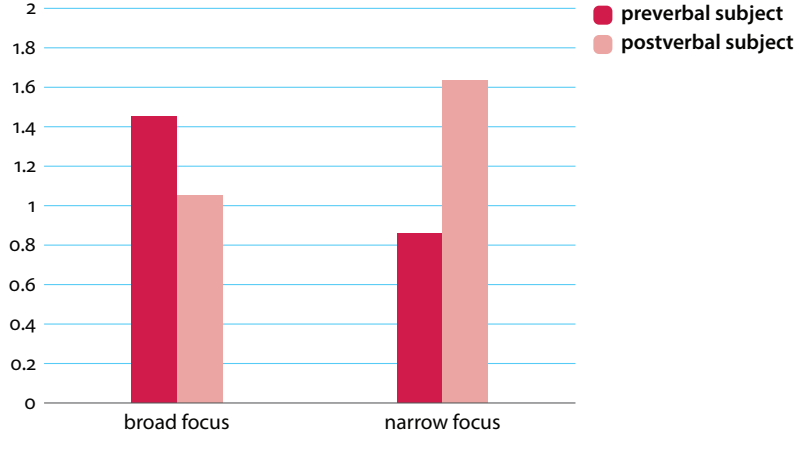


Figure 2. Main effect of focus in monolingual speakers

The fact that there is no significant interaction between verb type and focus suggests that it is not the case that focus *overrides* verb type, but that both factors have an effect at the same time. If focus did override verb type, we would expect no difference between broad and narrow focus for unaccusative verbs, and no difference between unergative and unaccusative verbs in narrow focus. Figure 3 illustrates that this is not what we find: the monolingual rate VS higher with unaccusative predicates in narrow focus than in broad focus, and they rate VS higher with unaccusatives in narrow focus than unergatives in narrow focus.

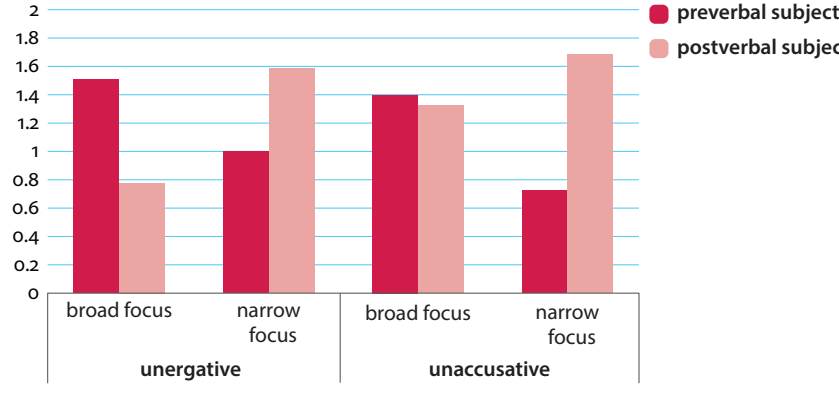


Figure 3. Effects of verb type and focus in monolingual speakers

Finally, the main effect of definiteness (Estimate = 0.73, SE = 0.20, t = 3.61, p = 9.63^−4) indicates that monolingual speakers have a stronger relative preference for postverbal subjects when the subject is indefinite than when it is definite, as depicted in Figure 4.

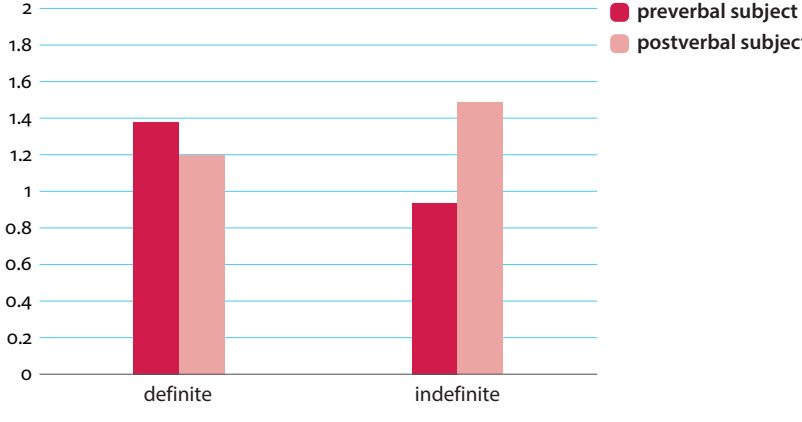


Figure 4. Main effect of definiteness in monolingual speakers

Heritage speakers

The same model was performed on the heritage speakers' ratings. Again, subject and item were included as random effects and verb type, focus and definiteness were fixed effects. For the heritage speakers, there were significant main effects of verb type and focus, but not of definiteness. Just as for the monolingual speakers, there were no significant interactions between factors. The main effect of verb type (Estimate = 0.84, SE = 0.31, $t = 2.69$, $p = 0.002$) indicates that heritage speakers, like the monolinguals, rated postverbal subjects relatively higher with unaccusative predicates than with unergative predicates, as shown in Figure 5.

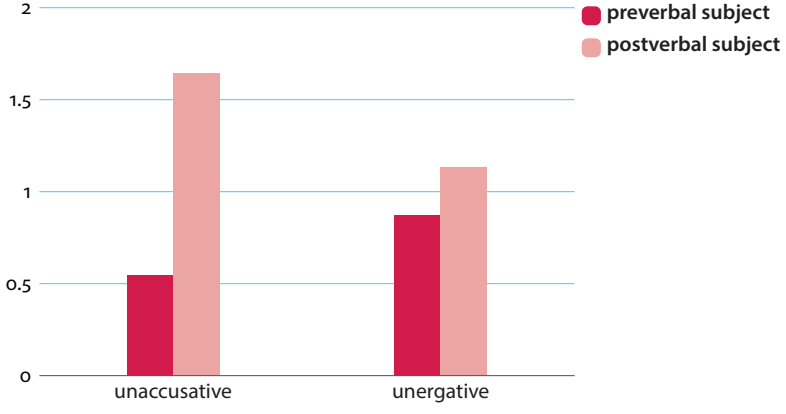


Figure 5. Main effect of verb type in heritage speakers

The significant main effect of focus (Estimate = 0.95, SE = 0.31, $t = 3.05$, $p = 0.004$) indicates that heritage speakers prefer postverbal subjects more in narrow focus than in broad focus, again in line with the monolingual results. This effect is illustrated in Figure 6.

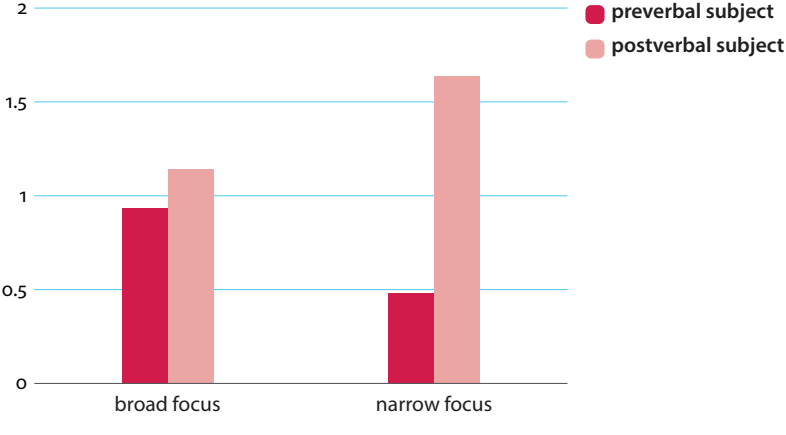


Figure 6. Main effect of focus in heritage speakers

However, the main effect for definiteness, which was significant in monolingual speakers, is not found in the heritage speaker data, as shown in Figure 7. Even though the preference seems to be somewhat higher for indefinite items, the effect is not significant (Estimate = 0.34, SE = 0.31, t = 1.08, p = 0.29).

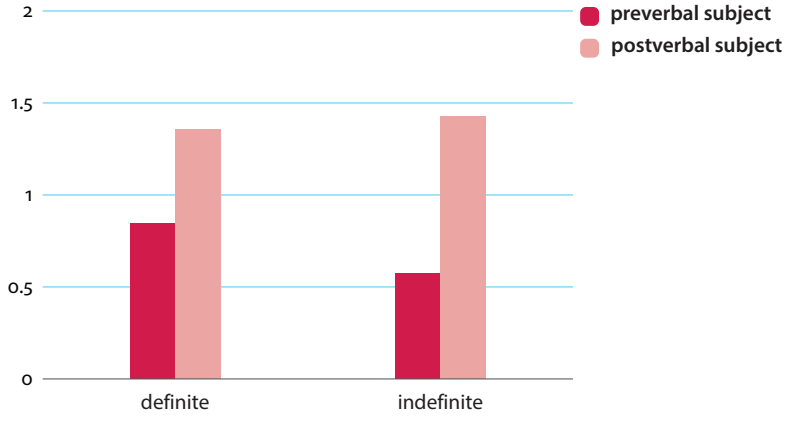


Figure 7. Main effect of definiteness in heritage speakers

Two additional linear mixed effects models were run on the overall (across conditions) ratings for preverbal and postverbal subjects, to see whether the groups differed in terns of their overall preferences across conditions. In these models, the only fixed effect was group, and subject was included as a random factor. The model for the ratings on preverbal subjects showed a significant effect of group (Estimate = 0.45, SE = 0.20, t = 2.28, p = 0.03). This effect indicates that heritage speakers reject preverbal subjects significantly more than monolingual speakers do; in other words: they overgeneralize postverbal subjects compared to the control group. This effect is illustrated in Figure 8.

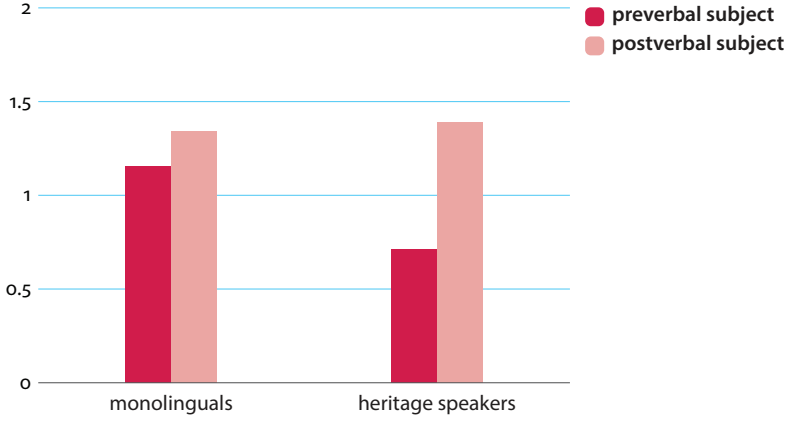


Figure 8. Preferences across conditions for both groups.

Individual differences

Individual differences between participants were quite large. In both groups, some participants preferred preverbal subjects across conditions, whereas other participants preferred postverbal subjects. There was no indication that this variation could be attributed to dialectal variation. To illustrate: within the monolingual group, the participant who rated preverbal subjects highest and the one who rated postverbal subjects highest, were both speakers of peninsular Spanish.

We also investigated individual differences with respect to the size of the effect for each factor separately. Individual effect size scores per participant per factor were calculated by subtracting the average relative preference for postverbal subjects in one condition from the average relative preference for postverbal subjects in the other condition. For instance, for verb type, each participant's average relative preference for postverbal subjects (= rating VS – rating SV) across all unergative items was subtracted from their average relative preference for postverbal subjects across all unaccusative items. This way, positive scores imply a higher preference for postverbal subjects for unaccusative predicates than unergative predicates; the higher the score, the bigger the effect. Similar calculations were performed on the other two factors: focus and definiteness. Again, individual differences with respect to effect size scores were large, for both heritage and monolingual speakers. For instance, some monolingual speakers had a negative effect size score for verb type; this means that they showed the opposite pattern: a higher relative preference for VS with unergative verbs than with unaccusative verbs. Again, no relation with specific varieties of Spanish could be detected. To illustrate: the two speakers who showed the biggest and the smallest effect of verb type were both speakers of Mexican Spanish. Similarly, the two monolingual participants with the biggest and the smallest effect for focus both spoke peninsular Spanish. As for the heritage speakers, we checked whether there were any correlations between their individual effect size scores and their proficiency scores on the DELE and the lexical decision task. None of the correlations turned out to be significant.

Item effects

To check whether certain characteristics (other than the factors of interest) of the items had an effect on word order preference, an individual item analysis was carried out. There was some variation between items, especially in those conditions where different factors target different word orders, e.g. unaccusative predicates (targeting VS) with definite subjects (targeting SV) in broad focus (targeting SV). Some of the variation seems to be related to the type of verb used: within the

unaccusative predicates, *entrar* 'to enter,' *venir* 'to come,' and *llegar* 'to arrive' prompt postverbal subjects more than *regresar* 'to come back,' *irse* 'to go away' and *desaparecerse* 'to disappear.' This may be related to a semantic difference between these types of verbs: even though all verbs denote a change of location, and thus fall into the core unaccusative category within Sorace's (2000, 2004) hierarchy, the former three indicate the *appearance* of something/someone, whereas the latter three indicate the *disappearance* of something/someone. There may thus exist two subcategories within the category of change of location predicates, where in one, the change results in the *presence* of something/someone, and in the other in the *absence* of something/someone. This makes sense given that the only verb in Spanish that is obligatorily used with a postverbal subject is the presentational verb *haber*, the verb par excellence to denote the presence of something. Of course, this is merely a suggestion, which should be supported by further studies.

8. Discussion

The data for the monolingual speakers showed significant main effects for all three factors. This means that in monolingual Spanish, verb type, focus and definiteness all have an effect on the position of the subject relative to the verb. The fact that there was no interaction between verb type and focus means that our data does not completely correspond to the expected pattern as it is presented in the generative theoretical literature, which assumes that the distinction between verb types is overridden in narrow focus. Table 1 is repeated here for clarification.

Table 1. Expected pattern based on theoretical literature

	broad focus	**narrow focus**
unergative predicates	SV	VS
unaccusative predicates	VS	VS

Based on this pattern, we would expect no differences between unaccusative and unergative predicates in narrow focus, and no differences between unaccusative verbs in broad and in narrow focus. In statistical terms, this would imply an interaction effect between the factors predicate type and focus: a difference between verb types is expected in broad, but not narrow focus. Or phrased in a different way: a difference between broad and narrow focus should arise for unergative predicates, but not for unaccusative predicates. In our data, monolingual speakers do not completely behave in line with this pattern, because they do not prefer VS with unaccusative predicates in broad focus; they thus treat unaccusative predicates

differently in broad and in narrow focus. Instead of a pattern in which focus overrides verb type, this pattern is more suggestive of two main effects, verb type and focus, playing a role at the same time. If this is the case, we would expect the strongest preference for preverbal subject in the condition where *both* of the factors favour preverbal subjects (unergative verbs in broad focus), the strongest preference for postverbal subjects in the condition where *both* factors favour postverbal subjects (unaccusative verbs in narrow focus condition) and an in-between-pattern for the other two conditions, which corresponds to what we see in Figure 3. Indeed, if we look closely at the results for monolinguals in previous studies, we often see a similar pattern. The monolingual groups in Lozano (2006), Domínguez and Arche (2008), de Prada Pérez (2010), Roggia (2011) and Parafita Couto et al. (2015) all show a pattern in which the preference for postverbal subjects is stronger for unaccusative verbs in narrow focus than in broad focus.

The present study furthermore attested an effect of definiteness on word order in monolingual Spanish: the preference for postverbal subjects was stronger when the subject was indefinite, than when the subject was definite, confirming previous non-generative studies. Based on our and previous studies' findings for monolingual speakers, we would like to argue that the representation of the factors influencing word order in Spanish as it is presented in the generative theoretical literature is too simple. It does not seem to be the case that focus overrides verb type, but both factors appear to simultaneously influence word order. Moreover, definiteness also plays a role and should be taken into account in future studies on the topic.

Having established the monolingual pattern, we can now turn to our second research question: *Do heritage speakers of Spanish show knowledge of the same factors as monolingual speakers? If not, which of the factors is/are more vulnerable?*

The prediction, based on the Interface Hypothesis, was that focus and definiteness would be more vulnerable than verb type, given that both focus and definiteness are related to discourse/pragmatics and thus represent an external interface. The hypothesis was only partly borne out by our data. Heritage speakers showed knowledge of verb type and focus, but not of definiteness. This confirms our prediction for the factors verb type and definiteness. Verb type, which is related to syntax and semantics and thus represents an internal interface, was expected to be relatively robust in heritage speakers, and indeed: the results demonstrated solid knowledge of the distinction between unergative and unaccusative predicates. Definiteness, which is related to discourse/pragmatics and thus is located at an external interface, was expected to be vulnerable and indeed heritage speakers showed no knowledge of the difference between definite and indefinite subjects. However, contrary to our prediction, heritage speakers did show knowledge of the distinction between broad and narrow focus. This is surprising in light of the Interface Hypothesis, given that focus, too, is an external interface factor and thus

should be as vulnerable as definiteness. We suggest several possible explanations for this finding.

First of all, focus seems to be the strongest factor in monolingual Spanish. This could mean that there was more evidence for this factor in the input to which the heritage speakers were exposed. Heritage speakers are at a disadvantage compared to monolingually raised children: they receive at best half, and oftentimes much less than the input a monolingual child receives throughout childhood. Thus, the more categorical a certain rule is in the input, the easier it will be for the child to acquire it. This possibility has also been suggested by de Prada Pérez and Pascual y Cabo (2012), who attested better performance by heritage speakers for focus than for verb type. In an earlier study, de Prada Pérez (2010) found that monolingual speakers of Spanish were more categorical in their preference for postverbal subjects in narrow focus, than in the distinction between the two verb types in broad focus. These authors conclude from their findings that an explanation based on categoricalness in the input heritage speakers receive (the Vulnerability Hypothesis) can better account for their data than the Interface Hypothesis.

