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The comprehension of A-bar dependencies in French and Romanian

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To my family

PREFACE

Chapters 2 and 5 report research that was jointly conducted with Stephanie Durrleman. Chapter 4 reports on research conducted with Stephanie Durrleman and Luigi Rizzi. Part of Chapter 2 was published with Stephanie Durrleman as co-author in *Romance Languages and Linguistic Theory 2011. Selected papers from 'Going Romance' Utrecht 2011* (2013), Baauw, Drijkoningen, Meroni, and Pinto (Eds.) and in *New Directions in the Acquisition of Romance Languages: Selected Proceedings of the Romance Turn V* (2014), Costa, Fiéis, Freitas, Lobo and Santos (Eds.). Part of chapter 3 was published in *Proceedings of the 36th Annual Boston University Conference on Language Development. Online Supplement* (2012). Part of chapter 4 was published in *Lingua* with Stephanie Durrleman and Luigi Rizzi listed as co-authors. Part of chapter 5 was published with Stephanie Durrleman as co-author in *Proceedings of the 38th Annual Boston University Conference on Language Development. Online Supplement* (2014). Parts of all the chapters have been presented at various language acquisition and syntax conferences from 2011 to 2015. I am extremely grateful to the participants at these conferences for challenging questions and insightful criticism.

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“Humans are so innately hardwired for language that they can no more suppress their ability to learn and use language than they can suppress the instinct to pull a hand back from a hot surface.”
(Steven Pinker, *The Language Instinct*)

1. INTRODUCTION

Language acquisition is such a fast and effortless process that one might be led to think it must also be an extremely simple one. However, the complexity of the task that the child faces when acquiring a language becomes clear once we take into account that language consists of many different levels of representation (e.g. acoustic, phonetic, phonemic, lexical, morphological, syntactic, semantic, prosodic, pragmatic, etc.), and that children must somehow map the language input to these distinct representational levels in order to comprehend language.

An essential part of grasping the meaning of a sentence is to understand how the different words fit together. A sentence like “*The dog bit the cat*” does not have the same meaning as “*The cat bit the dog*”. Notice that simply relying on linear word order is not enough to get the right meaning of a sentence like “*The cat was bitten*”, nor to establish the reference of a pronoun like *she* in “*When she was at the party, the boy cruelly teased the girl during the party games*”, nor to determine the correct form of the verb in a sentence like “*The cover of the books is covered in dust*”. Uncovering the underlying structure of sentences is therefore key to understanding their meaning.

From this perspective, we can think of language acquisition as the fitting together of two main components: *knowledge* of the linguistic system and *use* of this knowledge in real time. Children must not only acquire the linguistic knowledge, but must also learn to tie this knowledge to an adequate performance system that enables them to produce speech and to

correctly interpret strings of words in real time (Frazier & De Villiers 1990; Chang, Dell, & Bock 2006).

A large body of research on language acquisition, spanning several decades, has uncovered the early development of grammatical knowledge in children (for syntactic structure, see Crain 1991, Guasti 2002, and Lidz, Waxman, & Freedman 2003, among many others). Although this might lead one to think that children's comprehension mechanisms mirror those used by adults, there is substantial evidence that children display non-adult like behaviors when it comes to processing "complex" syntactic configurations like movement dependencies: relative clauses and wh-questions. Given their unbounded nature and uniquely linguistic character, these dependencies are an ideal place to examine the relation between the acquisition of grammatical knowledge and the accompanying deployment system, in both children and adults.

1.1. Background: A-bar dependencies

A core property of human language is the existence of *dependencies*: interpretive and/or structural relations between two elements in a sentence. Some relations are very local, others less so. For example, subject-verb agreement in English involves a relation that is structurally local, but the agreeing noun can be linearly separated from the verb by many intervening words (1b). Subscript indices indicate the words and phrases that form a linguistic dependency.

- (1) a. The mouse_i likes_i cheese.
- b. The mouse_i that is always chased by the cat likes_i cheese.

Certain linguistic phenomena, however, involve relations between elements that are far less structurally local. Consider the following sentences:

- (2) a. The cat kicked [the dog].
- b. [The dog] that the cat kicked ___ ran away.
- c. [Which dog] did the cat kick ___?

The nominal expression *the dog* is interpreted in all three examples as the semantic argument of the verb *kick*, the object of the action expressed by the verb. But it is only in (2a) that this

nominal expression or DP¹ appears in its canonical position of object of *kick*, immediately after the verb. In (2b-c), it is pronounced at the beginning of the clause (what has been termed ‘the left periphery’ of the clause (Rizzi 1997)) and appears in a position that is both linearly and structurally distant from the position where it receives an interpretation. In these and subsequent examples an underline is used to indicate the gap corresponding to the canonical position of the fronted element. Therefore, the fronted DP can be pronounced quite far away from the verb in relation to which this element needs to be interpreted:

- (3) a. [The dog] that the lion thought that the mouse said the cat kicked ran away.
 b. [Which dog] did the lion think that the mouse said the cat kicked ?

The above represent a class of dependencies commonly allowed in human languages and derived by movement of some constituent to the left periphery of the phrase. The complexity of such dependencies arises from the fact that *the dog* and *which dog* surface in a position (‘A’-filler’) different from the one in which they are actually interpreted in the sentence, as the object of the action of *kicking* (‘the gap’). The A’-filler must be interpreted in the gap position in order to receive a thematic role (i.e. the role that an argument plays with respect to the predicate), while the gap must receive referential identity from the filler. In this sense there is a *non-local dependency* between the moved element and its canonical position in the sentence. Structures like in (2b-c) and (3) are known as filler-gap dependencies in the psycholinguistic literature or as A’ (“A-bar”) dependencies in the theoretical syntax literature (the term A-bar dependency comes from the fact that the moved element is in what is called an A-bar (a non-argument) position: an interrogative expression like *which dog* moves from its argument position, i.e. object of the verb *kicked*, to a position at the left periphery of the sentence where the wh-phrase functions as an interrogative operator that binds a variable²). Throughout this dissertation I will use the terms A’-filler or target (of movement) to refer to the moved element.

Relative clauses of the type given in (2b) and (3a) and wh-questions exemplified in (2c) and (3b) are only some of the constructions in the world’s languages that contain such non-local dependencies between the position targeted by the movement of an element and the position where this element was merged in the sentence. Other such dependencies include

¹ Following Abney’s (1987) influential DP-hypothesis, it has been widely accepted that traditional noun phrases are embedded under a higher functional projection – Determiner Phrase or DP – and that determiners (D) head this functional projection. Articles, like *the* in English, represent the most common example of the class of elements that can occupy the D position in a DP.

² The logical form of the question in (3b) is something like *For what x, x is a dog, the cat kicked x.*

topicalization (4a), in which the displaced element is the topic and the rest of the sentence is a comment about that topic; clefts (4b), where *the dog* is a sort of focus material analyzed as foregrounded against a presupposed background expressed by the rest of the sentence; and adjective-*though* constructions (4c):

- (4) a. I like most dogs, but [this dog], I simply adore __ .
b. It is [this dog] that I adore __, (not the other one).
c. Cute though [this dog] is __, I still prefer the Westie.

For the remainder of the chapter, I will focus on relative clauses and wh-questions. The way in which these two constructions develop in child language represents the scope of the experimental investigations conducted in this dissertation.

Although both relative clauses and wh-questions are instantiations of A'-dependencies, several differences emerge in the surface properties of the two constructions. In English, for example, only wh-questions contain a wh-word and allow subject-auxiliary inversion (see (2c) and (3b) above); the moved element is always clause-initial in wh-questions, but not in relative clauses, evidenced by the fact that the nominal expression modified by a relative clause can also appear in the object position of a different verb:

- (5) Show me [the dog] that the cat kicked __ .

Moreover, the two constructions are associated with different prosodic patterns when uttered aloud.

In spite of these differences, both relative clauses and wh-questions involve movement of an element from its canonical position as argument of the verb, where it receives a thematic role, to a higher position at the left periphery of the clause. The movement of the A'-fillers in the two sentences appears to be parallel, as both are subject to the same constraints governing the position from where the A'-fillers can be extracted. The examples in (3) illustrate that neither relative clauses, nor wh-questions are constrained by standard measures of length and can span several clauses. However, both sentences become unacceptable when the gap appears inside certain structures. For example, it is not possible to relativize a nominal expression or to extract a wh-phrase across another relative clause boundary (6) or from a wh-clause (7).

(6)a. *This is [the dog] that the lion saw [the cat that kicked __]³.

b. *[Which dog] did the lion see [the cat that kicked __]?

(7) a. *This is [the dog] that the lion saw [who kicked __].

b. *[Which dog] did the lion see [who kicked __]?

The domains that block the movement of an element to a clause-initial position have been known as ‘islands’ since seminal work by Ross (1967).

Given the similarities in the derivation of the two constructions, there are reasons to believe that the same grammatical mechanisms underlie the generation of structures like relative clauses and wh-questions. As such, the comprehension of both types of dependencies is also expected to be driven by a similar mechanism, as both require the comprehender to somehow link up the A'-filler with the gap. In order to correctly interpret these sentences, one has to retain information about the A'-filler until the gap position is encountered. At this point, the processing system must be able to effectively retrieve the A'-filler from memory, despite the elements and the interpretive processes that intervene between the filler and its base position. These dependencies, which require interpreting constituents in a position different from the one in which they are pronounced, have long represented a test case for exploring the relation between knowledge of the linguistic system and the deployment of this knowledge in both children and adults.

The sort of cognitive manipulation involved in wh-questions and relative clauses poses problems to language learners, as they are faced with the challenge of determining who did what to whom. For example, given a subject relative clause (8a) or a subject wh-question (9a), a child learning English might decide that the first noun phrases ‘the cat’ and ‘which cat’, pronounced sentence initially, are interpreted as the agents of the predicate ‘kick’. This strategy, however, would lead to misinterpretation in the case of object relative clauses (8b) and object wh-questions (9b), where the first noun phrases should instead be interpreted as the object of the verb ‘kick’:

(8) a. [The cat] that __ kicked the dog ran away.

b. Show me [the cat] that the dog kicked __.

(9) a. [Which cat] __ kicked the dog?

b. [Which cat] did the dog kick __?

³ The asterisk indicates that the sentence is ungrammatical.

Interestingly, children master subject relative clauses and subject *wh*-questions already at the age of 3, whereas they struggle with the comprehension of object relative clauses and *which*-object questions until after the age of 5. These findings have been replicated with typically-developing children in a variety of languages (for Chinese: Hu, Gavarro, Vernice, & Guasti, 2015; for English: Avrutin 2000; Brown 1971; Contemori and Marinis 2014; De Villiers, Tager Flusberg, Hukata, & Cohen 1979; Goodluck & Tavakolian 1982; Sheldon 1974; Tavakolian 1981; for French: Guasti and Cardinaletti 2003; Guasti and Shlonsky 1995; Labelle 1990, 1996; for German: Adani, Sehm, & Zukowski 2013; for Hebrew: Friedmann & Novogrodsky 2004; Friedmann, Belletti, & Rizzi 2009; Arnon 2005, 2009; for Italian: Adani, van der Lely, Forgiarini, & Guasti 2010; Adani 2011; Arosio, Guasti, & Stucchi 2011; Contemori & Belletti, 2014; De Vincenzi, Arduino, Cicarelli, & Job 1999; Guasti and Cardinaletti 2003; Guasti, Branchini, & Arosio 2012; for Portuguese: Corrêa 1995; Costa, Lobo, & Silva 2011; a.o). Moreover, the same subject/object asymmetry emerges in atypical language acquisition (Volpato & Adani 2009, Contemori & Garaffa 2010, Friedmann & Novogrodsky 2011), healthy adults (Frauenfelder, Seguí, & Mehler 1980, Crain and Fodor 1985, etc.) and in agrammatic aphasics (Avrutin 2000, Garraffa & Grillo 2008, Grillo 2008, Neuhaus and Penke 2008).

Although the grammatical mechanism responsible for generating subject dependencies (8) is the same as the one generating object dependencies (9), the two configurations differ in their surface form. The distance between the moved elements and the position where they are interpreted in the sentence is greater for object extraction than for subject extraction. Moreover, in object dependencies, an embedded subject (e.g. *the cat*) appears between the filler and the gap. In subject dependencies no such element disrupts the canonical position of the argument and the position targeted by the moved element at the left periphery of the phrase. While the comprehension of both types of dependencies requires linking the filler with the gap, object dependencies seem to be more costly for children to process than subject dependencies. The subject-object asymmetry thus illustrates the apparent disjunction between knowledge and the way in which this knowledge is deployed. Understanding what generates these asymmetries taps into what governs both adults' and children's linguistic behavior. This raises important questions for developmental research, as children must be able to assign correct structures to the sentences they hear in order to acquire target-like linguistic knowledge. If children are unable to successfully parse the input due to cognitive limitations or the linguistic complexity of the input, then this could significantly impact the time course of language development. In this sense, understanding what makes children succeed or fail in

processing various syntactic structures is essential for understanding how the development of linguistic knowledge unfolds and how children attain adult-like competence (Fodor 1998, Trueswell & Gleitman, 2007, Valian 1990).

Before tackling the question of how children comprehend complex syntactic structures like relative clauses and *wh*-questions, I will first present some relevant background on the processing of these dependencies in adults and on the syntactic factors that are assumed to constrain the interpretation of such structures. I will then show how these factors can explain children's processing difficulties with complex syntactic configurations.

1.2. A-bar dependencies and adult processing

The basic assumption underlying the way in which sentence processing unfolds in adults is that a sequence of words first needs a structural and semantic analysis before arriving at the meaning of the whole structure. Take, for example, the case of subject-verb agreement briefly mentioned in (1b) and repeated here as (10). In establishing the correct agreement dependency between the noun *mouse* and the verb *likes*, readers need to keep all elements active in memory and integrate them into structures that also need to be kept in memory until integration of the whole sentence is completed.

(10) The mouse_i that is always chased by the cat likes_i cheese.

When it comes to resolving A'- or filler-gap dependencies, it is widely agreed that adult speakers do this by using an active filling strategy (Crain & Fodor 1985; Frazier & Flores D'Arcais 1989; Traxler & Pickering 1996). The Active Filler Strategy states that speakers attempt to link the A'-filler to the earliest possible gap, without waiting for unambiguous information at the gap site. Converging evidence comes from both reading time and eye-tracking measures.

For example, Stowe (1986) compared reading times in closely matched sentences like (11), only one of which contains a *wh*-dependency. She found that reading times slow down at the direct object position *us* in the condition containing a fronted *wh*-element (11a), but not in the control condition where no *wh*-word is present (11b). The slowdown is expected if readers try to link the *wh*-phrase to the earliest available gap, analyzing it as the direct object of the verb *bring* and then get into difficulty when they encounter the overt pronoun *us* in the

direct object position. The presence of these *filled-gap effects* suggests that a direct object gap has already been posited before encountering the actual gap position.

- (11) a. My brother wanted to know who Ruth will bring *us* home to ____ at Christmas.
b. My brother wanted to know if Ruth will bring *us* home to Mom at Christmas.⁴

Similar evidence for active dependency processing comes from eye-movement measures. In an eye-tracking experiment manipulating the predicted position of the A'-filler based on the semantic fit between the filler and the verb, Traxler & Pickering (1996) compared the comprehension of sentences like (12).

- (12) *Preamble: Waiting for a publishing contract.*
The big city was a fascinating subject for the new book.
a. We like the city that the author *wrote* unceasingly and with great dedication about ____ while waiting for a contract.
b. We like the book that the author *wrote* unceasingly and with great dedication about ____ while waiting for a contract.

Both sentences are equally plausible, but a plausibility mismatch effect was observed at the critical verb in (12a). The results show that the eye-gaze duration was longer at the transitive verb *wrote* when the A'-filler was an implausible object of the verb (*the city*), compared to when the filler was a plausible object of this verb (*the book*), suggesting that readers initially constructed an implausible interpretation of the relativized NP *the city* as the direct object of the verb.

This tendency to postulate an interpretation before encountering the actual gap position has also been used to account for the presence of an asymmetry in adults' processing of subject and object A'-dependencies, showing that subject dependencies are easier to complete than object dependencies. Experimental evidence for such a subject-object asymmetry comes from the processing and comprehension of relative clauses, where the focus has mainly been on long-distance extractions (i.e. extraction from sentences with several levels of embedding). Different fine-grained experimental measures, ranging from reading time (in both self-paced reading and eye tracking), response accuracy to

⁴ If speakers attempt to link the gap to the earliest possible position, then the same filled-gap effects should be observed in subject dependencies as well. However, Stowe found no such effects when the filler was linked to the subject position. On the other hand, in an experiment that modified Stowe's design, Lee (2004) did find filled-gap effects in subject position.

comprehension questions, online lexical decision, show that adults find object relative clauses more difficult to process than subject relative clauses. This has been found for English (King & Just 1991; Gibson 1998, 2000; Gordon, Hendrick, & Johnson 2001, 2004; Traxler, Pickering, & McElree 2002; Warren & Gibson 2002, 2005; a.o.), for French (Frauenfelder et al. 1980), Dutch (Frazier, 1987; Mak, Vonk, & Schriefers 2002) and German (Schriefers, Friederici, & Kühn 1995).

This difference in difficulty has been attributed to the way in which the processing of A'-dependencies unfolds in adults. In relative clauses, for example, as soon as the speaker encounters a relative pronoun following a DP, he will postulate a gap in the embedded subject position, which is the earliest possible position where an argument could occur. Whereas this processing strategy converges on the correct syntactic analysis for subject relatives (13), it fails with object relatives (14), which require reanalysis. The result is poorer comprehension and an increased complexity of object dependencies, as indexed by slower reading times at the critical verb *kicked*.

(13) The cat that __ *kicked* the dog ran away.

(14) The dog that the cat *kicked* __ ran away.

However, the subject-object asymmetry is not absolute and can be modulated by several factors, which reduce the processing advantage for subject dependencies. Readers find object extraction significantly easier to process when the relative clause contains a mismatch in animacy between the subject and the object (Mak et al. 2002, 2006; Traxler et al. 2002; Trueswell, Tanenhaus, & Garnsey 1994). The same holds true for agrammatic aphasics (Garraffa & Grillo 2008). This difference in subject-object processing can also be modulated by the type of nominal elements intervening between the filler and the gap. Gordon et al. (2001, 2004) show that manipulating the similarity between the two DPs in a relative clause by mismatching the referential properties of the second DP significantly reduces (or eliminates) the processing difficulty associated with object dependencies (i.e. they observe no slowdown in reading times for object extraction when the subject DP inside relative clause is either a second-person pronoun (*you*), a proper name, or a quantified expression (*everyone*) as shown in the contrasts between (15a) and (15b).

(15) a. The salesman that *you/Bob/everyone* contacted spoke very quickly.

b. The salesman that contacted *you/Bob/everyone* spoke very quickly.

The authors take this as evidence of a fundamental property of human memory, its “susceptibility to interference during encoding, storage, and retrieval, arising from the similarity of the items being processed” – an observation they attribute to Crowder (1976). These observations about interveners, however, are clearly reminiscent of the syntactic constraint on locality formalized as Relativized Minimality or Minimal Configuration by Rizzi (1990, 2004).

1.2.1. Relativized Minimality and Adult Grammar

Despite the unbounded flavor of syntactic representations, structures in the language are the result of reiterative mechanisms that apply to local environments: locality principles constrain syntactic computations to take place within small portions of syntactic structure. Rizzi (1990, 2004) starts from the observation that “core structural relations are local” and shows that many locality conditions boil down to a very simple principle called Relativized Minimality (RM), which immediately explains various constraints on the movement of words and phrases in the syntactic structure. For instance, the ungrammaticality of a sentence like in (16b) illustrates that it is impossible to extract a *wh*-element over another. The position indicated in angled brackets represents the argument position where the displaced *wh*-word was merged in the structure (Following Chomsky (1995), I assume that the element in brackets represents a silent trace, i.e. a full (unpronounced) copy of its antecedent, the moved constituent):

- (16) a. I wonder where Mary bought this book.
 b. **What* do you wonder *where* Mary bought <*what*> <*where*>?
-

The basic idea is that of *intervention*: local relations do not allow the intervention of an element that could be a potential candidate for the same syntactic relation. In other words, a relation between two syntactic positions X and Y (for example movement of the *wh*-phrase *what* to a left-peripheral position) is disrupted when there is an element Z (*where*, also a *wh*-word) which shares a set of properties with the elements being linked and which intervenes between *what* and its trace.

The RM principle, in its 1990 version (Rizzi 1990), formally captures this along the lines in (17):

- (17) Relativized Minimality (simplified version)
 In the configuration ... X ... Z ... Y ...,

X can be connected by movement with Y only if there is no Z such that:

- (i) Z is of the same structural type as X
- (ii) Z intervenes between X and Y

This definition of intervention makes the notion of ‘similarity’ encountered in processing accounts more precise, as ‘similarity’ is defined in terms of “same structural type”. As a first step, Rizzi (1990) links the potential interveners to particular syntactic positions in the syntactic tree, namely heads or Specifiers and, in the latter case, he introduces a distinction between A-specifier (argumental) and A'-specifiers (quantifier/operator or adjunct). The distinction is meant to capture the observation that the only element affecting the A'-chain of *what* and its trace in (16b) is another A'-specifier (the embedded wh-phrase *where*) and not the subject DP *Mary*, which appears in an A-specifier position.

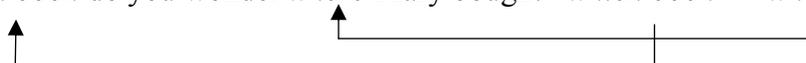
Another important observation of RM is that the type of intervention entering the computation for syntactic locality is hierarchical intervention and not simple linear intervention, which is assumed by pure processing accounts. In other words, in order for an element Z to intervene between Z and Y, it must occur in a structural position in the syntactic tree in which Z c-commands Y, but does not c-command X. C-command (for *constituent command*) is a structural relation between two elements in a syntactic dependency which can be defined as follows (see Adger (2003)):

- (18) A constituent X c-commands a constituent Y if, and only if,
 - (a) X’s sister is Y, or
 - (b) X’s sister contains Y

Given the notion of hierarchical intervention expressed in terms of c-command, (ii) in the definition in (17) amounts to saying that Z must structurally qualify as a potential relevant antecedent for Y, while (i) tries to capture the notion of “similarity”.

Starke (2001) further refined the notion of RM and showed that intervention effects are modulated by certain characteristics of the intervener (Z) and the moved element or the target (X). For instance, the unacceptability of sentences like (16) decreases if the moved constituent is a complex wh-phrase containing a full lexical noun phrase, referred to as *lexical restriction* (or, in more technical terms, a +NP feature). Example (19) illustrates this:

(19) *Which book* do you wonder *where* Mary bought <*which book*> <*where*>?



Under Starke’s approach, the relation between X and Y can still hold (a) when the moved element is more richly specified in morphosyntactic features than the intervener and (b) the features on the intervener are properly included in the set of features characterizing the displaced element. As a consequence, we can redefine the notion of similarity along the lines of Rizzi (2004):

(20) “same structural type” = Spec licensed by features of the same class⁵

This leads to a tripartite system of set relations between the featural specification of the target X and the intervener Z, summarized in (21) below, where A and B represent abstract morphosyntactic features:

(21)	X		Z		Y		
a.	+A ...		+A ...		<+A>	*	(identity)
b.	+A,+B ...		+A ...		<+A,+B>	OK	(inclusion)
c.	+A ...		+B ...		<+A>	OK	(disjunction)

The three main types of relations are: (a) **identity**, (b) **inclusion** and (c) **disjunction**. Let us see how this system works in connection with (16b) and (19). In (22) I illustrate the featural specifications of each wh-phrase involved: the [+Q] feature designates the presence of a question operator, while [+NP] shows that the element contains a lexical restriction (I am only showing the trace of the wh-element moved to the left periphery of the matrix clause to keep a simpler level of representation):

	X		Z		Y
	+Q		+Q		
(22) a.	* <i>What</i> do you wonder where Mary bought < <i>what</i> >?				

	X		Z		Y
	+Q +NP		+Q		
b.	? <i>Which book</i> do you wonder where Mary bought < <i>which book</i> >? ⁶				

⁵ Within a cartographic approach to left periphery of CP (Rizzi, 2004), what was traditionally called Spec,CP is divided in a hierarchy of functional positions, each of which is associated to a specific set of morphosyntactic features (cf. (61) in Rizzi (2004) reported below):

- (i) a. Argumental: person, number, gender, case
- b. Quantificational: Wh, Neg, measure, focus
- c. Modifier: evaluative, epistemic, Neg, frequentative, ...
- d. Topic

Structures are ruled out by featural RM as ungrammatical when the intervener Z (**where**) and the moved element X (*what*) fully match in features, as shown in (22a). RM is satisfied and structures are well-formed when the two elements have disjoint features (21c) or when the moved element shares a subset of features with the intervener (21b), exemplified in (22b) by the inclusion relation between the features of *which book*, a [+Q +NP] element, and the intervener **where**, since this is specified as [+Q]. On the other hand, (22c) is ruled out as ill-formed:

X	Z	Y
+Q	+Q +NP	

(22) c. **Where* do you wonder **which book** Mary bought <*where*>?

Here the intervener **which book** is more richly specified [+Q +NP] than the target X (*where*), which now has only the feature [+Q]. The critical difference between (22b) and (22c) is that in the latter case the featural specification of the intervener Z fully matches that of the target X, given that both are specified as [+Q]. *Where* cannot be connected with its trace in (22c) and this results in a violation of locality.

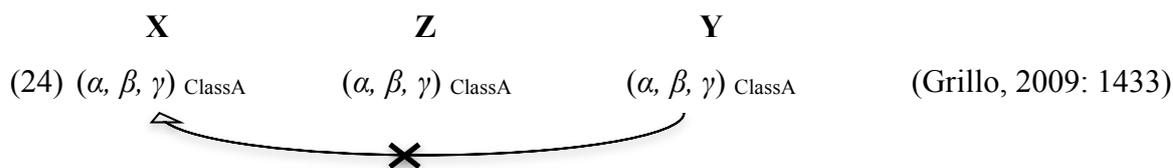
The featural approach to intervention effects has also been shown to have explanatory potential in the domain of language pathology and language acquisition. Grillo (2008, 2009) proposed a generalization of the locality principle of RM to account for the difficulties that agrammatic Broca's aphasics have in the interpretation of object relative clauses and *wh*-questions and of other non-local dependencies in which a noun phrase intervenes between the displaced constituent and the canonical position from where this element is extracted and where it receives an interpretation. This is depicted in (23).

(23) [DP_{Object} [DP_{Subject} [V <DP_{Object}>]]]

The basic idea behind the Generalized Minimality (GM) approach is that a minimality effect is expected to arise in non-local dependencies involving movement over an intervening element when the feature structures of the moved object and of the intervening subject are not distinguishable (the features of the intervener and the displaced object belong to the same class – Argumental, Quantificational, Modifier, Topic). More specifically, in order to

° As Luigi Rizzi (p.c.) points out, the degraded status of (22b) indicates that the categorical distinction between identity and inclusion in (21) is not so straightforward, as, for adults as well, there seems to be a cost associated with the computation of inclusion.

distinguish between a moved DP and an intervening DP, it is necessary to represent the whole array of morphosyntactic features associated with the two elements.