A second possible account for the robustness of focus is that the heritage speakers are helped by their knowledge of Dutch, which exhibits effects of focus on word order, albeit for objects. In Dutch, focused objects can be preposed to the preverbal position, as in (15):

(15) *De appel heb ik gegeten.*
The apple have I eaten
'The apple I have eaten.'

Although the specific instantiations of focus differ between the two languages, it may be the case that the possibility to change word order in order to assign focus to a constituent in Dutch indirectly helps the heritage speakers become aware of the focus effect on word order in Spanish.

Another interesting finding of the present study is the fact that the heritage speakers overgeneralize postverbal subjects across conditions compared to monolingual speakers. This contradicts the well-attested overgeneralization of preverbal subjects by heritage speakers of Spanish in the US (Montrul, 2005; Zapata et al., 2005; Hinch Nava, 2007; de Prada Pérez & Pascual y Cabo, 2012). We suspect that this different behaviour on part of our heritage speakers is due to influence from Dutch. Even though Dutch, like English, predominantly has preverbal subjects, postverbal subjects also occur frequently due to the V2 rule, which states that in main clauses the verb is always in second position. This means that whenever a main clause starts with a non-subject constituent, the subject follows the verb, like in locative constructions (16), sentences with preposed objects (17) or sentences with existential *er* (there) (18).

(16) *Buiten loopt een man.*
Outside walks a man

(17) *Dat ziet een man.*
That (obj) sees a man

(18) *Er loopt een man.*
There walks a man

In English, postverbal subjects are also possible with locative constructions (*In the bed lay a woman*), as well as with existential *there* (*There is a pen on the table*), but both these constructions are less frequent in English than in Dutch. Locative inversion is quite marked in English and *there*-inversion with any verb other than *to be* becomes odd as well (#*There walks a man*). In Dutch on the other hand, locative inversions are completely acceptable and existential *er* can occur with a wide range of verbs.

The greater flexibility regarding word order in Dutch might explain why heritage speakers of Spanish in the Netherlands show fewer SV overgeneralizations than their US peers. Of course, this is a mere suggestion which needs to be corroborated by comparative studies in both countries. Not much is known yet about heritage speakers of Spanish with different dominant languages than English. If it is indeed the case that the results in this study are caused by the different dominant language, this finding underlines the importance of adding new language combinations to heritage speaker research.

9. Conclusion

This study has investigated monolingual and heritage speakers of Spanish regarding their knowledge of three factors determining word order with intransitive predicates in Spanish: verb type, focus and definiteness.

The monolingual results showed that the pattern as it is typically described in the theoretical literature does not completely seem to cover all relevant effects on word order. First of all, it appears to be the case that focus does not *override* the effect of verb type, but that both factors apply simultaneously. Furthermore, definiteness of the subject was demonstrated to exert an additional influence on word order: indefinite subjects are more likely to be placed after the verb than definite subjects.

As for the heritage speakers, it was hypothesized, based on the Interface Hypothesis, that focus and definiteness, two factors that pertain to the external interface between syntax and discourse/pragmatics, would be more vulnerable than verb type, which is located at the internal interface between syntax and semantics.

This prediction was only partly borne out. The heritage speakers showed knowledge of the distinction between verb types and the distinction between broad and narrow focus, but not of the distinction between definite and indefinite subjects. The fact that definiteness is a vulnerable factor is in line with the Interface Hypothesis, but the fact that focus was not, contradicts it. We suggest that this unexpected result may be attributed to the more categorical nature of the distinction between broad and narrow focus in heritage speakers' input, or to the awareness of the possibility of focus-related anteposition in Dutch.

An additional finding in the present study is the overgeneralization of post-verbal subjects on part of the heritage speakers, as compared to the monolingual control group, contradicting the preference for preverbal subjects typically attested for heritage speakers of Spanish in the US. We suggest that this difference may be attributed to cross-linguistic influence from Dutch as opposed to English. Future research is necessary to corroborate the effects of cross-linguistic influence by directly comparing different dominant languages.

Acknowledgments

The research presented in this study was funded by a grant from the graduate program of the Netherlands Graduate School of Linguistics (LOT), which received the funds from the Netherlands Organisation for Scientific Research (NWO) in the context of the project "Language – from cognition to communication" (NWO project number 022.004.015). Much appreciation goes to Dirk Jan Vet and Nelson Ogliastri for their assistance in designing the experiment, and to all the participants. We would also like to thank Aafke Hulk and Suzanne Aalberse for their useful comments on this paper. Finally, we express our acknowledgements to the audience at Romance Turn 8, the anonymous reviewers, and the editors, whose comments helped make this paper clearer. Any weaknesses and errors remain entirely ours alone.

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Acquisition of backward anaphora in European Portuguese by Chinese learners

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This study investigates pronominal resolution in backward anaphora in European Portuguese and its acquisition by second language learners whose first language is Chinese. An off-line experiment was conducted to investigate what strategies were adopted by the learners. The results show that the upper-intermediate (B2) learners may be influenced by their first language and the language universal active search mechanism of Kazanina et al. (2007), while the advanced (C1) learners only adopt the latter. The findings also show that learners from both levels fail to link the backward anaphoric pronoun to an extra-contextual entity.[1]

Keywords: second language acquisition, European Portuguese, Chinese, backward anaphora, pronominal resolution

1. Introduction

It is generally recognized that there are different types of null subject languages. The Romance null subject languages, such as Italian, Spanish and European Portuguese (EP), are among the consistent null subject languages proposed by Roberts and Holmberg (2010), as the availability of empty subjects (often called *pro*, which indicates their pronominal nature) is linked to rich verbal agreement. Some Asian languages, such as Chinese and Japanese, may also allow null arguments, despite the lack of verbal agreement. These languages are described as discourse null subject

1. I am very grateful to the Chinese students from the Institute of Portuguese Language and Culture of the Faculty of Letters of the University of Lisbon (FLUL) who participated in the experiment of this study, as well as to the Portuguese participants who were attending Bachelor degree courses in FLUL. I would also like to thank the editor and the two reviewers for their useful comments and suggestions.

https://doi.org/10.1075/lald.62.10zhe

languages (Roberts & Holmberg, 2010), as the reference of their null subjects is linked to the discourse.

There may be a division of labor between null and overt subjects in consistent null subject languages, according to studies like Carminati's (2002) (for Italian) and Costa et al.'s (1998, 1999) (for EP), since the null subject is preferentially interpreted as referring to an antecedent in subject position, while an overt pronominal subject is preferentially interpreted as referring to an antecedent in other positions. This property is known as Position of Antecedent Strategy (PAS), which was proposed by Carminati (2002). Previous studies concerning anaphoric pronominal resolution in second language (L2) acquisition (e.g. Sorace & Filiaci, 2006; Rothman, 2008; Madeira et al., 2012) demonstrate that L2 learners of consistent null subject languages have difficulties in acquiring the discursive uses of null and overt pronouns in forward anaphora, confirming the Interface Hypothesis of Sorace and Filiaci (2006), which proposes that properties on the interface between syntax and discourse-pragmatics are difficult for L2 learners.

However, there is another kind of anaphora, namely backward anaphora, in which an anaphoric expression (such as *pro* or pronoun) precedes its potential antecedent. This kind of anaphora may involve more complex factors considering its processing order, and has received less attention in the literature. In this paper, we present a study on the L2 acquisition of pronominal resolution in backward anaphora of EP, a consistent null subject language, by learners whose first language (L1) is Chinese, a discourse null subject language.

Two factors may be involved in the interpretation of backward anaphora in EP, namely syntactic position and proximity, which may lead to two different interpretation strategies. The syntactic position factor implies that a strategy like the PAS of Carminati (2002) should be adopted for backward anaphora, while the proximity factor implies that a strategy like the universal active search mechanism (Kazanina et al., 2007), which requires the pronoun to encounter its antecedent as soon as possible, should be adopted. As the two strategies make the same prediction for the interpretation of null pronouns, this study will focus on the interpretation of overt pronouns, where the two strategies make different predictions.

An off-line experiment was conducted to test which strategy is favored by Chinese learners of L2 EP, as well as by native speakers of EP, concerning the interpretation of overt pronouns in a left-dislocated adverbial adjunct. The experiment also served to test if the Chinese learners show difficulties in accepting an extrasentential entity as the antecedent of the backward anaphoric pronoun.

This paper will be organized as follows: Section 2 reviews previous studies on the syntactic structure and processing of forward and backward anaphora. Section 3 proposes the objectives of the study. Section 4 describes the methodology, and presents and discusses the results. Finally, Section 5 presents the conclusion.

2. Review of previous studies

2.1 Previous studies on forward anaphora

Inspired by the Accessibility Theory of Ariel (1990, 2001), Carminati (2002) proposes the PAS, which claims that, in intra-sentential structures of Italian, the antecedent of a null pronoun is preferentially in subject position (SpecIP), while the antecedent of an overt pronoun is preferentially in non-subject positions. This hypothesis has been confirmed in many consistent null subject languages; for EP, see Brito (1991), Costa et al. (1998, 1999), Canceiro (2014, 2016), etc.

The anaphoric resolution properties related to PAS were also tested in many studies concerning the L2 acquisition of the consistent null subject languages. For example, Sorace and Filiaci (2006), Rothman (2008), Madeira et al. (2012) and Zheng (2013) demonstrate that, in Romance null subject languages, L2 learners show difficulties in acquiring the discursive uses of null and overt subjects, which confirms the Interface Hypothesis proposed by Sorace and Filiaci (2006).

The Interface Hypothesis proposes that in L2 acquisition, as well as in bilingual acquisition, heritage language acquisition, etc., while purely syntactic properties are acquirable, interface properties, for example, those aspects that involve the interface between syntax and discourse-pragmatics, are difficult, even for near-native speakers. White (2011) argues that the Interface Hypothesis should be extended also to speakers who are still in the process of L2 acquisition.

For instance, in EP, for a sentence like (1), which is adapted from Madeira et al. (2012), the native speakers prefer the co-reference reading between the embedded null subject and the matrix subject, and the disjoint reading between the embedded overt subject and the matrix subject, in accordance with PAS. Madeira et al. (2012) showed that elementary and advanced Chinese learners of L2 EP show an undetermined interpretation of the overt pronouns, as they accept either the matrix subject or the matrix object as its antecedent, though they have the same interpretation as the native speakers in the case of null subject.

(1) *A Inês*$_1$ *vive com a Ana*$_2$ *desde que pro*$_1$*/ela*$_2$ *se divorciou.*
the Inês lives with the Ana since that she $_{SE}$ divorced
'Inês lives with Ana since she got divorced.'
(adapted from Madeira et al., 2012)
(Native speakers: *pro* = *Inês*, *ela* 'she' = *Ana*; Chinese learners of L2-EP: *pro* = *Inês*, *ela* 'she' = *Inês* or *Ana*)

2.2 The properties of backward anaphora

Now we turn to backward anaphora, where there is a change in the processing order, as the embedded pronoun (null or overt) precedes its potential antecedents, since processing is always from left to right.

(2) *Quando ele chegou a casa, o João abraçou o Pedro.* (EP)
→→→→→→→→→→→→→→→→→→→→→.
Processing order
'When he arrived home, João hugged Pedro.'

Hence it may be interesting to investigate if this change in processing order influences the interpretation of the pronouns in the structure of backward anaphora, as some processing factors may affect the pronominal resolution in this case.

Firstly, I review the analysis of the syntactic structure of backward anaphora. In EP, taking a left-dislocated temporal adverbial adjunct as an example, the adverbial clause can be analyzed as a CP, where a temporal connector such as *quando* 'when' occupies the C^0 position, while the structure below C^0 consists of a finite TP.[2]

There are two types of analysis of the structure of the left-dislocated adverbial adjunct. Barss (1986), Duarte (1987) and Lasnik and Saito (1991) propose that the embedded clause in sentences like (3) is an adjunct to the TP, which undergoes movement from its original position to the left of TP.

(3) $[_{CP}$ $[_{TP}$ $[_{CP}$ $[_{C}$ *Quando* $[_{TP}$ *ele chegou a casa*]]]$_1$, $[_{TP}$ *o João chamou*
When he arrived to home the João called
o Rui $[-]_1$]]].
the Rui
'When he arrived home, João called Rui.'

Valmala (2009), on the other hand, proposes that the left-dislocated adverbial adjunct is directly inserted in the topic position in the left periphery of the sentence, which is within the CP system of Rizzi (1997).

(4) $[_{CP1}$ $[_{TopP1}$ $[_{CP2}$ $[_{C}$ *Quando* $[_{TP2}$ *ele chegou a casa*]]], $[_{TP1}$ *o João*
when he arrived to home the João
chamou o Rui]]].
called the Rui
'When he arrived home, João called Rui.'

2. It should be noted that Móia (2001) considers the temporal connector *quando* 'when' in EP as a relative pronoun (which functions as the head of a free relative), which is equivalent to 'at the moment in which'.

Nevertheless, in neither analysis does the embedded pronoun c-command the matrix subject. As a result, the co-reference reading between the embedded pronoun and the matrix subject does not violate the binding principles, as there is no c-command relationship between the two constituents. As a consequence, the co-reference resolution of the embedded pronoun in backward anaphora is only a pragmatic matter, but it is not constrained by syntax.

Based on the structure of (4) and using an off-line task, Canceiro (2014, 2016) proposes that, in EP, an embedded null pronoun in backward anaphora refers to the matrix subject, while an embedded overt pronoun may refer to either the matrix subject or to another entity.

(5) a. *Uma vez que* $[-]_{1,*2}$ *sai tarde, o filho da* $Maria_1$
one time that leaves late the son of+the Maria
chega sempre atrasado.
comes always late
'Since (he) leaves late, Maria's son always comes late.'

b. *Uma vez que* $ele_{1,2}$ *sai tarde, o filho da* $Maria_1$
one time that he leaves late the son of+the Maria
chega sempre atrasado.
comes always late
'Since he leaves late, Maria's son always comes late.'

(adapted from Canceiro, 2014)

The examples shown in Canceiro (2014, 2016) do not contain a matrix complement as an interpretative possibility for the embedded pronoun. When the matrix object is also included as an interpretative possibility, Lobo and Silva (2016) and Lobo et al. (2017) have shown that the matrix object is slightly preferred by the native EP speakers (around 60% of acceptance).[3] In Italian, on the other hand, according to Sorace and Filiaci (2006) and Serratrice (2007), native speakers prefer to interpret the embedded overt pronoun as referring to a third entity which is not referred in the sentence, instead of to an argument within the matrix clause, though, for the embedded null pronoun, they also prefer the matrix subject as its antecedent.[4]

3. However, these two studies do not count an unmentioned referent as an interpretative possibility for the embedded pronoun.

4. It should be noticed that these two studies of Italian allow three interpretative possibilities for the embedded pronoun, including an extralinguistic referent.

(6) *Mentre lui*$_3$ *versa il vino nel bicchiere, il cliente*$_1$ *paga il conto al cameriere*$_2$.
while he pours the wine in+the glass the client pays the bill to+the waiter
'While he pours wine in the glass, the client pays the bill to the waiter.'
(Serratrice, 2007)

Chinese exhibits different properties from EP in the interpretation of overt pronouns in cataphoric contexts. Zhao (2014) proposes that Chinese does not permit co-reference between the overt pronoun and the matrix subject, and argues that this restriction is syntactic in nature. Zhao (2014) argues that in Chinese there may exist a c-command relation between the embedded pronoun and the matrix subject. In (7), the left-dislocated temporal adverbial adjunct is analyzed as a head-final CP, where the temporal connector *de shihou* 'when' appears in the C position of the subordinate clause.

(7) [$_{CP}$ [$_{TP}$ *Ta*$_1$ *chi wanfan*] [$_C$ *de shihou*]], *Zhangsan*$_2$ *dai zhe yi ding maozi*.
he eat dinner DE when Zhangsan wear PRG one CL hat
'When he was having dinner, Zhangsan was wearing a hat.' (Zhao, 2014)

The temporal adverbial adjunct (CP) c-commands the matrix subject, while the embedded pronoun *ta* 'he' is located in a lower structure, but according to the cyclic c-command of Huang (1982), *ta* 'he' may cyclically c-command the matrix subject. Cyclic c-command is defined as follows:

(8) A cyclic c-commands B if and only if:
a. A c-commands B, or
b. If C is the minimal cyclic node (NP or S′) that dominates A but is not immediately dominated by another cyclic node, then C c-commands B.
(Huang, 1982, p. 394)

S′ in Huang (1982) is considered as a CP in the Minimalist Program. Thus, in (7), the adjunct CP works as a cyclic node that c-commands the matrix subject *Zhangsan*. Zhao (2014) proposes that the embedded *ta* 'he' is dominated by the CP, which is not immediately dominated by another cyclic node. As a result, the structure of (7) meets the condition of (8b), which implies that the embedded pronoun *ta* 'he' may cyclically c-command the matrix subject *Zhangsan*. In this way, the co-referential reading between these two elements violates the Principle C of the Binding Theory.[5]

5. However, if the embedded subject is null, then it is possible to obtain the co-referential reading between the embedded null subject and the matrix subject. Zhao (2014) applies another

2.3 The processing of backward anaphora

The previous section showed that the interpretation of the embedded pronoun in backward anaphora structures of EP is not constraint by syntactic principles, meaning that it may refer to either the matrix subject or to another constituent. Considering the processing order, it should be reasonable to question if the PAS of forward anaphora may also play an important role for backward anaphora, where the processing may be more complex than that in forward anaphora, because the cataphoric expression precedes its potential antecedents. As processing is always incremental from left to right, the linear order between the cataphoric expression and its potential antecedents may increase the cost of processing. It has also been claimed that the search of antecedent for the cataphoric pronoun is activated right after the pronoun is processed (Kazanina, 2005; Kazanina et al., 2007). Thus, it is natural to doubt if the processing factors that determine the pronominal resolution in forward anaphora can still determine backward anaphora resolution.