The processing cost of representing all the morphosyntactic features might be too high to pay for a grammatical system endowed with weaker computational abilities and will therefore generate comprehension difficulties, for example in agrammatic aphasics (see also Garraffa & Grillo 2008).

This line of reasoning and the attempt to explain the local behavior of linguistic dependencies by defining interfering factors (which in the syntactic case actively block the dependency) clearly parallels Gordon et al.'s (2001, 2004) concept of similarity interference put forth for the processing of A'-dependencies in adults in order to account for the slowdown in adult reading times. The difference between an approach to similarity based on RM or featural intervention and an approach along the lines of Gordon et al. (2001) is that the former appeals to a formal grammatical principle to define the relevant notion of similarity in terms of morphosyntactic features that trigger syntactic movement (see Belletti & Rizzi 2013 for a more detailed interpretation of the experimental results of adult performance in terms of an RM approach).

1.3. A-bar dependencies and child grammar

Friedmann, Belletti, & Rizzi (2009) further extended the application of RM outlined in section 1.3.1 and appealed to the notion of *intervention* in order to explain children's persisting difficulties with the comprehension and production of certain object A'-structures. The general observation about the acquisition of wh-questions and relative clauses is that they do not all emerge at the same point in time. Both A'-dependencies are acquired as early as 3-4 years old when the head of the dependency is the subject (see examples in (a) below). Object dependencies with a 'bare' (-NP) moved element (i.e. *who*-questions and 'free' relative clauses) illustrated in (25b) and (28b) are also consolidated early (Avrutin 2000, Friedmann et al. 2009). In contrast, object dependencies with a lexical restriction (meaning sequences such

as ‘*the/which* + *NP*’, given in (26b) and (27b)) are difficult for children to comprehend until around the age of 6 (Corrêa 1995, Adani 2011, Friedmann et al. 2009, a.o.):

- (25) a. Who [___ is kissing the girl]?
 b. Who is [the girl kissing ___]?
- (26) a. Which boy [___ is kissing the girl]?
 b. Which boy is [the girl kissing ___]?
- (27) a. The boy that [___ is kissing the girl].
 b. The boy that [the girl is kissing ___].
- (28) a. Show me who [___ is kissing the girl].
 b. Show me who [the girl is kissing ___].

In a series of comprehension experiments with 22 Hebrew-speaking children aged 3;7-5;0, Friedmann et al. (2009) bring clear evidence that it is the internal structure of both the intervener and the target that accounts for the selective problems in processing object A-bar dependencies. Their results illustrate that children comprehend well structures in which no intervention effects arise, either because (i) the A'-moved element does not cross over an intervener, as is the case in subject dependencies (29a) and (29b) or (ii) because the moved element and the intervener have a different featural specification, i.e. when only the A'-object or only the embedded subject is lexically restricted. This is the case with free object relatives (29c) and *who* object questions (29d). Moreover, Friedmann et al. (2009) showed that intervention effects also when the moved object DP crosses an impersonal arbitrary *pro* subject (29e), an intervening subject with no lexical restriction (but which has plural specifications, marked on the agreeing verb).

- (29) a. Tare li et ha-para she-menasheket et ha-tarnegolet.
 show to-me ACC the-cow that-kisses ACC the-chicken
 ‘Show me the cow that is kissing the chicken.’
- b. Eize kelev noshex et ha-xatul?
 which dog bites ACC the-cat
 ‘Which dog bites the cat?’
- c. Tare li et mi she-ha-yeled menadned.
 show to-me ACC who that-the-boy wets

- ‘Show me the one that the boy is wetting.’
- d. Et mi ha-xatul noshex?
ACC who the-cat bites
‘Whom does the cat bite?’
- e. Tare li et ha-sus she-mesarkim oto.
show to-me ACC the-horse that-brush-pl him
‘Show me the horse that someone is brushing.’

The children tested in Friedmann et al.’s experiments only struggle with object relative clauses headed by a lexically restricted element (with (30a) or without a resumptive pronoun (30b)) and object *which NP* questions (30c).

- (30) a. Tare li et ha-pil she-ha-arie martiv.
show to-me ACC the-elephant that-the-lion wets
‘Show me the elephant that the lion is wetting.’
- b. Tare li et ha-kof she-ha-yeled mexabek oto.
show to-me ACC the-monkey that-the-boy hugs him
‘Show me the monkey that the boy is hugging.’
- c. Et eize kelev ha-xatul noshex?
ACC which dog the-cat bites
‘Which dog does the cat bite?’

Based on this observation, Friedmann et al. (2009) show that children’s selective problems with A’-dependencies stem from intervention effects that can be subsumed by RM. The difference between children and adults derives, in this approach, from the hypothesis that child and adult grammars have different cut-off points in an otherwise identical locality system, based on RM expressed in terms of the featural specifications of the target (i.e. the landing position of the moved constituent) and the intervener and of their set-theoretic relations. Note that this version of RM put forth in Friedmann et al. (2009) allows the subject DP, which appears in an A-specifier position, to act as an intervener in the A’-dependency involved in *wh*-questions and relative clauses. Although this differs from the initial formulation of the principle of RM (Rizzi 1990), in which intervention was defined in terms of particular syntactic positions such as A or A’, it follows from the revised version of RM (Starke 2001, Rizzi 2004), which takes into consideration a more fine-grained typology, based on morphosyntactic features.

Whereas adult grammar only rules out configurations that involve an **identity** of the relevant morphosyntactic features between the target X and the intervener Z, i.e. when the sets of features specifying the two elements are fully identical, children also struggle with configurations that express an **inclusion** relation. An intervention effect holds when the child system, endowed with weaker computational capacities, is not able to distinguish between the features of the moved DP object and the intervening DP subject. The authors identify the [+NP] feature (indicating the presence of a *lexical restriction*) as the source of these intervention effects. The intervener thus blocks the local relation connecting the moved element and its trace, as illustrated in (31a) for headed object relative clauses and in (31b) for *which NP* object questions ([+R] and [+Q] are the scope-discourse or ‘criterial’ features attracting the target to the corresponding A’-position⁷):

- +R +NP +NP <+R +NP>
- (31) a. Show me the lady [that the girl is kissing <the lady>].
- 
- +Q +NP +NP <+Q +NP>
- b. Which lady [is the girl kissing <the lady>].
- 

Headed subject relative clauses and *which NP* subject questions, on the other hand, pose no problems for comprehension as they do not contain a Z-type element intervening between the relative head or the *wh*-element and its trace in the subject position (32).

- +R +NP <+R +NP>
- (32) a. Show me the girl [that <the girl> is kissing the lady].
- +Q +NP <+Q +NP>
- b. Which girl [<which girl> is kissing the lady]?

Immature systems are only able to compute configurations in which the moved A’-object and the embedded subject differ maximally. As a result, children perform adult like with those dependencies headed by a bare [-NP] element as in (33), because these display a **disjunction** relation between the relevant featural specifications of the two elements. (33a) is an example

⁷ Friedmann et al. (2009) assume a raising/promotion analysis of relative clauses (see Vergnaud 1974, Kayne 1994, Bianchi 1999), which postulates that relative clauses are derived by raising the DP head from a position internal to the relative clause.

of a free object relative clause and (33b) illustrates a bare object *wh*-question in which the A'-moved object and the embedded subject do not share similar features.

- +Q +NP <+Q>
- (33) a. Show me who [the girl is kissing <who>].

- +Q +NP <+Q>
- b. Who [is the girl kissing <who>]?

An important observation is that the features that enter the computation of locality in the configurations above are the features that function as attractors for movement. [+Q] and [+R] are the attracting features of the *wh*-elements and the relative heads, respectively. As for the [+NP] feature, there is evidence in favour of considering lexical restriction as an attractor for movement in different constructions. Take the case of certain Northeastern Italian Dialects. For example in Bellunese, studied by Munaro (1999, cited in Poletto & Pollock 2000), bare *wh*-words and lexically restricted *wh*-elements target different positions in the left periphery of the clause; the first occur in a sentence-final position, while the latter move to a sentence-initial position in the clause:

- (34) a. Ha-tu magnà *che*?
 have-you eaten what ?
 ‘What did you eat ?’
- b. **Che* ha-tu magnà?
 what have-you eaten ?
- c. *Che* vestito à-la comprà?
 what dress has-she bought
 ‘Which dress did she buy?’
- d. *Ha-la comprà *che* vestito?
 has-she bought what dress ?

The difference in syntactic behavior between lexically-restricted and bare *wh*-phrases points to the presence of different attractors for the movement of the two types of *wh*-elements.

Converging evidence also comes from Romanian multiple *wh*-phrases. Romanian, like Bulgarian and other Slavic languages, requires that all *wh*-elements be fronted overtly to the left periphery of the clause, illustrated in (35):

(35) *Cine ce a cumpărat?*

who what has bought

‘Who bought what?’

Whereas there is a rigid ordering with respect to the fronting of bare *wh*-words, with *cine* (‘who’) preceding other *wh*-arguments – *pe cine* (‘whom’), *cui* (‘to whom’), *ce* (‘what’) – or *wh*-adjuncts – *când* (‘when’), *unde* (‘where’), *cum* (‘how’) – lexically restricted *wh*-elements always appear clause-initially (see Laenzlinger & Soare 2005, Soare 2009 for a more detailed account of the ordering of *wh*-phrases in Romanian):

(36) *Care rochie cine a cumpărat-o?*

which dress who has bought-her

‘Who bought which dress?’

The lexically restricted element can also be separated from other bare *wh*-phrases by fronting it to the left periphery of a matrix clause with bare elements appearing in a lower position (37a). This option is ruled out for bare *wh*-words (37b).

(37) a. *Care rochie vrei să știi cine când a cumpărat-o?*

which dress want.2.SG SUBJ know.2.SG who when has bought-her

‘Which dress do you want to know who bought when?’

b. **Ce vrei să știi cine când a cumpărat?*

what want.2.SG SUBJ know.2.SG who when has bought

‘Which dress do you want to know who bought when?’

The data from Bellunese and Romanian clearly show that there must be different attractors for lexically restricted and bare *wh*-elements as the presence of a lexical restriction on the *wh*-phrase determines different landing sites for movement. The crucial point to make here is that the [+NP] feature forms part of the array of morphosyntactic features that trigger movement and, as such, should enter into the determination of locality.

Summarizing, children have to be able to compute the subset-superset relations between the features on the moved element and the intervener in order to distinguish between the two elements and converge on the correct interpretation for these sentences. When they fail to do this, due to their supposed limited computational resources, a RM violation arises. This results in children’s poor comprehension of structures in which a lexically-restricted [+NP] object is extracted over an embedded subject also containing a [+NP] feature.

If [NP] is considered to be a feature in the grammar, along the lines of the RM approach outlined above, then the natural question to ask is whether other morphosyntactic features modulate comprehension of A'-dependencies. This is particularly relevant in light of recent studies which have revealed that features such as number and gender modulate comprehension of headed A'-dependencies. More specifically, a mismatch in these features facilitates processing of A'-structures, although the effects surface to different degrees from language to language. For example, Adani et al. (2010) tested 50 typically-developing Italian children (age range 5;0 to 9;0) on center-embedded relative clauses and found that a number mismatch between the moved object and the intervening subject improves performance with object relative clauses in Italian (compared to the conditions in which the two elements matched in features). The authors also reported better results when the two elements mismatched in gender features, although the effect was not as prominent as in the case of a number mismatch. Adani et al. (2010) take these results as evidence for considering a finer-grained analysis of the notion of lexical restriction put forth by Friedmann et al. (2009) and for distinguishing the role that specific morphosyntactic features (i.e. Number, Gender) play in modulating intervention effects.

In the same vein, Belletti, Friedmann, Brunato, & Rizzi (2012) investigated the impact of a gender mismatch on the comprehension of headed relative clauses in Hebrew and Italian. In an experiment with 62 typically-developing Hebrew and Italian children (age range 3;9 to 5;5), Belletti et al. (2012) observed that a gender mismatch sharply improved the comprehension of headed object relative clauses in Hebrew. However, the gender mismatch between the object DP and the embedded subject DP did not significantly affect comprehension of the same dependencies in Italian. Based on the selective effect of gender in Hebrew and Italian, Belletti et al. (2012) postulate an enrichment of RM effects present in child grammar, by adding another set theoretic relation, **intersection**, along the lines of (38):

(38)	Target	Intervener	Trace	<i>Adults</i>	<i>Children</i>
	<i>X</i>	<i>Z</i>	<i>Y</i>		
Identity	A	A	<A>	*	*
Inclusion	A,B	B	<A,B>	ok	*
Non-inclusion: Intersection	A,C	C,D	<A,C>	ok	ok
Non-inclusion: Disjunction	A	B	<A>	ok	ok

(adapted from Belletti et al., 2012)

The claim is that the child system performs better on non-inclusion configurations. More specifically, in the system above, children are able to comprehend not only disjunction, but also **intersection** relations, in which the intervener differs from the target in at least one ‘relevant’ feature (given as D in the abstract representation above). A feature is relevant in a given language when it is syntactically ‘active’ in the sense that it belongs to the feature set triggering movement. This would be the source of the cross-linguistic difference attested between Hebrew and Italian: a mismatch in gender impacts processing in Hebrew as gender is morphologically specified on the verb in this language and it plausibly belongs to the set of Phi features attracting a DP to subject position. In Italian, on the other hand, the gender feature is not an attracting feature and therefore it does not enter the computation of locality. This condition on delimiting the array of features to those triggering movement is a consequence of the hypothesis that RM is the operative principle. Pursuing this line of reasoning, it becomes evident why number does impact processing in Italian since, unlike gender, number acts as an attractor for movement in this language.

1.4. Goals and outline of the dissertation

However, more remains to be understood about the atoms of intervention in A’-dependencies. In the context of these findings described in the preceding sections, the purpose of this thesis is twofold. On the one hand, it seeks to contribute to the theoretical discussion of complexity and the different aspects of syntactic locality in child grammar; on the other, it engages into the empirical investigation of how the comprehension process of A’-constructions unfolds in French and Romanian, with the goal of assessing whether the crucial complexity factor in the acquisition of relative clauses and *wh*-questions in these two languages can be identified as an intervention effect of a Relativized Minimality type.

The dissertation focuses on syntactic dependencies derived by movement of one element to the left periphery of the phrase and it zooms in, among these constructions, on object dependencies (where the element targeted by movement is the object of the verb). More specifically, it examines two key elements that play a role in establishing the correct grammatical dependency between the moved element (‘the A’-filler’) and the embedded subject. The latter intervenes in the interpretive chain formed by the A’-filler with the gap and can thus potentially hinder the establishment of the syntactic relation between the moved constituent and its original position. Through a series of comprehension studies with

typically-developing French and Romanian-speaking children, I provide a structural explanation of the selective difficulties children experience with object relative clauses and *wh*-questions, based on the Relativized Minimality model of syntactic locality (Belletti et al, 2012; Friedmann et al., 2009; Rizzi, 1990, 2004, 2013; Starke, 2001). The studies fall under the scope of cross-linguistic investigation, which has proven very fruitful so far in identifying consistent patterns of performance with respect to restrictive relative clauses and *wh*-questions. The analysis integrates the grammar-based view on language development with the cartographic approach to syntactic structures (Belletti 2004, Cinque 2002, Rizzi 2004) and current models of syntactic locality (Rizzi 1990, 2004), with the goal to explore the empirical coverage of RM in A'-dependencies in early child grammar. A better understanding of the grammatical principle underlying the acquisition of this type of constructions can help us explain their acquisition process through a mechanism we understand in detail and, consequently, offer a unified and simplified approach to complex phenomena present in child language.

The rest of the dissertation is organized as follows. Chapters 2 and 3 present a series of experiments in French and Romanian that aim to uncover whether children are able to make use of various language-specific grammatical strategies in order to disambiguate between a subject and an object interpretation of relative clauses and *wh*-questions.

Chapter 2 includes two experiments on the comprehension of relative clauses and *wh*-questions in French which exploited the rather large variation with respect to movement operations that French matrix *wh*-questions allow, contrary to relative clauses: the *wh*-element can remain in-situ or be fronted to spec-CP with or without the filling of C. Relative clauses lack this structural optionality, as the head of the relative clause cannot appear in-situ in its canonical position (i.e. as subject or object of the embedded verb). This makes French a particularly suitable language for examining the effect of the structural features that may violate RM and modulate comprehension of A'-constructions.

Chapter 3 investigates the syntactic properties of A'-dependencies in Romanian, as this language also provides an ideal testing ground for the use of various strategies that can distinguish between a subject and an object interpretation of A'-constructions. In Romanian, both relative pronouns and *wh*-pronouns show overt case-marking in the Accusative and the Dative. In principle, this should provide children with a cue which should facilitate the assignment of the correct theta-role to the A'-filler and the establishment of the grammatical dependency between the A'-element and the object gap contained in the relative clause or the *wh*-question.

The following two chapters examine whether the featural specification of the moved element or of the intervener reduces intervention effects in object dependencies in child grammar. Given an account of children's difficulties which appeals to Relativized Minimality effects triggered by syntactically active features, a study of the features associated with the moved element or the intervener allows us to uncover the fine-grained features that have an effect on children's comprehension of object dependencies.

Chapter 4 looked at the comprehension of object relative clauses and *wh*-questions in French-speaking children in an attempt to answer several questions: (i) How should the [+NP] specification be understood exactly? In other words, do intervention effects still arise when the moved element does not contain an overt NP lexical restriction as in the case of French relative clauses headed by demonstrative pronouns like *celui/celle*. (ii) What is the role of animacy? Does an animacy mismatch between the target and the intervener give rise to an intersection configuration in the sense of Belletti et al. (2012), thus improving comprehension? And if so, what makes animacy a 'relevant' feature for the computation of RM? Does the way in which animacy is expressed in the structure matter?

Chapter 5 takes a different view on the features that have the potential to modulate the comprehension of object A'-dependencies in children and investigates to what extent the lexical descriptive content of the object or subject DPs affect comprehension. More specifically, the experiments presented in this chapter compare children's processing of object relative clauses and *wh*-questions in which the extracted object or the intervening DP are either descriptively impoverished nouns, such as *person* or *animal*, or descriptively rich nouns, like *girl* or *dog*.

Chapter 6 summarizes the main findings and considers the limitations of the current studies, as well as implications for future research.

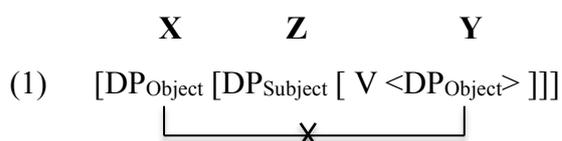
“Subject and object are not as distinct as most people think. If the boundary separating the two isn’t clear-cut to begin with, it is not such a difficult task to intentionally shift back and forth from one to the other.”
(Haruki Murakami, *1Q84: Book 3*)

2. THE COMPREHENSION OF RELATIVE CLAUSES AND WH-QUESTIONS IN CHILD FRENCH

Chapter 1 showed that psycholinguistic studies of adult performance bring evidence for increased complexity in the processing of object A’-dependencies as compared to subject A’-dependencies (for studies on the processing of relative clauses), see Gordon et al. 2001, 2004; Traxler et al 2002; Warren & Gibson 2002, 2005; Mak et al. 2002, 2006; etc.; for studies on the processing of wh-questions, see Frazier and Flores D’Arcais 1989; De Vincenzi 1991). The complexity associated with processing object dependencies also emerges in production experiments revealing that, in contexts eliciting object relatives, adults produce passive object relative clauses (PORs) like, for example, “I would rather stay with the children that are lifted by the elephant” (Belletti & Chesi 2011; Contemori & Belletti 2014). More specifically, the preferred strategy that adults use to avoid the production of an object relative is to transform the elicited active object relative into a subject relative in the passive (see Belletti 2014 for a detailed discussion of PORs). Cross-linguistic research on the acquisition of A’-movement has uncovered a pattern similar to the one emerging from experimental studies with adults: both relative clauses and *wh*-questions are easier to process when the head of the dependency is the subject rather than the object. Studies of children’s comprehension of relative clauses in experiments have shown that there is a greater computational demand in processing object relatives, which yield low comprehension scores until around the age of 6 (Corrêa 1995; Adani 2011; Friedmann et al. 2009 a.o.). This subject/object asymmetry holds in *which*-questions but is less prominent in *who*-questions, which are comprehended well by age 4 (Avrutin 2000, Friedmann et al. 2009). Friedmann et al. (2009) relate the problems children

show with certain A'-dependencies in the early stages of language acquisition to Relativized Minimality (RM), a syntactic principle capturing the effects of intervention locality.

The gist of this approach, to which I will refer as the featural intervention account from now on, is that children encounter difficulties with movement structures in which one element containing a lexical restriction (i.e. a [+NP] feature) intervenes in the movement of another [+NP] element. In other words, children only struggle with those structures in which (i) the A'-chain linking the object to its base-generated position crosses an intervening subject and (ii) the intervening element shares a featural specification with the A'-moved object. This results in an intervention configuration in headed object relative clauses and *which*-object questions since the subject DP represents a potential competitor in establishing the correct grammatical dependency between the A'-moved constituent and its original position, as shown in (1):



Chapter 2 takes the comprehension of relative clauses and *wh*-questions in French as a case-study for the featural intervention account. French offers a good testing-ground as in relative clauses, the complementizer overtly signals whether the head of the relative should be interpreted as the subject or the object of the embedded verb. Matrix *wh*-questions in French display several optional strategies: the *wh*-element can remain in-situ or be fronted to spec-CP with or without an overt element present in C. The rather large variation with respect to movement operations allowed in French matrix *wh*-questions makes this a particularly suitable language for examining the effect of the structural properties that may modulate comprehension of A'-constructions. Moreover, verbs in French inflect for person and number so French, like Italian, overtly expresses number agreement in the verbal morphology.

- (2) a. Le garçon lave le chat.
 the boy wash.SG the cat
 ‘The boy is washing the cat.’
- b. Les garçons lavent le chat.
 the.PL boys wash.PL the cat
 ‘The boys are washing the cat.’

Unlike in Italian, though, number marking on the verb in French for the third person can be realized or not phonologically. For example, despite the difference in spelling between the singular verb in (2a) and the plural verb in (2b), the two forms are homophonous. The conjugation class the verb belongs to determine the phonological properties of verbal number agreement in French. There are three conjugation classes in French (Arrivé 2006, but see Riegel, Pellat, & Rioul 1994 for a different classification based on phonological properties). The verbs belonging to the first class, that is verbs with an infinitive form *-er* and a single stem (e.g. *laver* ‘wash’), display no audible distinction between singular and plural inflected forms. Number marking on the verb in the third person is audible with verbs from the second conjugation class (i.e. verbs ending in *-ir* like *punir* ‘punish’) and from the third conjugation class containing the irregular verbs with infinitives ending in *-ir*, but also in *-oir*, *-re*, etc. (e.g. *prendre* ‘take’). Therefore, even if an object relative contains an embedded plural subject, the agreement morphology on the verb will only disambiguate the sentence towards an object reading when number marking is phonologically audible.

The two studies included in this chapter investigated the comprehension of subject and object relatives and wh-questions in typically developing French-speaking children aged 4 to 6 years old. The goal of these experiments was twofold: (i) determine *the effect of structural properties* (alternation in the form of the complementizer in relative clauses, alternation in question-formation strategies) that modulate comprehension of A'-constructions in child French and (ii) examine *the role of featural intervention*, by exploring whether a similar featural specification (presence of a [+NP] feature) of the subject and object DPs hinders parsing of relative clauses and wh-questions in French-speaking children and whether number dissimilarities between the subject and object DPs facilitate children's comprehension of objects relative clauses.

The first part of the chapter focuses on relative clauses: after a brief account of the syntactic structure of French relative clauses, I will revise previous findings in the acquisition of these constructions and then present the first study ran on the comprehension of subject and object relatives. In the second part of the chapter, I will discuss the syntax and acquisition of wh-questions in French, before introducing the second study that dealt with the comprehension of subject and object bare (*who*) and lexically-restricted (*which*) questions⁸.

⁸ Pesetsky (1987) introduces the notion of “Discourse-linked” (D-linked) to refer to wh-phrases like *which cat* as these elements prompt an answer chosen from a set of referents already present in the discourse, whereas wh-phrases like *who* do not.

2.1. French relative clauses: from syntax to acquisition

In French, the form of the relativizer in subject and object relative clauses signals the position from which the head noun has moved inside the embedded clause: as shown in (3a-b), the complementizer *qui* is present if the relativized element is the subject of the embedded verb; *que* appears if the relativized element is the object of the embedded verb.

- (3) a. Le garçon *qui* lave le chat.
‘The boy that washes the cat.’
b. Le chat *que* le garçon lave.
‘The cat that the boy washes.’

The use of *qui* and *que* in relative clauses is purely grammatical (they indicate a subject or object function) and is not related to the animate or inanimate character of their referents (examples (4a-b)). This distinguishes them from the *wh*-pronouns *qui* and *que* found in questions and whose referents can only be animate (in the case of *qui*) or inanimate (for *que*), as illustrated in (5a-b).

- (4) a. Un rayon de lumière *qui* rebondit d’ un miroir.
a ray of light QUI bounces of a mirror
‘A ray of light that bounces off a mirror.’
b. Le président *que* la presse a véhément critiqué.
the president QUE the press has strongly criticized
‘The president that the press has strongly criticized.’
- (5) a. **Qui* rebondit d’ un miroir? Un rayon de lumière.
who bounce of a mirror ? a ray of light
*‘Who bounces off a mirror ? A ray of light.’
b. **Qu’ est-ce que* la presse a véhément critiqué? Le président.
what EST-CE QUE the press has strongly criticized? the president
*‘What has the press strongly criticized? The president.’

Rizzi & Shlonsky (2006) analyze *qui* as composed of *que* + *-i*, where *que* occupies the corresponding position for (relative) force in the left periphery and *-i* is a nominal element specified for [+Fin], [+N], [α PI] and externally merged in Fin, the lowest head in a split complementizer system (Rizzi 1997). *-i* in Fin appears in a local configuration with the head

of the functional projection *Subj* and is therefore able to satisfy the Subject Criterion⁹ (Rizzi 2006), under a more general characterization of the criterial configuration in terms of *c*-command, which accounts for both *Spec*-head and local head-head configurations. This is given in (6) below:

(6) For [+F] a criterial feature, *X*+F is locally *c*-commanded by *A*+F.

The Subject Criterion represents a criterial requirement formally similar to the Topic Criterion, the Focus Criterion, etc., which reformulates the classical Extended Projection Principle (EPP) – the requirement that all clauses have subjects. Thematic subjects move to the criterial *Subj* position where they are frozen in place and their further movement becomes impossible (Criterial Freezing). Consequently, the derivation of a subject relative clause would crash if the relative element moved to [*SpecSubj*], the specifier position of *Subj*, because there (i) it would satisfy the Subject Criterion, (ii) would be frozen in place according to the Criterial Freezing and (iii) would not be able to move further to the criterial position for relative operators in the left periphery. This problem does not arise if a higher head *Fin* is merged in the structure taking a ‘nominal’ variant *-i* since it can satisfy the Subject Criterion under the definition of a criterial configuration in (5). The relative operator can thus skip the [*Spec*, *Subj*] position and move to the position where the Relative Criterion must be satisfied in the left periphery. Rizzi & Shlonsky (2007) further assume that the relative element passes through [*SpecFin*] on its way to the left periphery of CP in order to value the number feature on *-i*. The above analysis, therefore, has the advantage of explaining how the thematic subject can skip the freezing position (i.e. the Subject Criterion position) and be moved from a lower, predicate internal position, to a position at the left periphery of the complementizer system.

Let us now turn to the acquisition of relative clauses in French. This has been mainly studied in production and there has been a lot of debate in the L1 acquisition literature as to the mechanisms children use to derive relative clauses. Labelle (1990, 1996) argues that, although *wh*-movement appears in early *wh*-questions, *wh*-movement is not available in relative clauses, at least until 6 years of age, despite the evidence children get from the input.

⁹ Criteria are principles that require specifier-head agreement with a functional head carrying the same features: Q, Top, Foc, R for questions, topic, focus, relatives, etc.

(i) XP_F and X_F must be in a *Spec*-head configuration, for $F = Q, \text{Top}, \text{Foc}, R, \dots$ (Rizzi, 2004)

Once an element reaches a position where it satisfies a criterion (i.e. a position which expresses scope-discourse interpretive properties), the element is frozen in place and cannot move further in the structure (Criterial Freezing).

In her study, Labelle (1990) looked at 1'348 relative clauses elicited from 108 Canadian French-speaking children aged 3 to 6 years. The five types of relative clauses investigated were subject, direct object, indirect object relative clauses (with *à qui* 'to whom'), possessive relative clauses (with *dont* 'whose') and locatives (introduced by *dans lequel* 'in which' and *où* 'where'). relative clauses were elicited using pairs of pictures describing different activities which involved the object or character indicated by the head of the relative. Children then had to answer the experimenter's questions with a relative clause.

Labelle's data show that children do not produce any relative clauses which involve pied-piping of the relative element, pied-piping being the overt evidence that *wh*-movement has taken place. Instead, they generalize the gap strategy to all types of relative clauses, an option which is ungrammatical in standard French:

- (7) Sur la boîte que la petite fille elle embarque (K 4;04)
 on the box that the little girl she goes
- (8) Sur la petite fille que le monsieur i(l) montre un dessin (MJ 3;06)
 on the little girl that the man he shows a drawing

Another relativization strategy that French-speaking children use is the resumptive strategy. In examples (9) to (11) taken from Labelle (1990: 99-100) we see that children produce relative clauses introduced by the complementizer *que* and containing either a resumptive pronoun (9), a resumptive preposition (10) and a resumptive NP (11), coindexed with the head of the relative.

- (9) Celle-là que le papa lui montre un dessin (JF 5;00)
 that one that the father her shows a drawing
- (10) Sur la boîte que le camion rentre dedans (S 4;08)
 on the box that the truck goes inside
- (11) Sur la boîte que la petite fille est debout sur la boîte (K 4;04)
 on the box that the little girl is standing on the box'

Taking into account the absence of pied-piping¹⁰ and the abundant use of resumptive pronouns in child relative clauses, strategies which are ungrammatical in standard French¹¹,

¹⁰ It is interesting to note that children even at 2 years of age produce *wh*-questions with pied-piping:

that movement is indeed involved in the derivation of relative clauses in early grammars. The child system makes use of a mechanism also present in the adult system, thus eliminating the need to postulate unwanted differences between child and adult grammars.

For example, Guasti & Shlonsky (1995) reanalyse the data in Labelle's corpus and propose a derivational mechanism along the lines of Kayne's (1994) raising analysis for the analysis of relative clauses in adult grammar. The gist of their proposal is that relative clauses in child French do involve movement, but it is movement of the relative head, not of an operator. Their analysis accounts for the presence of gap relative clauses in child language, but it also presupposes that children derive relative clauses through movement of the relative head from a position internal to the relative to the specifier position of the relative CP, assumed to be the sister of the external determiner (D):

- (13) a. Le livre que j'ai lu hier.
 the book that I have.1.SG read yesterday
 'The book I read yesterday.'
 b. [DP [D° le [CP [NP livre]_i [C° que j'ai lu t_i hier]]]]

For Guasti & Shlonsky (1995), children overgeneralize the structure in (13b) and apply it to all types of relative clauses, including pied-piping relative clauses. As for the resumptive strategy present in relative clauses in child French, Guasti & Shlonsky suggest that the resumptive elements are in situ, while the head of the relative appears in [SpecCP], reminiscent of the option of having wh-in-situ in questions.

- (14) a. Sur la boîte que la petite fille est debout sur la boîte (K 4;04)
 on the box that the little girl is standing on the box'
 b. [PPSur[DP [D° la [CP [NP boîte]_i [C° que la petite fille est debout sur la boîte_i]]]]]

Under this account, the resumptive element moves to [SpecCP] at LF and replaces the head of the relative clause, thus allowing the formation of a predicational structure.¹²

¹² See Utzeri (2007) for a more recent analysis of relative clauses with a gap and with a resumptive pronoun or resumptive DP in child Italian, which could be extrapolated to resumptive relative clauses in child French. Utzeri (2007) puts forth a derivation of resumptive relative clauses adopting Belletti's (2005) analysis of doubling structures (i.e. constructions found in languages like Romanian, for example, in which a single argument seems to be duplicated in a clitic pronoun and a lexical noun phrase as in 'Am văzut-o pe Maria. / 'I saw her Mary.') as a single big constituent (hence the term 'big DP') in which both the pronoun and the doubled lexical argument originate (see also Belletti 2009 for a more detailed analysis of these constructions). The advantage of a derivation along these lines is that the same syntactic mechanism is postulated for generating both relative clauses with a gap and with a resumptive element.

Such an analysis of relative clauses in child French involving movement to the left-periphery of the clause is also compatible with the more recent grammatical intervention account to the acquisition of relative clauses (Friedmann et al. 2009, Belletti et al. 2012) demonstrating that intervention effects are at stake in the comprehension of relative clauses in Hebrew and Italian. It would be hard for a non-movement approach to the derivation of early relative clauses to account for such intervention effects since these arise due to the movement of an element over another element bearing a similar featural specification.

2.2. Experiment 1: Comprehension of relative clauses with and without a number mismatch in French

The first study (Experiment 1) tested the comprehension of subject and object relative clauses in French with the goal to determine, on the one hand, if the *que/qui* alternation found in these structures guides children's interpretation of relative clauses and, on the other hand, to investigate whether a mismatch in number information between the head noun and the embedded DP, as well as the presence or absence of audible verb agreement, facilitate children's processing of relative clauses.

Number dissimilarities between the subject and object DPs in a relative clauses have been shown to facilitate the comprehension of object relative clauses by Italian- and English-speaking typically-developing children, in both offline (Adani et al. 2010, Adani 2011) and online tasks (Contemori & Marinis 2014). By using an offline picture-matching task in which participants had to choose among four possible scenarios, Adani et al. (2010) tested 50 Italian children (age range 5;0 – 9;0) on center-embedded relative clauses and found that a number mismatch between the moved object and the intervening subject (15b) improves performance with object relative clauses in Italian (compared to the conditions in which the two elements matched in features, as in (15a)).

- (15) a. The cat that the goat is washing has climbed onto the stool.
b. The cat that the goats are washing has climbed onto the stool.

Adani (2011) tested the comprehension of right branching subject and object relative clauses (with a preverbal and a postverbal subject) containing a number mismatch between the head of the relative (a noun in the singular) and the noun phrase internal to the relative clause (a plural noun). She found that the object relative clauses with a preverbal subject and a number

mismatch are comprehended better than object relative clauses with a postverbal subject, despite the presence of a number mismatch in both cases. Adani's (2011) results show that, while 3 year-olds perform at chance with object relative clauses with a preverbal plural subject (53%), the comprehension rate of these structures increases with age (83% for the 4yo, 74% for the 5yo, 85% for the 6yo and 89% for the 7yo).

These results stand in contrast with those obtained for Italian and Greek by Guasti, Stavrakaki & Arosio (2008). These authors also investigated the comprehension of subject and object relative clauses disambiguated by number agreement (singular relative clause head and plural embedded subject) and subject position (pre and postverbal). Guasti et al. (2008) found that 5-year-old Italian and Greek children comprehend subject relatives better than object relative clauses, despite the number mismatch between the relative clause head and the embedded subject, and that this difference was more pronounced in the case of object relative clauses with a postverbal subject. Moreover, they reported no difference between Greek and Italian in the comprehension of object relative clauses disambiguated through number agreement, as performance was around 50% accuracy in both languages for object relative clauses with a preverbal subject and around 40% accuracy for object relative clauses with a postverbal subject.

The effect of number on object relative clause processing has been investigated in online comprehension as well. Contemori & Marinis (2014) tested a group of 34 English-speaking children aged 6;01 – 8;11 in a self-paced listening task, coupled with comprehension questions. The authors found that the presence of a number mismatch between the subject and object DPs facilitates children's offline comprehension of object relative clauses, along the lines of Adani (2011); however, they found no effect of a number mismatch on children's online processing of object relative clauses, although they do report an effect of the plural marking – that is, children process object relative clauses faster whenever these contain one or two plural NPs.

The role that the number feature plays in facilitating comprehension of object relative clauses has been associated to the role that a mismatch in gender plays on the processing of object relative clauses in Hebrew (Belletti et al. 2012). Belletti et al. (2012) found a selective effect of gender in Hebrew and Italian and postulated that the features triggering intervention in child grammar are those that function as attractors for movement and that the overt realization of a particular feature in the verbal morphology may indicate whether or not this feature plays an active morphosyntactic role in the language. That a mismatch in gender positively impacts comprehension of object relatives in Hebrew, but not in Italian (Belletti et

al. 2012) follows straightforwardly from this approach, as gender in Hebrew counts as a syntactic attractor for movement of the subject to the specifier position of the clausal inflectional head, whereas this is not the case for Italian. On the other hand, the number feature in Italian is overtly manifested in the verbal morphology and is part of the featural set triggering syntactic movement. Hence, a number mismatch in Italian should facilitate children’s processing of object relatives, which is what Adani et al. (2010) found for Italian.

French is also a suitable language for testing the effect of a number mismatch on relative clause comprehension because, like we saw at the beginning of the chapter, number marking in French is morphologically expressed in the inflectional head, however it is phonologically irregular as it can be silent or audible depending on the type of verb. This is particularly interesting given the idea put forth in Belletti et al. (2012) that the overt expression of a feature on the verbal inflection could be an indication of its morphosyntactic role in a certain language. French thus offers a way to investigate whether it is purely the overt phonological manifestation of number agreement on the tensed verb that plays a role in the computation of intervention. This can distinguish, as Belletti et al. (2012) put it, between an “overt-inflection-based approach” and a “pure-feature-based account”. While the former predicts an effect of number mismatch only in the audible conditions, the latter predicts no difference between audible and non-audible instances of number agreement “under the natural assumption that different items of the paradigm have the same nature with respect to the attracting property, namely that when a feature is an attractor in tensed verbs in a certain paradigm in a certain language, it is an attractor for the whole paradigm, even if it is not morphologically [or phonologically] manifested in some slots of the paradigm.” (footnote 5, p. 1066).

2.2.1. *Participants*

A total of 48 French-speaking children from one primary school in Geneva, Switzerland, took part in the experiment. There were 21 girls and 28 boys aged 4;7 to 7;1 (mean age = 5;8; standard deviation (SD) = 0.74) with no diagnosed language or speech disorders. Table 2.1 gives more details as to the age ranges tested.

Age group	No. of participants	Age range	Mean Age (S.D.)
5 y.o	27	4;7 – 5;7	5;3 (0.31)
6 y.o.	21	6;0 – 7;1	6;6 (0.41)

Table 2.1. Participant data per age group (total number, age range, mean age and standard deviation)

2.2.2. *Design and Procedure*

2.2.1.1 Materials

The experiment included 28 restrictive right-branching relative clauses, 14 subject (see examples in (16)) and 14 object relative clauses (illustrated in (17)). Half of the items contained a number mismatch between the head of relative and the embedded noun phrase. Additionally, among the items that contained a number mismatch, there were 4 with audible number agreement on the verb and 3 with silent (non-audible) number agreement. Since the study focused on the impact of an audible or non-audible number agreement on the comprehension of relative clauses, we only manipulated the plural or singular specification of the subject DP, while the object DP was always a DP in the singular.

(16) a. Subject relative clause – Number match

Montre-moi le garçon qui lave le chat.

show-me the boy QUI washes the cat

‘Show me the boy that is washing the cat.’

b. Subject relative clause – Number mismatch (non-audible agreement)

Montre-moi les garçons qui lavent le chat.

show-me the boys QUI wash the cat

‘Show me the boys that are washing the cat.’

c. Subject relative clause – Number mismatch (audible agreement)

Montre-moi les chiens qui mordent le chat.

show-me the dogs QUI bite the cat

‘Show me the dogs that are biting the cat.’

(17) a. Object relative clause – Number match

Montre-moi le chat que le garçon lave.

show-me the cat QUE the boy washes

‘Show me the cat that the boy is washing.’

b. Object relative clause – Number mismatch

Montre-moi le chat que les garçons lavent.

show-me the cat QUE the boys wash

‘Show me the cat that the boys are washing.’

c. Object relative clause – Number mismatch (audible agreement)

Montre-moi le chat que les chiens mordent.

show-me the cat QUE the dogs bite

‘Show me the cat that the dogs are biting.’

All the verbs expressed transitive actions which were semantically reversible (both characters could be either the agent or the patient of the action expressed by the verb. In this experiment as in all the other experiments in the dissertation, only semantically reversible sentences were included. The reason behind testing such sentences is that the child must solely rely on syntax, and not on world knowledge, for example, in order to correctly interpret them.

The verbs appearing in the non-audible number agreement condition were *arroser* (to splash), *couvrir* (to cover), *laver* (to wash), *photographier* (to photograph), *coiffer* (to do somebody’s hair), *pousser* (to push), *taper* (to hit), *tirer* (to pull), whereas *mordre* (to bite), *suivre* (to follow), *peindre* (to paint), *applaudir* (to cheer), *nourir* (to feed) were used in the audible agreement condition. All nouns were matched for gender in order to neutralize the potential use of a gender mismatch as a cue for comprehension. The nouns designated only animate entities, either [+Human] (e.g. *le garçon*) or [–Human] (e.g. *l’éléphant*). Appendix A lists all target sentences.

The visual material consisted of sets of pictures depicting actions performed by the same characters with reversed agent-patient roles (figures 1 and 2). The presence of two entities of each kind (e.g. two boys and two cats) made the use of relative clauses pragmatically felicitous (see Hamburger and Crain 1982).

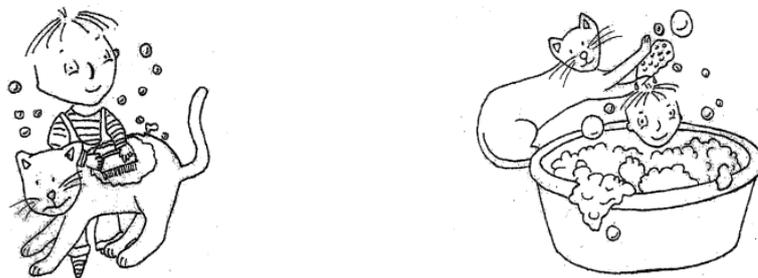


Figure 2.1. Example of images paired with one target sentence in the number match condition

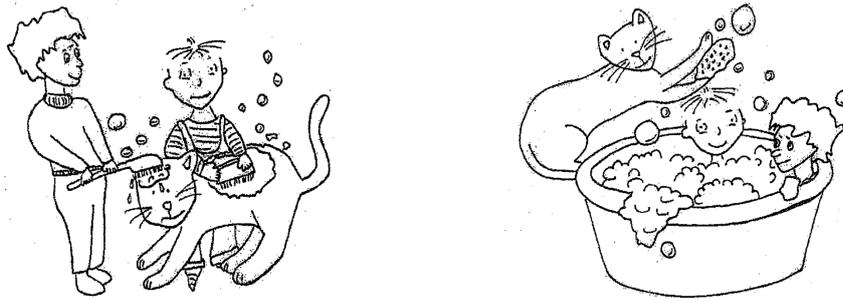


Figure 2.2. Example of images paired with one target sentence in the number mismatch condition

The experiment also included ten filler items to ensure that participants did not develop answer strategies and to control for their level of attention throughout the task. These were questions like “Where is the elephant with the headphones?” associated with pictures in which several characters were performing various actions. In addition, each experimental session started with four practice trials. Consequently, each child saw a total of 42 sentences.

2.2.1.2 Procedure

Comprehension of relative clauses was assessed using a character-selection task adapted to French and based on Friedmann et al.’s (2009) design for Hebrew. A warm-up phase preceded the actual experiment aimed at familiarizing children with the characters and with precise pointing. The warm-up started with a simple pointing task in which each child saw various pictures and had to find and show the specific character named by the experimenter as in, for example *Where can you see a crocodile?*. This was followed by four practice trials, which included pictures similar to those used in the experimental trials.

At the beginning of each session, the experimenter explained to the child that he/she would see two images at a time and would have to point to the correct character in one of these images. Moreover, the experimenter drew the child’s attention to the fact that he/she should choose and point out only one of the four possible options given in the images. The fillers used throughout the experiment also prompted the child to point to a specific character that was identified through the use of a prepositional phrase modifier. If the child’s response was ambiguous (e.g. pointing to the whole image), the experimenter would pretend that she did not pay attention and would ask the child to identify again the precise character. However, this happened very seldom as children were very eager to point to only one character. During the test phase, the experimenter first gave the child a short lead-in: “Look! Here we see two boys and two cats!” The child was then prompted to point to the correct character as identified

by a subject or object relative clause like in examples (16) and (17) above. Each target sentence was used only once and was associated with a picture depicting four characters (figures 1 and 2). Therefore, children had to choose the correct character out of 4 possible options. For half of the items, the target answer consisted of pointing to the agent of the action, and for the other half the target answer consisted of pointing to the patient of the action expressed by the verb. The order of presentation of the trials, as well as the direction of the actions and the position of the target character were randomized across conditions. Children received positive feedback after each trial, irrespective of whether their response was correct or not. The experimenter recorded each answer on the response sheet.

Children were tested individually in a separate room at their school. One experimental session lasted approximately 25 to 30 minutes. The experimenter also made sure that children could take a break if they wanted to or if they showed signs of fatigue. Each child received a small reward at the end of the task.

2.2.3. *Predictions*

If children can exploit the alternation in the form of the complementizer in order to assign the correct theta role to the relative head noun, the prediction is that there should be no difference in children's performance with subject and object relative clauses. If, on the other hand, children's difficulties with object relative clauses arise from the presence of a lexical restriction or [+NP] feature on both the head noun and the intervening subject (Friedmann et al. 2009, Belletti et al. 2012), then the *que/qui* alternation should not be a sufficient cue to override such intervention effects and children should comprehend subject relative clauses better than object relative clauses. Under the featural intervention account, the factors that are expected to play a role in modulating the comprehension of object relative clauses are those affecting the featural specification of the two nominal elements, the moved A'-object and the intervener DP. More precisely, comprehension should only be enhanced in the presence of a featural dissimilarity between the two nominal expressions determined by a mismatch in morphosyntactic features that act as triggers for movement.

This brings us to the second set of predictions for Experiment 1, which are related to the effect that a number mismatch between the object and the subject DP has on the comprehension of relative clauses in French-speaking children. If the number feature in French, which is overtly manifested on the verb, counts as a trigger for movement much like in Italian, then it should also modulate comprehension of object relatives in French, as compared to subject relatives. Therefore, dissimilarities in the number features of the subject

and object DP should improve French children’s processing of object relative clauses, irrespective of the audible or non-audible nature of number agreement on the verb.

2.2.4. Results

Figure 2.3 illustrates the proportion of correct answers obtained for both subject and object relative clauses with or without a number match between the subject and the object DPs. An answer was coded as accurate if the child identified the correct character among the four present in each picture, on the basis of the information provided by the relative clause. When the child pointed to any of the other three characters in the pictures, the response was coded as error. The bars in all figures represent the standard error to the mean.

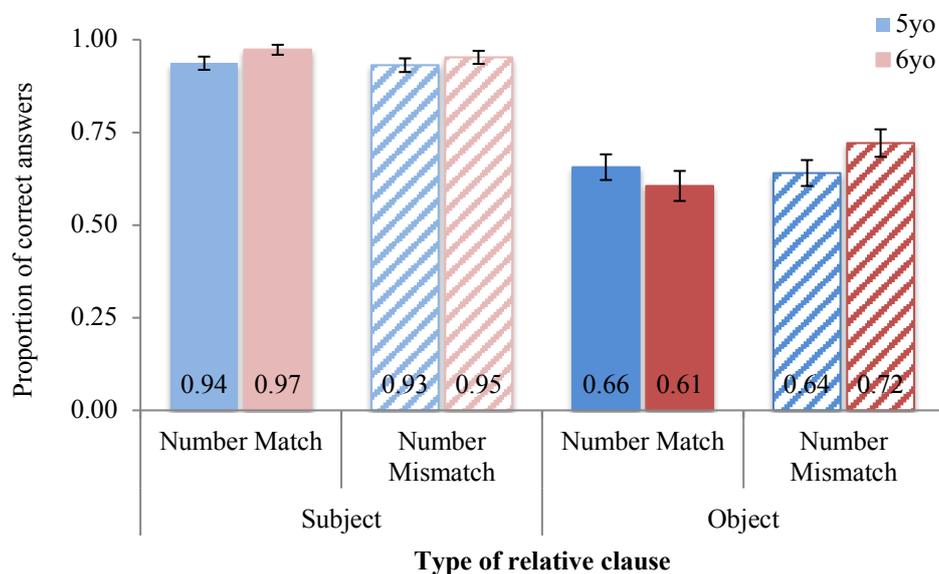


Figure 2.3. Overall proportion of correct responses for subject and object relative clauses by number match/mismatch condition in 5- and 6-year-old French-speaking children

The data in Figure 2.3 reveal that: (i) the children tested comprehend subject relatives very well, whereas they have more difficulties assigning a correct interpretation to object relatives; (ii) the asymmetry in children's comprehension of subject and object relative clauses holds irrespective of whether the subject and object DPs match or mismatch in their number specification; (iii) the presence of a number mismatch (i.e. plural subject and singular object) does not improve comprehension as compared to the number match conditions in the case of subject relative clauses; (iv) while the 5yo perform on a par with object relative clauses with or without a number mismatch, the mismatch in number specification improves performance with object relative clauses in the 6yo children.

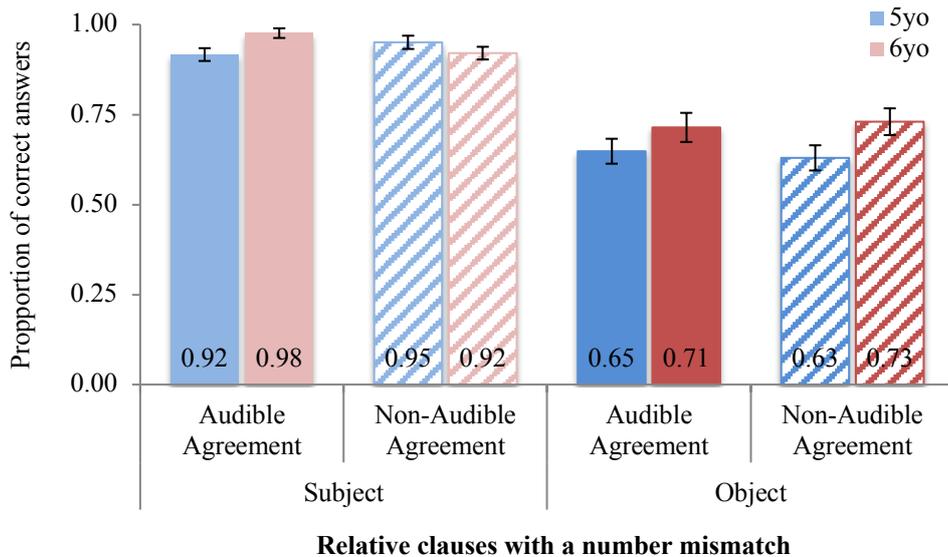


Figure 2.4. Proportion of correct responses for subject and object relative clauses with a number mismatch by audible/non-audible agreement condition and by age group

Figure 2.4 illustrates the overall results obtained for subject and object relatives with a number mismatch only and which are split according to whether subject-verb agreement was audible or not. In the case of the 5 year-olds, we see that children comprehend subject relatives with non-audible agreement slightly better (0.95) than subject relatives with audible agreement (0.92), while object relatives show a very slight improvement when agreement is audible (0.65) compared to when it is non-audible (0.63). As for the 6 year-olds, they find subject relative clauses with audible verb agreement easier (0.98) than subject relatives with non-audible agreement (0.92), while the reverse comprehension pattern holds for object relative clauses, which they comprehend better when agreement is non-audible (0.73) than when it is audible (0.71). Again, we find a difference with respect to the improved comprehension scores of the 6-year-olds for object relative clauses as compared to the 5-year-olds.

2.2.4.1. Statistical analysis

Response accuracy was the categorical dependent variable used in Experiment 1, as well as in all the other experiments presented in the forthcoming chapters. Response accuracy represents the accuracy in identifying the correct character out of a given set. R (R Core Team, 2014) and the *lme4* package for Linear Mixed Effects (Bates, Maechler, Bolker, & Walker, 2014) were used to perform mixed-effect logit models in order to analyze the results (Baayen, Davidson, & Bates, 2008; Jaeger, 2008). All the models included a number of fixed factors

such as structure type (e.g. subject relative clause vs. object relative clause), as well as a modeling of random effects like subjects and items. The inclusion of random factors in the analysis allows to generalize beyond the subjects and items in the present studies. In each case, the final model was selected by first including all main effects and interactions and then removing predictors step by step. I then calculated the fit of the simpler model as compared to the more complex model (using a chi-square test based on the log likelihood ratio statistics) until the fit of the simpler model was not significantly worse than the fit of the larger model. The full final model will be given when presenting the relevant experiments and analyses.