Kazanina et al. (2007) propose that the processing of backward anaphora is constrained by the language universal active search mechanism, which is very similar to the processing of Wh-movement, where the strategy of filler-gap is applied. For example, for a language with Wh-movement, when the parser encounters a Wh-constituent, a mechanism is activated to search for a gap, which is the base position of the Wh-constituent. In this process, due to memory limitations, the parser will preferentially choose the first potential gap position as the initial position of the Wh-constituent. As a result, it is predictable that in (9), reading 1 is preferred over reading 2, since the gap in 1 is closer to the Wh-constituent than that of 2, which indicates that the Wh-constituent prefers to take scope over the matrix clause, rather than over the subordinate clause. In other words, readers may prefer to interpret the sentence as 'when did John say that sentence,' rather than 'when did Peter buy the car, according to what John had said.'

(9) *When did John say [–]$_1$ that Peter bought the car [–]$_2$?*

Hence Kazanina et al. (2007) consider backward anaphora resolution to be similar to Wh-interpretation in (9). In the case of left-dislocated adverbial adjuncts, the parser first encounters the subordinate pronoun, which is a referentially dependent form. Then the same mechanism as in (9) will be activated, as the parser tries to find the closest nominal element as the antecedent of the embedded pronoun, because of memory limitations. A self-paced reading test confirms this proposal, see (10).

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mechanism to explain this phenomenon, claiming, in this case, that the null subject is in fact a Ø topic, which was initially proposed by Zhao (2012).

(10) a. *Because last semester while she was taking classes full-time Kathryn was working two jobs to pay the bills, Russell never got to see her.*
b. *Because last semester while she was taking classes full-time Russell was working two jobs to pay the bills, Erica never got to see her.*
(adapted from Kazanina et al., 2007, p. 390)

The participants (native speakers of English) read sentences like (10a) and (10b), where a pronoun functions as the subject of the subordinate clause, while there are two names (distinguished by gender) which function as the subjects of the larger subordinate clause and of the matrix clause, respectively. It has been found that the reading time of the first name (which is closer to the pronoun) is increased when there is a mismatch of gender between the pronoun and the name (10b). These results reveal that the readers prefer the co-referential interpretation between the cataphoric pronoun and the first nominal element (which is the closest) coming after it.

Although Kazanina et al. (2007) only investigate a language without null subjects (English), their proposal may be extended to null subject languages, as the embedded pronoun in dislocated adverbial adjuncts, either null or overt, is referentially dependent, and must find its antecedent as soon as possible. Hence, according to this proposal, in null subject languages, even the overt cataphoric pronoun should choose the matrix subject as its antecedent, which is against the PAS.

In fact, the universal active search mechanism of Kazanina et al. (2007) predicts that the key factor for backward anaphora is the proximity between the pronoun and its antecedent. A similar proposal, namely the active parser proposal of Sorace and Filiaci (2006), based on Kazanina (2005), also predicts that second language learners of Italian tend to accept the co-reference reading between the embedded overt pronoun and the matrix subject in backward anaphora. However, the native speakers of Italian in Sorace and Filiaci's study do not show this preference, which is also corroborated by Serratrice (2007), see (6).

The results of Sorace and Filiaci (2006) and Serratrice (2007) seem to illustrate that cataphoric resolution in Italian continues to obeys the PAS. In fact, the PAS implies that the decisive factor for anaphoric resolution is the syntactic position of the antecedents. If this factor also determines backward anaphoric pronominal resolution, then the interpretation of the cataphoric pronouns should also be related to certain syntactic positions, with the null pronoun in cataphora also preferring an antecedent in subject position, while the overt pronoun selects an antecedent in other positions.

As for EP, however, Canceiro (2014, 2016) proves that only the null pronoun shows a preference for the matrix subject, while the overt pronoun does not present any preference for a constituent in a certain syntactic position. Lobo and Silva (2016) and Lobo et al. (2017) tested different structures (with both the matrix subject and object as interpretative possibilities for the pronoun) from those in

Canceiro (2014, 2016), and the results show that the object antecedent receives a slightly higher preference than the subject antecedent, concerning the interpretation of overt cataphoric pronoun.

3. The objectives of the study

The present study aims to investigate how Chinese learners of L2 EP interpret overt pronouns in backward anaphora structures of EP in left-dislocated temporal adverbial adjuncts.

Two proposals which may lead to two different strategies will be discussed and tested. Strategy 1 is based on the PAS, and it assumes that the main factor to determine the backward anaphoric resolution is the syntactic position of the antecedent. This strategy predicts that the overt pronoun in left-dislocated subordinate clauses should be disjoint from the matrix subject. Strategy 2 is based on the language universal active search mechanism of Kazanina et al. (2007), according to which the main factor to determine the backward anaphoric resolution is the proximity between the cataphoric expression and its potential antecedent. This strategy predicts that the embedded overt pronoun should choose the matrix subject as its antecedent.

Previous studies concerning the Interface Hypothesis demonstrate that L2 speakers of Italian (Sorace & Filiaci, 2006) and bilingual speakers of Italian and English (Serratrice 2007) prefer the matrix subject as the antecedent of an embedded overt pronoun in the left-dislocated adverbial adjunct, which is in contrast to the interpretation of the (monolingual) native speakers.[6] Sorace and Filiaci (2006) argue that the non-native interpretation is due to the increased processing cost in backward anaphora, as the pronoun precedes its antecedent. They then propose an active parser strategy (see Section 2.3), which is similar to the universal active search mechanism of Kazanina et al. (2007), according to which the referentially-dependent pronoun should find its antecedent as soon as possible.

It should be noted that the interpretation of backward anaphora for monolingual speakers of EP may be different from that of Italian, as Canceiro (2014, 2016) has already shown that L1 EP speakers may not present a clear interpretative preference for overt pronouns. However, her data only concerns sentences with one potential antecedent (the matrix subject). Similar studies like Lobo and Silva (2016) and Lobo et al. (2017) tested sentences with matrix subject and object, but do not allow the participant to choose an extralinguistic entity as the antecedent of the cataphoric pronoun. So, the first objective of this study is to investigate how

6. Belletti et al. (2007) show that the near-native Italian speakers do not perform a dominant preference for the matrix subject, but their percentage for this interpretation (51%) is still higher than that of the native speakers (20%).

native speakers of EP interpret the pronouns in backward anaphora, considering three potential interpretative possibilities (matrix subject, matrix object and an extralinguistic entity), to find out whether there are any differences with respect to the previous studies.

The second and main objective of this study is to investigate how Chinese learners of L2 EP interpret the embedded pronouns in the left-dislocated temporal adverbial adjunct in EP. As discussed above, there are two factors that may determine the resolution of backward anaphora, the syntactic position and the proximity of the antecedent, corresponding respectively to strategies 1 and 2 mentioned above. This study seeks to understand which factor determines the interpretation of L2 learners.

On the one hand, previous studies such as Sorace and Filiaci's (2006) show that it is difficult for learners of L2 Italian to master properties related to PAS (our strategy 1), so it is natural to assume that Chinese learners may adopt strategy 2, especially when considering that the active search mechanism of Kazanina et al. (2007) is a universal strategy, meaning that it is easier for L2 learners.

However, it should also be kept in mind that Chinese learners may transfer some properties from their L1 to the L2. As it is argued in the previous section, the temporal adverbial adjunct in Chinese may preclude the co-referential reading between the embedded pronoun and the matrix subject due to a syntactic factor, namely cyclic c-command, which is specific to Chinese, as Zhao (2014) proposes that there is a parameter concerning the possibility of a D head to have a [+cyclic c-command] feature, which separates Chinese from other languages. If L2 learners transfer this syntactic property to the L2, then they should reject the co-referential reading in EP. One of our goals in this study will be to verify whether this prediction is actually confirmed.

4. The experimental study

4.1 Methods

4.1.1 *Participants*

The experiment was administered to three groups of participants: two groups of Chinese learners and one control group of native speakers of EP. The Chinese learners were divided into two levels, advanced (C1) and upper intermediate (B2).[7] The B2 group consists of 19 participants (age range: 20–44, mean = 22.89). The C1 group is composed of 12 participants (aged range: 19–24, mean = 21.58). All the Chinese participants were attending the Portuguese Language and Culture course in

7. The learners' proficiency levels are described by the Common European Framework of Reference for Languages.

the Faculty of Letters of the University of Lisbon (FLUL) and their proficiency level in Portuguese was determined by a placement test administered by the Institute of Portuguese Culture and Language of FLUL before their course. The group of native speakers of EP included 19 participants (age range: 19–34, mean = 21.84). All the Portuguese participants were attending Bachelor degree courses in FLUL.

4.1.2 *Materials and procedure*

An off-line preference judgment task was administered in EP, in order to investigate how native speakers and Chinese learners of L2 EP interpret the overt pronoun in backward anaphora. As shown in (11), the test sentence always contains a left-dislocated adverbial adjunct, with an overt pronoun as its subject, while the matrix clause contains a subject and an object. After reading the test sentence, the participants answered a question about the interpretation of the sentence, by choosing the antecedent of the embedded overt pronoun among three alternatives: the matrix subject, the matrix object and a previously unmentioned referent.

(11) *Quando ela acabou o trabalho, a Joana abraçou a Ana.* 'When she finished the work, Joana hugged Ana.'
Quem é que acabou o trabalho? 'Who finished the work?'
A. *a Joana* 'Joana' B. *a Ana* 'Ana' C. *uma outra pessoa* 'another person'

Referents are matched for gender in each experimental item, which serves to test if the participants prefer the matrix subject, the matrix object or another entity as the antecedent of the embedded pronoun.

There are 16 test items in this experiment, plus 32 fillers, with 48 items in total. 8 test items use the masculine pronoun, while the other 8 test items use the feminine pronoun.[8] The participants were only allowed to choose one option for each question; if they thought that two or more options were available, they were requested to choose the one that fit the interpretation best. This setup for the experiment is triggered by the following concerns: if the interpretation of the structures in question is not constrained by syntactic principles, the participants are likely to prefer one interpretation but may also accept one or both of the other two. Had they been allowed to choose more than one option, it would be impossible to know which of the three is their preferred answer.[9]

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8. The full set of the testing items was provided in the appendix of the paper.

9. Some languages may not have a preferred interpretation in similar situations. Just as Okuma (2012) pointed out, for forward anaphoric structures in Japanese, the native speakers do not have a preference for the interpretation of overt pronouns, since they choose all of the possible interpretations at some point. In this sense, if EP does not show a preferred interpretation for the cataphoric structures with overt pronoun, the participants of the control group in the current study are expected to fluctuate between the three interpretations.

4.2 The results of the experiment

The results are shown in Figure 1.

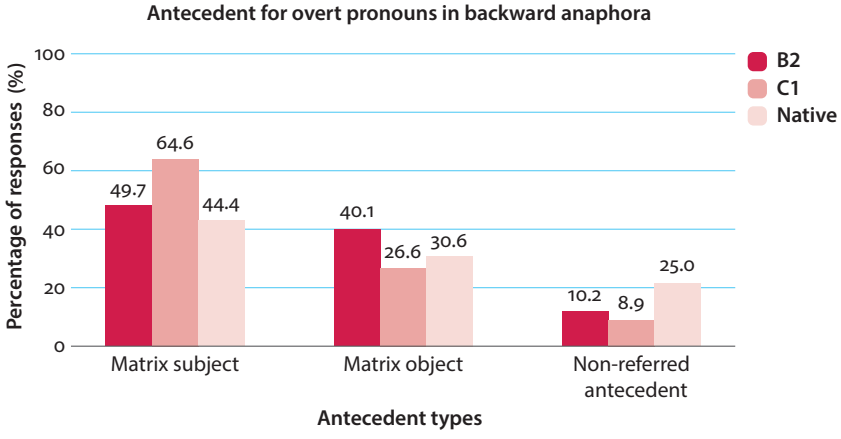

Figure 1. Interpretation of overt pronoun in backward anaphora in EP by native speakers and L2 learners

Let us first consider the group of native EP speakers, who fluctuate between the three interpretations, with the matrix subject having the highest acceptance percentage (44.4%). However, the acceptance percentages for matrix object and extralinguistic referent also reach 30.6% and 25% respectively. The results indicate that all three interpretations are available for the native speakers of EP, though the subject antecedent was slightly favored.[10]

As for the B2 level learners, they fluctuated between the subject antecedent (49.7%) and the object antecedent (40.1%), but rarely chose the extralinguistic referent (only 10.2%). These results reveal that the B2 level learners do not prefer an unmentioned antecedent, but do not show a clear preference for the matrix subject and the matrix object.

Concerning the C1 level learners, they prefer the subject antecedent (64.6%), while their acceptance of the object antecedent and an extralinguistic referent is relatively lower (with 26.6% and 8.9% respectively). These results prove that the C1 learners have a clear preference for the subject antecedent, which is similar to that

10. It should be noted that there is a difference between EP and Italian, as the latter clearly prefers an extralinguistic referent (see Sorace & Filiaci, 2006; Serratrice, 2007). However, studies like Sorace and Filiaci (2006) and Serratrice (2007) used a picture verification task to test Italian sentences, in contrast to the multiple choice task used in this study.

shown by the L2 Italian learners of Sorace and Filiaci (2006). Like the B2 learners, the C1 learners also rarely consider an unmentioned referent as the antecedent of the pronoun.

Three independent t-tests were conducted to compare the B2 learners and the native EP speakers concerning their acceptance of the subject antecedent, the object antecedent and the unmentioned referent respectively, taking subjects and items as independent variables. There is no significant difference between the two groups in their acceptance of the subject antecedent ($t_1(36) = 0.72$, $p = 0.48$, $t_2(30) = 0.80$, $p = 0.43$) and the object antecedent ($t_1(36) = 1.4$, $p = 0.17$, $t_2(30) = 1.25$, $p = 0.22$). However, there is a difference in the case of the unmentioned referent, where the native speakers were significantly more likely to accept this interpretation than the B2 learners ($t_1(36) = -2.15$, $p = 0.04$, $t_2(30) = -3.09$, $p < 0.01$). The same t-tests were conducted to compare the C1 learners and the native speakers, revealing that the learners accept the subject antecedent significantly more than the native speakers ($t_1(29) = 2.78$, $p = 0.01$, $t_2(30) = 2.69$, $p = 0.01$). Moreover, the native speakers accept more extralinguistic referents than the learners (marginal by subject and significant by item) ($t_1(29) = -1.99$, $p = 0.056$, $t_2(30) = -3.36$, $p < 0.01$). The main difference between the native speakers and the learners (from both levels) is the fact that the native speakers accept the extralinguistic referent, while the learners rarely have this interpretation (which was proved by a one-way ANOVA test: $F_1(2, 47) = 3.417$, $p = 0.041$; $F_2(2, 45) = 8.872$, $p = 0.01$). Finally, comparing the two groups of learners, the C1 learners accept more subject antecedents than the B2 learners: the difference is marginal by subject and significant by item ($t_1(29) = -1.91$, $p = 0.066$, $t_2(30) = -2.18$, $p = 0.04$). Learners from both groups show a marginal acceptance of the unmentioned referent.

4.3 Discussion

This experiment served to test which of the strategies described in Section 3 were used by the native speakers of EP and by the Chinese learners of L2 EP. If the participants chose strategy 1, which corresponds to the PAS, then they would not select the matrix subject as the antecedent of the embedded cataphoric pronoun. If they chose strategy 2, which is supported by the active search mechanism, then they would select the matrix subject as the antecedent of the embedded pronoun.

Firstly, the results reveal that the native speakers of EP fluctuate between the subject and non-subject antecedents, and generally speaking, all three interpretations are available, despite the fact that the subject antecedent has the highest acceptance. This result suggests that there is no strongly preferred interpretation in the structure in question in EP, as none of the three interpretations yields an

overwhelming preference. It is possible that the fluctuation in interpretation found in EP is caused by a combined effect of the syntactic position of the antecedent (which is linked to its salience) and the proximity between the antecedent and the cataphoric expression (which originates in the active search mechanism). The interaction between the two factors can be explained in the following way: on the one hand, as the overt pronoun in EP is more informative than the null pronoun, it should choose a less salient antecedent, namely a non-subject; on the other hand, the active search mechanism requires the parser to search for the nearest antecedent, which is the matrix subject. These two factors predict different interpretations, which lead to the fluctuation in interpretation displayed by the native speakers of EP, meaning that they may choose the two strategies (described in Section 3) alternately when facing the backward pronominal resolution. It is also worth noting that the behavior of EP native speakers is different from that of native speakers of Italian, who clearly prefer an antecedent outside the sentence, meaning that strategy 2 is not adopted in Italian.

Regarding the B2 level learners, they also fluctuate between the subject and the object antecedent, while their acceptance of the subject antecedent is quite similar to that of the native speakers (49.7% vs. 44.4%). As a result, it is natural to consider that there is also a combined effect of the salience of the antecedent and its proximity for the learners, who, as a consequence, fluctuate between the subject antecedent (which is closer) and the object antecedent (which is less salient), just as the native speakers do. The only difference between the B2 learners and the native speakers of EP is the fact that the learners do not accept an unmentioned referent as much.

The C1 learners show a different interpretation from that of the B2 learners, as the former have a clear preference for the subject antecedent (64.6%). This indicates that they respect strategy 2, namely the active search mechanism of Kazanina et al. (2007), which predicts that the first nominal constituent of the matrix clause, (the closest to the embedded pronoun) should be its antecedent. Comparing the behaviors of the B2 and C1 learners, it is clear that the interpretative preferences of the B2 learners are closer to those of the native speakers of EP. It is obvious that the C1 learners do not transfer the cyclic c-command from Chinese to EP. As a result, it is reasonable to ask why it is the more advanced learners (C1), and not the less advanced learners (B2), that display a performance which deviates further from that of the native speakers.

In fact, the similarity between the B2 learners and the native speakers may have different causes. The B2 learners may show a similar performance to the C1 learners, by adopting strategy 2, namely the active search mechanism. However, they show a difference regarding their dependence on their L1. As for the B2 learners, they still do not yet master their L2 and are more likely to be influenced by their L1, which preclude the co-referent reading between the matrix subject and the

overt cataphoric pronoun, due to the cyclic c-command explained in Section 2. As a result, they may prefer the matrix subject as the antecedent of the cataphoric pronoun, but this preference is reduced through the influence of their L1 grammar. As a consequence, there is a combined effect of strategy 2 and the L1 Chinese, which leads to a similar interpretation to that of the native speakers of EP. As for the C1 learners, they may not depend so much on their L1, thus they do not transfer the properties related to cyclic c-command. However, although they are at a more advanced developmental stage, their L2 still differs significantly from that of the native speakers. For example, their interpretative preference in the L2 may be more easily influenced by the active search mechanism, which is considered as universal by Kazanina et al. (2007). As a result, the C1 learners prefer the subject antecedent in backward anaphora.

There is another finding from the learners of both groups, as they do not prefer an unmentioned referent as the antecedent of the cataphoric pronoun. In other words, they can only establish anaphoric relations between the constituents which are referred in the utterance, but fail to link the pronouns to an extralinguistic referent. This phenomenon may be explained by the Interface Hypothesis, as the search for an antecedent which is not referred in the sentence involves the interaction between a given sentence and a presupposed but unmentioned context, which proves to be costly for the L2 learners to interpret, as the unmentioned context is related to the discourse-pragmatic information, which interferes with the syntax. A similar result is found in Zhao (2012), who demonstrates that the English learners of L2 Chinese also have difficulty in accepting an antecedent which is not mentioned in the sentence for the forward anaphoric pronouns in Chinese.

5. Conclusions

This study made an investigation of the acquisition of pronominal resolution in backward anaphora by Chinese learners of L2 EP. An off-line experiment revealed that monolingual EP speakers display different interpretations, compared to Italian speakers, concerning the interpretation of the embedded overt pronoun in left-dislocated temporal adverbial adjuncts, as they accept both subjects and non-subjects as the antecedent of the pronoun. The fluctuation between the subject and the non-subject antecedents of the native EP speakers may be influenced by a combined effect of two factors, namely the syntactic position (related to salience) and the proximity of the antecedent. Thus, they may use the two strategies (PAS and active search mechanism) related to the two factors alternately, resulting in similar acceptance percentages for the three possible interpretations. Chinese learners, on the other hand, showed different interpretations from the native speakers. Firstly,

learners from both proficiency groups did not show a preference for an extralinguistic referent, which indicates that they have difficulties making a link between the cataphoric pronoun and an unmentioned referent. This phenomenon may be related to the Interface Hypothesis. Secondly, although the B2 learners seem to display a similar performance to that of the native speakers of EP, as they also fluctuate between the subject antecedent and the object antecedent, the C1 learners are only influenced by the proximity of the antecedent, relying on the active search mechanism and easily accepting the co-referential reading between the overt cataphoric pronoun and the matrix subject.

It would thus be interesting to investigate why it is the more advanced learners, but not the intermediate ones, that differ more widely from the native speakers in their interpretation. One explanation is to suppose that the transfer of the syntactic property (namely the cyclic c-command) only takes place in the earlier stages, and is therefore still active for the B2 learners, so they can transfer their interpretation from their first language, which does not allow the co-referential reading between the overt cataphoric pronoun and the matrix subject. Meanwhile, they are also influenced by the active search mechanism, which predicts the opposite interpretation. The combined effect of the two factors mentioned above results in a similar interpretation to that of the EP native speakers. The C1 learners may not transfer the cyclic c-command from their L1 and only be influenced by the active search mechanism, so they show a different interpretation from that of the B2 learners.

The experimental task in this study was off-line; future studies should test the same conditions using on-line methods, in order to investigate the real-time processing of the L2 learners, as well as that of the native speakers.

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Appendix

The testing items of the experiment

(1) *Quando ele voltou ao país, o João abracou o Nuno.*
when he returned to+the country the João hugged the Nuno
'When he returned to his country, João hugged Nuno.'
Quem é que voltou ao país? 'Who returned to his country?'
A. *o Nuno* 'Nuno' B. *o João* 'João' C. *uma outra pessoa* 'another person'

(2) *Quando ele parou o carro, o Paulo cumprimentou o Pedro.*
when he stopped the car the Paulo greeted the Pedro
'When he stopped the car, Paulo greeted Pedro.'
Quem é que parou o carro? 'Who stopped the car?'
A. *o Paulo* 'Paulo' B. *o Pedro* 'Pedro' C. *uma outra pessoa* 'another person'

(3) *Quando ele comprou o jornal, o Carlos ajudou o Marcos.*
when he bought the newspaper the Carlos helped the Marcos
'When he bought the newspaper, Carlos helped Marcos.'
Quem é que comprou o jornal? 'Who bought the newspaper?'
A. *o Marcos* 'Marcos' B. *o Carlos* 'Carlos' C. *uma outra pessoa* 'another person'

(4) *Quando ela acabou o jantar a Maria assustou a Paula.*
when she finished the dinner the Maria scared the Paula
'When she finished dinner, Maria scared Paula.'
Quem é que acabou o jantar? 'Who finished the dinner?'
A. *a Paula* 'Paula' B. *a Maria* 'Maria' C. *uma outra pessoa* 'another person'

(5) *Quando ela entregou a caixa, a Helena beijou a Susana.*
when she delivered the box, the Helena kissed the Susana
'When she handed over the box, Helena kissed Susana.'
Quem é que entregou a caixa? 'Who handed over the box?'
A. *a Helena* 'Helena' B. *a Susana* 'Susana' C. *uma outra pessoa* 'another person'

(6) *Quando ele deu a festa, o João serviu o Hugo.*
when he gave the party the João served the Hugo
'When he held the party, João served Hugo.'
Quem é que deu a festa? 'Who held the party?'
A. *o João* 'João' B. *o Hugo* 'Hugo' C. *uma outra pessoa* 'another person'

(7) *Quando ela começou as férias, a Rita visitou a Sara.*
when she started the holidays the Rita visited the Sara
'When she started the holidays, Rita visited Sara.'
Quem é que começou as férias? 'Who started the holidays?'
A. *a Rita* 'Rita' B. *a Sara* 'Sara' C. *uma outra pessoa* 'another person'

(8) *Quando ela organizou a reunião, a Maria conheceu a Laura.*
when she organized the meeting the Maria knew the Laura
'When she organized the meeting, Maria met Laura.'
Quem é que organizou a reunião? 'Who organized the meeting?'
A. *a Laura* 'Laura' B. *a Maria* 'Maria' C. *uma outra pessoa* 'another person'

(9) *Quando ela fez o trabalho, a Joana enganou a Maria.*
when she did the work the Joana misled the Maria
'When she did the work, Joana misled Maria.'
Quem é que fez o trabalho? 'Who did the work?'
A. *a Joana* 'Joana' B. *a Maria* 'Maria' C. *uma outra pessoa* 'another person'

(10) *Quando ele saiu da escola, o Diogo empurrou o Paulo.*
when he left from+the school the Diogo pushed the Paulo
'When he left the school, Diogo pushed Paulo.'
Quem é que saiu da escola? 'Who left the school?'
A. *o Paulo* 'Paulo' B. *o Diogo* 'Diogo' C. *uma outra pessoa* 'another person'

(11) *Quando ela terminou o curso, a Sara procurou a Helena.*
when she finished the course the Sara searched the Helena
'When she finished the course, Sara looked for Helena.'
Quem é que terminou o curso? 'Who finished the course?'
A. *a Helena* 'Helena' B. *a Sara* 'Sara' C. *uma outra pessoa* 'another person'

(12) *Quando ela veio à cidade, a Joana recebeu a Paula.*
when she came to+the city the Joana received the Paula
'When she came into town, Joana welcomed Paula.'
Quem é que veio à cidade? 'Who came into town?'
A. *a Paula* 'Paula' B. *a Joana* 'Joana' C. *uma outra pessoa* 'another person'

(13) *Quando ele acabou a viagem, o João empregou o Hugo.*
when he finished the trip the João hired the Hugo
'When he finished the trip, João hired Hugo.'
Quem é que acabou a viagem? 'Who finished the trip?'
A. *o João* 'João' B. *o Hugo* 'Hugo' C. *uma outra pessoa* 'another person'

(14) *Quando ela chego ao estádio, a Susana chamou a Helena.*
when she arrived to+the stadium the Susana called the Helena
'When she arrived to the stadium, Susana called Helena.'
Quem é que chegou ao estádio? 'Who arrived to the stadium?'
A. *a Helena* 'Helena' B. *a Susana* 'Susana' C. *uma outra pessoa* 'another person'

(15) *Quando ele terminou a reunião, o Tiago recolheu o Bruno.*
when he finished the meeting the Tiago picked the Bruno
'When he finished the meeting, Tiago picked up Bruno.'
Quem é que terminou a reunião? 'Who finished the meeting?'
A. *o Tiago* 'Tiago' B. *o Bruno* 'Bruno' C. *uma outra pessoa* 'another person'

(16) *Quando ela despiu o casaco, a Rita atendeu a Sara.*
when she undress the coat the Rita attended the Sara
'When she took off her coat, Rita served Sara.'
Quem é que despiu o casaco? 'Who took off her coat?'
A. *a Rita* 'Rita' B. *a Sara* 'Sara' C. *uma outra pessoa* 'another person'

Sentence repetition and language impairment in French-speaking children with ASD

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This study investigates formal language abilities in French-speaking children with Autism Spectrum Disorder (ASD). We report on the usefulness of the LITMUS-Sentence-Repetition-French task in distinguishing children with impaired language (ASD-LI) from children with normal language (ASD-LN). We examined complexity of syntactic computation, to determine whether children with ASD-LI behave analogously to children with SLI. Results showed that the ASD-LI group performed like the SLI group, while the ASD-LN group performed like the TD group. Despite the existence of a link between nonverbal IQ (NVIQ) and performance on SR, this correlation was not linear, due to the presence of children with each of the four formal language ability/NVIQ profiles, indicating the possible independence of formal language from nonverbal intelligence.

Keywords: Autism Spectrum Disorder (ASD), formal language, sentence repetition, cognitive profile and NVIQ, autism severity, Specific Language Impairment (SLI)

1. Introduction

This study addresses the formal aspects of language in children with Autism Spectrum Disorder (ASD), following the recent trend that has aimed at filling this shortcoming in the literature on language and autism (Durrleman & Zufferey, 2009, 2013; Durrleman et al., 2016, 2017; Groen et al., 2008; Janke & Perovic, 2015; Prévost et al., 2017; Riches et al., 2016; Schaeffer, 2016, 2017a, 2017b; Terzi et al., 2013; Tuller et al., 2017), which has predominantly concentrated on the

https://doi.org/10.1075/lald.62.11sil

universal pragmatic deficits in this disorder (Baron-Cohen, 1988; Boucher, 2003; Tager-Flusberg, 1996). The nature of linguistic abilities in children with ASD shows great variation from one individual to another, ranging from the absence of verbal ability or little functional communication to relatively well-developed syntactic capabilities and functional speech (Klinger et al., 2003; Tek et al., 2014). Because of the large variation in linguistic abilities, there is very little consensus among researchers about which aspects of formal language are impaired or not in children with this condition (Eigsti, Bennetto, & Dadlani, 2007; Eigsti et al., 2011; Tager-Flusberg et al., 2009).

In the last decade, there has been renewed interest in linguistic functioning in ASD and in the fact that some children display a language profile that is similar to that of children with Specific Language Impairment (SLI), which is, by definition, independent from any kind of intellectual disability, sensory impairment or neurological dysfunctions (Tager-Flusberg, 2006; Loucas et al., 2008; Tomblin, 2011, a.o.). These two conditions appear to share, for some individuals, analogous shortcomings in formal language such as grammatical marking of tense, 3rd person *-s* and past *-ed* in English (Modyanova, Perovic, & Wexler, 2017; Roberts, Rice, & Tager-Flusberg, 2004), pronominal clitics (Prévost & Tuller, 2016; Durrleman & Delage, 2016) and complex constructions, e.g. relative clauses (Riches et al., 2010) and wh-questions (Zebib et al., 2013; Durrleman et al., 2016; Prévost et al., 2017). However, since for children with ASD formal language impairment is one among other deficits, one question that arises is if extra-linguistic factors, notably low nonverbal abilities and severity of autism symptoms, may have an effect on language functioning.

It is known that nonverbal abilities seem to be a primary factor in predicting general language level in pre-school children with ASD, suggesting that nonverbal IQ (NVIQ) is a strong predictor of early linguistic outcomes (Anderson et al., 2007; Charman et al., 2005; Luyster et al., 2008; Maljaars et al., 2012; Szatmari et al., 2009; Thurm et al., 2007). However the overall picture seems less clear after age five (Anderson et al., 2007; Sigman et al., 2005), with studies ranging from those that found significant correlations between NVIQ and linguistic capabilities (Chan et al., 2005; Joseph et al., 2002; Kjelgaard & Tager-Flusberg, 2001) to those that found no such correlations (Bailey et al., 1996; Ghaziuddin & Mountain-Kimchi, 2004; Siegel et al., 1996). Moreover researchers have pointed out the existence of three main profiles combining nonverbal and language abilities in ASD: children who have normal NVIQ and normal language abilities; children who have low NVIQ and low language abilities; and a third profile in which children show discrepancies between a normal NVIQ and low language abilities, similar to the profile that defines children with SLI (Geurts & Embrechts, 2008; Lincoln et al., 1998; Siegel et al., 1996; Tomblin, 2011). However the existence of a fourth profile has also been evoked (Kjelgaard & Tager-Flusberg, 2001): children with low NVIQ

and normal language abilities. This other kind of discrepant profile has so far been much less studied, seemingly because it may be less frequent in the ASD population. However the existence of these discrepancies could be taken as an indicator that language skills can be independent of NVIQ in verbal children with autism (Anderson, 1992; Joseph et al., 2002; Scheuffgen et al., 2000).

Similarly, the relationship between language and severity of autism symptoms has not yet given rise to a complete picture in the literature: some studies have found significant negative correlations between the two measures (Charman et al., 2005; Luyster et al., 2007), while others have found no significant correlations (Lindgren et al., 2009; Loucas et al., 2008; Riches et al., 2011; Whitehouse et al., 2008).

Since very few studies have investigated the link between these two extra-linguistic factors and formal aspects of language, it remains to be seen if generalized learning disability and/or severity of autism symptoms might contribute to poor performance of children on formal aspects of language or whether these results could be caused from a specific linguistic breakdown, as is the case for children with SLI (Jakubowicz, 2005; Jakubowicz & Tuller, 2008; Prévost et al., 2010).

One way of addressing these questions consists in examining the complexity of syntactic computation and its relation to nonverbal ability and severity of autism, while limiting as much as possible the effect of pragmatics in the language assessment. It is plausible that pragmatic shortcomings have an impact on how well children perform on certain language tasks, particularly those in which the child has to take the context into account (act-out, structured-interview, narrative). Furthermore it is possible that a tighter control of the pragmatics of the task may lead to more reliable assessment of structural language in these children (see for example Prévost & Tuller, 2016). Following this path, this paper seeks to evaluate morphosyntactic outcomes in French-speaking children with ASD, through use of the French version of the LITMUS Sentence Repetition task (LITMUS-SR-French), developed for detecting SLI in monolingual and bilingual children, within COST Action IS0804.[1]

2. Background and aims: The role of sentence repetition in evaluating formal language impairment

Sentence Repetition (SR) is gaining increasing attention as a source of information about children's sentence-level abilities in clinical assessment. Specifically it has been shown to be very sensitive in identifying SLI in monolingual and bilingual

1. COST Action IS0804 (2009–2013) developed a series of tasks for Language impairment testing in multilingual settings (LITMUS); see www.bi-sli.org.

populations (Conti-Ramsden et al., 2001; de Almeida et al., 2017; Marinis & Armon-Lotem, 2015; Riches, 2012; Tuller et al., 2013 for an overview). SR is not a mere verbatim echoing of the stimulus: if adequately modeled in order to minimize the effect of child's short term memory and to include an adequate degree of syntactic complexity, it can evaluate the effects of different types of long-term linguistic knowledge on immediate recall (Lombardi & Potter, 1992; Potter & Lombardi, 1990, 1998; Slobin & Welsh, 1968). To perform this type of task, participants have to comprehend the sentence in terms of abstract grammatical system representation and then process the linguistic information using their own grammatical and memory systems (Baddeley, 2000).

While SR should reveal impairment in the domain of morphosyntax, it should be less sensitive to pragmatic deficits (Polišenská et al., 2015). The design of SR incorporates formal aspects of sentence processing (lexicon, phonology and morphosyntax), but it is less constrained by pragmatic features: sentences given as stimuli in SR tasks are only remotely linked to a pragmatic context. In other words, formal language abilities and the ability to use language in context are not densely intertwined in SR, in contrast to what is typically the case in other kinds of tasks (act-out, sentence-picture matching, a.o.). We propose therefore to use the peculiarity of this task, which narrows the possible influence of pragmatic impairment in ASD, to focus on morphosyntactic abilities, and to highlight possible similarities between children with ASD and children with SLI.