The data of Experiment 1 were fitted to a mixed logit model with Sentence type (subject relative clause vs object relative clause), Number (match vs mismatch) and Agreement (audible vs non-audible) as fixed factors and Age as a covariate. The reference categories were object relative clauses for the Sentence type factor, number match for the Number factor and non-audible for the Agreement factor. Neither the Number ($\chi^2(1) = 0.26, p = 0.61$), nor the Agreement factor ($\chi^2(1) = 0.02, p = 0.87$) affected the comprehension of relative clauses. The Structure type factor yielded a significant effect ($\chi^2(1) = 54.31, p < .001$) indicating that response accuracy significantly improved in the case of subject relative clauses as compared to object relative clauses ($\beta = 2.76, SE = 0.39, z = 7.02, p < .001$). Older children were also more accurate than younger ones for the comprehension of object relative clauses, as revealed by the effect of age ($\beta = 0.26, SE = 0.13, z = 1.96, p < .001$). No interactions appeared as significant ($\chi^2(3) = 3.71, p = 0.29$). Table 2.2 reports the results of the full final model.

Fixed effects	Coefficient	SE	Wald Z	p
(Intercept)	0.69	0.13	5.28	<.001***
Structure Type = <i>Subject</i>	2.76	0.39	7.02	<.001***
Age	0.26	0.13	1.96	<.05*

Table 2.2. Summary of significant fixed factors in GLMM of correct responses for subject and object relative clauses for all age groups¹³

Subjects and items were modeled as random factors, with a by-subject random slope for the

¹³ Final model : ResponseAccuracy ~ Structure Type + Age + (1+ Structure Type| Subject) + (1|Item); N = 1344, AIC = 1135.5, BIC = 1172.0, log-likelihood = -560.8.

effect of structure type. A summary is given in Table 2.3.

Random effects	s²	SD	Correlation with random effect for Intercept
Subjects Intercept	0.27	0.51	
Structure Type = <i>Subject</i>	1.68	1.30	-0.53
Items Intercept	0.06	0.24	

Table 2.3. Summary of random effects and correlations in the mixed logit model for all age groups

In order to look in more detail at the effect of the fixed factors on response accuracy within each of the age groups tested, I ran two separate analyses for the 5-year-olds and the 6-year-olds with the same fixed factors (Structure Type, Number and Agreement) and random structure (subjects and items) as in the main model. The reference levels for each factor were also identical to the ones in the main model. The mixed-logit model for the 5-year-old group ($N = 756$, $AIC = 676.7$, $BIC = 713.7$, $\log\text{-likelihood} = -330.3$) reveals a significant improvement in the subject relative clause condition ($\chi^2(1) = 31.73$, $p < .001$; log-odds coefficient $\beta = 2.61$, $SE = 0.50$, $z = 5.23$, $p < .001$), but no effect of a number mismatch ($\chi^2(1) = 0.0019$, $p = .97$) or of an audible number agreement between the subject and the verb ($\chi^2(1) = 0.06$, $p = .80$). Table 2.4 summarizes the random effects.

Random effects	s²	SD	Correlation with random effect for Intercept
Subjects Intercept	0.16	0.39	
Structure Type = <i>Subject</i>	1.68	1.29	-0.42
Items Intercept	0.17	0.41	

Table 2.4. Summary of random effects and correlations in the mixed logit model for the 5-year-old group

The results pattern is different in the case of the 6 year-olds, since both Structure Type and Number significantly impact the comprehension of relative clauses for this age group ($\chi^2(1) = 2.88$, $p < .05$). As illustrated by the increase in log-odds in Table 2.5, the 6 year-olds comprehend subject relative clauses better than object relative clauses. They also perform

better with object relatives in the number mismatch condition than in the number match condition. Like in the case of the 5yo group, the presence or absence of an audible agreement had no significant impact on relative clause comprehension for the 6yo group ($\chi^2(1) = 0.24$, $p = .62$). The interaction between the main effects was also not significant ($\chi^2(2) = 5.17$, $p = .08$).

Fixed effects	Coefficient	SE	Wald Z	p
(Intercept)	0.46	0.22	2.10	<.05*
Structure Type = <i>Subject</i>	3.27	0.53	6.08	<.001***
Number = <i>Mismatch</i>	0.56	0.25	2.17	<.05*

Table 2.5. Summary of significant fixed factors in GLMM of correct responses for subject and object relative clauses for the 6yo group¹⁴

The maximal random effect structure justified by the data included only a by-subject intercept ($s^2 = 0.39$, $SD = 0.62$).

2.2.5. Interim discussion

These findings for the comprehension of relative clauses in French are consistent with previous results attested for other languages (Sheldon 1974; Tavakolian 1981; Corrêa 1995; Costa et al. 2011; Arnon 2005, 2010; Friedemann et al. 2009; Adani et al. 2010; Adani 2011; Arosio et al. 2011; a.o.), indicating that children comprehend subject relatives better than object relatives. Subject relative clauses are not problematic for French-speaking children: in these structures, the complementizer signals the extraction of the embedded subject by taking the form *qui*. The presence of *qui*, analyzed as *que* + *-i*, has been interpreted as a rescue mechanism allowing the embedded subject to by-pass the Subject Criterion position (which would freeze the moved element in place) and therefore target the corresponding relative position at the left periphery (Rizzi & Shlonsky 2007). In this sense, we could say that *qui* is more informative than *que* because of its complex internal morphology. We could thus associate the lack of comprehension difficulties found with subject relative clauses to the presence on *qui* of specific information linked to the extraction of the embedded subject.

¹⁴ Final model : $\text{ResponseAccuracy} \sim \text{Structure Type} + \text{Age} + (1 + \text{Structure Type} | \text{Subject}) + (1 | \text{Item})$; $N = 588$, $AIC = 467.9$, $BIC = 494.2$, $\log\text{-likelihood} = -228.0$.

If this reasoning were on the right track, we would expect children not only to draw on the presence of *qui* to assign the correct subject interpretation to the moved A'-element, but also to be able to distinguish between the use of *qui* and *que* and associate the latter with the extraction of the embedded object. This should eliminate the difference in performance with subject and object relative clauses. However, the subject-object asymmetry found for relative clause comprehension in the present study suggests that the *que/qui* alternation, determined by the nature of the extracted DP, does not help French-speaking children overcome the problems associated with the parsing of object relative clauses. The presence of *que* and, indirectly, the absence of *qui* are not informative enough to guide the assignment of thematic roles in the case of object relatives.

Such results immediately follow from an intervention account of children's pronounced difficulties with object relatives (Friedmann et al. 2009, Belletti et al. 2012): object relative clause comprehension is hindered by the intervention of a full lexical NP subject in the movement dependency created between the A'-object and its gap position inside the relative clause. According to this approach, the intervention effect triggered by the presence of the embedded NP subject can be modulated by manipulating the morphosyntactic features of the relative head and of the intervening subject; this would create a mismatch configuration in which the dissimilarity between the two nominal elements would contribute to varying the strength of the intervention configuration. Moreover, following Belletti et al (2012), the relevant morphosyntactic features for the computation of dissimilarity between the A'-object and the intervener are those features that trigger syntactic movement. Given that the alternation in the form of the complementizer in French relative clauses does not lead to a mismatch in relevant morphosyntactic features between the relative clause head and the intervening subject, it also does not reduce children's comprehension difficulties with object relative clauses. As a side note, I should point out that these results also bear on the debate as to whether relative clauses in child French are derived through movement or not. For example, Labelle (1990, 1996) argued that children derive relative clauses by applying a process of lambda abstraction. However, this analysis makes it hard to account for the subject-object asymmetry found with relative clause comprehension. By contrast, an analysis in terms of movement (i.e. movement of the head noun as in Kayne 1994, Bianchi 1999) offers a straightforward explanation.

If the *que/qui* alternation does not facilitate the processing of object relative clauses, then children must rely on other cues to distinguish between a subject and an object interpretation of the relative clause. *Do children make use of number agreement in the*

comprehension of relative clauses? French, like Italian, overtly expresses number not only in the nominal morphology (*le garçon* ‘the boy’ – *les garçons* ‘the boys’), but also in the verbal morphology, through number agreement with the subject. Agreement can be audible or silent depending on the type of verb. Despite being phonologically irregular, number is realized in the agreement morphology of the tensed verb in French and it has the status of an attracting feature, along the lines of gender in Hebrew (Belletti et al. 2012). Therefore, the dissimilarity created by a number mismatch between the relative clause head and the intervening subject, both in an agreement and in a non-agreement configuration, should impact the computation of intervention in the case of French as well, in a similar vein with number in Italian and gender in Hebrew.

This prediction is only partially borne out. 5- and 6-year-old French-speaking children are more accurate with subject relative clauses than with object relative clauses, both in the number match and in the number mismatch condition. Whether agreement is phonologically audible or silent has no effect on comprehension either. At first sight, these results indicate that number, although morphologically marked on the verb, does not affect comprehension of relative clauses in French. However, an analysis of the results by age group reveals that, while the 5-year-olds perform on a par for both types of object relative clauses, a significant difference appears in the comprehension of object relative clauses for the 6 year-olds, as they are more accurate in the number mismatch (with or without audible agreement) than in the number match condition. Thus, the number feature plays a role in the computation of the similarity between the head of the relative and the intervener, however it is only the older children, as opposed to the younger ones, who are able to draw on the mismatch in number specification between the object and subject DPs to assign the correct interpretation to a given structure.

Thus, the picture that emerges from the comprehension of relative clauses reveals that a DP subject containing a lexical restriction interferes in the creation of the corresponding syntactic chain between the A'-moved object and its trace and leads to difficulties in the processing of object relative clauses as compared to subject relative clauses. I will now turn to another construction in French which instantiates the same intervention configuration as in relative clauses and will look at the comprehension of wh-questions in child French.

2.3. French wh-questions: from syntax to acquisition

French displays several optional strategies for the formation of matrix wh-questions (Table 2.6): the wh-element can remain in-situ (18) or be fronted to [SpecCP] without subject-verb inversion (19) or with insertion of *est-ce que* (ESK) in C (20). Note that wh-fronting is obligatory in ESK questions and that movement of the verb to C is impossible in this construction since ESK occupies the C position. Following Rooryck (1994), I take *est-ce que* to be an unanalyzed question marker inserted under C° - it is a complex Q-complementizer, while C° is lexicalized by the verb in cases of inversion (see Prévost (2009) for a more detailed discussion on the nature of *est-ce que*). Movement of the wh-phrase to a clause initial position can also be accompanied by subject-verb inversion, illustrated in (21) and (22). Example (21) shows that a subject clitic can follow the auxiliary, like in English subject-auxiliary inversion¹⁵. However, this type of inversion does not apply to subject DPs, which appear in a postverbal position in wh-questions – that is, they have to follow the lexical verb, as in (22), an option known as Stylistic Inversion. French allows a further possibility, namely wh-movement to [SpecCP] appearing with a preverbal full DP subject that co-occurs with a postverbal pronominal clitic co-referential with the subject. This option of apparently allowing two subjects, named complex inversion (henceforth CI) in the syntactic literature, is illustrated in (23):

Wh-constructions	Examples
<i>wh in-situ</i>	(18) Tu as rencontré qui? you have met who 'Who have you met?'
<i>wh ex-situ</i> no inversion	(19) Qui tu as rencontré? who you have met
<i>wh ex-situ</i> with <i>est-ce que</i>	(20) Qui est-ce que tu as rencontré? who ESK you have met
<i>wh ex-situ</i> with clitic inversion	(21) Qui as-tu rencontré? who have-you met

¹⁵ Contrary to English, the fronted verb in a French root interrogative can also be a lexical verb and not necessarily an auxiliary :

- (i) Vois-tu tes amis souvent ?
see.SG-you your friends often
'Do you often see your friends ?'

wh <i>ex-situ</i> with Stylistic Inversion	(22)	A qui a téléphoné Pierre? to who has telephoned Peter 'Who did Peter telephone?'
wh <i>ex-situ</i> with Complex Inversion	(23)	Qui Pierre a-t-il rencontré? who Peter has-T-he met 'Who has Peter met?'

Table 2.6. Typology of wh-constructions in French

Despite the great amount of structural variation, French children master root wh-questions rather early and they already produce such questions around the age of 2;0, as illustrated by various studies of children's spontaneous productions (Hulk, 1996; Plunkett, 1999; Hamann, 2000). Regarding the position occupied by the wh-word in these early questions, most children start with wh in-situ, as it was found for Augustin and Marie, the children of the Geneva corpus examined by Hamann (2000, 2006). Questions with a fronted wh-element only account for 10% of the total number of *wh*-questions produced by Augustin (from 2;0.2 to 2;9.30) and Marie (between the age of 1;8.26 and 2;3.3). Other children, however, may produce more questions with wh-fronting in the early stages of acquisition. This is the case of Philippe (data collected by Suppes, Smith & Leveillé 1973) who only produces one in-situ wh-question between the age of 2;1.19 and 2;3.21 and otherwise produces exclusively wh-questions with a fronted element (see Hamann 2000). An elicited production study (Hulk & Zuckermann, 2000) showed that younger children prefer forming questions with wh in-situ, whereas children aged 4 to 5 produce a greater number of questions with wh ex-situ. Various studies have also shown that there is a delayed development of ESK questions and that French children start producing questions with ESK only around the age of 2;8 (Plunkett, 1999, Jakubowicz 2004, 2005).

Haiden, Prévost, Tuller, Ferré, & Scheidnes (2009) looked at the comprehension of subject and object *who*-questions in typically developing (TD) French children and children with specific language impairment (SLI). They showed that TD children aged 4 and 6 understand wh-questions with or without ESK and wh in-situ questions equally well. Children perform the lowest on the comprehension of questions involving a wh-element ex-situ coupled with stylistic inversion, as shown in (12) above (37.2% correct responses for 4-year-old TD children and 54.2% correct responses for 6-year-old TD children). A significant difference between wh in-situ and plain fronting was reported for children with SLI.

However, none of the previously mentioned studies have investigated the acquisition of *which*-NP questions. Exploring the impact of these questions both in ex-situ and in-situ contexts would provide empirical support for determining the featural properties that trigger intervention effects in children, as well as shed light on the syntactic analysis assigned to wh-in-situ in French, which has been a matter of debate in the literature.

Theoretically speaking, since the pioneering work of Huang (1982), structures like in (14) above have been assumed to have the same logical form as that of an ex-situ question (given in 15), i.e. ‘for what x [... x ...]’. As such, wh-in-situ elements are considered on a par with quantifiers and covert movement is generally admitted for in-situ questions since this movement produces the relevant operator-variable structure. However, works since the late 90’s show that there are different types of wh-in-situ which yield different treatments: covert phrasal movement, no movement, feature movement (see Cheng 2003 for a review). As for French, it has been argued that wh-in-situ undergoes wh-feature movement and is therefore sensitive to constraints on movement and chain formation (Mathieu 1999; Cheng and Rooryck 2000, Baunaz 2011; see Shlonsky 2012 for a recent summary). In this context, investigations into the acquisition process of such structures can help us better understand how in-situ wh-elements are interpreted and whether and how covert movement is involved.

2.4. Experiment 2: Comprehension of wh-questions in French

As underlined above, French allows wh-elements to appear either fronted or in-situ. Moreover, among the strategies used with wh-fronting, we can find no subject-verb inversion and no question marker inserted in C or no subject-verb inversion and insertion of *est-ce que* in C. It is important to note that *est-ce que* insertion disambiguates between subject and object questions, as only an object interpretation is compatible with the presence of *est-ce que*. Indeed, the *que/qui* alternation characterizing the complementizer system of relative clauses can also be observed in wh-questions where the alternation between *est-ce qui* and *est-ce que* signals the locus of extraction of the wh-element (i.e. subject or object position), irrespective of whether its referent is animate or inanimate, as shown below:

- (24) Qu’ est-ce qui effraie Pierre ? La foudre.
 what EST-CE QUI frightens Pierre ? the lightning
 ‘What frightens Pierre ? Lightning.’

(25) *Que effraie Pierre ?

‘What frightens Pierre ?’

(26) Qui est-ce que Pierre aperçoit ? Son frère. / *La foudre.

who EST-CE QUE Pierre sees ? his brother. / the lightning.

‘Who does Pierre see ? His brother. / *Lightning.

Moreover, the *que/qui* alternation appears in long-distance questions extracting from subject position (*que* is ungrammatical in such cases):

(27) a. Qui penses-tu qui est venu à ma fête ?

who think you QUI is come to my party

‘Who do you think came to my party?’

b. *Qui penses-tu qu’ est venu à ma fête ?

who think you QUE is come to my party

The study on wh-questions thus contrasted French children’s comprehension of both –NP (*qui*) and +NP (*quel*) questions by investigating the interplay between the presence or absence of movement of the A’-object (i.e. +/- movement) and the presence or absence of intervention effects determined by a similar featural specification on the elements of the A’-chain (i.e. +/- featural intervention). The aim was to understand (i) to what extent +/- movement plays a role, (ii) whether the different structural strategies for question-formation modulate comprehension and (iii) how these structural factors interact with featural specification, by exploring how the +/- NP feature of wh-object affects parsing, regardless of the overt or covert nature of movement.

2.4.1. Participants

The participants in the study were 46 French-speaking typically-developing children aged (age range = 4;3 – 6;3, mean age = 5;2, SD = 0.54) from a primary school in Geneva. There were 25 girls and 21 boys. The participants were divided across two age groups, according to the distribution in Table 2.7:

Age group	No. of participants	Age range	Mean Age (S.D.)
4 y.o	24	4;3 – 5;2	4;8 (0.24)
5 y.o.	22	5;3 – 6;3	5;7 (0.28)

Table 2.7. Participant data per age group (total number, age range, mean age and standard deviation)

2.4.2. Design and Procedure

2.4.2.1. Materials

Comprehension of *wh*-questions explored the role of (i) the featural make-up of the *wh*-element, (ii) its movement to [Spec,CP], and (iii) the overt filling of C in object questions. There were 32 experimental items, 8 subject questions and 24 object questions, in which the *wh*-word appeared in-situ, fronted to SpecCP (object ex-situ) or fronted to SpecCP and accompanied by *est-ce que* (object ESK). Half of the items contained a bare –NP *wh*-element and half a lexically-restricted +NP *wh*-phrase, meaning that there were four items for each experimental condition. Examples for each condition are provided in (28) to (31) and a full list of experimental items is given in Appendix A:

(28) –NP/ +NP Subject questions

Qui/ Quel garçon lave le chat?
 who/which boy washes the cat
 ‘Who/Which boy is washing the cat?’

(29) –NP/ +NP Object in-situ questions

Le garçon lave qui/ quel chat?
 the boy washes who/which cat
 ‘Who/which cat is the boy washing?’

(30) –NP/ +NP Object ex-situ questions

Qui/Quel chat le garçon lave?
 who/which cat the boy washes
 ‘Who/Which cat is the boy washing?’

(31) –NP/ +NP Object ESK questions

Qui/ Quel chat est-ce que le garçon lave?

who/which cat ESK the boy washes
'Who/Which cat is the boy washing?'

Like in the relative clause experiment, all the verbs expressed transitive actions performed by the same characters with reversed Agent-Patient roles. There was no mismatch in gender or number between the characters involved in the actions and all the entities were animate. These sentences were paired with the same type of pictures as those used in the relative clause study. The experimental items were intermixed with 8 fillers (sentences like "Show me the elephant with the headphones.") and each session started with a warm-up phase in which the child saw 2 practice trials. Therefore, each child was tested on 42 sentences.

2.4.2.2. Procedure

The experiment lasted 25 to 30 minutes and the procedure was identical to the one used in Experiment 1 on the comprehension of the relative clauses.

2.4.3. Predictions

Several predictions hold for the study. If both overt movement and featural intervention affect comprehension of *wh*-dependencies, then structures that do not involve overt movement and those that involve movement but do not give rise to intervention effects should yield higher accuracy scores. These structures are [- NP] subject, all types of [- NP] object questions, and [+NP] subject questions. Children should have most difficulty parsing *wh*-dependencies that involve moving a [+NP] element over the intervening subject that also contains a [+NP] feature. These configurations include [+NP] object *ex-situ* and [+NP] object ESK questions.

Regarding [+NP] object *in-situ* questions, if children apply a covert phrasal movement analysis (along the lines of Huang 1982 a.o.), they should perform on a par with [+NP] questions involving movement. Under this view, we expect no difference between object *in-situ* and object *ex-situ* questions. On the other hand, if children only move the *wh* feature (along the lines of Mathieu 1999, Shlonsky 2012), then no featural intervention should arise in these instances. This analysis therefore predicts overall better performance with *in-situ* structures than with their *wh*-fronted counterparts. Furthermore, if the presence of additional disambiguating material signaling an object interpretation plays a role in modulating intervention effects, children should be more accurate in parsing object ESK (example (29)) than object *ex-situ* questions (example (28)), irrespective of the featural specification of the *wh*-elements.

2.4.4. Results

The overall results for wh-questions (Figure 2.5) show that both 4 yo and 5 yo children comprehend –NP (*qui* ‘who’) and +NP (*quel NP* ‘which NP’) questions well: the two groups perform on a par for –NP subject questions. Children have no difficulties processing –NP object questions with a wh-element ex-situ, both in the case of questions without subject-verb inversion (*object ex-situ*) and in the case of questions with *est-ce que* insertion (*object ESK*). Children struggle the most with +NP object questions with a moved element (both ex-situ and ESK), as evidence by the low accuracy scores obtained for these two conditions in both age groups. Moreover, the results indicate that lexically restricted or +NP questions are the ones for which comprehension accuracy improves more with age. The difference in performance between the 4yo and the 5yo for subject, object ex-situ and object ESK questions with a lexically-restricted element suggest that we are dealing here with a developmental effect. Crucially, all children are at ceiling for wh in-situ questions, regardless of the featural specification of the wh-element. They are highly accurate on both –NP and +NP object in-situ questions.

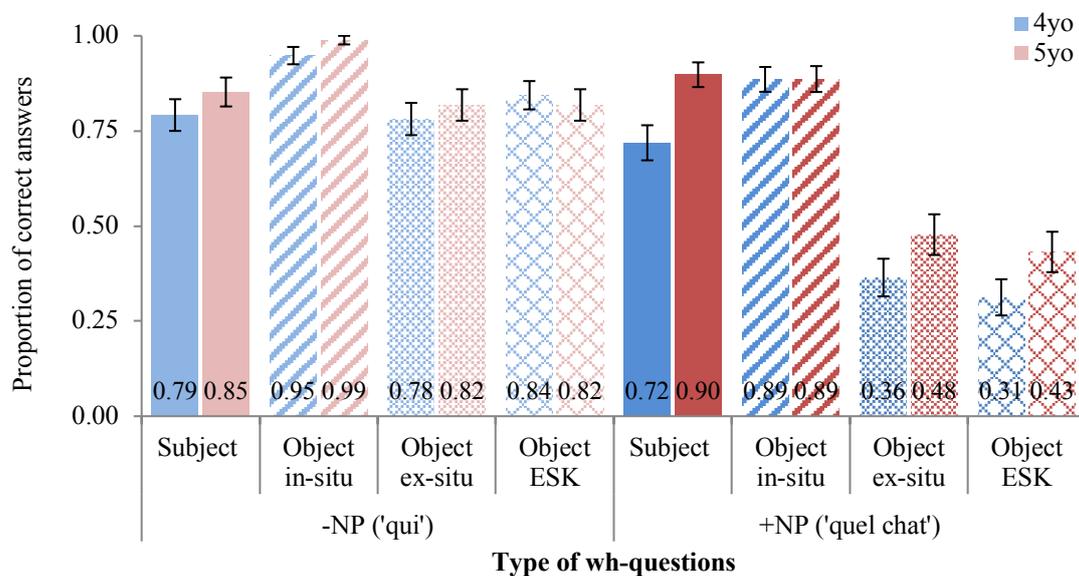


Figure 2.5. Proportion of correct responses for subject and object WH-questions in French-speaking children aged 5 to 7. The bars represent the standard error to the mean.

2.4.4.1. Statistical analysis

Like in Experiment 1, the data were fitted to a mixed logit model. Structure Type (Subject vs Object In-situ vs Object Ex-situ vs Object ESK), WH Type (–NP and +NP) were included as

fixed factors and Age was included as a covariate. The reference level for Structure Type was object ex-situ and for Lexical Restriction was +NP. The results show that the effect of Age only approaches significance ($\chi^2(1) = 3.06, p = .08$) and that the interaction of the fixed factors with Age was not significant ($\chi^2(7) = 10.02, p = .19$). The interaction of Structure Type and WH type added significant information to the model significant ($\chi^2(3) = 14.41, p < .01$). Table 2.8 summarizes the results of the final full model.

Fixed effects	Coefficient	SE	Wald Z	p
(Intercept)	-0.35	0.25	-1.39	= .17
Structure Type = <i>Object ESK</i>	-0.25	0.34	-0.73	= .46
Structure Type = <i>Object in-situ</i>	2.54	0.38	6.59	< .001***
Structure Type = <i>Subject</i>	1.89	0.35	5.26	< .001***
WH Type = <i>-NP</i>	1.85	0.36	5.18	< .001***
Age	0.28	0.15	1.76	= .08
Interaction = <i>Object ESK & -NP</i>	0.47	0.51	0.92	= .36
Interaction = <i>Object In-situ & -NP</i>	-0.45	0.65	-0.70	= .48
Interaction = <i>Subject & -NP</i>	1.72	0.52	3.31	< .001***

Table 2.8. Summary of significant fixed factors in GLMM of correct responses for subject and object relative clauses for the 6yo group¹⁶

As summarized in Table 2.9, the maximal random effects structure supported by the data contained by-subject and by-item intercepts and no random slopes.

Random effects	s²	SD	Correlation with random effect for Intercept
Subjects Intercept	0.23	0.49	
Items Intercept	0.13	0.37	

Table 2.9. Summary of random effects and correlations in the mixed logit model for wh-questions

¹⁶ Final model : ResponseAccuracy ~ Structure Type *WH Type + Age + (1| Subject) + (1|Item); N = 1472, AIC = 1378.9, BIC = 1473.1, log-likelihood = -678.4.

The positive coefficients in Table 2.9 show that comprehension accuracy improved with both object in-situ ($\beta = 2.54$, $SE = 0.38$, $z = 6.59$, $p < .001$) and with subject questions ($\beta = 1.89$, $SE = 0.35$, $z = 5.26$, $p < .001$), whereas there was no difference in performance between object ESK and object ex-situ questions ($\beta = -0.25$, $SE = 0.34$, $z = -0.73$, $p = .46$). The type of wh-phrase also affected comprehension: questions introduced by a –NP (i.e. non-lexically restricted) element yielded better accuracy than questions introduced by a +NP wh-word ($\beta = 1.85$, $SE = 0.36$, $z = 5.18$, $p < .001$). The results also revealed an interaction between type of structure and type of wh-word.