To our knowledge, only three studies have employed SR as a possible marker of syntactic deficits in ASD. Botting and Conti-Ramsden (2003) used the English Recalling Sentences subtest of the CELF-R (Semel, Wiig, & Secord, 1987), in conjunction with the Past Tense Task (PTT) and Children's Nonword Repetition, CNRep (Gathercole et al., 1994) in order to distinguish different groups within the observed clinical population. The sentence repetition task turned out to be the most accurate marker for differentiating the three groups of children with communication disorders, SLI, ASD and PLI (pragmatic language impairment). Analogously, Harper-Hill et al. (2013) detected two cluster groups of language ability (impaired and not impaired), using two of the same tasks used in the Botting and Conti-Ramsden study, CNRep and the CELF-4 Recalling Sentences subtest, in a group of 9- to 16- year-old English-speaking children with a diagnosis of ASD. Lastly, Riches et al. (2010) was the only study which included an experimental task of sentence repetition in conjunction with the Recalling Sentences of the CELF-3, in three groups of adolescents (14;4–15;3 years old): ALI (Autism and Language Impairment), SLI and TD (typically developing). The experimental task included a set of 24 sentences containing relative clauses modeled on four different configurations of increasing complexity. Consistent with previous research, sentence repetition demonstrated sensitivity as a marker of language impairment, yielding

high error rates in both clinical groups and low error rates in the typically developing participants.

All three studies identified SR tasks as very sensitive measures for detecting formal language impairment in children with ASD. However each of these studies has limitations. First of all, none of the three studies utilized a linguistically based sentence repetition task which targeted computational complexity and included a variety of different structure.[2] Recalling Sentences (CELF-4) is composed of a variety of different conditions, but it is highly memory based, since increasing sentence length plays a large role. The SR task in Riches et al. (2010) met the criterion of computational complexity, but it focused only on relative clauses, which prevents the investigation of a variety of complex constructions. Having other constructions than relatives could be useful for better distinguishing the difficulties and the errors across the computationally complex features in groups with language impairment. Moreover a more heterogeneous task is easily transferable to clinical practice since it should be less stressful for children, who should at least succeed in repeating less complex sentences. Finally these studies investigated only adolescents and high-functioning individuals, not including the entire age range relevant for the development of language abilities and giving a partial view of the ASD population, since the autism spectrum is composed of different levels of both severity and cognitive abilities.

The aim of the present study was threefold. First, we wanted to test the efficacy of the LITMUS-SR-French task in children with ASD for detecting possible formal language impairment. Second, we sought to determine whether children with ASD and impaired language (ASD-LI) perform analogously to children with SLI, and whether children with ASD and normal language (ASD-LN) perform like TD children. We expected to find significant differences for performance on more complex structures between the two groups of children with impaired language (ASD-LI and SLI) and the two groups of children with normal language (ASD-LN and TD). Third, we aimed to examine potential correlations between formal language and

2. Computational complexity in a generative linguistic theoretical framework can be measured in terms of the nature and number of operations needed for the derivation of a syntactic construction. This account suggests that children with language impairment, notably children with SLI, show a deficit in the computational system, which leads to the inconsistent use of certain grammatical operations. It has been demonstrated that "structure-dependent" relationships that can be observed in tense marking, case marking and long-distance dependencies which necessitate movement, may constitute a source of impairment for these children. The LITMUS-SR task was constructed in order to have both less complex (computationally less demanding) and more complex structures (computationally more demanding) structures. We predict that computational complexity will have a stronger effect in language impaired groups than in children who show typical linguistic development.

extra-linguistic measures in order to see whether language deficits in children with ASD are independent of their nonverbal level, as is the case for children with SLI, but also independent from the severity of autism symptoms.

3. Methods

3.1 Participants

The participants were 18 French-speaking children with a diagnosis of ASD according to the ICD-10 criteria, confirmed by the Autism Diagnostic Observation Schedule, ADOS (Lord et al., 1989) and/or the Child Autism Rating Scale, CARS (Schopler et al., 1988).[3] Participants with ASD were recruited through parent associations in Switzerland ('Autisme Genève' and 'Autisme Suisse Romande') and from the Autism Center at the Regional University Hospital Center in Tours (France). The group was composed of two girls and sixteen boys aged 7;8–10;11 (M = 9;5, SD = 11;3). All the children produced utterances of at least three words, which was the inclusionary criterion to ensure that language tests could be administrated. There was no exclusionary criterion for nonverbal ability, which was evaluated through Raven's Progressive Matrices, RPM (Raven, 1998); following the usual cut-off score (i.e. < 10th percentile), the participants included both children with and without intellectual disability. The group was further split into two subgroups: the first was composed of 10 children with ASD and impaired language (ASD-LI); the second was composed of 8 children with ASD and normal language (ASD-LN). The distinction between the two groups was made on the basis of a composite, independent language score calculated on the performance of each child on standardized measures via a task of receptive vocabulary and a task of sentence-picture matching for morphosyntactic comprehension (N-EEL, Chevrie Muller & Plaza, 2001); see Table A in the Appendix for details.

The children with ASD were compared to a group of 12 children with SLI aged 7;1–8;7 (M = 7;9, SD = 5;8) recruited in a hospital language diagnostic center in France. All of these children had a diagnosis for the so-called phonological-syntactic deficit type of SLI, and following the usual exclusionary criteria, had IQs within norms. The group was composed of eight girls and four boys. Finally, a control group of 18 typically developing (TD) French children (9 girls and 9 boys) aged

3. The total ADOS score for each child has a possible range from 1 to 10. The cut-off for a diagnosis of autism is 4. The total CARS score for each child has a possible range from 15 to 60 with 30 being the cut-off for a diagnosis of autism. Scores 30–37 indicate mild to moderate autism, while scores between 38 and 60 are characterized as severe autism.

7;1–8;4 (M = 7;8, SD = 4;9) was included. Non-parametric Mann–Whitney tests (adjusted with Bonferroni correction) revealed that children in the ASD subgroups were significantly older than children in each of the other groups (ASD-LI/SLI: $U(21) = 5$, $p = <.001$, $r = -0.79$); ASD-LN/TD: $U(25) = 14$, $p = .001$, $r = -0.64$). However on RPM there was no difference between the ASD-LN and the TD groups ($U(25) = 86$, $p = .844$) and between the ASD-LI and the SLI group ($U(21) = 25$, $p = .021$), suggesting that these two pairs were similar in mental age. Comparisons on language composite scores showed that ASD-LI had significantly lower scores than ASD-LN ($U(17) = 3$, $p = .001$, $r = -0.60$), and than SLI ($U(17) = 11$, $p = .001$, $r = -0.77$). Table 1 shows the participants' characteristics by group.

Table 1. Participant characteristics by group: Mean (SD) and minimum/maximum values

	Age (yrs; months)	**CARS (raw score)**	**RPM (percentile)**	**Language composite score (z-score)**
ASD-LI (n = 10)	9;3 (8.9)	32 (4.8)	16 (17.7)	−3.5 (2.4)
	8;1–10;6	25–42.5	5–62.5	−9.54 – −1.04
ASD-LN (n = 8)	9;3 (15)	36 (5.4)	48 (34.8)	−0.59 (0.8)
	7;8–10;11	30–45	5–95	−1.92–0.6
SLI (n = 12)	7;9 (5.8)		32 (22)	−0.99 (0.9)
	7;1–8;7		7.5[a]–90	−2.6–0.4
TD (n = 18)	7;8 (4.9)		51 (21)	
	7;1–8;4		17.5–90	

[a] One child with SLI was at percentile 7.5 on RPM, but his Perceptual Reasoning Index, PRI (WISC-IV) performance was normal.

3.2 Materials and procedure

3.2.1 *Experimental task: Sentence repetition*

LITMUS-SR-French (Prévost, Tuller, & Zebib, 2012) includes constructions known to be particularly difficult for children with SLI. It is composed of 30 sentences (five structure types with six items each) which vary in terms of syntactic complexity, e.g. embedding and syntactic movement (for a detailed explanation of the LITMUS-SR-French task, see de Almeida et al., 2017 and Fleckstein et al., 2016; see also Table B in the Appendix). Each structure type is further divided in two subtypes of less complex (monoclausal sentences, no wh-movement, and singular verb agreement) and more complex (sentences with embedding, wh-movement, and plural verb agreement) constructions. Within each structure condition, the sentences did not differ in MLU. In this sense the different levels of performance in the repetition of more versus less complex structure subtypes could not be explained by a potential

influence of memory components, but rather would highlight the importance of computational complexity. It was expected that less complex substructures should be repeated better than more complex ones.[4] The repetition cut-off rate was established at 80%, which corresponded to high levels of diagnostic accuracy for language impairment (specificity, 91.9%, and sensitivity, 94%) in de Almeida et al.'s (2017) study (obtained on monolingual TD children and children with SLI). Each participant was tested individually in a quiet room. Children were seated in front of a computer screen and instructed to listen carefully and repeat exactly what they heard. The sentences were pre-recorded by a French native speaker and presented, in pseudo-randomized order, through a PowerPoint presentation along with an interactive image, which showed the child his/her progression during the task. The sentences were played only once, unless external interruptions occurred. The experimenter was instructed to give no response-contingent feedback, but only general encouragement. Children's productions were audio-recorded with high quality microphones and then transcribed and coded. Repetitions were scored as correct or incorrect on three aspects: if they were verbatim repetitions of the stimulus sentence (Identical Repetition), if they were grammatical (Grammaticality) and if they preserved the structure targeted in the stimulus sentence (Target Structure) even in presence of other errors (substitutions or omissions). For example, the sentences repeated in (1), (2) and (3) were coded as in Table 2.

Table 2. Identical repetition, grammaticality and target structure (1 = correct; 0 = incorrect)

Repeated sentence	Identical repetition	Grammaticality	Target structure
(1)	1	1	1
(2)	0	1	0
(3)	0	0	1

(1) Input: *Les chats boivent du lait.*
The-PL cats drink-3PL some-MASC milk
(Structure: SVO present tense 3P)
Child repetition: Les chats boivent du lait.

(2) Input: *J'ai vu le chat qui a griffé la vache.*
I've seen the.MASC.SG. cat who has scratched the.FEM.SG. cow
(Structure: Subject relatives)
Child repetition: Le chat il a griffé la vache.

4. For a detailed explanation of why some constructions are considered more complex than others in French we refer to Fleckstein et al. (2016).

(3) Input: *Les* *parents* *ont* *rangé* *les* *jouets.*
The-PL parents have-3PL put+away the-PL toys
(Structure: SVO past tense 3P)
Child repetition: Les parents ont joué les jouets.

4. Results

Due to the non-normal distribution of the data (confirmed by the Shapiro–Wilk test), our analyses were conducted with non-parametric tests, with ANOVA by ranks (Kruskal–Wallis test) in order to reveal group effects, the Mann–Whitney test for inter-group comparisons and the Wilcoxon test for intra-group comparisons, associated with Spearman's rank correlations. Post-hoc t-tests included Bonferroni correction in order to avoid a type 1 error due to multiple comparisons: results were considered significant at $p < .008$. Although we will concentrate on group data, individual performance is reported in Figure 3 below.

4.1 The repetition task

We first report results on the general performance of the four groups on the SR task (see Figure 1).

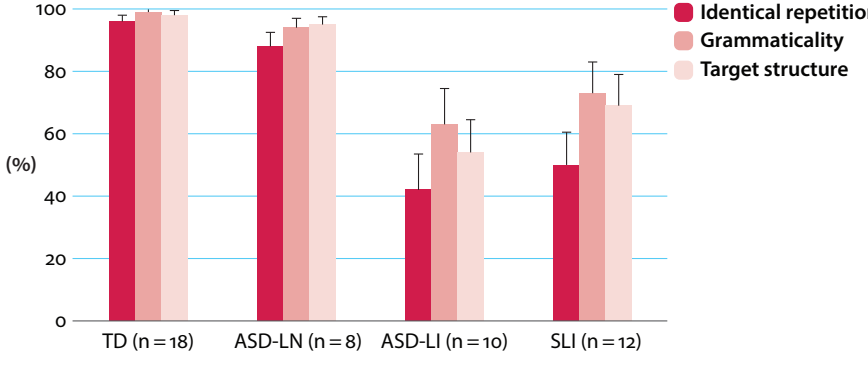

Figure 1. Mean production rate of identical repetition, grammaticality and target structure in each group

Significant between-group differences were found on identical repetition (X^2 (3, $N = 48$) = 27.817, $p = <.001$), grammaticality (X^2 (3, $N = 48$) = 25.024, $p = <.001$) and target structure (X^2 (3, $N = 48$) = 22.512, $p = <.001$). Mann–Whitney inter-group comparisons showed that the children in the ASD-LN group performed

significantly better than the children in the ASD-LI group on all three measures: identical repetition (U (17) = 1, p = <.001, r = −0.82), grammaticality (U (17) = 1, p = .003, r = −0.66), and target structure (U (17) = 1, p = <.001, r = −0.84). The comparisons between the ASD-LI and SLI groups showed no significant differences: identical repetition (U (21) = 48.5, p = .456), grammaticality (U (21) = 42.5, p = .254) and target structure (U (21) = 41, p = .228). Moreover we did not find any significant differences between the ASD-LN and TD groups on any of the three measures: identical repetition (U (26) = 30, p = .019), grammaticality (U (26) = 34.5, p = .035) and target structure (U (26) = 41, p = .090). Comparisons between the ASD-LN and SLI groups systematically showed significant differences on identical repetition (U (20) = 4, p = <.001, r = −0.76), grammaticality (U (20) = 10.5, p = .002, r = −0.65) and target structure (U (20) = 12, p = .004, r = −0.62). Finally, significant differences were found between the ASD-LI and TD groups on identical repetition (U (28) = 0, p = <.001, r = −0.82), grammaticality (U (28) = 11, p = <.001, r = −0.77) and target structure (U (28) = 0, p = <.001, r = −0.87).

For the whole ASD group, the task had a sensitivity of 100% (10/10) and a specificity of 87.5% (7/8) on the three measures, which allowed us to significantly distinguish the children with impaired language from the children with normal language. For the non-ASD participants (SLI and TD), the task had a sensitivity of 91.7% (11/12) and a specificity of 100% (18/18). In short, the general results for the performance on the whole task showed that the children in the ASD-LI group performed analogously to the children with SLI and that the children with ASD-LN performed like TD children.

A fine-grained look at performance for identical repetition on the different structures of the task confirmed these general tendencies (see Figure 2). Since there were no intra-group differences for performance on the SR measures (identical repetition, target structure and grammaticality), the following analysis will be limited to identical repetition.

Mann–Whitney intergroup comparisons (with Bonferroni correction) between the ASD-LI and ASD-LN groups showed significant differences for the more complex constructions on all five conditions: SVO present tense 3P (U (17) = 8, p = .002, r = −0.76); SVO past tense 3P (U (17) = 8, p = .003, r = −0.72); *quel* 'which' object wh-questions (U (17) = 9, p = .003, r = −0.71); object relatives (U (17) = 7.5, p = .002, r = −0.74) and finite argument clause (U (17) = 4, p = .001, r = −0.83). No differences were found for less complex constructions on four conditions: SVO present tense 3S (U (17) = 28.5, p = .192); SVO past tense 3S (U (17) = 23.5, p = .080); *qui* 'who' object wh-questions (U (17) = 20, p = .023); and subject relatives (U (17) = 17, p = .030). The only exception was the non-finite argument clause condition (a less complex structure), where a significant difference was also found (U (17) = 4.5, p = .001, r = −0.78).

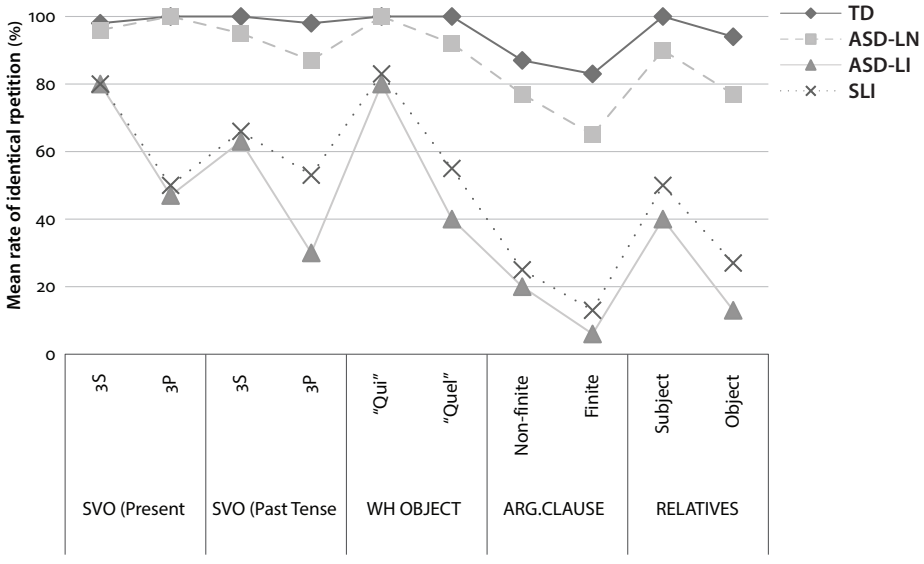

Figure 2. Group performance on identical repetition of substructures in the SR task

In contrast, no significant differences were found between the ASD-LI and SLI groups for any structure, including the more complex ones: SVO present tense 3S (U (21) = 58, p = .908) and 3P (U (21) = 57, p = .838); SVO past tense 3S (U (21) = 57.5, p = .858) and 3P (U (21) = 42.5, p = .230); object wh-questions with *qui* (U (21) = 51, p = .497) and *quel* (U (21) = 44, p = .272); argument clause non-finite (U (21) = 49.5, p = .450) and finite (U (21) = 47.5 p = .260); subject relatives (U (21) = 52, p = .583) and object relatives (U (21) = 50, p = .442). Significant differences were systematically found between the TD and ASD-LI groups and between the TD and SLI groups, on structures involving embedding (relatives and argument clauses), wh-movement, and plural verb agreement.

Moreover none of the comparisons between the ASD-LN and TD groups showed significant differences: SVO present tense 3S (U (25) = 67, p = .807) and 3P (U (25) = 72, p = 1); SVO past tense 3S (U (25) = 63, p = .134) and 3P (U (25) = 66.5, p = .509); object wh-questions with *qui* (U (25) = 72, p = 1) and *quel* (U (25) = 63, p = .134); argument clause non-finite (U (25) = 59, p = .401) and finite (U (25) = 49.5 p = .160); subject relatives (U (25) = 54, p = .031) and object relatives (U (25) = 53, p = .124).