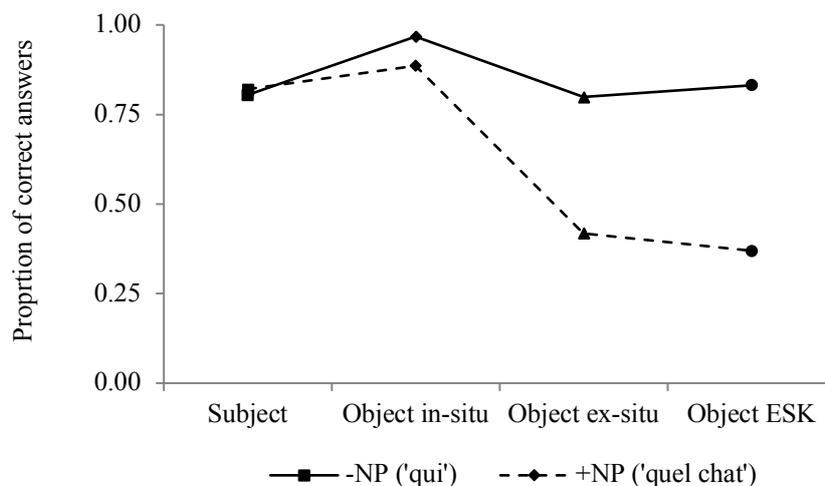


Figure 2.6. Overall proportion of correct answers for wh-questions as a function of structure type (subject/object in-situ/object ex-situ/object ESK) and WH type (+/-NP) for all age groups

The interaction (Figure 2.6) shows that the type of structure has a different effect depending on whether the wh-phrase contained or not a lexical restriction. More specifically, in the case of –NP questions, so questions headed by a bare element like *qui* ‘who’, there was no difference in performance with subject, object ex-situ and object ESK questions. On the other hand, a subject-object asymmetry held in +NP or lexically restricted questions: while the performance on subject +NP questions matched that for subject –NP questions, +NP object ex-situ and +NP object ESK yielded lower accuracy scores. The highest accuracy scores were obtained with object in-situ questions, irrespective of whether the wh-element was –NP and +NP. However, children were more accurate with object in-situ questions containing a –NP wh-word as compared to object in-situ questions with a +NP element.

2.4.5. *Interim discussion*

Experiment 2 reveals that French-speaking children comprehend subject and object in-situ questions very well, both when the wh-element was lexically-restricted +NP (*quel chat* ‘which cat’) and when the wh-phrase was a bare –NP constituent (*qui* ‘who’). Object questions with a moved –NP wh-word also lead to high comprehension scores, irrespective of the presence or absence of *est-ce que*. On the other hand, children have more difficulties with questions in which the A’-object is a +NP wh-phrase. This confirms the prediction that the most problematic configurations for comprehension are those in which a +NP element crosses over an intervening subject that also contains a lexical restriction. Note that, in order to disambiguate between a subject and an object interpretation for these structures, children could have relied on word order (WH NP V) in the case of object ex-situ question without subject-verb inversion; in the case of object *ESK* questions, *est-ce que* offers further indication that the fronted wh-phrase should be interpreted as an object. Neither word order, nor *est-ce que* insertion seem to modulate comprehension of +NP object questions, suggesting that the featural make-up of the wh-elements plays an important role in comprehension. As for the role of *est-ce que* in the comprehension of wh-questions, we see that its presence neither hinders, nor improves performance, as children respond on a par for both types of object questions with a fronted wh-element, be it +NP or –NP.

A final remark concerns children’s comprehension of object in-situ questions. Both –NP and +NP in-situ questions yielded the highest accuracy scores as compared to the other types of questions tested. This shows that in-situ questions in which the wh-element is lexically-restricted do not pose difficulties for comprehension and do not give rise to the same intervention effects as those found in questions with a +NP fronted wh-object. However, the results obtained for in-situ questions reveal an asymmetry between –NP and +NP in-situ questions, the former yielding more accurate responses than the latter. In fact, the same pattern emerges for subject questions: children perform better with bare –NP subject questions as opposed to subject questions with a +NP restriction. The same effect has also been found for subject questions in English (Goodluck 2010) and in Hebrew (Friedmann et al. 2009). The crucial observation is that the improvement with –NP elements is found across the board: it has a stable but more modest effect in subject and object in-situ questions, while it has a very large effect on object questions that involve movement of the wh-element across an intervening subject. This strongly supports the idea that there is a distinction between –NP and +NP elements which manifests itself to different degrees depending on the complexity of

the structure. Note that subject questions and object in-situ questions do not create an intervention configuration as no element moves across the intervening subject. One way to explain why such differences hold even in non-intervention contexts would be to appeal to the fact that expressions containing a lexical NP restriction are more difficult to compute, all other things being equal, as they require calculating and holding in memory a larger array of features specified on the complex wh-phrase (Grillo 2008, Gibson 2000). Establishing the reference of these expressions could be more costly for children who have weaker computational capacities and could surface not only as a subject-object asymmetry, but also as a difference in, for example, subject and object in-situ +NP (*quel*) and –NP (*qui*) questions.

2.5. General discussion

The motivation for the two studies presented in this chapter was to examine how structural properties and the featural specification of the target and the intervener affect French children's comprehension of relative clauses and wh-questions. Experiment 1 assessed the comprehension of subject and object relative clauses in order to investigate whether a structural cue like the *que/qui* alternation found in French relative clauses could guide children in assigning the correct structural representation to the incoming linguistic material and, therefore, in disambiguating between a subject and an object interpretation of the relative clause. In addition, Experiment 1 addressed the question of whether a mismatch in Number features between the subject and the object DPs, as well as the presence or absence of audible number agreement on the verb, modulate processing of relative clauses by French-speaking children. Experiment 2 investigated the comprehension of subject and object wh-questions and focused on the interplay between structural complexity as induced by syntactic movement and the presence of a lexical restriction (or +NP feature) on the A'-moved element.

The main findings of the two experiments show that French-speaking children struggle more with movement structures in which an element containing a +NP restriction intervenes in the movement of another element that bears the same featural specification. Experiment 1 reveals a difference in children's comprehension of subject and object relative clauses, despite the alternation in the form of the complementizer. On the other hand, a distinct number marking on the head noun and the intervening subject has the potential to facilitate processing of object relative clauses. However, French-speaking children only seem to be able to rely on this cue for comprehension starting from an older age (6 years old, in this particular case).

Experiment 2 provides a general picture in which 4 and 5 year-old French speaking children have the least difficulties with the comprehension of in-situ questions, irrespective of the +NP (*quel chat*) or –NP (*qui*) nature of the wh-word. They also perform very well with +NP and –NP subject questions, as well as with –NP object questions, so structures in which there is either no intervener in the movement of the wh-word to the corresponding position in the left periphery of the clause (i.e. subject questions), or structures in which the sets of features on the A'-moved element and the intervening one are disjoint (i.e. –NP object questions). Like in Experiment 1, word order or the presence of additional disambiguating material (*est-ce que*), do not seem to help children in assigning the correct interpretation to +NP questions with a wh-fronted object. In the remainder of the discussion, I will first address the subject-object asymmetry present in the comprehension of both relative clauses and wh-questions, and I will then move on to discuss the role of number agreement for relative clause processing in French.

If we consider these results from a cross-linguistic perspective, we see that they confirm differences found for English (Avrutin 2000), Hebrew (Friedmann et al. 2009), Italian (Adani 2011), and other languages, illustrating a pronounced subject/object asymmetry for +NP (*headed*) relative clauses and fronted +NP (*which*) questions, while no such asymmetry emerges in the case of –NP (*who*) questions. The subject/object asymmetry is visible when the head of the chain is an overtly fronted, +NP element and is present across all the age groups investigated in the present study. That children perform better with structures that involve fronting a –NP object hints at the fact that movement is not the main source of complexity in comprehension. Rather, it appears that children seem to have a pronounced difficulty with overt movement involving a +NP morphosyntactic featural specification. This is more taxing for computation and results in less accurate performance by immature or impaired systems because of their limited processing abilities (Delage & Frauenfelder 2012, Garraffa & Grillo 2008).

The subject-object asymmetry found in the comprehension of lexically-restricted A'-dependencies in French receives an immediate explanation within the featural intervention account (Friedmann et al. 2009; Belletti et al. 2012) and can be explained by appealing to the syntactic principle of Relativized Minimality (RM) (Rizzi 1990, 2004), discussed to a greater extent in chapter 1. The specific structures that pose problems for the participants of Experiment 1 and Experiment 2 involve a particular featural set-relation represented as follows:

Shlonsky 2012). If children derived wh in-situ questions through covert movement of the entire wh-phrase, under the RM analysis, this would predict the same results for the comprehension of +NP wh in-situ as for +NP object questions with an overtly moved wh-word. These findings show that this is not the case in French. This implies that in a question like (34) below it is only the +Q feature on the wh-element in-situ that will undergo movement, and not the whole set of features present on the object DP *quel chat*:



This readily accounts for the absence of intervention effects in such cases, as the +Q feature undergoing movement enters into a *disjunction* configuration with the set of features on the intervener, much like in the case of –NP object questions with a fronted wh-phrase: since the moved feature is distinct from the featural specification of the subject DP *le garçon*, it follows that such a configuration should not give rise to intervention effects in child grammar. Although +NP in-situ questions do not instantiate the same intervention configuration as that found in +NP ex-situ questions, they yield slightly lower results in comprehension than –NP in-situ question. This might stem from different interpretive constraints, which may yield intervention-independent effects in these structures. The fundamental point here is that an analysis of children’s comprehension of French wh in-situ questions in terms of wh feature movement and RM does predict better performance with +NP in-situ object questions as compared to fronted +NP or lexically-restricted object dependencies.

Let us now turn to the effect of number agreement on the comprehension of relative clauses in French. Experiment 1 showed that the subject-object asymmetry present in relative clauses can be reduced, but not removed, by a number mismatch between the head noun and the intervening subject. More specifically, object relative clauses headed by a noun in the singular and with a plural embedded subject were comprehended better than object relative clauses in which the object and the subject DP were both singular. There was no effect of the audible or non-audible number agreement on the verb. Note that this facilitation effect only manifested itself in the 6-year-old group and that there was no difference in performance between the number match and the number mismatch conditions in the 5-year-old group. These results pattern, on the one hand, with Guasti et al.’s (2008) finding that number agreement has no effect on object relative clause comprehension in 5-year-old Italian- and Greek-speaking children. On the other hand, the results for the 6-year-old group are in line

with those of Adani (2011), for example, who reports that a mismatch in number improves comprehension of relative clauses in Italian speaking children starting at the age of 4.

The facilitating role of number agreement found for the 6-year-olds suggests that they can interpret number as a distinctive feature and draw upon its presence to distinguish the set of features characterizing the intervener from the set of features of the A'-object. Crucially, as indicated by the existence of subject-verb agreement in French, like in Italian, number should have the same status of an attracting feature, much like gender in Hebrew (Belletti et al. 2012). Thus, number should belong to the array of morphosyntactic features that are relevant to the computation of intervention and to which the syntactic principle of RM is sensitive.

- +R +NP +Sg +NP +Pl <+R +NP +Sg>
- (35) Montre-moi le chat que les garçons lavent <le chat>.
 'Show me the cat that the boys are washing.'

The mismatch in number therefore creates an *intersection* relation between the features entering the computation of locality in the long-distance dependency created between the head noun and its gap in French object relative clauses (Belletti et al. 2012, Belletti & Guasti, 2015).

That the 5-year-old children do not perform better with object relative clauses with a number mismatch indicates that they cannot exploit the number agreement cue in these contexts. Arosio et al. (2010) already show that 9 year-old Italian children's ability to exploit the mismatch in number agreement on the verb is linked to their verbal short-term memory resources. Specifically, Arosio et al. found that children with a lower memory scores as measured by a digit-span task¹⁷ comprehended object relative clauses disambiguated through number agreement less well than children with higher digit-span scores. We could thus hypothesize that the processing cost associated with the computation of number agreement might be too high to pay for younger children who have weaker memory capacities. This generates comprehension difficulties since the feature structure of the intervener and the moved A'-object cannot be distinguished and the structure ends up being associated with an inclusion configuration, which is problematic for children. If the number feature is relevant in determining an intersection configuration, the fact that younger children have difficulties

¹⁷ The digit-span task consists of orally presenting the participants with a series of digits increasing in length from 2 to 9, for example. Children have to carefully listen to the series of digits and immediately repeat them aloud in the same order (yielding the forward digit span). The length of the longest list a participant can remember is their overall digit span.

computing such structures indicates that the intersection relation only becomes relevant at a later time. This may suggest that younger children are only sensitive to disjunction vs everything else, while older children can take into account the finer distinction between intersection and inclusion.

Another observation with respect to the effect of number agreement on French children's comprehension of object relative clauses is that no difference was found between instances of audible and non-audible agreement. This is not expected under an 'overt-inflection' view, which would predict that comprehension should improve when number agreement is audible on the verb, but not in instances when it is non-audible. The results obtained are more in line with a 'pure-feature' view that only takes into consideration morphosyntactic cues such as features that act as triggers for movement. Under this view, the number feature on the tensed verb in French has the same status both when number agreement is audible and when it is not. Hence, the audible and the non-audible agreement trials should yield similar performance, which is what the present findings show.

2.6. Conclusions

This chapter looked at the effect that various structural cues have on the comprehension of A'-dependencies in French (relative clauses and wh-questions) and whether this effect is modulated by the specific features of the elements used to establish such dependencies. Several comprehension patterns for object A'-dependencies emerge from this study: (a) subject relative clauses are comprehended better than object relative clauses; (b) wh in-situ questions are easier to understand than wh ex-situ questions regardless of the featural make-up of the wh-element; (c) -NP ex-situ and *est-ce que* questions yield better results than +NP ex-situ and *est-ce que* questions, suggesting that the presence of a +NP lexical restriction on the moved constituent matters. This shows that not all A'-dependencies are problematic for children, but only those in which an inclusion relation holds between the features of the element heading the A'-dependency and the intervener, namely the subject of the relative clause or of the wh-question. Children do not seem draw on the presence of a different complementizer in subject and object relative clauses, or on the presence of *est-ce que* in object questions, to assign an object interpretation to a given structure. They are nonetheless able to capitalize on the number mismatch between the object and subject DPs, which facilitates comprehension of object relative clauses in French at least from the age of 6. The

effect of number in French underlines the idea that children's comprehension of object A'-dependencies can only be modulated by morphosyntactic features which are relevant for the computation of dissimilarity between the target and the intervener, that is, features that play a role in triggering syntactic movement.

“There are words that I see and other words that I do not see.”
(A child, quoted in de Boysson-Bardies, *How Language Comes to Children: From Birth to Two Years*)

3. THE EFFECT OF CASE-MARKING ON THE COMPREHENSION OF A'-DEPENDENCIES IN ROMANIAN

In Chapter 2, it was argued that two factors impact comprehension of subject and object A'-dependencies in French: (i) the featural specification of the A'-elements and (ii) movement across a subject that shares an NP lexical restriction with the A'-object, thus blocking the realization of the A'-chain between the object and its original gap position. An inclusion relation between the moved A'-object and the intervening subject hinders comprehension of both headed object relative clauses and *which* object questions in French-speaking children, even in the presence of other disambiguating cues such as an alternation in the form of the complementizer in relative clauses and insertion of *est-ce que* in object wh-questions. We have also seen that a number mismatch between the head of the relative and the embedded subject has the potential to modulate the intervention effects that arise in headed object relative clauses, however only older children seem able to effectively use this cue for comprehension.

Determining which information helps children overcome the intervention effects created by the presence of a lexical restriction on both the A'-object and the intervening subject is thus an important step in identifying how processing of A'-dependencies unfolds and in accounting for the delay in the acquisition of certain types of object dependencies. If the acquisition of relative clauses and wh-questions is modulated by various cues, we want to examine to what extent the case information on the relative or interrogative pronoun facilitates comprehension of object relatives and object *which*-questions by looking at Romanian, a language in which the case-marking system helps distinguish between a subject and object interpretation. In Romanian, like in French, the different form of the relative pronoun straightforwardly disambiguates between a subject or object relative clause.

Disambiguation through case-marking is also present in *wh*-questions, which allows to compare the effect of case-marking in both A'-structures.

Previous studies have shown that A'-dependencies involving object extraction are not equally difficult to process when the A'-object and the embedded subject are differently marked for case. The comprehension of relative clauses disambiguated through case has been investigated in Greek and German monolingual children. Guasti, Stavrakaki, & Arosio (2008) assessed subject and object relatives in Greek children aged 4;5 to 5;9 in an offline character-selection task. Their aim was to evaluate the effect of overt case-marking on the subject and object DPs, of number agreement on the verb, and of the syntactic position of the embedded subject (pre or postverbal) on relative clause comprehension. Guasti et al's (2008) experimental findings revealed a significant subject-object asymmetry in Greek children's comprehension of relative clauses. Although case-marking on the DPs did not eliminate children's difficulties with object relatives, the authors show that case marking was a more efficient disambiguating cue than number agreement alone. While no difference was found in the comprehension of object relative clauses with a preverbal subject disambiguated through number agreement on the verb or through case on the embedded subject, the comprehension of object relative clauses with a postverbal subject significantly improved when the embedded subject was unambiguously marked for nominative, as compared to cases in which disambiguation came from number agreement on the verb. The authors thus concluded that case was a more effective disambiguating cue than number agreement at age five.

This conclusion holds for older children as well. In a study with German-speaking children aged 7;0 to 7;9, Arosio, Yatsushiro, Forgiarini & Guasti (2012) tested the comprehension of subject and object relative clauses disambiguated through case and number on the embedded DP. Their results show again that comprehension of subject relative clauses is easier than comprehension of object relative clauses and that seven-year-old German-speaking children comprehend object relatives disambiguated through case better than the object relative clauses disambiguated through number on the embedded subject DP¹⁸.

As for the effect of case-marking in *wh*-questions, Friedmann, Belletti & Rizzi (2009) showed that the presence of *et*, an accusative case marker, before the *wh*-element in object

¹⁸ These findings are in line with data from adult sentence processing. Meng and Bader (2000), for example, looked at German *wh*-sentences with subject-object ambiguities and showed that, in a speeded grammaticality judgment task with adults, examples disambiguated through case are more readily accepted as grammatical than those in which disambiguation was realized through number agreement. For ungrammatical sentences, case mismatch errors yielded a higher rate of false positive grammaticality judgments than number mismatch errors.

questions does not reduce Hebrew-speaking children's difficulties with the comprehension of *which*-questions. Children were at chance with object *which*-questions (58% correct responses) in an offline character selection task, but they were as high as 84% accurate with *who* and *which*-subject questions, as well as with *who*-object questions.

Roesch & Chondrogianni (2015) examined the effect of case-marking on the comprehension of subject and object *who* and *which*-questions in four- and five-year-old typically-developing German-speaking children. Case was marked either on both the *wh*-element and the embedded DP, or only on the *wh*-word. Roesch & Chondrogianni (2015) found that children were more accurate on the comprehension of subject than of both object *who* and *which*-questions. Whereas the presence of two or one case-marked elements did not affect comprehension of object *who*-questions, children were more accurate with *which*-questions when both the *wh*-word and the embedded DP were marked for case (approximately 80% accuracy for the 4-year-olds and 90% accuracy for the 5-year-olds) as compared to *which*-questions that carried the case cue only on the *wh*-phrase (around 60% accuracy for the younger group and 70% for the older age group).

Chapter 3 takes Romanian as testing ground and assesses the way in which *case marking* on the relative pronoun and on the *wh*-element impacts comprehension of relative clauses and *wh*-questions in Romanian-speaking typically-developing children. The difference between Romanian and the instances of case mismatch tested in German relative clauses is that in Romanian, disambiguation between subject and object relatives occurs earlier in the structure, already on the relative pronoun immediately following the relative clause head noun, whereas no case-marking appears on the embedded DP. As for *wh*-questions, case-marking is only present on the *wh*-element and again appears at the very onset of the question. If children can draw on the early presence of a case cue to assign the correct syntactic interpretation to the structure, then case-marking on the relative and on the interrogative pronoun could facilitate comprehension and thus reduce the subject-object difference in the processing of relative clauses and of *which*-questions, the structure that are most problematic for comprehension.

Furthermore, Romanian also has the option of forming *which*-questions without an overt NP. Although such *which*-questions do not carry an expressed NP, they still have lexical specificity, which limits the set of possible referents for the *wh*-expression to those existing in the discourse context. As we have seen in chapters 1 and 2, Friedmann, Belletti, & Rizzi (2009) proposed that the source of children's difficulties with *which*-questions lies in the *intervention* of the subject in the interpretive chain formed by the *wh*-object with its canonical

position in the structure (i.e. object of the verb). The presence of *which*-questions without an overt NP offers a good test case in order to determine whether children’s grammar is sensitive to the presence of a lexical restriction or NP feature on both the moved element and the intervener, even when the lexical NP is not overtly expressed in the wh-expression.

This chapter is organized as follows: after introducing the syntax of relative clauses in Romanian, I will present the experiment that assessed the comprehension of relative clauses in Romanian with or without case disambiguation on the relative pronoun. I will then move on to discuss the properties of *who* and *which*-questions in Romanian and the experimental study that looked at the role of case-marking on wh-questions.

3.1. Properties of Romanian relative clauses

Subject relative clauses in Romanian are introduced by the relative pronoun *care* (‘*who/which*’). In (1a), the relativized element is the subject of the embedded verb. In (1b), the head of the relative is linked to a gap in the embedded object position. *Care* is preceded here by the preposition *pe*, indicating that the relative pronoun is marked for Accusative case (Dobrovie-Sorin 1994), although it appears in a position at the left periphery of the phrase, a position in which it cannot receive case. The presence of *pe* indicates that the head of the relative should be interpreted as the object of the embedded verb.

- (1) a. Băiatul *care* îmbrățișează fata.
 boy-the.M.SG *who* hugs girl-the.F.SG
 ‘The boy that is hugging the girl.’
- b. Băiatul *pe* *care* fata îl îmbrățișează.
 boy-the.M.SG *pe*.ACC *who* girl-the.F.SG him hugs
 ‘The boy that the girl is hugging.’

It is generally assumed that *pe*-marking of noun phrases in simple sentences in Romanian is triggered by conditions such as animacy, specificity, and definiteness: it is obligatory with personal pronouns (referring to both animate and inanimate entities), animate proper names, and (modified) definite human postverbal noun phrases; it is optional with animate unmodified definite and indefinite nouns; and it is ungrammatical with inanimate noun phrases (Dobrovie-Sorin 1994, Pană-Dindelegan 1997, Cornilescu 2001, von Heusinger & Onea 2008, Chiriacescu & von Heusinger 2010; Ciovârname & Avram 2012, von Heusinger

& Chiriacescu 2013, a.o.). However, the *pe* marker is present in headed direct object relative clauses in standard Romanian irrespective of the $[\pm]$ animate, $[\pm]$ specific, $[\pm]$ definite nature of the relative head. This contrasts with *pe*-marking of noun phrases in simple sentences, which is an instantiation of differential object marking (DOM) – overt marking of the direct object determined by conditions such as animacy, specificity and definiteness.

Romanian object relatives also require the obligatory presence of object clitics. Again, this contrasts with declarative sentences in which clitic doubling of the object is not obligatory and, moreover, is ungrammatical with inanimate noun phrases, among other nominal expressions¹⁹:

- (2) a. Mașina *pe* care *(o) conduc.²⁰
 car-the.F.SG *pe*.ACC which her drive.1.sg
 ‘The car that I am driving.’
 b. *O conduc mașina.
 her drive.1.sg car-the.F.SG
 ‘I drive the car.’

Dobrovie-Sorin (1994) argues that *care* configurations require the obligatory use of clitics because *care*, by being referential or discourse-linked, does not have the status of a syntactic quantifier and, therefore, cannot bind a syntactic variable.

A further characteristic of Romanian relative clause is that the embedded subject, when realized as a full lexical DP, can appear either in a preverbal position, where it is interpreted as a topic or focus (Cornilescu 1997) or in a postverbal position, the latter being the unmarked option. (3a) indicates the two options by showing the subject in parenthesis, either pre- or postverbally. Overt subjects can alternate with null subjects in finite clauses (represented as *pro* in syntactic theory), a property which Romanian shares with languages like Italian and Spanish. This phenomenon is present in languages with a rich inflectional morphology, in which subject-verb agreement overtly manifests on the verb, allowing the reconstruction of the subject. Thus, the overt morphological expression of subject-verb agreement in (3b) shows that the subject of the sentence is a 1st person singular pronoun.

- (3) a. Băiatul *pe* care (fata) îl îmbrățișează (fata).
 boy-the.M.SG *pe*.ACC *who* (girl-the.F.SG) him hugs (girl-the.F.SG)

¹⁹ For the interdependence between clitic doubling and *pe*-marking, see Dobrovie-Sorin (1994), a.o.

²⁰ Contrary to the masculine clitic, the feminine clitic follows the verb in compound tenses.

- b. Băiatul *pe care* îl îmbrățișez.
 boy-the.M.SG *pe*.ACC *who* him hug.1.sg
 ‘The boy that I’m hugging.’

Pe can also be omitted in regional varieties of the colloquial Romanian, as illustrated in (4):

- (4) Băiatul *care* (fata) îl îmbrățișează (fata).
 boy-the.M.SG *who* (girl-the.F.SG) him hugs (girl-the.F.SG)
 ‘The boy that the girl is hugging.’

Omission of *pe* can engender an ambiguous reading for direct object relatives: these can receive a subject interpretation when they contain a null–subject and the verb and direct object clitic agree in *phi*-features with both the subject and the object. For example, (5b) can receive either (i) a subject relative clause interpretation, in which case it would mean ‘the boy that is hugging his father’, with the clitic *îl* (‘him) taking a discourse antecedent (e.g. *the father*); or (ii) an object relative clause interpretation with the meaning ‘the boy that the father is hugging’. The clitic, in the latter case, takes the relative head as antecedent.

- (5) a. Băiatul *care* (tata) îl îmbrățișează (tata).
 boy-the.M.SG *who* (father-the.M.SG) him hugs (father-the.M.SG)
 ‘The boy that the father is hugging.’
 b. Băiatul *care* îl îmbrățișează.
 boy-the.M.SG *who* him hugs

Apart from the ambiguity which can arise in object relative clauses without *pe* and null subjects, there is no interpretative difference between object relative clauses in which the preposition *pe* is present or omitted. However, it has been proposed that there is a difference as far as the derivation of the two types of object relative clauses is concerned. Grosu (1994) attributes this difference to the presence or absence of *wh*-movement. More specifically, Grosu (1994) shows that the obligatory clitic inside the relative clause can be co-indexed with the head of an object relative clause introduced only by *care* and without *pe*, even across a complex DP island boundary (6a). This is not allowed in object relative clauses introduced by *care* preceded by *pe*, as evidenced by the ungrammaticality of (6b).

- (6) a. Băiatul_i *care* [ți- am arătat o fată [care îli simpatizează]].
 boy.the.M.SG that you-have shown a girl.F.SG who him likes

‘The boy that I showed you a girl who likes him.’

- b. *Băiatul_i *pe* *care* [ți- am arătat
 boy.the.M.SG *pe*.ACC who you-have shown
 o fată [care îli simpatizează]].
 a girl.F.SG who him likes

‘The boy whom I showed you a girl who likes him.’

(Grosu 1994: 234)

According to Grosu (1994), when *pe* is omitted, *care* acts as a complementizer, similar to *that* in English. In this instance, the relative clause structure does not involve *wh*-movement and instead contains a null operator base-generated in SpecCP. Moreover, Grosu (1994) analyses the clitic inside the complex DP island as a resumptive pronoun, bound by the null operator. It is this resumptive pronoun that consequently binds an empty category in the object position. The presence of the resumptive element thus accounts for the grammaticality of (6a), since resumptives can occur in configurations such as islands that block *wh*-movement. The sentence in (6a) would thus have the derivation in (7):

- (7) [DP băiatul_i [SpecCP OP_i [C *care* [TP fata îli simpatizează e_i]]]]
 [DP the boy_i [SpecCP OP_i [C that [TP the girl him_i likes e_i]]]]

On the other hand, *care* acts as a relative pronoun when preceded by the case-marking preposition *pe*. Thus Grosu (1994) suggests that the ungrammaticality of (6b) follows from the fact that these structures do not have a base-generated null operator and that the pronominal clitic is bound by an A'-element.

Dobrovie-Sorin (1994) proposes a movement analysis for relative clauses in Romanian in which the head of the relative, with *care* in its specifier position, originates in the object position of the embedded verb and then undergoes A'-movement to SpecCP. Given that *care* does not bear quantificational features and, hence, cannot bind a variable, a clitic must double and bind the trace in the embedded object position (8).

- (8) [SpecCP [NP *care* băiat]_i [C [TP fata îli simpatizează t_i]]]
 [SpecCP [NP which boy]_i [C [TP the girl him_i likes t_i]]]

This *wh*-movement analysis straightforwardly accounts for the ungrammaticality of (6b) as the movement of the relative headed across an island boundary is blocked. (see Bențea 2012

for a raising analysis of restrictive relative clauses in Romanian; see also Sevcenco 2010, Sevcenco, Avram, & Stoicescu (2013)).

In addition to direct object relatives, case-marking on the relative pronoun *care* also appears in indirect object relatives, as illustrated in (9). *Care* is specified for Dative case and agrees in phi-features (number and person) with the relative head. Lack of agreement would give rise to ungrammaticality effects. Although the relative determiner *care* inflects for gender and number, it is not distinguished by the value of the feature [\pm] Human, like the English relative determiners *who/which*.

- (9) Îl zăresc pe băiatul căruia/(căreia)
 him see.1.sg pe.ACC boy-the.M.SG who.DAT.m.sg/*(who.DAT.f.sg)
 fata îi dă un cadou.
 girl-the.F.SG him.DAT.sg gives a present
 ‘I see the boy to whom the girl is giving a present.’

Much like in the case of direct object relative clauses in which the preposition *pe* precedes the relative pronoun *care*, it is impossible to relativize an indirect object across a complex DP island boundary:

- (10) *Băiatul_i căruia [ți-am arătat
 boy.the.M.SG who.DAT.m.sg you-have shown
 o fată [care _i-a dat un cadou]].
 a girl.F.SG who him.DAT-has given a present
 ‘The boy to whom I showed you a girl who gave him a present.’

The ungrammaticality of (10) above can be taken as evidence that, in the analysis proposed by Grosu (1994), indirect object relative clauses are also derived by movement along the lines of the analysis proposed in Dobrovie-Sorin (1994), which can better account for the impossibility of extracting a relativized element from a complex DP island.

To summarize, Romanian, contrary to a language like English, for example, provides children with various cues which should help them disambiguate between a subject and an object relative clause reading and facilitate the correct realization of the A'-chain linking the relative head to the corresponding subject or object position inside the relative clause: (i) case-marking on the relative pronoun at the very onset of the relative clause should inform on how to analyze the structure (as a subject or an object relative); (ii) the presence of the object

clitic should signal again an object interpretation of the relative clause, as well as indicate the position where the A'-object should be interpreted inside the clause; (iii) subject-verb agreement should be informative for the correct identification of the subject. Moreover, the derivation of object relative clauses introduced by *care* and *pe care* and of indirect object relative clauses has been linked to the presence or absence of wh-movement. This could imply that those structures not involving movement should pose less difficulties for comprehension.

3.2. Experiment 3: Comprehension of relative clauses disambiguated through Case in Romanian

The present study takes the comprehension of subject and object relative clauses by typically-developing Romanian-speaking children as a test ground in order to determine what extent case disambiguation at the onset of the relative clause can prevent children from misanalysing the structure and assist their comprehension of object relatives. As described in the previous section, Romanian provides an ideal testing ground because relative pronouns show overt case-marking for Accusative and Dative case. In principle, this should offer a cue in identifying the structure of the relative clause and in correctly assigning the A'-filler to the gap contained in the relative clause, even when both the head of the relative clause and the intervening subject contain a NP lexical restriction. In addition to case information on the relative pronoun, object relative clauses in Romanian are also characterized by the obligatory presence of object clitics, whose presence in the embedded clause provides further indication as to the interpretation of the gap. Furthermore, we have seen that relative clauses are associated with two possible derivations: (i) one that involves wh-movement in the case of relative clauses introduced by the relative pronoun *care* preceded by the preposition *pe* and of relative clauses introduced by *care* morphologically marked for Dative case; (ii) one that does not involve movement, namely those relative clauses introduced by the bare complementizer-like *care*. Given that these two options often co-occur in the spoken language, one could hypothesize that children could find the less complex option, the one without movement, easier to comprehend than the one that does involve movement.

The experiment on the comprehension of relative clauses in Romanian manipulated case-marking on the relative pronoun in Romanian subject, direct object and indirect object relative clauses with the goal to answer the following questions:

- (1) Does an early case disambiguation in Romanian preempt misanalyses?

- (2) If children misanalyse the structure, do case-marking and the object clitic inform on how to repair the structure?
- (3) Does presence or absence of movement affect comprehension?
- (4) Can the crucial complexity factor in child object relative clauses be identified in an intervention effect of a Relativized Minimality type?

3.2.1. *Participants*

The participants were 30 monolingual typically-developing Romanian children, 14 boys and 16 girls, age range 4;0 to 6;10 (mean age 5;4; SD = 0.76). Table 3.1 gives more detailed information about the age groups tested. All the children were recruited in two kindergartens in the town of Bistrița, Romania.

Age group	No. of participants	Age range	Mean Age (S.D.)
4 y.o.	10	4;0 – 4;11	4;6 (0.26)
5 y.o.	10	5;0 – 5;6	5;3 (0.18)
6 y.o.	10	6;0 – 6;10	6;3 (0.26)

Table 3.1. Participant data per age group (total number, age range, mean age and standard deviation)

3.2.2. *Design and Procedure*

3.2.2.1. *Materials*

Thirty-two experimental sentences were divided into four conditions: (a) Subject relatives (SR) as in (11); (b) Direct object relatives with overt case-marking (DOR_{pe}), exemplified in (12); (c) Direct object relatives without case-marking (DOR) in (13); and (d) Indirect object relatives (IOR) given in (14).

(11) Subject relative (SR)

Arată-mi elefantul **care** stropește crocodilul.
 show-me elephant.the.M.SG which splashes crocodile.the.M-SG
 ‘Show me the elephant that splashes the crocodile.’

(12) Direct object relatives with overt case-marking (DOR_{pe})

Arată-mi elefantul **pe care** crocodilul **îl** stropește.

show-me elephant.the.M.SG PE which crocodile.the.M.SG him splashes
'Show me the elephant that the crocodile splashes.'

(13) *Direct object relatives without overt case-marking (DOR)*

Arată-mi elefantul *care* crocodilul **îl** stropește.
show-me elephant.the.M.SG which crocodile.the.M.SG him splashes
'Show me the elephant that the crocodile splashes.'

(14) *Indirect object relatives (IOR)*

Arată-mi vulpea *căreia* gâsca **îi** cântă un cântec.
show-me fox.the.F.SG which.DAT.F.SG goose.the.F.SG her.DAT sings a song.
'Show me the fox to whom the goose is singing a song.'

All nouns were singular and each pair of nouns associated with an action had the same gender. Only the case information on the relative pronoun was manipulated. The sentences were semantically reversible and object relative clauses contained preverbal subjects only. The reason for testing object relative clauses with preverbal subjects only was to keep word order as close as possible to studies run in other languages and see whether case-marking modulates comprehension in object relative clauses in which word order is DP_{object} – DP_{subject} – Verb. The complete list of items can be found in Appendix B.

Children were presented with PowerPoint animations involving two pairs of animals (e.g. two crocodiles and two elephants) performing the same action but with reversed roles. Each action, as well as the Agent-Patient relation, was clearly illustrated in the animations. The experiment started with two practice items and each scenario was preceded by a description of the characters involved in the action. Every action was then presented in turn through a PowerPoint animation. At the end of each animation, the child saw a static picture of the characters performing the actions. The experimenter prompted the child to identify the correct character in one of the two scenarios appearing on the screen by using a relative clause of the type given in (8) to (11) above. Children saw each animation twice, associated every time with a different condition. An example of the description paired with a test item is given in (15).

(15) *Lead-in:* Uite doi elefanți și doi crocodili! Să vedem cum se joacă împreună.

'There are two elephants and two crocodiles. Let's see how they play together.'

1st action: Aici elefantul stropește crocodilul.

‘Here the elephant is splashing the crocodile.’

2nd action: Iar aici crocodilul stropește elefantul.

‘And here the crocodile is splashing the elephant.’

Test sentence: Arată-mi elefantul care stropește crocodilul.

‘Show me the elephant that is splashing the crocodile.’

Figure 3.1 shows the sequence of events in the visual display associated with a direct object relative, while Figure 2 exemplifies the visual material used for indirect object relatives. Both types of animations were used to assess comprehension of subject relatives.

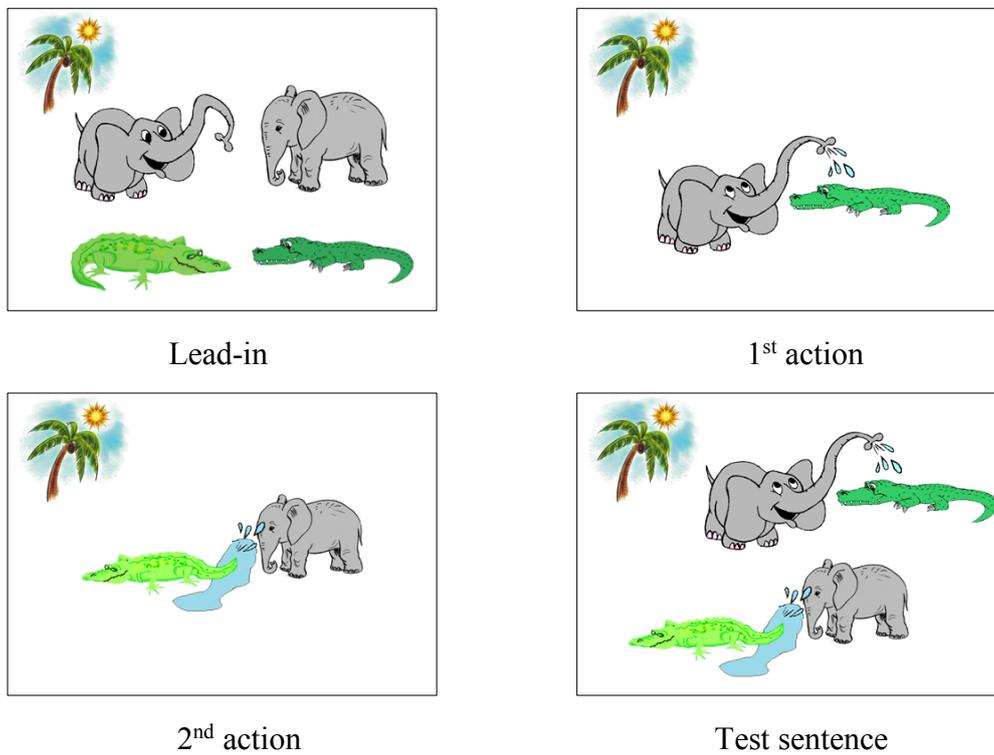


Figure 3.1. Example of animations paired with one target sentence in the SR/DOR condition





Figure 3.2. Example of animations paired with one target sentence in the SR/IOR condition

The left-right position on the screen of the target character was counterbalanced across conditions. Fourteen filler items were interspersed with the experimental items. The filler pictures had the same display as the test items and were associated with sentences like ‘Show me the pink pig’. Two lists were created based on two pseudo-randomized orders of the items and the children were randomly assigned to one of the two lists. The practice trials, experimental items and the fillers added up to a total of forty-eight items per list.

3.2.2.2. Procedure

Children were tested individually in a quiet room at their kindergarten. The task consisted of choosing the correct character out of the four characters present in a static image. The experiment was set up as a game in which children interacted with the puppet Heidi who asked for help from the children in understanding what was going on in the animations. Each experimental session was preceded by a warm-up phase in which children got familiarized with the setting, the marmot, and the task. During the test phase, for each experimental trial, the experimenter described the characters and the actions along the lines of (15) above while manipulating the animations with a remote control. At the end of each story, the experimenter paused the animation, presented the test sentence to the child through the puppet, and recorded the child’s answer on a separate answer sheet. One experimental session lasted approximately 30 minutes, with a short break halfway through the experiment. However, the experiment was also stopped if children wanted to take a break or if they showed signs of fatigue. Each child received a small reward at the end of the task.

3.2.3. Predictions

The predictions for the experiment can be summarized as follows: if case disambiguation at the onset of the relative clause prevents initial misanalyses, similar performance should be observed for both subject and object relative clauses. In addition, if case marking on the relative pronoun and the object clitic correctly inform on how to analyze the structure, children should comprehend object relatives with case marking better than object relatives without case marking. On the other hand, if children are more sensitive to the presence or absence movement affects comprehension, then we should observe that children are more accurate with object relative clauses introduced by invariable *care* and without movement. By contrast, if difficulties in comprehension are due to the featural similarity between the target (the A'-object) and the intervener (the subject), children should perform better with subject relatives than with object relatives, irrespective of case-marking on the relative pronoun, since both the head noun and the subject of the embedded relative clause bear the same features, thus creating a maximal intervention configuration in terms of Relativized Minimality effects.

3.2.4. Results

An answer was counted as correct when children pointed to the character corresponding to the head of the relative clause. The results obtained (Figure 3.3) show that Romanian children performed at ceiling for subject relative clauses, whereas their comprehension scores on both direct object relatives (with *pe* or without *pe*) and indirect object relatives are low.

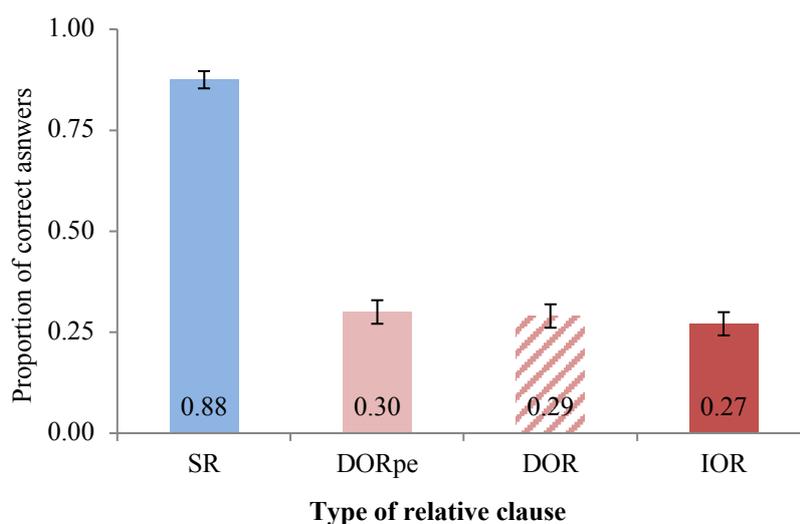


Figure 3.3. Proportion of correct responses by type of relative clause tested for Romanian children

(age range 4;0 – 6;10). The bars indicate the standard error to the mean.

The graph in Figure 3.3 also shows that the presence or absence of case-marking did not affect comprehension of object relatives. Children performed on a par with direct object relative clauses in which the relative pronoun was preceded by the case-marking preposition *pe* and with direct object relative clauses without *pe*. In addition, their performance with direct object relatives matched their performance with indirect object relatives, in which the relative pronoun itself was morphologically marked for case and agreed in phi-features with the head of relative.

The comprehension scores for object relative clauses, when compared to a chance level of 25%²¹, reveal that children perform at chance with these constructions and that their responses seem to be the result of guessing. However, when analyzing the errors children make with object relative clauses (Figure 3.4), we see that their errors show a well-defined error pattern.

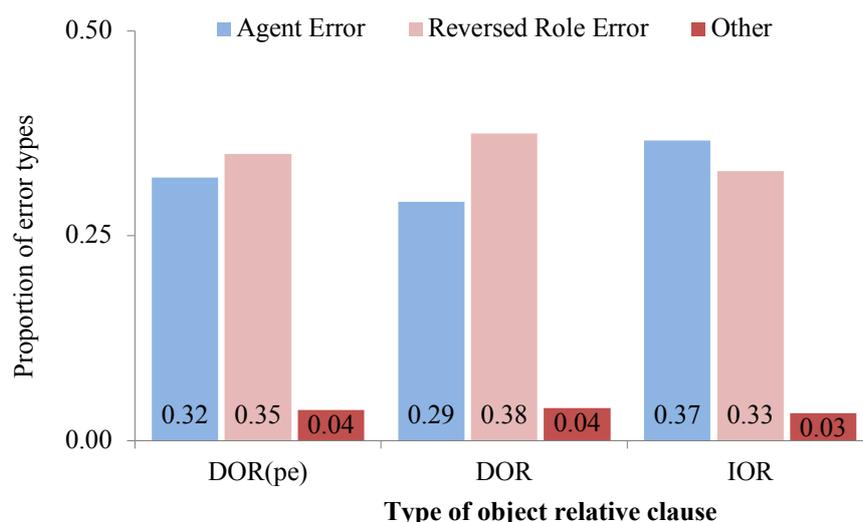


Figure 3.4. Proportion of error types in the comprehension of object relative clauses by Romanian children aged 4;0 – 6;10

Children make two recurrent types of errors with object relative clauses: *Agent errors*, when they point to the embedded subject and not to the head of the relative. For example, when hearing a direct object relative clause like *Show me the elephant that the crocodile is splashing*, children would point to the crocodile on the bottom left of the picture associated

²¹ The reason for considering a chance level of 25% is that, whenever children cannot analyze the structure and attempt to interpret the structure unsuccessfully, they will choose a character at random out of the four characters present in a picture.

with the test sentence in Figure 1 above. In this case, children identify the correct action (i.e. crocodile splashes elephant), but they seem to fail at identifying the correct argument, since they point to the Agent of the embedded verb; the second type of errors are *Reversed role errors*, when children point to the correct animal, but assign the wrong thematic role to the relative head by interpreting it as the Agent. That is, children would point to the top left elephant in Figure 1 when they hear a sentence like *Show me the elephant that the crocodile is splashing*, therefore assigning a subject interpretation to an object relative clause. Table 2 indicates the number of children who systematically chose one type of error (Agent error or Reversed role error) over the other.

Age Group	Agent error			Reversed role error		
	DOR(pe)	DOR	IOR	DOR(pe)	DOR	IOR
4 y.o.	2	1	1	1	1	0
5 y.o.	1	1	2	1	2	0
6 y.o.	2	0	1	1	1	1

Table 3.2. Error type by structure and number of children who made each error at least 6 times

It is worth noting only one child out of the 30 children tested constantly chose the Reversed Role error, irrespective of the type of object relative clause. Five children made more Reversed Role errors with direct object relative clauses without the preposition *pe*, while making more Agent errors with the other two types of object relatives in which the relative pronoun was marked for case.

Note also that, whenever they make an Agent error, children actually point to the correct image, but they end up choosing the wrong character. If we had also computed as accurate the times children pointed to the correct image, then response accuracy for object relative clauses would have increased to 60% for direct object relative clauses with *pe*, to 57% for direct object relative clauses without *pe* and to 64% for indirect object relatives. Although the subject-object asymmetry would still hold, these scores for comprehension accuracy with object relatives would have been closer to those reported for the comprehension of object relatives in Hebrew, for example (Friedmann, Belletti, & Rizzi 2009). This has implications for studies that have tested the comprehension of relative clauses using a picture-sentence matching task (Friedmann, Belletti, & Rizzi, 2009; Belletti, Friedmann, Brunato, & Rizzi, 2012; Contemori & Belletti, 2014, etc.). In these experiments, children were asked to choose

one of two pictures matching the sentence that they heard, instead of pointing to the character identified through the use of the relative clause. This is precisely the function of the relative clause: to single out a character whose relevant properties are described by the relative clause. Therefore, by asking children to choose a picture and not a character, it is unclear whether they point to the correct image because they recognize the correct referent of the relative clause in that picture or because they appeal to some other pointing strategy. That is, in order to choose the correct picture matching the sentence *Show me the elephant that the crocodile is splashing*, it is enough to rely on the embedded clause *the crocodile is splashing* and choose a picture that depicts this particular. And this is precisely what the Romanian children tested in this study seem to be doing whenever they make Agent errors. Despite the fact that the main finding of both the picture-sentence matching and the character-sentence matching is the same, i.e., the subject/object asymmetry in relative clauses, the information obtained with the two tasks is slightly different and provides different cues on the course of development of relative clause comprehension. I will return to this point in the Interim discussion.

3.2.4.1. Statistical analysis

The results obtained were fitted to a mixed logit model with response accuracy as a categorical dependent variable, Sentence Type (SR vs DORpe vs DOR vs IOR) as fixed predictor and Age as a covariate. The reference category was the response accuracy mean for direct object relatives without case-marking (DOR). The means for the other levels of the Sentence Type factor were compared to this reference level. The analysis revealed that neither the interaction with Age ($\chi^2(3) = 2.82, p = 0.42$), nor the effect of Age ($\chi^2(1) = 0.29, p = 0.59$) were statistically significant. All age groups displayed the same subject-object asymmetry and although comprehension improved with age, this effect was not significant. Sentence Type had a significant effect ($\chi^2(2) = 43.03, p < .001$), as summarized in Table 3.3.

Fixed effects	Coefficient	SE	Wald Z	p
(Intercept)	-1.45	0.41	-3.49	<.001***
Sentence Type = <i>Direct object with pe</i>	-0.13	0.37	-0.36	= .71
Sentence Type = <i>Indirect object</i>	0.05	0.35	0.15	= .87
Sentence Type = <i>Subject</i>	4.01	0.58	6.90	<.001***

Table 3.3. Summary of fixed factors in GLMM of correct responses for subject and object

relative clauses for all age groups²²

The maximal random effect structure justified by the data included random intercepts for both subject and items, as well as by-subject random slopes for the effects of Sentence Type. Table 3.4 summarizes the random effect structure of the model.

Random effects	s²	SD	Correlation with random effect for Intercept
Items Intercept	0.12	0.35	
Subjects Intercept	3.19	1.79	
Sentence Type = DOR pe	0.16	0.40	0.98
Sentence Type = IOR	0.20	0.45	-0.70
Sentence Type = SR	3.50	1.87	-0.74

Table 3.4. Summary of random effects and correlations in the mixed logit model for all age groups

Table 3.3 illustrates that comprehension accuracy significantly improves with subject relatives ($\beta = 4.01$, $SE = 0.58$, $z = 6.90$, $p < .001$), as compared with direct object relatives without case-marking. However, there is no difference between children performance for direct object relative clauses without pe and their performance with direct object relative clauses preceded by pe ($\beta = -0.13$, $SE = 0.37$, $z = -0.36$, $p = .71$) or with indirect object relative clauses ($\beta = 0.05$, $SE = 0.35$, $z = 0.15$, $p = .87$). These results show that children find all object relatives equally difficult to process, independent of the presence or absence of case-marking on the relative pronoun, while they succeed very well in the comprehension of subject relatives.

3.2.5. *Interim discussion*

The findings of Experiment 3 on relative clauses disambiguated by case reveal a clear asymmetry between subject and object relatives (both direct object and indirect object) in early Romanian. Although case-marking appears at the very onset of the object relative clause, the difference in case between the relative pronoun and the embedded subject does not help Romanian children disambiguate between subject and object relatives, neither does it improve comprehension of case-marked as compared to non-case-marked object relative

²² Final model: Response Accuracy \sim Sentence Type + (1 + Sentence Type | Participant) + (1 | Item); N = 960, AIC = 870.3, BIC = 943.3, log-likelihood = -420.1, $\chi^2 = 43.03$.

clauses. This is consistent with other studies on Romanian-speaking children's comprehension of relatives (Sevcenco & Avram 2012), also showing that the presence or absence of *pe* does not modulate processing of object relatives in Romanian. In addition, the obligatory presence of clitic pronouns inside object relative clauses, which should further disambiguate object relatives from subject relatives, does not seem to play a role in improving Romanian children's comprehension of object relative clauses. Case-marking on the relative pronoun and object clitic pronouns do not seem to be informative enough cues which could help children assign the corresponding interpretation to the object dependency. Thus, the first two predictions of the present study are not borne out. Case-marking does not prevent children from misanalysing the structure and does not point towards the correct analysis of the relative clause head.

The types of errors children make with direct and indirect object relative clauses reinforce this conclusion. The Reversed role errors reflect that children start with a subject interpretation to the object relative construction and analyze the first NP as the agent of the verb. This means that, in order to assign an object interpretation to the sentence, children have to be able to revise their initial subject analysis based on the linguistic information they encounter after the relative head. The Reversed role error indicates that children continue to interpret the structure as a subject relative, irrespective of the presence of a case-marked relative pronoun immediately after the relative clause head. This type of error shows that children cannot use the presence of case-marking to successfully analyze the structure as an object relative. The Agent errors, on the other hand, indicate that children correctly assigned theta roles to the two noun phrases; they are able to identify the correct action described by the object relative clause, but they fail to integrate the thematic interpretation into the structural representation of the sentence as a relative clause.

The Agent Error was previously noted by Arnon (2005) for Hebrew and Adani (2011) for Italian, thus pointing out the limitations of a picture-matching task, described as well in the Results section. Arnon (2005) modified the picture-sentence matching task by asking Hebrew-speaking children (N = 14, aged 4;5 – 5;2, M = 4;7) to choose a character instead of an action. Like in the present study on Romanian, Arnon used two pictures, one displaying character A performing an action on character B and the other showing B performing an action on A. Children were consequently instructed to choose A or B in the relevant picture. Arnon's results displayed the same subject-object asymmetry as found in picture-sentence matching task. In contrast to experiments that used this latter task, Arnon detected a more fine-grained class of errors. These included, besides the Reversed role error (27%), the Agent

Error, which children made in 22% of the cases. An important observation of Arnon's study was that the Agent error couldn't be identified in the picture-matching sentence task: these errors would fall under correct responses in such a task. Arnon (2005) associated the Agent error to children's difficulty in identifying the modifier nature of the restrictive relative clause. That is, children fail to realize that the relative clause modifies the head noun and they interpret the phrase as a co-ordinated structure. For example, a direct object relative clause like *Show me the elephant that the crocodile is splashing* would be interpreted as *Show me the elephant. The crocodile is wetting*. This brings us back to the Conjoined Clause analysis proposed by Tavakolian (1981), according to which, whenever children cannot process complex sentences, they analyze them as simple non-embedded structures and conjoin the two sentences into a co-ordinate structure. Such an analysis faces a learnability problem (see Crain & Thornton 1998, Guasti 2002), as children will have to unlearn the conjoined-clause interpretation for relative clauses and in order to do that, they should have access to negative evidence (i.e. being told that a certain interpretation is not possible in the language they are exposed to). Research has shown that children rely on positive evidence in acquiring a language, whereas negative evidence is rare and does not seem to play a role in improving children's linguistic behavior (Guasti 2002, a.o.).