Similar results were found for measures of target structure and grammaticality.

4.2 The impact of linguistic and extra-linguistic measures in the ASD group

Performance on the SR task was examined in relation to independent measures of standardized language assessment, namely on morphosyntactic comprehension (MorsynR), lexical comprehension (LexR) and on a language composite score calculated on these two measures (Table 3). Significant correlations emerged between the three measures of SR and all language scores.

Table 3. Correlation coefficients for independent measures of standardized language and the three measures of performance on SR task in ASD group (n = 18)

	MorsynR	LexR	Language composite score
Id Rep	r_s = .757, p = <.001	r_s = .572, p = .013	r_s = .775, p = <.001
Target	r_s = .783, p = <.001	r_s = .672, p = .002	r_s = .872, p = <.001
Gramm	r_s = .560, p = .016	r_s = .550, p = .018	r_s = .683, p = .002

The individual distribution of children in the ASD group on the basis of their language composite scores and their performance on identical repetition in the SR task corresponds to the two subgroups that were created on the basis of composite language scores in the beginning: ASD-LI (n = 10) and ASD-LN (n = 8), as shown in Figure 3.

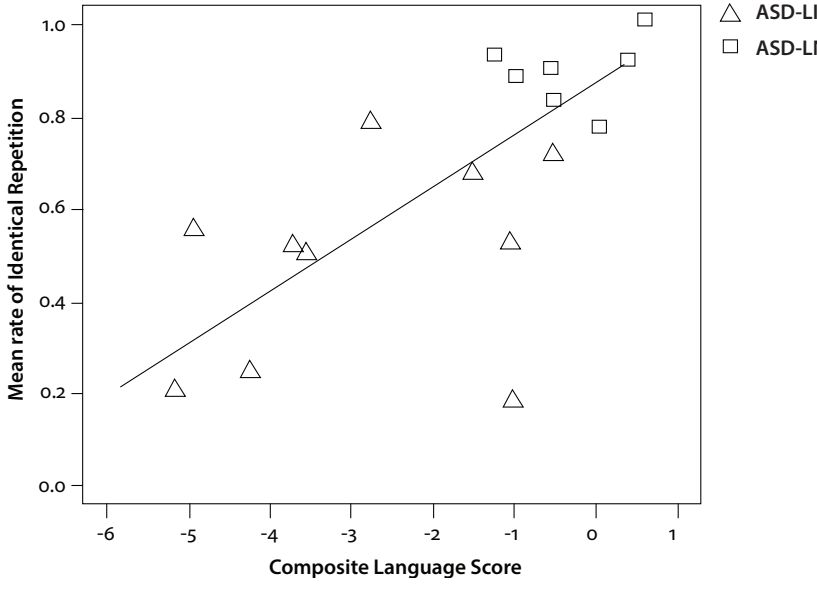

Figure 3. ASD subgroups: Comparison between composite language score and mean rate of identical repetition

We must recall that no significant differences were found between ASD-LI and ASD-LN on age ($U(17) = 39$, $p = .929$), RPM ($U(17) = 17.5$, $p = .043$) and CARS ($U(17) = 20$, $p = .123$).

In addition we ran correlational analysis between performance on the three measures of the SR task and extra-linguistic measures, namely autism severity and nonverbal cognitive level. No significant correlations were found between severity of autism and target structure ($r_s = .348$, $p = .171$) and between severity of autism and grammaticality ($r_s = .447$, $p = .072$). A significant, but positive, correlation was found between the measure of identical repetition and the CARS score ($r_s = .517$, $p = .028$) (greater autism severity linked to higher SR score). This correlation was in fact due to two CARS outliers, both of whom had scores below 30, along with very low performance on the SR task (see Table A, Appendix). When these outliers were excluded, the correlation was no longer significant ($r_s = .395$, $p = .130$).

We looked at the impact of nonverbal cognitive level in two ways: first we ran correlational analyses on the whole ASD group between measures of nonverbal ability (RPM) and the three main measures of the SR task (identical repetition, grammaticality and target structure); second we looked at participant distribution according to NVIQ, as measured by RPM and to SR, as measured by identical repetition.

The correlational analysis results depended on the particular SR measure. The correlation between performance on RPM and the mean score for identical repetition just missed significance ($r_s = .453$, $p = .059$) and no significant correlation was found with the mean score on grammaticality ($r_s = .292$, $p = .240$). However, a significant correlation was found between performance on RPM and the mean score for target structure ($r_s = .531$, $p = .023$).

Examination of individual results (see Figure 4) revealed that the distribution of the ASD group was quite heterogeneous. Importantly, four different groups of children were identified, which seemed to correspond to the four different profiles described above in Section 1: ASD-LN with normal RPM score (quadrant I), ASD-LN with low RPM score (quadrant II), ASD-LI with low RPM score (quadrant III) and ASD-LI with normal RPM score (quadrant IV).

The same distribution was found when RPM was mapped onto the rate of target structure: a non-linear correlation between the two variables. This was due to two groups of children with discrepant profiles, notably the children in quadrant II, who had a low NVIQ and normal language abilities, and the children in quadrant IV, who had normal NVIQ and low language abilities.

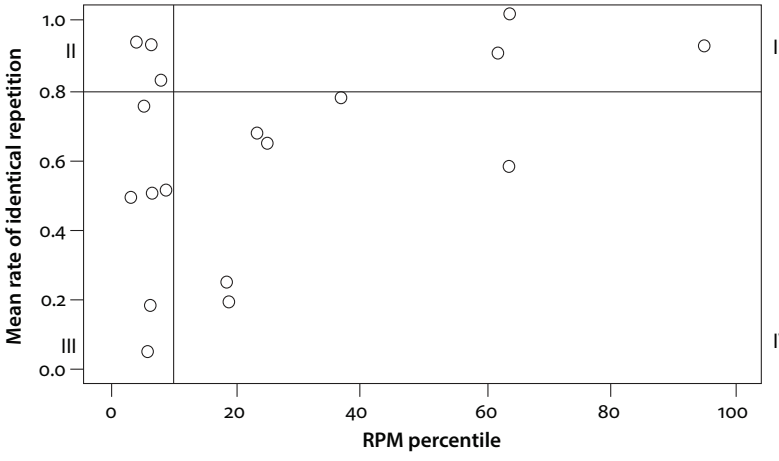

Figure 4. Distribution of the ASD group: Comparison between nonverbal cognitive level (RPM) and mean rate of identical repetition on SR

5. Discussion

Formal language abilities in children with ASD were assessed in order to determine if a subset of these children showed syntactic impairments similar to children with SLI (Tager-Flusberg, 2006; Loucas et al., 2008; Tomblin, 2011). The specific linguistic properties of LITUMS-SR were designed to narrow the possible impact of pragmatics (Polišenská et al. 2015; Prévost & Tuller, 2016) and word-span length effect (Botting & Conti-Ramsden, 2003, Harper-Hill et al., 2013) and to clearly distinguish the children with impaired language (ASD-LI) from the children with normal language (ASD-LN). The task exhibited high rates of sensitivity (100%) and specificity (87.5%), which suggested that this tool is in fact promising for the identification of language impairment not only in children with SLI (Conti-Ramsden et al., 2001; de Almeida et al., 2017; Marinis & Armon-Lotem, 2015; Riches, 2012; Tuller et al., 2013), but also among children with ASD. These results are in line with the study of Riches et al. (2010), since the profiles of the two language-impaired groups were qualitatively similar, with error rates increasing in response to syntactic complexity. However the present study gives a more fine-grained perspective on formal language abilities of children with ASD, since the larger number of structures investigated helps pinpoint difficulties and errors due to computational complexity.

Scores on the three basic SR measures (identical repetition, grammaticality and target structure) showed that children with ASD and impaired language performed

analogously to children with SLI, and children with ASD and normal language performed like TD children. Interestingly, these results were confirmed by the individual distribution of children in the ASD group. The two subgroups that were created on the basis of a composite language score on standardized tests were confirmed by the performance on identical repetition in the SR task. The correlations between two independent standardized measures for vocabulary (receptive) and morphosyntax (comprehension) and the three measures of SR performance showed that each of the former was strongly correlated to each of the latter. This is not surprising since we know that SR requires knowledge in different linguistic domains, from the regeneration of the sentence from a conceptual representation, using activated lexical entries, to the surface syntax, regenerated using normal mechanisms of sentence production (Baddeley, 2000; Lombardi & Potter, 1992; Potter & Lombardi, 1990, 1998; Slobin & Welsh, 1968). However, this hypothesis should be verified with standardized tests for morphosyntax, lexicon and phonology in both expression and comprehension. This would give us a more complete overview of child's language abilities and should contribute to high diagnostic accuracy rates even with a much larger sample size.

Close examination of identical repetition performance for each of the different structures included in the task confirmed our general expectations regarding the impact of computational complexity. We predicted that the effect of structural complexity would be stronger for the two groups of children with impaired language (ASD-LI and SLI) than for the two groups of children with unimpaired structural language (ASD-LN and TD). No significant differences were found for identical repetition, grammaticality and target structure performance on less and more complex structures between the ASD-LI and SLI groups, and between the ASD-LN and TD groups. Regarding the ASD-LN / TD similarity, despite the fact that these two groups were similar in mental age, the chronological age difference could have had an effect, since the TD group was significantly younger than the ASD-LN group. It might be the case that a chronological age match may lead to a difference, with the clinical group performing lower than the TD group (Tuller et al., 2017).

Furthermore the ASD-LI group performed significantly lower than the ASD-LN group on more complex structures (SVO present tense 3P, SVO past tense 3P, *quel* object wh-questions, object relatives), while they did not differ for the least complex ones (SVO present tense 3S, SVO past tense 3S, *qui* object wh-questions, subject relatives). The only exception was the argument clause condition, which showed significant differences for both finite (more complex) and non-finite structures (less complex). Actually, the mean rate of repetition for the argument clause condition was the lowest one in each of the four groups, indicating that this specific construction is one of the most difficult to process and replicate. Moreover, considering the

whole set of structures, we can argue that these results are not merely a word-span length effect, since the MLU of more complex and less complex conditions was controlled. For example the SVO present tense 3S and 3P conditions did not differ for MLU ($M = 6.66$). Yet, intra-group performance in each of the two language impaired groups differed significantly: ASD-LI ($Z = -2.565$, $p = .010$) and SLI ($Z = -2.251$, $p = .024$). We interpret this as indicating that computational complexity is in fact the main factor that can pinpoint children with impaired grammar and separate them from children with normal language within the ASD group, as was the case when monolingual children with SLI and TD monolingual children are examined (de Almeida et al., 2017).

The impact of extra-linguistic factors in the ASD group

Another aim of our study was determining whether extra-linguistic factors could have an impact on the linguistic performance of the whole ASD group. Regarding the impact of autism severity on formal language abilities, we found only one significant positive correlation between the measure of identical repetition and the CARS score. This means that children with more severe autism generally performed better on the SR task.[5] Taken as a general consideration this finding is surprising because it goes against previous studies which found significant negative correlations (Charman et al., 2005; Luyster et al., 2007), or no significant correlations between measures of autism severity and linguistic capabilities (Lindgren et al., 2009; Loucas et al., 2008; Riches et al., 2011; Whitehouse et al., 2008). However a closer look at individual performances allowed us to identify two outliers, who had extreme performance on both measures with a CARS score under 30 combined with very low performance on the SR task. When these two children were excluded, the correlation was no longer significant.

In order to cast new light on the impact of nonverbal abilities on grammatical competence in ASD, we looked for the existence of the four profiles that were described by Joseph et al. (2002) and Kjelgaard and Tager-Flusberg (2001). We looked especially for what Joseph et al. (2002) called discrepancies between verbal and non-verbal abilities, in other words for children with normal NVIQ and impaired language and children with low NVIQ and normal language. The general correlation between the measures of NVIQ and performance for identical repetition (and target structure) at the SR task had a certain tendency toward significance, even if it was quite distant from the strong correlation found in Joseph et al. (2002) and

5. It could be argued that these results may be related to echolalia. However autism severity cannot be reduced to echolalia itself. In the CARS, echolalia is only a subpart of the verbal communication item, which itself is one of 15 items comprising the total score.

Kjelgaard and Tager-Flusberg (2001). However the individual distribution of the children with ASD clearly showed that the correlation between the two variables was not linear. This non-linearity was due to the existence of the two discrepant profiles that we expected to find: 3/18 children had low NVIQ and normal language abilities and 5/18 children had normal NVIQ and impaired language abilities. To conclude, this result, and especially the presence of these discrepancies, seem to go in the direction of the independence of formal language skills and NVIQ in verbal children with ASD (Anderson, 1992; Scheuffgen et al., 2000).

6. Limitations and future directions for research

Additional research is needed to test the replicability of the current findings and to address the following limitations. The number of participants in the current study was limited raising the question of the extent to which the results could be generalized. Moreover task performance results should be confirmed by comparing children of the same chronological age, in order to verify that children with ASD-LN perform similarly to TD children and that children with ASD-LI perform similarly to SLI children of the same age. Concerning the results it would be interesting to perform a qualitative error analysis on the three measures (identical repetition, grammaticality and target structure) in order to further compare the performance of the ASD-LI and SLI groups and see whether these two groups performed similarly also on the types of errors that were committed.

The group of children with ASD was divided into language impaired and normal language subgroups on the basis of just two standardized tests. Additional language assessment tasks (in comprehension and production) would give more information about the general linguistic level of the participants and provide a more reliable independent language measure, which could then be correlated to the scores on our SR task, to further validate the SR task as a diagnostic tool for language impairment. Similarly, measures of autism severity and nonverbal cognitive level could be multiplied (PRI measure of WISC-IV test and ADOS and ADI-R, ECA-2 scores), in order to have a more complete picture regarding the possible absence of correlation between our task and these diagnostic tools (see Silleresi et al., 2017). Finally, the number of children with discrepant NVIQ and linguistic abilities needs to be expanded so that these understudied, but still present, profiles among children with ASD can be better investigated and understood.

Lastly, additional research is also needed to look at the performance at the same task in a longitudinal perspective, in order to investigate if knowledge of formal language changes over time, following the pattern that has been launched in the last decade (Richler et al., 2010; Tek et al., 2014; Whitehouse et al., 2009).

Acknowledgments

This research was supported by a grant from the Swiss National Science Foundation (project PA00P1_136355 awarded to Stephanie Durrleman) and by the Autism Team at the University in Tours. We would like to thank all the children and the families that took part in the study, the staff of the CHRU de Tours, the speech-language therapists and particularly Marion Duhanez.

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A. Appendix

Table A. Age, CARS, non-verbal scores on the RPM and language composite score of children with ASD divided in subgroups[a]

Subgroup	Code	Age (months)	CARS	RPM	Composite language score
ASD-LI	LOE	98	33.5	62.5	−4.93
(*n* = 10)	THO	110	34	5	−2.78
	EPI	110	28[c]	17.5	−4.26
	THE	111	31	25	−1.50
	MIR	113	25[c]	17.5	−1.04[b]
	YAT	116	31.5	7.5	−3.93
	JOS	118	31	7.5	−9.54
	MAR	119	37	5	−3.57
	FIZ	119	33.5	5	−2.05
	NIK	128	42.5	7.5	−5.15
ASD-LN	LOU	92	34	62.5	0.6
(*n* = 8)	GAB	98	31.5	62.5	−1
	BRU	102	32.5	25	−0.51
	LUC	108	41	90	0.38
	DIE	118	41	7.5	−0.53
	ADO	130	30	37.5	−1.92[b]
	ROD	131	38	5	−0.54
	JAN	131	45	95	−1.24

[a] Children were assigned to the ASD-LI group when their composite language score (receptive vocabulary + receptive morphosyntax) was below < −1 SD in combination with a receptive morphosyntax score below < −1.25 SD.

[b] Following this criterion MIR was put in the ASD-LI group because he had a low score in receptive morphosyntax (N-EEL) = −1.46 SD; and ADO was put in the ASD-LN group because he had a normal score = −0.34 SD.

[c] EPI and MIR had a CARS score under 30, however the diagnosis of autism was confirmed by the ADOS and/or the clinicians of the Autism Center at the Regional University Hospital Center in Tours (France).

Table B. LITMUS-SR-FR: Structures and substructures

Structure	LESS COMPLEX substructure		MORE COMPLEX substructure	
SVO present tense	3S	The boy takes a bath the-MASC-SG boy takes a-MASC bath *Le garcon prend un bain*	3P	The cats drink some milk the-PL cats drink-3PL some-MASC milk *Les chats boivent du lait*
SVO past tense	3S	*La maman a fermé la fenêtre.* the-FEM mother has closed the-FEM window The mother closed the window	3P	Les parents ont rangé les jouets. the-PL parents have-3PL put + away the-PL toys The parents put away the toys
Wh-object questions	Qui	*Qui la maîtresse punit?* Who the.FEM.SG. teacher punishes?Who does the teacher punish?	Quel	*Quel enfant la maîtresse punit?* Which child the.FEM.SG. teacher punishes?Which child does the teacher punish?
Arg. Sclause	Non-Finite	*Le papa sait très bien conduire la voiture* The.MASC.SG. daddy knows very well to + drive the.FEM.SG. car The daddy knows to drive the car very well	Finite	*La dame dit que le garcon a pris le ballon* The.FEM.SG. woman says that the.MASC.SG. boy has taken the.MASC.SG. ball The woman says that the boy has taken the ball
Relatives	Subject	*J'ai vu le chat qui a griffé* I've seen the.MASC.SG. cat who has scratched *la vache* the.FEM.SG. cow I've seen the cat who has scratched the cow	Object	*Tu as vu le cheval que le chien a mordu* You 've seen the.MASC.SG. horse whom the.MASC.SG. dog has bitten You've seen the horse whom the dog has bitten

On the comprehension of recursive nominal modifiers in child Romanian

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We investigate the comprehension of recursive locative adnominal PPs and subject RCs by Romanian monolinguals with a view to weighing the role of language specific properties (overt functional category encoding recursion and definiteness of the modified DP) in the acquisition of recursive structures. Our data show that comprehension of recursive nominal modifiers is delayed. Romanian 5- and 7-year-olds randomly assign a recursive or a conjunctive interpretation to recursive nominal modifiers. The availability of overt recursion markers in both modification structures is reflected in the absence of a main effect of structure; PP and RC modifiers are equally vulnerable. Our data suggest that children acquire recursive nominal modifiers late across languages, but language specific properties may determine the acquisition path.