The Agent Error has also been reported for the comprehension of object relative clauses by Italian-speaking children (N = 116, aged 3;4 – 7;9), using a different version of the character-sentence matching task (Adani 2011). In this study, only one picture was used for each target sentence with one character A on the left, a character B in the middle and another character A on the right. Contrary to Arnon's (2005) findings for Hebrew, fewer Agent errors occurred overall in the Italian children's results presented in Adani (2011). Children made the Agent error in 10% of the cases, as compared to Reversed role errors detected in 20% of responses. Moreover, children did not systematically choose the Agent error over the Reversed role error, which Adani (2011) takes as evidence for the fact that children were able to represent the entire relative clause structure and not simply assign it a conjoined-clause analysis.

The results of the study on Romanian relative clauses also show that the Agent error co-occurs with the Reversed Role error at the level of individual performance. In addition, despite making this Agent error, children are actually capable to identify the action corresponding to the events described in the object relative. Therefore, this type of error suggests that children's interpretation of object relatives is hindered by the presence of the subject in the dependency created between the A'-filler and the gap in the object position of

the embedded verb. This object dependency is disrupted by the interference of a structurally similar element, which is computationally costly for younger children. The analysis of children's incorrect responses revealed that the Agent error is attested more with object relatives with case-marking (direct object relatives preceded by *pe* and indirect object relative clauses), while the Reversed Role error occurs significantly more frequently with direct object relative clauses introduced by bare *care*. These findings indicate that children have a greater tendency to interpret object relative clauses with the complementizer-like *care* as subject relative clauses contrary to object relative clauses in which the relative pronoun is marked for case.

To recall the discussion in section 3.1, Grosu (1994) postulated that the two types of relatives instantiate different structures: one that does not imply wh-movement, as in the case of object relative clauses introduced by bare *care*, and one that does involve movement (direct object relative clauses introduced by *pe care* and indirect object relative clauses). If structures derived by wh-movement are computationally more costly for children than those that do not involve movement (see Jakubowicz 2004, 2005), we could speculate that children should find less complex structures easier to comprehend than more complex ones. Nonetheless, the children tested in Experiment 3 have equal difficulties with both case-marked and non-case-marked object relatives, thus suggesting that an account in terms of presence or absence of movement cannot capture the results obtained. These findings for comprehension stand in contrast with those for production, which report that children omit *pe* in object relatives in most of the instances when they produce such structures (Sevcenco, Avram & Stoicescu, 2012, 2013).

At the same time, the authors point out that children produce direct object relatives at a very low rate, although they have the less complex option of forming direct object relative clauses without movement (i.e. introduced by the invariable complementizer *care* and not preceded by *pe*). In their view, the low production rate underscores the idea that derivational complexity cannot be measured only in terms of presence or absence of movement.

Children's difficulties with processing object relative clauses seem to stem mainly from the structural configuration of object relative clauses, which prevents children from correctly mapping between arguments and surface syntactic position. These results fall in line with Friedmann, Belletti, & Rizzi's (2009) results for the comprehension of object relative clauses in Hebrew, which also contained an Accusative marker similar to *pe* in Romanian

preceding the head of the object relative²³. Friedmann et al. (2009) also found a subject-object asymmetry in the comprehension of relative clauses in Hebrew. The results of Experiment 3, together with those from Friedmann et al. suggest that the presence of an embedded lexically-restricted subject hinders the creation of the A'-dependency between the head of the object relative and its gap position even when the head is clearly marked for Accusative case.

Still, the question remains of why Romanian children's comprehension of object relative clauses does not improve in the presence of case-marking on the relative pronoun. We have seen that in the system proposed by Belletti, Friedmann, Brunato, & Rizzi (2012), a difference in features such as gender (for Hebrew) or number (for Italian) between the embedded subject and the relative clause head creates an intersection configuration which is easier for children to compute, thus enhancing their comprehension of object relative clauses. Thus, one could hypothesize that case in Romanian is also a potential candidate for creating an intersection relation, much like gender in Hebrew and number in Italian. However, the features that can modulate children's comprehension of object relative clauses are those features that act as attractors for movement, a potential manifestation of this status of a given feature being that it 'is realized in the agreement morphology of the tensed verb' (Belletti et al. 2012: 1062). In the structures tested in Romanian, case is expressed on the relative pronoun, either morphologically – as in indirect object relative clauses – or through the use of a functional external case-marker *pe* in direct object relative clauses. However, if we assume following (Alboiu, 2000) that Romanian DPs do not move for Case checking, then neither the preverbal subject, nor the A'-object are attracted for reasons of case-assignment. Given that only features functioning as attractors for movement are considered to be 'syntactically active' in the sense of Belletti et al. (2012) and to modulate the comprehension of object A'-dependencies, we can account for the lack of a facilitating effect of case on the processing of object relative clauses in Romanian.

I will come back to the role of case-marking in the General discussion part and I will now turn to the comprehension of *who*- and *which*-questions by Romanian-speaking children with the goal to examine whether Romanian displays the same subject/object asymmetry found in relative clauses and the same object *who*/object *which* asymmetry found in other languages (Ervin-Tripp 1970; Tyack & Ingram 1977; De Vincenzi, Arduino, Ciccarelli & Job 1999; Avrutin 2000; Philip, Coopmans, van Atteveldt, & van der Meer 2001; Friedmann,

²³ Different constraints govern the distribution of *et* and *pe*, since *et* in Hebrew is used with both animate and inanimate definite objects (Danon, 2001), while the use of *pe* in Romanian is determined by conditions such as animacy, specificity and definiteness.

Belletti & Rizzi 2009). A comparison between *wh*-questions and relative clauses can show whether presence of *pe* has a similar impact on the processing of A'-dependencies in Romanian and whether the two dependencies share the same level of complexity.

3.3. Properties of Romanian *wh*-questions

Subject and object *wh*-questions in Romanian referring to [+animate] entities can be introduced by two *wh*-elements: *cine* ('who') for non-lexically-restricted *wh*-questions (examples (16) and (17)) and *care* ('which') for lexically-restricted questions, as in (18) and (19)²⁴. The noun phrase in parentheses in these latter examples illustrates the option of having *care*-questions without an overtly-expressed lexical NP.

- (16) Cine *l-a* interviewat *pe* student?
 who *him_i.ACC*-has interviewed *pe.ACC* student_{*i*}
 'Who interviewed the student?'
- (17) *Pe cine a* interviewat profesorul?
pe.ACC who has interviewed professor.the.M.SG
 'Who did the professor interview?'
- (18) *Care (profesor) l-a* interviewat *pe* student?
 which professor *him_i.ACC*-has interviewed *pe.ACC* student_{*i*}
 'Which professor interviewed the student?'
- (19) *Pe care (student) l-a* interviewat profesorul?
pe.ACC which student_{*i*} *him_i.ACC*-has interviewed professor.the.M.SG
 'Which student did the professor interview?'

Note that in subject *wh*-questions illustrated in (16) and (18) above, the direct object *pe profesor* is doubled by a co-indexed clitic pronoun *l* ('him'). This is an instantiation of the 'clitic doubling' phenomenon present in languages like Romanian and Spanish, whereby an

²⁴*Wh*-questions can also be introduced by the interrogative pronoun *ce* ('what'), whose syntactic behavior patterns with that of *cine* ('who') (see Dobrovie-Sorin 1994 for a more detailed discussion):

- a. *Ce (carte) ai citit de curând?*
 what book have.2.sg read of recent
 'What book have you read recently?'
- b. *Ce (autor) a scris 'Robinson Crusoe'?*
 what author has written 'Robinson Crusoe'
 'What author wrote 'Robinson Crusoe?'

accusative or dative clitic pronoun appears together with a co-referential full lexical noun phrase. Clitic doubling in Romanian requires the direct object to be additionally marked by means of *pe*, a marker similar to the Spanish *a*, as evidenced by the ungrammaticality of (20):

- (20) *Studentul_i a impresionat profesor_i cu răspunsul său.
 student.the.M.SG_i him_i.ACC-has impressed professor_i with answer his_i.
 ‘The student impressed the professor with his answer.’

When the direct object is a definite noun phrase, it appears without *pe* and without clitic doubling:

- (21) Studentul_i (*l-)a impresionat (*pe) profesorul cu răspunsul său._i
 student.the.M.SG_i has impressed professor with answer his_i.
 ‘The student impressed the professor with his answer.’

This brings us to the contrast between direct object questions in (17) and (19) with respect to the distribution of clitic pronouns: these are illicit in non-lexically-restricted interrogatives, but are obligatory with lexically-restricted *wh*-phrases, as shown by the examples in (22) and (23) which contrast with those in (17) and (19):

- (22) *Pe cine_i l_i-a interviewat profesorul?
 pe.ACC who_i him_i-has interviewed professor.the.M.SG
- (23) *Pe care (student) a interviewat profesorul?
 pe.ACC which student has interviewed professor.the.M.SG

Given the parallelism between *care* +*NP* and *care* –*NP* structures with respect to the obligatory presence of a clitic pronoun corresponding to the moved argument, it follows that these two elements also share the same structural properties and that *care* –*NP* is only an apparent case of bare *wh*-element. That the obligatory clitic appearing with *care* constructions is not a resumptive pronoun is indicated by the fact both *cine* and *care* structures are sensitive to islands (Dobrovie-Sorin (1994):

- (24) *Pe cine cunoști profesorul care a interviewat _?
 pe.ACC who know.2.SG professor.the.M.SG which has interviewed
 *‘Who do you know the professor that interviewed?’

- (25) *Pe care student_i cunoști profesorul

pe.ACC which student_i know.2.SG professor.the.M.SG

care I_i-a interviewat _?

which him_i-has interviewed

*‘Which student do you know the professor that interviewed?’

Dobrovie-Sorin (1994) links the obligatory absence of clitics in *cine* structures and their obligatory presence in *care* structures to the different quantification features associated with the two types of wh-elements. *Cine* acts as a syntactic quantifier binding a variable in an A-position. Assuming the definition of variables in (26):

- (26) α is a variable if and only if α is an empty category that (a) occupies an A-position, (b) is bound by a quantifier, and (c) is Case-marked.

(Dobrovie-Sorin 1994:201)

The ban on clitics from *cine* quantifier-variables configurations follows from the fact that the clitic absorbs the Case which would normally be assigned to the empty category in the direct object position. *Care* configurations, on the other hand, require the obligatory use of a clitic pronoun because *care* does not bear quantification features and, therefore, cannot bind a syntactic variable. This has also been shown for relative clauses in section 3.1. Contrary to *cine*, *care* wh-elements are, according to Dobrovie-Sorin, ‘restricted quantifiers’ whose domain of quantification is restricted by the lexical NP following them²⁵.

The presence of a clitic pronoun in *care*-structures determines additional differences with respect to *cine*-structures as to the presence or absence of weak crossover (WCO) effects²⁶ and whether they license or not parasitic gaps. While movement of an interrogative phrase over a coindexed pronoun is not possible with *cine*-phrases, as evidenced by the ungrammaticality of (27a), movement of *care*-phrases does not trigger WCO effects (27b). In addition, only *cine*-structures, which are not doubled by a clitic, license parasitic gaps (28). The examples are from Dobrovie-Sorin (1994):

²⁵ While the logical form of the question in (6) is something like *For which x, x is a human, the professor interviewed x*, the logical form of a question like in (8) is *For which x_i, x_i is a student, the professor interviewed him_i*.

²⁶ Roughly speaking, weak crossover effects arise when an operator has to cross over a variable on its way to its scope position and cannot felicitously bind the variable. In other words, if a wh-chain and a pronoun are co-indexed, the tail of the wh-chain must c-command the pronoun, as illustrated in the examples below:

- (i) Who_i t_i loves his_i mother?
(ii) *Who_i does his_i mother love t_i?

- (27) a. *Pe cine_i a certat mama lui_i ?
 pe.ACC who_i has scolded mother.the.F.SG his_i
 ‘Who_i did his_i mother scold?’
- b. Pe care_i l_i-a certat mama lui_i t_i?
 pe.ACC which_i him_i-has scolded mother.the.F.SG his_i
 ‘Who_i was scolded by his_i own mother?’
- (28) a. Pe cine ai apreciat t înainte de a cunoaste e?
 pe.ACC who have.2.SG appreciated t before knowing e
 ‘Who did you appreciate before knowing?’
- b. *Pe care_i l_i-ai apreciat t înainte de a cunoaste e?
 pe.ACC which_i him_i-have.2.SG appreciated t₁ before knowing e_i

Further evidence in favor of a distinction between *cine* and *care* wh-phrases comes from the ordering of these elements at the left-periphery of the clause. Romanian, like Slavic languages, allows multiple wh-elements to be fronted to a clause-initial position:

- (29) Cine pe cine a interviewat?
 who pe.ACC who has interviewed
 ‘Who interviewed whom?’

- (30) *Pe cine cine a interviewat?

Laezlinger & Soare (2005) and Soare (2009) convincingly argue that, while there is a strict ordering among bare wh-elements, D-linked or lexically-restricted wh-expressions always appear clause-initially, preceding bare phrases. From an interpretive standpoint, they are associated with the notion of ‘givenness’ and have been analysed as topics (see Comorovski 1996, Alboiu 2000):

- (31) Care (profesor) pe cine a interviewat?
 which professor pe.ACC who has interviewed
 ‘Which professor interviewed whom?’
- (32) Pe care (student_i) cine l_i-a interviewat?
 pe.ACC which student_i who him_i-has interviewed
 ‘Who interviewed which student?’

The lexically-restricted element can also be separated from other bare *wh*-phrases by fronting it to the left periphery of a matrix clause with bare elements appearing in a lower position (33a). This option is ruled out for bare *wh*-words (33b).

- (33) a. *Pe care (student) vrei să știi cine când l-a interviewat?*
 pe.ACC which student_i want.2.SG SUBJ know.2.SG
 cine când l-a interviewat?
 who when him_i-has interviewed
 ‘Which student do you want to know who interviewed when?’
- b. **Pe cine vrei să știi cine când a interviewat?*
 pe.ACC who want.2.SG SUBJ know.2.SG who when has interviewed
 ‘Whom do you want to know who interviewed when?’

By adopting a split-CP analysis (Rizzi 1997) and a cartographic approach to syntactic structures (Belletti 2004, Cinque 2002, Rizzi 2004), Laenzlinger & Soare (2005) and Soare (2009) show that *care* *wh*-phrases in Romanian get attracted to a higher position than the position occupied by bare elements at the left periphery²⁷. Given the topic flavour of lexically-restricted or D-linked *wh*-constituents, the authors suggest that these phrases target the specifier position of a Topic+Wh head above the Specifier Focus position which is the landing site of bare *wh*-phrases. These observations related to the position of *which*-elements in the Romanian left-periphery bring further support to the view that there must be different attractors for lexically restricted and bare *wh*-elements, as the presence of a lexical restriction on the *wh*-phrase determines different landing sites for movement.

To resume, this section has shown that *cine* (‘who’) and *care* (‘which’) interrogative elements in Romanian behave differently, both at a syntactic and at an interpretive level. Knowing how such differences influence the acquisition pattern of *wh*-questions in Romanian can prove very insightful for the study of children’s syntactic development.

²⁷ Within a cartographic approach to left periphery of CP (Rizzi 1997, 2004), the traditional representation of the C system as a single head and projection is replaced with a view in which the complementizer system is defined by a universal hierarchy of functional positions. The heads delimiting this system are Force (declarative, interrogative, etc.) and Fin (Finiteness):

(i) Force ... Top* ... Foc ... Top* ... Fin IP (Rizzi 1997, 2004)

3.4. Experiment 4: Comprehension of wh-questions disambiguated through case and lexical restriction in Romanian

In light of the above considerations, the current study explores Romanian children's sensitivity to morphosyntactic information in the interpretation of bare and lexically-restricted wh-questions and investigates to what extent children's selective difficulties with movement dependencies can be modulated by language-specific properties. To date, there are only two very recent studies that have looked at the comprehension of *who*- and *which*-questions by Romanian children, Sevcenco & Avram (2015) and Sevcenco, Măniță & Avram (2015). These studies examined the comprehension of subject and object *who* and *which*-questions with a number match or mismatch and found an overall asymmetry between *who* and *which* questions. Sevcenco, Măniță & Avram, for example, report that children had more difficulties not only with object *which*-questions (43.37% accuracy) as compared to object *who*-questions (56.52% accuracy), but also with subject *which*-questions (only 42.02% accuracy) vs subject *who*-questions (60.86% correct responses). The subject-object asymmetry only surfaced in their study with *which*-questions in the number match condition, while no such difference appeared in the number mismatch condition, arguably due to the low comprehension rate of subject *which*-questions. The results from the comprehension task contrast with the data that Sevcenco, Măniță & Avram (2015) provide from longitudinal corpora and which shows that, despite a delay in the production of subject and object *which*-questions with respect to *who*-questions, children comprehend them very well and they even give higher rates of correct answers to object questions than to subject questions. Together with these two studies, the experiment presented in this chapter aims to fill the gap in the acquisition literature on the comprehension of wh-questions in Romanian. The goals of the study were two-fold: (i) assess the nature and impact of the NP feature on children's comprehension of Abar-dependencies and (ii) examine the role that case-marking plays on the comprehension of object wh-dependencies and whether children are able to draw upon this language-specific property.

3.4.1. Participants

Fifty typically developing monolingual Romanian-speaking children aged 3;8 to 7;2 were recruited at a pre-school and a school in Bistrița, Romania. Data from 6 children were excluded based on three criteria: they did not complete the whole experiment (n=1); they were not paying attention during the task (n=2); their answers showed a strong bias towards

pointing only to the character found in a specific part of the screen (n=2). The study reports the results of the remaining 44 participants divided across two age groups, as illustrated in Table 3.5. In addition, 10 adult native speakers of Romanian were included as a control group.

Age group	No. of participants	Age range	Mean Age (S.D.)
4 y.o	21	3;8 – 5;2	4;4 (0.60)
6 y.o.	23	5;8 – 7;2	6;5 (0.62)
Adults	10	18;0 - 40	31 (6.73)

Table 3.5. Participant data per age group (number per group, age range, mean age and standard deviation)

3.4.2. Design and procedure

3.4.2.1. Materials

The experiment investigated the comprehension of subject and object questions introduced by various types of wh-elements. 18 sets of 6 sentences like those exemplified in (34) were constructed. As we can see, condition (a) was a subject question with a bare wh-word *cine* ‘who’; condition (b) was an object bare question introduced by *cine* ‘who’ preceded by the case-marker *pe*; in condition (c) we have a subject *which* +NP question where the wh-phrase *care* ‘which’ is followed by a lexical noun (i.e. *girafă* ‘giraffe’), while in condition (d) we have an object *which* +NP question, hence the presence of *pe* at the onset of the wh-expression; (e) and (f) illustrate the *which* –NP conditions, so subject and object questions also introduced by the wh-element *care* ‘which’, but without a lexical noun.

- (34) a. Subject *cine* (‘who’) question
Cine a gâdilat țestoasa?
 who has tickled turtle.the.F.SG
 ‘Who tickled the turtle?’
- b. Object *cine* (‘who’) question
Pe cine a gâdilat țestoasa?
 pe.ACC who has tickled turtle.the.F.SG
 ‘Who did the turtle tickle?’
- c. Subject *care* NP (‘which +NP’) question
Care girafă a gâdilat țestoasa?

which giraffe has tickled turtle.the.F.SG

‘Which giraffe tickled the turtle?’

d. Object care NP (‘which +NP’) question

Pe care girafă a gâdilă-o țestoasa?

pe.ACC which giraffe has tickled-her.ACC turtle.the.F.SG

‘Which giraffe did the turtle tickle?’

e. Subject care (‘which –NP’) question

Care a gâdilă țestoasa?

which has tickled turtle.the.F.SG

‘Which one tickled the turtle?’

f. Object care (‘which –NP’) question

Pe care a gâdilă-o țestoasa?

pe.ACC which has tickled-her.ACC turtle.the.F.SG

‘Which one did the turtle tickle?’

The study thus used a 2 X 3 design with type of structure (*subject vs object*) and type of wh-element (*who vs which +NP vs which –NP*) as within-participant factors. The *which +NP* and *which –NP* notation distinguishes between *which*-questions with and without an overt full lexical noun. In using this notation, I adopt the terminology of previous studies (Friedmann et al., 2009, Belletti et al., 2012) where the +NP feature characterized cases involving the presence of a lexical noun and, accordingly, I initially classify wh-questions headed only by *care* and *pe care* as –NP.

Children saw each item twice: for example, they would see the item given in (34) once in the (a) condition, so paired with a *subject cine (‘who’) question* and once in the (d) condition, therefore paired with an *object care NP (‘which +NP’) question*. The 6 sentences of each set were divided into three lists such that each list included 6 items for each of the 6 conditions. Appendix B lists all the experimental trials in Experiment 4. Items were presented in a randomized order within each list and were mixed with 18 fillers. Additionally, there were 2 practice trials at the beginning of each list. Consequently, each list included 2 practice trials, 36 target sentences and 18 fillers, summing up to a total of 56 trials per list.

All target sentences contained the transitive verbs and nouns that matched in gender and number. The characters were always either two animals or two humans. A postverbal subject was used in all object questions, which is the default option in Romanian. In addition, the object noun phrase in subject questions, although it was an animate definite NP, was not

preceded by *pe* and was not doubled by a clitic pronoun, which is also a possible option in Romanian. This allowed to neutralize word order as a disambiguating cue and to zoom in only on the effect of the case-marking preposition *pe* when present on the *wh*-word. As such, (i) *pe* was the only element that signaled an object interpretation vs. a subject interpretation for *cine* ('who') questions in (34a-b); (ii) subject and object *care NP* 'which +NP' and *care* ('which – NP') questions in (34c-d) and (34e-f) were disambiguated through the use of *pe* and the clitic pronoun, which can appear either postverbally (in the case of the feminine clitic) or preverbally (in the case of the masculine clitic); (iii) object *cine* ('who') and object *care* ('which –NP') questions were only distinguished, at a surface level, by means of the clitic pronoun in the latter structures.

The task used was a character-selection task adapted from Friedmann, Belletti, & Rizzi's (2009) study on *wh*-questions in Hebrew and Adani's (2011) study on relative clauses in Italian. The visual stimuli were cartoon movies realized with an animation software. This type of visual stimuli differs from that employed in previous studies which assessed comprehension or production of *wh*-questions through the use of static pictures. Each cartoon displayed three characters (e.g. two giraffes and a turtle) involved in the same action and was accompanied by a pre-recorded description of the scenes. A sample description and an example of test question are illustrated in (35). Figure 5 shows the sequence of events in the visual display.

(35) *Lead-in*: Uite două girafe și o țestoasă!

'Look! There are two giraffes and a turtle.'

1st action: Să vedem ce se întâmplă! O girafă gădilă țestoasa.

'Let's see what happens next! A giraffe is tickling the turtle.'

2nd action: Acum uite! Țestoasa gădilă o altă girafă.

'Now look! The turtle is tickling another giraffe.'

Question: Care girafă a gădilat țestoasa?

'Which giraffe tickled the turtle?'

In order to create a pragmatically felicitous context for the use of *care* ('which –NP') questions *Care a gădilat țestoasa?* ('Which one tickled the turtle?'), the target question was always preceded by an introductory question (e.g. *Ai văzut girafele?* *Did you see the giraffes?*).

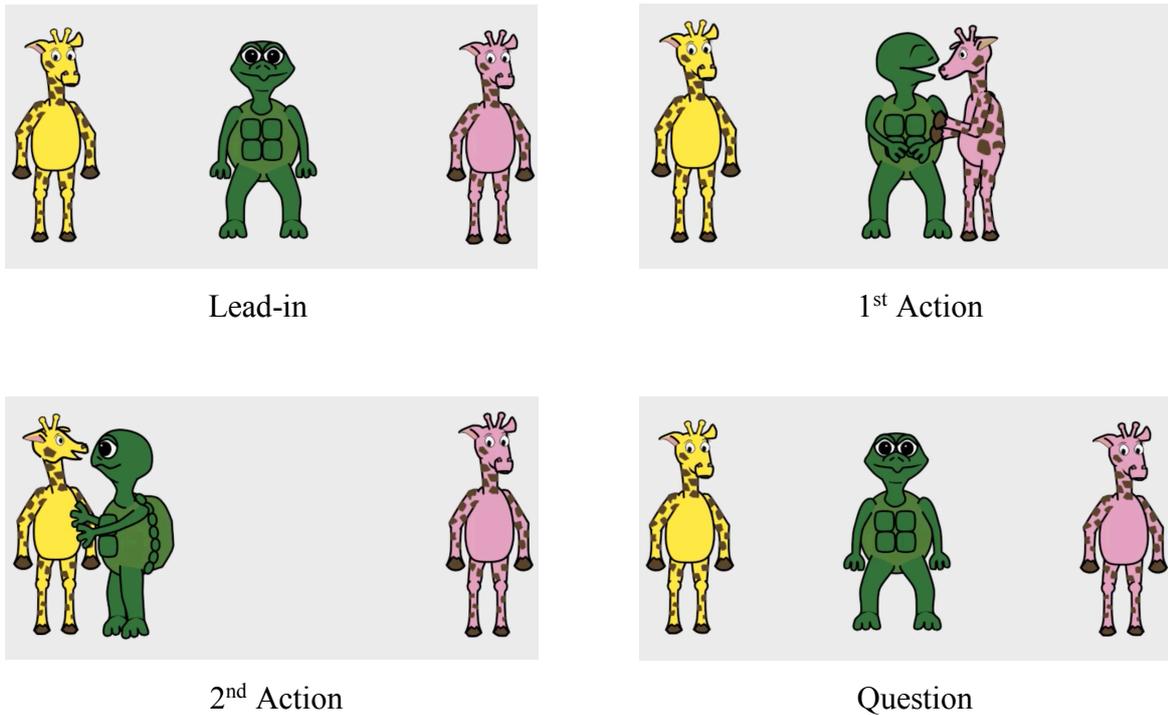


Figure 3.5. An example of animation sequence used to assess comprehension of wh-questions

The target questions were associated with a static display presenting the characters in their original position. After each question, the child had to point to the correct character or reply by describing the color of the character (e.g. ‘the pink giraffe’). Given that the correct answers always consisted of pointing to one of the characters on the sides (left or right), the position of the target character as well as the direction of the action were counterbalanced. In addition, the answers to filler sentences targeted the middle character, so as to remove a potential bias of pointing only to the characters on the sides. The animations associated with the fillers had the same design as that of the other experimental items (e.g. two girls and a boy; one girl dances together with the boy, then the boy dances with the other girl) and were paired with sentences such as ‘Show me who the girls are dancing with’. The adult participants saw the same experimental stimuli.