Keywords: recursive structure, recursion marker, noun modifier, comprehension, Romanian

1. Aim

Recursion, understood as embedding of category XP inside XP, is a central property of human language which accounts for linguistic discrete infinity (Hauser et al., 2002). However, recent studies provide convincing evidence that the acquisition of recursive structures by typically developing children is delayed and that it does not proceed uniformly, i.e. the acquisition path of different recursive structures is not the same. Pérez-Leroux et al. (2012), for example, offer production data which show that recursive genitive phrases pose more difficulty to preschool English children than recursive PP modification does. Sevcenco et al. (2017) provide experimental data from English which show that comprehension of recursive structures in the clausal domain (RCs) has a slight advantage over structures in the non-clausal domain (PP) for 5-year-old children. For Japanese, Terunuma et al. (2017) show that

https://doi.org/10.1075/lald.62.12sev

overall the comprehension of recursive locative modifiers by 4- and 5-year-old children is not as good as that of recursive possessives (of the same level of embedding).

These previous studies highlight the role of language specific properties in the acquisition of recursive nominal modification. Various recursive structures are not acquired concurrently, different patterns of asymmetries in acquisition emerge. Extending the investigation to other languages could contribute to the understanding of the role of these properties in the acquisition path of similar recursive structures. In the present paper, we investigate the acquisition of Romanian recursive adnominal locative PP and subject RC modifiers. We address two main questions:

i. Is the acquisition of recursive nominal modification delayed in child Romanian as well, as shown for other languages in previous studies?
ii. What is the role played by language specific properties in the acquisition path of recursive nominal modification?

The paper is organized as follows. Section 2 offers the theoretical background on recursion as the core property of language. In Section 3 we present previous findings with respect to the acquisition of recursive nominal modification. Section 4 briefly discusses the main properties of recursive Romanian adnominal locative PPs and RCs. Section 5 presents the study. Section 6 summarizes the main findings.

2. Direct and indirect recursion

Human language is based upon a generative system whose defining property is recursion, roughly understood as the property of a category XP to embed an infinite number of times in a hierarchical configuration (Hauser et al., 2002).

More recently, a distinction has been drawn between the notions of direct (unstructured and structured) recursion and indirect recursion (Roeper, 2011; Arsenijevic & Hinzen, 2012; Roeper & Oseki, to appear). Roeper and Oseki (to appear) propose that direct unstructured recursion comes as the result of the application of a phrase structure rule to its own output in an unbounded fashion (1). It builds a structure within which the order of the constituents can change without this affecting in any way the truth-value of the sentence. For instance, even if the iterated PPs in (2) appear in a different order, the sentence will still preserve its meaning.

(1) XP = > XP XP +

(2) John put an apple [$_{PP}$ in the kitchen], [$_{PP}$ in the bedroom] and [$_{PP}$ in the balcony]. (Roeper & Oseki, to appear)

Quite importantly, (2) is ambiguous: it could be about three apples that are set in three different locations or about one apple that is successively put in three locations. In direct structured recursive configurations, see the structure in (3) and its exemplification in (4), the sequence of PPs cannot be ambiguous anymore: it just refers to an apple placed in one specific location.

(3) XP = > XP XP

(4) John put an apple [[$_{PP}$ in the house] [[$_{PP}$ in the kitchen] [$_{PP}$ in the cabinet]]]. (Roeper & Oseki, to appear)

Indirect recursion, on the other hand, refers to the property of a rule to reapply to its own categorical output via a functional head (di Sciullo, 2015), overt or covert. It creates a hierarchical structure by application of an intermediate phrase structure rule (5). The order of the constituents that make up the structure is not permutable; any change will alter the overall meaning (6).

(5) a. XP = > X Y a′. PP = > P NP
b. YP = > Y XP b′. NP = > N (PP)

(6) a. John put an apple [$_{PP}$ in [[$_{NP}$ the cabinet] [$_{PP}$ in [[$_{NP}$ the kitchen] [$_{PP}$ in [$_{NP}$ the house]]]].
b. #John put an apple [$_{PP}$ in [[$_{NP}$ the kitchen] [$_{PP}$ in [[$_{NP}$ the house] [$_{PP}$ in [[$_{NP}$ in the cabinet]]]]. (Roeper & Oseki, to appear)

In syntax, recursive structures are built incrementally across phasal domains by Merge. Upon completion, at the Spell-Out point, each phase is transferred to the language external interfaces: Conceptual-intentional (C-I) and Sensorimotor (SM). Since syntactic structure is built bottom-up, there will be chunks of syntactic objects, i.e. the completed, spelled-out phases, which are no longer accessible to narrow syntax.

(7) *the apple in the cabinet in the kitchen*

In (7) above, *the kitchen* is a referential argument that, upon embedding under the preposition *in* becomes part of a predicate that, in its turn, combines with another predicate, *cabinet*. When the definite article enters the structure, the sequence *the cabinet in the kitchen* becomes a referential argument. After this argument is embedded under P, it turns again into a predicate that combines with the predicate *apple*. Composition with the definite article turns *the apple in the kitchen in the cabinet* into an argument again. The overall recursive interpretation arises after what Roeper (2010, p. 14) terms 'periodic phase interpretation'.

3. Recursion in language acquisition

Language acquisition studies that have probed into the acquisition of recursive modification show that this, indeed, is a vulnerable domain. There is a delay both in the production and in the comprehension of recursive nominal modifiers.

Limbach and Adone (2010) investigated the early comprehension of multiple possessors by three groups of English-speaking children (mean age 3;7, 4;5, and 5;7). Their data reveal a developmental path which starts with structure simplification (the younger children preferred to trim down the structure to one modifier only), goes to conjunctive answers (the option the older children went for) and then settles down to recursive responses.

Tóth et al. (2016) present data from the acquisition of recursive Hungarian complex noun modification. Their findings also reveal a delay in the acquisition of these structures, but they also show that recursive structures are not equally vulnerable. Hungarian has two ways of rendering recursive nominal modification: (i) by means of combining the suffix *-i* with a preposition, thus turning the preposition into an adjectivized form, or (ii) by using the present participle of the verb *be (lévő)* which heads a participial phrase. The participial form is more salient lexically, phonologically and semantically than the adjectivizing suffix. The 7-year-olds in their study assigned a recursive interpretation to the participial structures more frequently than to those with the adjectivizing suffix. When children failed to choose the recursive answer, they went for the conjunctive interpretation. The 9 year-old participants had adult performance on both types of recursive modifiers.

Tóth (2017) tested nominal modification by means of PPs with the adjectivizing *-i* suffix and participial phrases with *lévő* with Hungarian-speaking children: preschoolers (mean age 6;7) and second graders (mean age 8;5). She concludes that children interpret recursive sequences as conjunctive first and then move on to the indirect recursion reading. This study does not confirm the result of the previous investigation regarding the asymmetry in comprehension between the *lévő* and the *-i* modifying structures. It found no support for the hypothesis that the more salient *lévő* helps with the interpretation of recursive nominal modification to a larger extent than the *-i* suffix. Additionally, Tóth (2017) mentions that PP modifiers may occur in two different orders: subject – PP – V and PP – subject – V. Her results indicate that the second possible order leads more frequently to the recursive interpretation.

Sevcenco et al. (2017) tested the comprehension of PP and relative clause modifiers with six groups of English-speaking children (mean age 4;3, 5;4, 6;1, 7;3, 8;2 and 9;3). They show that (i) children younger than 6 assign a conjunctive reading to recursive structures, (ii) the 5-year-old group seem to find RC recursion slightly easier than its PP counterpart and (iii) the 5-, 6- and 7-year-old groups understand

two-level embedded recursive modifiers better than their three-level embedded counterparts. Regarding the second result, the authors suggest that the slight advantage of RC over PP recursion might be the consequence of a language specific property. More precisely, only in the case of RC is recursion marked overtly on the complementizer *that*; PP recursion associates with a covert functional marker. This difference could account for the second of their findings.

Terunuma et al. (2017) report an asymmetry in the comprehension of recursive possessive and locative PP modifiers. 4- and 5-year-old Japanese-speaking children find recursive possessives easier to interpret. Also, the possessive/locative asymmetry is visible in terms of level of embedding: two and three-level embedded possessives are available before their 4-level counterparts by the age of 4 or 5; two-level embedded locatives are mastered at the age of 4, but three and four-level locatives are not well comprehended at all.

A quick overview of the studies on the production of recursive nominal modifiers offers a similar picture.

Pérez-Leroux et al. (2012) tested three groups of English-speaking children (mean ages 3;2, 4;4 and 5;2) on the production of coordinated nominals, recursive possessives ([[[N's] N's] N]), and recursive PPs ([N [P N [P N]]]. Three main findings emerge from this study. The first is that children produce coordinated structures more readily than recursive ones. The second highlights the presence of two developmental stages, i.e. children acquire single level embedding first and only after that do they manage to master the ability to iterate embedding recursively. Third, even though single level embedded possessives and PPs are acquired simultaneously, it turns out that multiple (double) possessors are significantly more difficult than multiple recursive PPs.

Pérez-Leroux et al. (2015) contrast the production of doubly modified recursive and coordinated PPs in child English and note that both the children (mean age 4;11) and the adults in their control group perform worse on the recursive condition; they do not succeed to integrate all the referring expressions in their answers. However, children differed from adults in three respects: they produced complex structure less frequently, they gave more descriptively complete yet syntactically unintegrated answers, and they offered more over-elaborated answers (an alternating mix of PP and RC structures instead of PP sequences) in the recursive condition. The conjunctive condition did not trigger this mix.

More recently, Roberge et al. (to appear) offer findings from child French which they compare to the English data in Pérez-Leroux et al. (2012). Interestingly, the comparison reveals no developmental difference between French-speaking and English-speaking children with respect to the acquisition of recursive complex NPs in spite of the differences between recursive nominal modification in these languages.

Summing up, all the previous studies on the acquisition of recursive nominal modifiers offer similar findings: delayed acquisition, a learning path which begins with direct unstructured recursion (conjunction) and moves then to indirect recursion. Also, structures with one-level embedding are acquired before those with multiple embedding (two or more).

All the explanations that have been provided for these findings revolve around the idea that recursive structures bring along complexity overload and, consequently, children resort to avoidance strategies to cope with this complexity. According to Pérez-Leroux et al. (2015), the early preference for coordination over embedding is taken to indicate that English-speaking children have no problems with applying Merge and with building structure. Their difficulty with the modifying recursive sequences comes from an increased level of complexity resulting from the way in which syntax and semantics work together to introduce deeper levels of embedding across phasal domains and 'intermediate domains of reference' (Pérez-Leroux et al., 2015). Children differ from adults in two respects: (i) they come up with answers that are descriptively complete, but that do not rely on syntactic integration of the modifiers into a multiply embedded configuration and (ii) they resort to responses that enhance structure, i.e. mixes of RCs/PPs instead of producing the required NP/PP configurations, perhaps in an attempt to clarify the relationship between the modified constituents.

Sevcenco et al. (2017) account for the delayed acquisition in terms of the interaction of two factors. The first is that the comprehension of indirect recursion results from a syntactic search all the way down the tree to identify all the functional categories associated with recursion and this proves to be computationally complex. The second concerns language specific variation in the functional category related to indirect recursion. If the respective category is overt, this contributes to a better understanding of the structure.

Terunuma et al. (2017) bring a semantic difference into the picture: the possessive marker *no* unambiguously expresses the possessive relation whereas locative *no* encodes various spatial relations, such as 'on' and 'in'. This difference is conjectured to account for the difficulty posed by locative PP recursion.

The findings reported in all these production and comprehension studies are strikingly similar. They reveal a cross-linguistic delay in the acquisition of recursive nominal modification, irrespective of the language specific properties of the nominal modifiers investigated. But, at the same time, the acquisition order of these recursive modifiers reflects their different properties.

4. Properties of Romanian recursive PP and RC noun modifiers

Adnominal locative PPs in Romanian contain the functional preposition *de* 'of' alongside the lexical preposition that gives the location meaning (Giurgea, 2015). For instance, for the Romanian equivalent of *the book on the table* to be grammatical, the lexical preposition *pe* 'on' needs to be preceded by the functional preposition *de* 'of':

(8) *Cartea *(de) pe masă e veche.*
book-the of on table is old
'The book on the table is old.'

De 'of' never modifies non-specific objects of intensional verbs or of verbs referring to possession. Thus, the DP *o casă* 'a house', embedded under the lexical preposition *la* 'at' in (9), is interpreted as non-specific, referring to any house. In (10), however, with *de* 'of' present, the DP acquires a specific interpretation, as indicated in the translation (Giurgea, 2015, his examples (10) and (11)).

(9) *Ion dorește/ vrea/ caută o casă la munte.*
Ion desires wants looks-for a house at mountain
'Ion wants/is looking for a house (that should be) in the mountains.'

(10) *Ion dorește/ vrea o casă de la munte.*
Ion desires wants a house of at mountain
'Ion wants a certain house, which is in the mountains.'

One specific property of Romanian is that prepositions (with the exception of *cu* 'with') select DP complements incompatible with an overt definite article. For example, *pe* 'on' in (11) can only be followed by a DP without the definite article (11a). The presence of the enclitic definite article on the noun in (11b) renders the sentence ungrammatical, unless the DP is further modified (11c); in this case, the presence of an article is obligatory:

(11) a. *Am o carte pe masă.*
have-I a book on table
'I have a book on the table.'
b. **Am o carte pe masa.*
have-I a book on table-the
Intended: 'I have a book on the table.'
c. *Am o carte pe masa din hol.*
have-I a book on table-the of. in hall
'I have a book on the table in the hall.'

Definiteness on the modified noun forces a recursive interpretation, i.e. the recursive reading unambiguously represents the only interpretive option. In (12), for example, the noun inside the first PP modifier is definite, *pădurea* 'forest-the'; in this case the second PP modifier, *de lîngă lac* 'next to the lake', can only be interpreted as modifying the nominal inside the previous PP modifier. If, on the other hand, the DP is headed by an indefinite article, ambiguity arises between either a recursive or a conjunctive interpretation, as shown in (13) below:

(12) *o casă de lîngă pădurea de lîngă lac*
a house of near forest-the of near lake
'a house next to the forest next to the lake'

(13) *o casă de lîngă o pădure de lîngă un lac*
a house of near a forest of near a lake
i. 'a house next to a forest next to a lake'
ii. 'a house next to a forest and a lake'

Full relative clauses are introduced by the relative pronoun *care* 'who/which':

(14) *casa care este lîngă pădurea care este lîngă lac*
house-the that is near forest-the that is near lake
'the house that is next to the forest that is next to the lake'

Just as in the case of PP modification, if the head noun has the definite article, the recursive reading follows unambiguously (15); the presence of an indefinite article leaves room for ambiguity between the recursive and the conjunctive interpretations (16):

(15) *o casă care e lîngă pădurea care e lîngă lac*
a house that is near forest-the that is near lake
'the house that is next to the forest that is next to the lake'

(16) *o casă care e lîngă o pădure care e lîngă un lac*
a house that is near a forest that is near a lake
i. 'a house that is next to a forest that is next to a lake'
ii. 'a house that is next to a forest and a lake'

Note that both PP and RC nominal modifiers have an overt functional head (the preposition *de* 'of' and the relative pronoun *care* 'who/which') on which recursion is encoded. Not all languages are similar to Romanian in this respect. English, for instance, has a relative complementizer, but no functional preposition shows up in recursive sequences with adnominal locative PPs.

PP and RC nominal modification in Romanian, as can be seen in the examples in this section, is uniformly right-branching. As the data presented in this section show, Romanian offers the perfect ground to test to what extent language specific

properties can modulate the comprehension of recursive structures. The presence of an overt recursion marker with both PP and RC noun modifiers offers a robust cue which might facilitate acquisition. Additionally, the disambiguating role of definiteness on the modified DP and uniformity of branching directionality could enhance the acquisition of recursive nominal modification in Romanian.

5. The study

5.1 Main questions

Our study attempts to shed light on two main issues. First, we want to determine whether the comprehension of recursive structures with double embedded nominal modifiers is delayed in Romanian as previously shown for other languages. How early do Romanian children show adult-like understanding of recursive nominal modification structures? Previous studies indicate that English- and Hungarian-speaking children start with conjunctive readings of comparable similar recursive noun modification structures (Sevcenco et al., 2017; Tóth, 2017). Is there an acquisition order in Romanian as well: e.g. conjunctive first – recursive next?

In order to address these issues, we investigate the comprehension of PP and subject RC nominal modification with double embedding by 5- and 7-year-old Romanian monolinguals. We selected subject RCs because they are mastered early in Romanian (Sevcenco & Avram, 2012; Sevcenco et al., 2013). They emerge early, before age 3, and at age 5 they are produced and comprehended in an adult-like manner; so, the relativization operation itself does not introduce any further difficulty in the task. Prepositions (locative ones included) are also acquired early, before age 3, in Romanian (Drăgan, 2017).

Our second goal is to weigh to what extent language specific properties influence the early comprehension of recursive nominal modifiers. As we saw earlier, the input offers robust cues with respect to recursive embedding. Additionally, the Romanian data can shed light on the slight difference between RC and PP recursion for the 5-year-old English-speaking group reported by Sevcenco et al. (2017). Data from Romanian could settle the question whether the advantage of RC recursion is due to the fact that this is a case of recursion being overtly encoded on a functional category (the complementizer) or whether it is the distinction between clausal and non-clausal domain that makes the difference. Definiteness, as shown in Section 4, also interacts with recursive interpretation. Recursive sequences with head nouns that carry the definite article should have a head start over their counterparts with indefinite head nouns because they unambiguously lead to the recursive reading.

5.2 Method and participants

In order to address the issues mentioned above, we used an act-out task with the *Explain Everything* application, presented on iPad support, an adaptation of the task originally designed for English (Sevcenco et al., 2017).

In the warm-up part, the experimenter made sure the child recognized all the animals on the iPad and showed her that she could move the animals on the screen and arrange them as she wanted to. The experiment started with a warm-up session during which the children were asked to repeat word by word four recursive structures and were shown how to move the animals around. In the testing part, the children were told to put animals in various arrays after hearing a prompt from the researcher. The researcher gave instructions such as: *Show me the dog next to the cat next to the horse*. We used 5 pictures with animals familiar to children (horse, pig, dog, cat and chicken) that were always shown in a fixed position on the display before the prompt was given (see Figure 1):

Figure 1. Display before the prompt was given

Each test item was repeated up to three times if necessary. The testing took place at the children's kindergarten or school, in a quiet room. The children were tested individually.

Stimuli included two conditions: recursive PP and RC noun modifiers with double embedding. Each condition had 8 test items, balanced for definiteness. We provide below examples of test items from the PP condition. The test item in (17) has PP recursion. Within this structure, the second modified noun (underlined

for convenience), has the definite article. The structure illustrated here allows only the recursive interpretation. The structure illustrated in (18), in which the second modified noun is preceded by the indefinite article (underlined for convenience), is ambiguous between the recursive and the conjunctive interpretation.

(17) *Arată-mi pisica de lîngă **calul** de lîngă pui.*
show me cat-the of near horse-the of near chicken
'Show me the cat next to the horse next to the chicken.'

(18) *Arată-mi un pui de lîngă **un cal** de lîngă un porc.*
show me a chicken of near a horse of near a pig
'Show me a chicken next to a horse next to a pig.'

The examples in (19) and (20) exemplify two test items with RC modification in which the modified nouns have the definite/indefinite article, respectively. Example (20) is ambiguous, with either a recursive or a conjunctive reading. Notice that in this structure, just as in (18), the second modified noun (underlined for convenience), is preceded by the indefinite article.

(19) *Arată-mi calul care este lîngă pisica care este lîngă porc.*
show me horse-the that is next.to cat-the that is next.to pig
'Show me the horse that is next to the cat that is next to the pig.'

(20) *Arată-mi un cal care este pe **un porc** care este pe un pui.*
show me a horse that is on a pig that is on a chicken
'Show me the horse that is on a pig that is on a chicken.'

To analyze the results, we coded the responses as: (i) recursive; (ii) conjunctive; (iii) other. An answer was coded as recursive if the array for a prompt like *show me the pig next to the chicken next to the cat* looked like the one in Figure 2:

Figure 2. Example of a 'recursive' array

We considered that the participants gave a conjunctive response if, at the prompt *Show me the cat next to the pig next to the chicken*, they came up with an array in which the cat appeared in between the pig and the chicken, as in Figure 3:

Figure 3. Example of a 'conjunctive' array

The category 'other' included random arrays with two or four animals, as exemplified below:

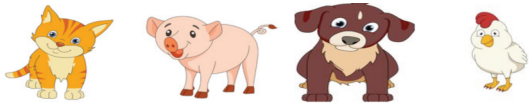


Figure 4. Example of 'other' array

The testing took place in a kindergarten and in a school in Bucharest. All the participants were Romanian monolinguals and typically developing children. 45 Romanian speaking children took part in the study. The children were divided into two age groups: a group of twenty-nine 5-year-olds (mean = 5;3, SD = .57) and a group of sixteen 7-year-olds (mean = 7;3, SD = .53). 10 Romanian adults (mean age 35;3) were also tested.

5.3 Results

Overall, the 5-year-olds responded with target (recursive) arrays 40% of the time and the 7-year-olds 64% of the time, i.e. older children performed better, but still non-adult-like. Adults gave recursive interpretation in 94% of cases. As shown in Table 1, the number of target responses did not differ in the two conditions (PP and RC) with either group of children or with the adult group.

Table 1. Recursive answers (mean and SD) in the PP and RC conditions

Group	PP /8	RC /8	Overall /16
5-year-olds	3.07 (1.56)	3.38 (1.61)	6.45 (2.70)
7-year-olds	5.06 (2.70)	5.06 (2.32)	10.12 (4.86)
Adults	7.33 (.81)	7.83 (.41)	15.16 (.99)

A standard paired-sample t-test at the $\alpha = .05$ level was conducted to test the effect of structure with the 5-year-olds. Recursive responses in the PP condition (M = 3.07, SD = 1.56) did not differ significantly from those in the RC one (M = 3.38, SD = 1.61), $p > .05$. A standard paired-sample t-test at the $\alpha = .05$ was also conducted to determine whether there is an effect of structure for the 7-year old group. Again, recursive responses in the PP condition (M = 3.5, SD = 1.87) was not significantly different from those in the RC one (M = 3.56, SD = 2.38): $p > .05$.

As shown in Figure 5, neither 5-year-olds nor 7-year-olds performed in adult-like manner in any of the two conditions. But one can notice an age effect.

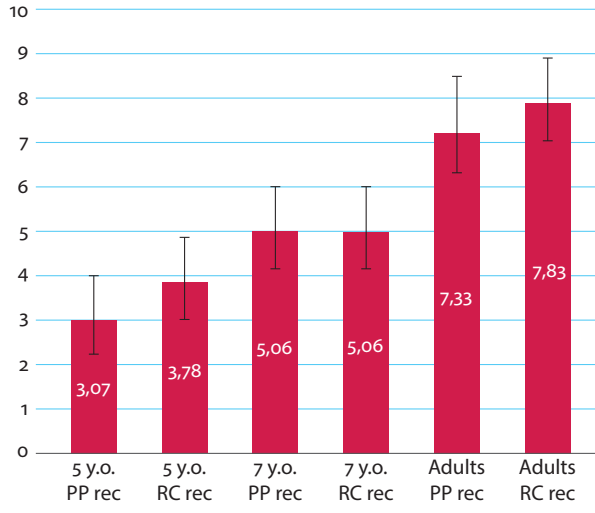


Figure 5. Target responses across conditions

A one-way repeated measures ANOVA at the α = .05 level was conducted to test the effect of definiteness in the two conditions, PP and RC. The number of 'recursive' answers did not differ significantly across the definite versus indefinite test items with the 5-year-olds ($F(3,84) = 31$, $p > .05$) or with the 7-year-olds ($F(3,45) = .31$, $p > .05$). Adults perform similarly with definite and indefinite head nouns inside recursive structures. Table 2 summarizes the results with respect to the role of definiteness.

Table 2. 'Recursive' responses with definite and indefinite modified DPs (mean and SD)

Group	PP def /4	PP indef /4	RC def /4	RC indef /4	Total def /8	Total indef /8
5-year-olds	1.52 (.83)	1.55 (1.12)	1.69 (1.20)	1.69 (.85)	3.24 (1.79)	3.21 (1.47)
7-year-olds	2.44 (1.41)	2.63 (1.45)	2.5 (1.21)	2.56 (1.15)	4.94 (2.57)	5.19 (2.45)
Adults	3.67 (.52)	3.67 (.52)	4.00 (.00)	3.83 (.41)	7.66 (.52)	7.5 (.55)

When children failed to make 'recursive' arrays on the iPad, they resorted to conjunctive ones or gave 'other' responses. The overall results are summarized in Table 3:

Table 3. Recursive, conjunctive and 'other' responses overall (mean and SD)

Group	Recursive	Conjunctive	Other
5-year-olds	6.45 (2.70)	6.07 (2.69)	3.45 (1.92)
7-year-olds	10.12 (4.86)	3.31 (3.16)	2.56 (2.63)
Adults	15.16 (.99)	.66 (.82)	.33 (.52)

A standard paired-sample t-test at the α = .05 level was conducted to test the difference between the overall recursive and conjunctive answers given by the 5-year-olds. Recursive responses (M = 6.45, SD = 2.70) did not differ from the conjunctive ones (M = 6.07, SD = 2.69), $p > .05$. Another standard paired-sample t-test at the α = .05 level was conducted to test the difference between the overall recursive and conjunctive answers given by the 7-year-olds. Recursive responses (M = 10.12, SD = 4.86) differed significantly from the conjunctive ones (M = 3.31, SD = 3.16), $p = .003$.

The picture is similar within each condition. The sum-up of these data is given in Table 4.

Table 4. Conjunctive responses in the PP and RC conditions (mean and SD)

Group	PP / 8	RC condition / 8
5-year-olds	3.31 (1.51)	2.77 (1.68)
7-year-olds	3.75 (2.05)	3.81 (2.59)
Adults	.50 (.55)	.20 (.40)

Four important findings emerge from our study: (i) the comprehension of recursive nominal modification is delayed in Romanian. At age 7, Romanian children do not understand these structures in an adult-like manner; (ii) structure type does not interact with comprehension since we observed no advantage of RC recursive arrays over the PP ones or the other way round; (iii) unambiguous structures in which the modified head noun has the definite article are not treated differently by the children from the ambiguous ones, with the indefinite article; (iv) when children could not come up with recursive arrays, they chose the conjunction or 'other' options. The number of conjunctive responses does not differ from the number of recursive responses for the 5-year-old children. However, with the 7-year-olds, the number of answers with recursive arrays is significantly higher than that with conjunctive ones.

5.4 Discussion

The first question which we addressed was whether the acquisition of recursive nominal structures is delayed in Romanian, as previously shown for other languages. The overall results indicate that Romanian 5-year-olds and 7-year-olds do not have an adult-like interpretation of recursive nominal modification with double embedding. This finding is in line with previous studies which showed that recursive nominal modification is a vulnerable domain in language acquisition (Limbach & Adone, 2010; Sevcenco et al., 2017; Tóth et al., 2016; Tóth, 2017; Terunuma et al., 2017; Pérez-Leroux et al., 2012, 2015).

The second question targeted the role of language specific properties in the acquisition of recursive structures. The presence of overt markers of recursion, the disambiguating role of definiteness and uniformity of branching directionality could, in principle, boost the acquisition of nominal modification in Romanian. However, our overall results do not show an age advantage for Romanian children when compared to the findings reported in previous studies on the acquisition of recursive structures in English, French or Hungarian (Sevcenco et al., 2017; Pérez-Leroux et al., to appear; Tóth et al., 2016).

Previous studies revealed a difference in the acquisition route of recursive PP and RC noun modification. Sevcenco et al. (2017) suggest that in English there is a head start in the comprehension of recursive structures with RCs over those with PPs. English overtly marks recursion in the clausal domain by means of the relative complementizer *that*, but not in the PP domain, where, arguably a covert marker is present. We found no clearly defined preference for recursive readings with the full clausal configuration (RC) over the reduced one (PP). Since Romanian has an overt recursion marker in both configurations, we can assume that this parametric difference between English and Romanian in the covert versus overt realization of functional heads associated with recursive structures does have a bearing upon the acquisition process. Of course, this claim is speculative at this point and requires further confirmation by further cross-linguistic data.

Previous studies also reported an acquisition order: children acquire conjunctive nominal modifiers before recursive ones (Limbach & Adone, 2010). A 'conjunctive first' stage has been observed in studies on English and Hungarian (Tóth et al., 2016; Tóth, 2017 for Hungarian; Sevcenco et al., 2017 for English, a.o.). Our findings support the availability of this acquisition order. Our results reveal that there is an early stage when Romanian children resort to conjunctive modification when they want to avoid recursive structures. The 5-year-olds who took part in our study assigned undifferentiated recursive/conjunctive interpretation to recursive sequences. The older children (the 7-year-olds), though, clearly differentiated between recursive and conjunctive to the advantage of the former.

The results of our study further revealed that the presence of the definite article in the second DP, which should in principle single out the recursive reading, does not facilitate comprehension. The children in the study did not assign significantly more recursive interpretations to those structures which included a definite modified noun than in those that included indefinite nouns, headed by the indefinite article. At age 7, Romanian children are not sensitive to the role played by the definite article on the modified noun in the comprehension of recursive nominal modification. This, however, cannot reflect a delay in the acquisition of definiteness *per se*. The use of the differential object marker *pe* is constrained by definiteness in child Romanian before age 3 (Ticio & Avram, 2015).

The overall delay in the acquisition of nominal recursive modification requires an explanation. In principle, the cause could be rooted in some deficiency pertaining to syntax or it could be linked to third factor issues, i.e. complexity effects brought about by the requirement for multiple embedding of the task. The syntactic deficit account, however, has to be rejected. All available studies show a cross-linguistic delay, irrespective of the syntactic properties of recursive nominal modifiers in the various languages investigated (see also the discussion in Roberge et al., to appear, for a similar argument). They also show that younger children opt for a less complex nominal modification structure, such as a coordination one.

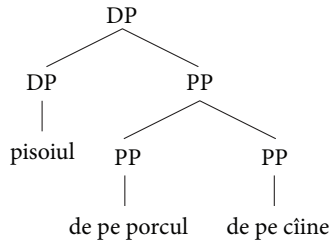
The conjunctive interpretation, which, in our study, was chosen instead of the recursive one, represents a way of integrating the required adjuncts in the overall configuration such as to avoid a second embedding across intermediate phasal domains. That is, the two nominal PP/RC modifiers are iteratively stacked onto the first DP in the sequence. This represents a feasible option for children since it is generally accepted that conjoined constituents are permutable, without affecting in any way the truth-value of the entire expression (Roeper & Oseki, to appear).

The difficulty children encounter in the comprehension of nominal modifiers could relate to establishing multiple embedding relationships across intermediate phasal domains. More precisely, the subdivided Merge system composed of the operations Merge, Minimal Search and Label (Chomsky, 2013) introduces the option of identifying recursion by means of Minimal Search Extended (Sevcenco et al., 2017).

(21) Minimal Search Extended: Find (or contextually project) identical heads of XPs across phase transfer sites.

When children fail to assign the recursive interpretation, they sometimes opt for the conjunction template that presupposes (i) finding, projecting and labeling a DP (the highest modified nominal), which instantiates a phasal domain, and (ii) relating that DP to two non-embedded adjuncts, as shown in (22):

(22)

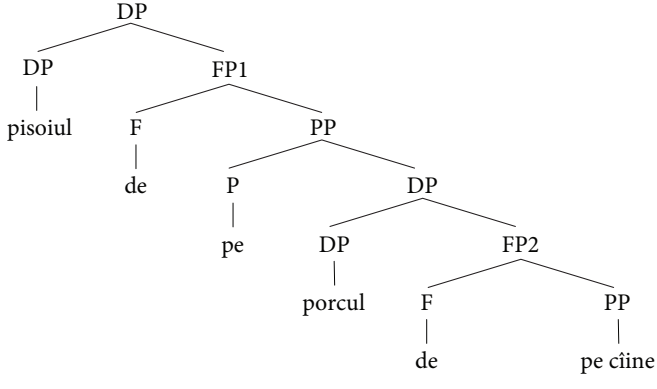


Establishing the on-target recursive reading involves more Minimal Search Extended steps and additional successive embedding steps. Consider an example with PP recursion:

(23) *pisoiul de pe porcul de pe cîine*
cat-the of on pig-the of on dog
'the cat on the pig on the dog'

In this case, the highest DP has to be projected and labeled (*pisoiul* 'the cat'), followed by the identification of the phasal domain headed by the functional preposition *de* 'of' and, inside that domain, a second, intermediate, DP needs identification by means of projection and labeling (*porcul* 'the pig') and the next phasal domain introduced by *de* 'of' has to be posited as an adjunct to this intermediate DP.

(24)



6. Conclusions

Our investigation of the acquisition of Romanian recursive nominal modifiers shows that, at age 7, these are not comprehended in an adult-like manner yet. Our findings are in line with those of previous studies on other languages; they add to the available evidence that the acquisition of recursive nominal modification is delayed irrespective of the language specific properties of the recursive structures investigated.

In spite of the fact that in Romanian several language specific properties could predict earlier acquisition, we did not find any age advantage for the Romanian children. We observed, however, that, unlike in English, RC and PP nominal modifiers are equally vulnerable. This suggests that language specific properties can determine the order in which various recursive nominal modifiers are acquired, even if, overall, they are not translated either into an age advantage or into a more severe delay. This actually reinforces the view that the challenge of recursive nominal modification cannot be explained in terms of a grammatical deficit. We suggest that the observed delay could be accounted for in terms of third factor effects manifested as Minimal Search Extended, according to which recursive structures involve a computationally more complex derivation.

Acknowledgment

We thank two anonymous reviewers for comments on an earlier version of this paper and valuable suggestions for improvement. All the remaining errors are ours. Work on this study was financed by research project PNII_RU_TE2014 4–1438, contract 374/2015.

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This volume presents eleven papers on the acquisition of Romance, most of them presented at the Romance Turn VIII, held in Bellaterra, Catalonia, Spain, in September 2016. Part I of the volume is devoted to passives and related constructions. The results unveil domains in comprehension in which children are adult-like, and other domains where there is delay. It is a challenge for current theoretical proposals to encompass such differences. Part II focuses on the TP-field, including clitics and negation. Part III deals with the CP-field, covering topics such as backward anaphora, subjects and the left periphery, and recursiveness. The volume includes studies carried out on a variety of populations: typically developing children, bilinguals, children with Autism Spectrum Disorders and Specific Language Impairment, and heritage speakers, with a view to arriving at a general theory of language acquisition.

ISBN 978 90 272 0177 5

JOHN BENJAMINS PUBLISHING COMPANY