3.4.2.2. Procedure

The experiment was set up as a quiz game in which the children interacted with a puppet, the reindeer Rudolf. Children were told that they would watch cartoon stories together with Rudolf, who will then ask a question after each story. Every experimental session started with two practice trials to ensure that the children understood the task and then continued with a presentation of the target and filler sentences, which all followed the same format as the one

described in (35) above. The cartoons and the recorded description of the stories were presented on a laptop using digital media player software. At the end of each story, when the characters appeared again on the screen in their initial position, the experimenter paused the cartoon, asked a question through the puppet and noted down each answer on the answer sheet. The questions were produced with a neutral prosody so as not to influence in any respect children's interpretation. After each child saw half of the total sentences, the experimenter paused the presentation of the cartoons. This allowed children to have a small break in which they could interact with the puppet, making sure that they stay attentive throughout the duration of the whole task. Children were also told that they could stop the experiment and have a break at any time. After each answer, the child received a short positive feedback to motivate them to pay attention, as well as a small reward from the puppet at the end of the task. Each experimental session lasted approximately 35 minutes.

The procedure used with the adult participants was similar, the only differences being that there was no puppet interacting with them during the task and there was no intermediate break. The experiment with the adults took approximately 15 minutes.

3.4.3. Predictions

Several predictions hold for the study. First, as we have seen in section 3.3, the syntactic behavior of *care* 'which -NP' phrases patterns with that of *which*-expressions with an overtly expressed noun and is distinct from that of bare wh-phrase like *who*. In addition, as far as their meaning is concerned, both types of *which*-expressions presuppose the availability of a given set of referents in the discourse context. Contrary to questions introduced by *cine* 'who', questions introduced by *care* 'which' cannot be asked out-of-the-blue since they imply a choice from "a set of individuals previously introduced into the discourse, or . . . part of the 'common ground' shared by speaker and hearer" (Pesetsky 2000:16). Despite the similarity in surface form between *cine* 'who' and *care* 'which -NP', only the first wh-element can be truly considered as -NP, whereas the latter only apparently lacks a lexical restriction. The apparently bare *care* is in fact analogous to the English *which one*. It could thus be assigned the form [WH [NP [N e]]], along the lines of Dobrovie-Sorin 1994, where the N has been deleted, contrary to *care NP* cases (e.g. *care* 'which one' vs *care girafă* 'which giraffe'), where an NP is present. As such, the instances of *care* 'which' are not followed by an overt full lexical noun still contain a [+NP] specification.

This has interesting consequences for an account of children's comprehension difficulties with object A'-dependencies in terms of intervention effects driven by a similar

featural specification on the A'-moved element and the intervening subject. An important observation of the intervention account is that the features that enter the computation of locality are the features that function as attractors for movement. Independent evidence in favour of considering lexical restriction as an attractor in different constructions comes from Northeastern Italian Dialects. As already mentioned in Chapter 1, Munaro (1999, cited in Poletto & Pollock 2000) showed that bare *wh*-words and lexically-restricted *wh*-elements in Bellunese occur in different positions at the left periphery of the clause, as lexically-restricted *wh*-phrases target a sentence-initial position, while bare *wh*-phrases appear sentence-finally. Examples (36a-d) from Chapter 1 are repeated below for convenience:

- (36) a. Ha-tu magnà *che*?
 have-you eaten what ?
 ‘What did you eat ?’
- b. **Che* ha-tu magnà?
 what have-you eaten ?
- c. *Che* vestito à-la comprà?
 what dress has-she bought
 ‘Which dress did she buy?’
- d. *Ha-la comprà *che vestito*?
 has-she bought what dress ?

The difference in syntactic behavior between lexically-restricted and bare *wh*-phrases points to the presence of different attractors for the movement of the two types of *wh*-elements. Romanian also supports this conclusion based on data from multiple *wh*-questions in which lexically-restricted *wh*-elements target a higher position than bare *wh*-words (see examples (31) to (33) above). Thus, the data from Bellunese and Romanian related to the behaviour of *wh*-elements with or without a lexical restriction clearly show that the NP feature acts as an attractor for movement of *which*-elements to a higher position than that of bare *wh*-phrases.

The NP feature thus forms part of the array of morphosyntactic features that trigger movement and, as such, should enter into the computation of intervention. Consequently, if NP enters the computation of locality, then the child’s grammar system should be sensitive to this feature although it is not overtly expressed through the presence of a noun from the contentive lexicon. If the child’s grammar system only paid attention to the surface form of the lexical elements and if this were enough to overcome comprehension difficulties, then performance for bare *who*-questions should be on a par with performance for *which*-questions

that do not have a full nominal element. Moreover, children should comprehend these questions better than *which +NP* ones.

The second prediction is linked to the effect that case-marking on the wh-pronoun has on the comprehension of questions in child Romanian. If the presence of *pe* at the very onset of the wh-question is an informative enough cue to signal that the wh-phrase should be assigned a patient theta-role and interpreted as the object of the verb and if children are able to draw upon this information, as well as the mismatch in case features between the A'-object and the intervening subject, then the presence of *pe* should greatly reduce and even eliminate any subject-object asymmetry attested in the comprehension of wh-questions. In addition, the fact that case-marking is present on both bare (*cine*) and lexically-restricted (*care*) wh-questions should equally facilitate processing of the two structures and modulate the difference between questions with (*which*) or without (*who*) a lexically restricted +NP feature attested cross-linguistically.

3.4.4. Results

Response accuracy was the dependent variable in the experiment: an answer was coded as correct when the child pointed to or described the corresponding character targeted by the wh-question. The bars in each figure represent the standard error to the mean. To recall, the label *Subject cine* ('*who*') and *Object cine* ('*who*') represents the conditions in which we tested bare wh-question introduced in Romanian by the wh-element *cine*; *Subject* and *Object care NP* ('*which +NP*') are the equivalent of wh-questions with a full lexical noun (e.g. *which giraffe*); the notation *Subject* and *Object care* ('*which -NP*') refers to *which*-questions without an overtly expressed lexical restriction. Both *which +NP* and *which -NP* dependencies are introduced in Romanian by the wh-phrase *care*.

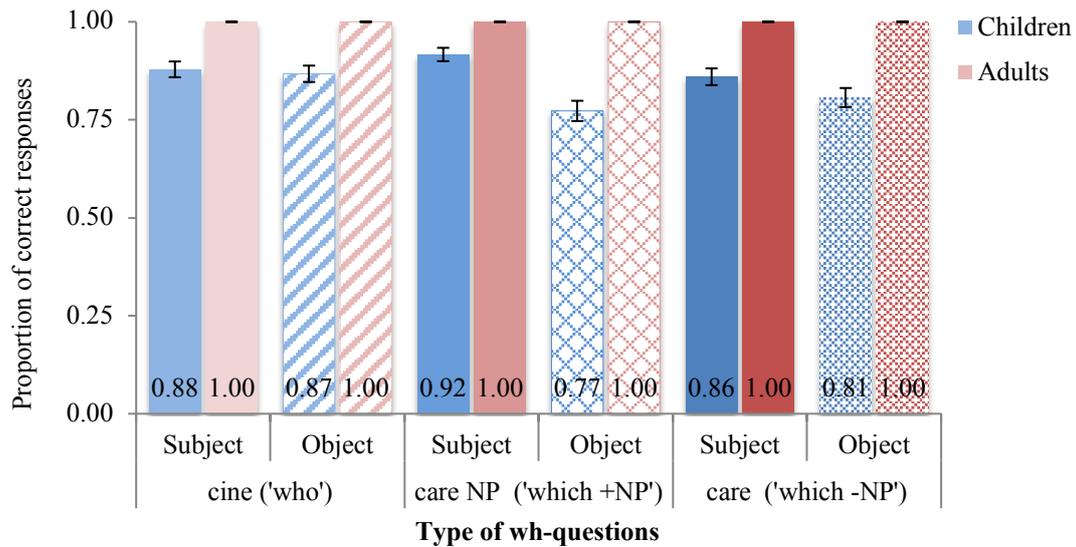


Figure 3.6. Proportion of correct answers for children (age range 3;8 – 7;2) and adults by condition

The overall results indicate that, although children comprehend subject and object questions very well, as evidenced by their high accuracy scores, they are less accurate than the adult participants on all six conditions. There is no difference in children's performance with subject and object *who* questions (0.88 vs 0.87 proportion of correct responses). Comprehension scores for subject and object *which -NP* questions are almost on a par (0.86 vs 0.81 proportion of correct responses). The subject-object asymmetry manifests itself in a more pronounced way in *which +NP* questions, because children comprehend subject *which +NP* questions better than object *which +NP* questions, suggesting that this latter structure poses the most problems for comprehension. The overall results also reveal an asymmetry within the three types of object questions tested in the experiment: children comprehend object *who*-questions better than both object *which +NP* and *which -NP* questions, these yielding similar accuracy scores.

Let us now look in more detail at the results obtained for each age group tested, summarized in Figure 3.7:

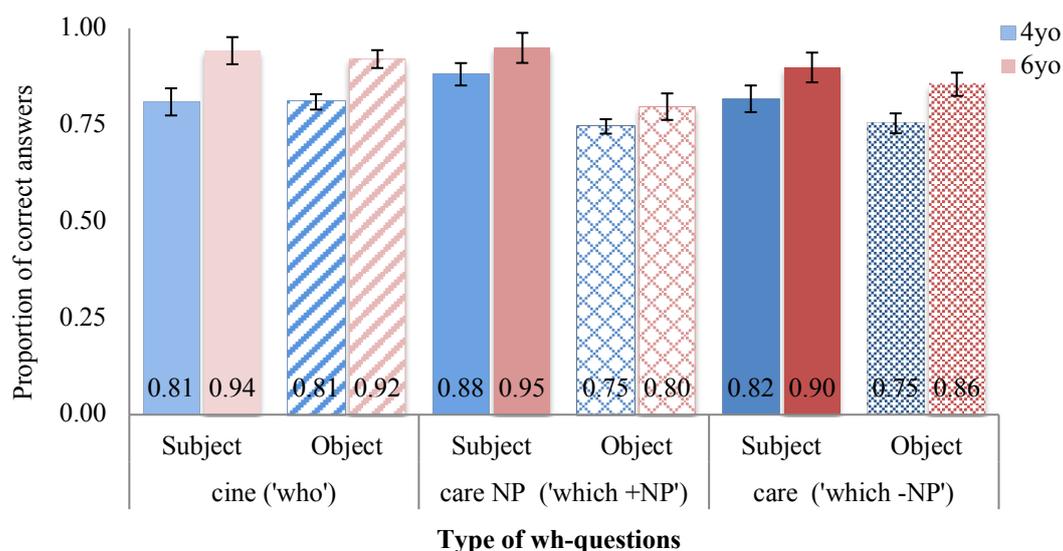


Figure 3.7. Proportion of correct answers for children by type of structure, wh-phrase and age group (4- and 6-year-olds)

Children's comprehension scores within the two age groups tested reveal that the 6-year-old group gives overall more accurate responses than the 4-year-old group. However, the same performance patterns can be observed within the groups for each of the experimental conditions. More specifically, both groups show equally good performance for subject and object *who*-questions. The 4-year-olds perform on a par for object *which +NP* and *which -NP* questions (0.75 proportion of correct responses), whereas they are more accurate with both subject *which +NP* and *which -NP* conditions. The comprehension scores for the 6-year-old group reveal similar performance for all three types of subject wh-questions. In contrast, when it comes to object questions, children comprehend *who*-questions better than both *which -NP* and *which +NP*. Like for the 4-year-old children, the accuracy scores of the 6 year-olds show that they struggle most with object *which +NP* questions and this leads to a sharper subject-object contrast in the comprehension of *which +NP* questions as compared to the other two types of wh-elements.

As for the types of errors children make, it is worth pointing out that there are only 2 Agent Errors²⁸ attested in the experiment, one performed by a 4-year-old and one by a 6-year-old. The Reversed Role errors represent 15% of children's answers. 62% of the total number of Reversed role errors was associated with object wh-questions, while children performed these errors with subject questions in 39% of the cases.

²⁸ Given the experimental stimuli, the Agent Error consists of pointing to the middle character, like in Adani's (2011) study.

3.4.4.1. Statistical analysis

I fit the data to a mixed logit model with type of structure (i.e. Structure Type), type of wh-element (i.e. Wh-word Type) and age group as fixed predictors. The reference level was the response accuracy mean for Object *Which –NP* against which the means for each of the other levels of the variables Structure Type, Wh-word Type and Age Group were compared. The maximal random effect structure justified by the data included intercepts for subjects and items, as well as by-subject random slopes for Structure Type. The analysis revealed that, while the interaction between Structure Type and Wh-word Type with Age Group did not add significance to the model ($\chi^2(5) = 4.01, p = 0.54$), the effect of Age Group was significant ($\chi^2(1) = 5.79, p < .01$), as was the interaction between Structure Type and Wh-word Type ($\chi^2(2) = 11.06, p < .001$). Table 3.6 and Table 3.7 summarize the fixed and the random effects in the full final model²⁹:

Predictors	Coefficient	SE	Wald Z	p
(Intercept)	1.37	0.31	4.46	<.001***
Structure Type = <i>Subject</i>	0.79	0.39	2.02	<.05*
Wh-word Type = <i>which +NP</i>	-0.27	0.23	-1.17	=.24
Wh-word Type = <i>who</i>	0.54	0.26	2.07	<.05*
Age Group = <i>6 y.o.</i>	0.84	0.35	2.43	<.05*
Interaction = <i>Subject & which +NP</i>	0.99	0.39	2.53	<.05*
Interaction = <i>Subject & who</i>	-0.29	0.39	-0.73	=.46

Table 3.6. Generalized linear mixed effects model of correct responses for subject and object wh-questions for all age groups

Random effects	s ²	Correlation with random effect for Intercept
Participant Intercept	1.31	
Structure Type = <i>Subject</i>	3.17	-0.54
Item Intercept	0.08	

²⁹ Final model: Response Accuracy ~ Structure Type + Wh-word Type + Age Group + Structure Type * Wh-word Type + (1 + Structure Type | Participant) + (1 | Item); N = 1584, AIC = 1186.4, BIC = 1245.4, log-likelihood = -582.20, $\chi^2 = 5.27$.

Table 3.7. Summary of random effects and correlation in the mixed logit model

Several main effects and one interaction appear as significant. The results show that children overall comprehend subject wh-questions better than object questions ($\beta = 0.79$, $SE = 0.39$, $z = 2.02$, $p < .05$). Children also perform better with object *who* questions than with object *which -NP* questions ($\beta = 0.54$, $SE = 0.26$, $z = 2.07$, $p < .05$). Although the negative coefficient for Wh-word type *which +NP* indicates that the presence of a wh-element followed by a lexical noun hinders comprehension, the difference in children's comprehension of object *which +NP* and object *which -NP* questions is not significant ($\beta = 0.20$, $SE = 0.23$, $z = 0.85$, $p < .05$). We can also observe that the 6-year-old group gives significantly more accurate responses ($\beta = 0.84$, $SE = 0.35$, $z = 2.43$, $p < .05$), illustrating that comprehension of wh-dependencies improves with age. The interaction between Structure Type: *Subject* and Wh-word Type: *Which +NP* was also significant (Figure 3.8):

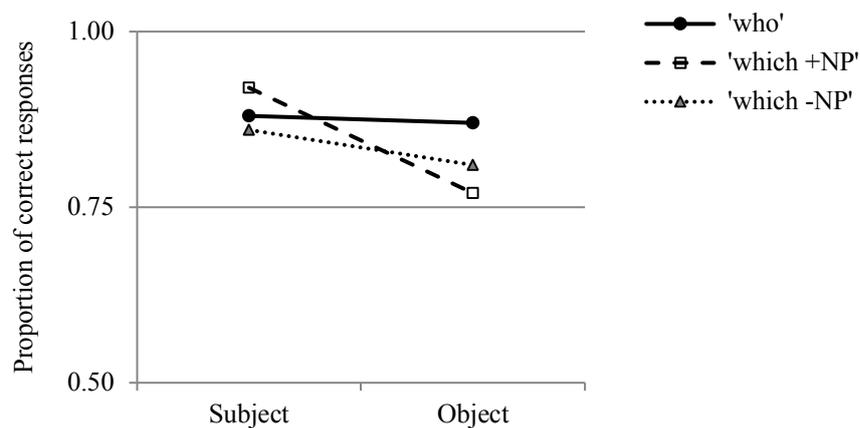


Figure 3.8. Proportion of correct responses for subject and object wh-questions by type of wh-word for all the children tested (age range 3;8 – 7;2)

As illustrated in Figure 8, no difference emerges between subject *Who* and subject *Which -NP* questions in the case of Subject questions, showing that children comprehend these two types of subject questions on a par. On the other hand, comprehension accuracy for subject questions improves in the presence of *which +NP* phrases. The picture is different when analyzing the effect of wh-type on object questions. Contrary to subject questions, there is no difference in performance between object *which -NP* and *object which +NP* questions. On the other hand, object *who* questions facilitate comprehension. This suggests that the interaction between Structure Type and Wh-word Type in the main analysis was due to Wh-word Type having a different effect on subject and object questions.

3.4.5. *Interim discussion*

The adult data showed no asymmetries in comprehension, as adults performed at ceiling for all the experimental conditions. I will therefore focus on the child data in the remainder of the discussion.

The general picture that emerges from the experimental findings reveals an asymmetry between subject and object *which*-questions: this asymmetry was more pronounced in *which* +NP questions and was present, but less salient, in *which* –NP questions. The subject-object contrast was absent from *who* questions, as children comprehended both subject and object *who* questions very well. Moreover, children had more problems assigning a correct interpretation for object *which*- as compared to object *who*-questions. These results are in line with the recent findings reported by Sevcenco & Avram (2015) and Sevcenco, Măniță & Avram (2015) for the comprehension of wh-questions in Romanian.

One of the findings of this study concerns the role that an overt or covert lexical restriction or +NP feature plays in the comprehension of wh-questions in Romanian. We have seen that Romanian has the option of forming *care* ‘which’ questions without a full lexical NP. Following previous proposals in the literature (Friedmann et al. 2009, Belletti et al. 2012), I classified *which*-questions introduced by *care* ‘which’ and not containing an overt lexical noun as –NP. Such a comparison is particularly relevant given the findings for *who*-questions, i.e. [–NP] questions that pose no difficulties for comprehension. *Which* –NP questions, although apparently similar to *cine*- ‘who’ bare questions, pattern with *care* +NP ‘which NP’ expressions both at a syntactic and at an interpretive level. This has been taken as evidence to show that *care* ‘which’ elements without a noun from the contentive lexicon still contain a [+NP] specification and have the form [_{WH} [_{NP} [_N e]]]. To recall, we predicted that if the child grammar system were only sensitive to the absence of a lexical noun, then performance for object *who* and object *which* –NP questions should be on a par. On the other hand, if the [+NP] feature acts as an attractor for movement and is taken into consideration for the computation of Relativized Minimality, then children’s comprehension of object wh-dependencies should be affected by the presence of a +NP feature on both the moved element and the intervener, even when the lexical NP is not overtly expressed on the wh-phrase. As a consequence, object questions introduced only by a *which*-element and without a lexical NP (so object *which* –NP questions) should still give rise to intervention effects and children should perform similarly for object *which* +NP and object *which* –NP questions.

The results of the present study seem to follow from the predictions of a featural intervention approach to the acquisition of A'-dependencies: children perform better with object *who* than with object *which* +NP and object *which* –NP questions. Moreover, there is no significant difference in children's comprehension of object *which*-dependencies, irrespective of the presence or absence of a noun from the contentive lexicon. These findings are in line with the predictions of an intervention account of the RM type (Friedmann et al. 2009, Belletti et al. 2012): children only struggle with those structures in which the A'-chain linking the object to its base-generated position crosses an intervening subject and the intervening element shares a partial featural specification with the A'-moved object, thus leading to an inclusion configuration between the features of the object and the intervener. The specific structures that pose problems for children involve a particular featural set-relation represented in (37a) and they contrast with the featural specification of the *wh*-phrase and the intervening element found in object *who*-questions (37b). [+Q] is the scope-discourse or 'criterial' feature attracting the target to the corresponding A'-position:

- | | | | |
|---------|--------|-------|------------------------------------|
| | +Q+NP | | +NP |
| (37) a. | Pe | care | (girafă) a gâdilă-o țestoasă? |
| | pe.ACC | which | giraffe has tickled-her turtle.the |
| | | | |
| | +Q | | +NP |
| b. | Pe | cine | a gâdilă țestoasă? |
| | pe.ACC | who | has tickled turtle.the |

Example (37a) illustrates that the element heading the A'-chain contains a [+NP] feature also present on the intervening subject. The computation of this inclusion relation, where the features on the embedded subject are included in the set of features present on the moved *wh*-element, is more problematic for children than the computation of a disjunction relation (37b). As a consequence, the intervening subject competes with moved A'-object and hinders the realization of the correct dependency between the moved element and its base-position as it becomes a potential candidate for this relation. This holds for both *care* NP and *care* –NP questions. In contrast, *who*-questions, in which the fronted constituent is [–NP], do not give rise to such intervention effects, since the featural sets of the subject and the object are in a disjunction relation. These findings further underscore the role that even the covert presence of a [+NP] element plays in the processing of *wh*-dependencies.

Experiment 4 also investigated the role of the preposition *pe* in children's parsing of wh-questions. As illustrated in section 3.3, the use of *pe* in the experimental material should straightforwardly disambiguate between a subject and an object interpretation, irrespective of the type of wh-word, and should help to identify the thematic role of the wh-argument in relation with the verb. Except for the presence of a clitic pronoun in object *which* questions, subject and object questions had the same word order – namely *WH Verb NP* – as a postverbal subject was used in all three types of questions. Verbal agreement also provided the same cues in all of the object questions (the verb was always singular and could agree in person and number with both the subject and the object). As such, *pe* at the very onset of the wh-question gave the most salient cue with respect to the syntactic position that the wh-constituent occupied in relation with the verb. The prediction was that if children can draw on this morphosyntactic cue to assign an object interpretation to the wh-phrase, the subject-object asymmetry attested cross-linguistically for the processing of *which*-questions should disappear. In addition, we should observe no asymmetry between object *which* and object *who* questions. These predictions, however, were not borne out. The findings revealed that, although case marking on the wh-pronoun in Romanian considerably improves comprehension of object questions with respect to language that do not use the object-marking strategy, it does not eliminate the difference in the comprehension of subject and object *which*-questions, nor the asymmetry between *who* and *which*-object interrogatives.

3.5. General Discussion

In two experiments, I explored Romanian children's comprehension of relative clauses and wh-questions with the aim to determine whether language-specific properties like case marking affect children's processing of A'-dependencies in Romanian, as well as understand the impact that the NP feature has on the comprehension of these syntactic structures.

For relative clauses, I found that children's performance with subject relatives was better than with object relatives. These findings not only match those of previous cross-linguistic studies on the acquisition of relative clauses (Arnon 2005; Adani 2011; Belletti et al. 2012; Corrêa 1995; Costa, Lobo & Silva 2011; Friedmann et al. 2009; a.o.), but also those reported in previous studies on the comprehension of relatives in Romanian (Sevcenco & Avram 2012). In addition, the results of Experiment 3 are compatible with Costa, Friedmann, Silva, & Yachini's (2014) findings for the acquisition of PP relatives in European Portuguese

and in Hebrew. In a series of comprehension and production experiments, these authors showed that intervention effects determined by the presence of an intervening DP subject hold both in nominal object relatives (i.e. when the A'-object is a DP) and in prepositional object relatives (i.e. when the moved object is a PP, as in 'Show me the boy on which the monkey lays a hand'). Costa et al. (2014) take these findings as evidence that what matters for the computation of intervention is featural identity (presence of a NP feature on both the relative clause head and the intervening subject) and that differences in grammatical category identity (DP vs PP) are not relevant for intervention configurations. Romanian children's performance for the comprehension of relative clauses reinforces the idea put forth in Costa et al. (2014). Critically, neither the presence of case marking on the relative pronoun in object relatives in Romanian, nor the presence, inside the embedded relative clause, of a clitic pronoun that doubles the relative clause head, improve Romanian children's comprehension of object relatives as compared to subject relatives. This insensitivity to case-marking occurs both when the case-marker is an external element preceding the relative pronoun, and when the relative pronoun is morphologically marked for case, as in indirect object relative clauses.

Children's performance with *wh*-dependencies also revealed a subject-object asymmetry for *which*-questions: children comprehended subject *which*-questions better than object *which*-questions, not only when the lexical NP overtly followed the *wh*-expression, but also when the lexical restriction was not expressed on the *wh*-phrase. No difference in performance emerged between subject *who*- and object *who*-questions. These findings are consistent with the results of a number of studies on a variety of languages (De Vincenzi et al. 1999; Avrutin 2000; Friedmann et al. 2009, Bențea and Durrleman 2013, 2014, etc.) illustrating that children struggle more with object *which*-questions and reinforce the idea that not all types of object movement configurations are problematic for acquisition, but only those that involve a displaced lexically-restricted A'-object and a subject containing a similar lexical NP feature. Children's performance with object *who*-questions shows that these questions are not taxing for comprehension, as there was no difference in performance between subject and object *who*-questions. In addition, children comprehended object *who*-dependencies better than object *which*-dependencies, although *pe* and a postverbal subject were present in both types of structures and should have facilitated comprehension to a similar extent.

Note however that the subject-object asymmetry surfacing in the comprehension of *which*-questions in Romanian is greatly reduced with respect to earlier studies with other languages, but also with respect to the subject-object asymmetry found for the comprehension

of relative clauses in Experiment 3. The children tested in this study comprehended object *which* +NP questions 77% of the time, compared with earlier findings of 58% for Hebrew (Friedmann et al. 2009), 50% for Italian (De Vincenzi et al. 1999), and around 40% for French with children of the same age range (see chapter 2; Bențea and Durrleman 2013, 2014). These results also contrast with those reported in Experiment 3 for the comprehension of relative clauses in Romanian, which yielded accuracy scores as low as 25% in the case of object relatives and as high as 95% with subject relatives.

Two explanations come to mind to account for such differences. One very plausible possibility would be to relate the improvement found with object wh-questions to task-specific effects. Contrary to other studies, Experiment 4 assessed comprehension of wh-questions using animations and not static pictures. An important feature of this type of experimental material was that each target sentence was preceded by a pre-recorded preamble where all the characters were named and each action was clearly described and illustrated. This allowed the child to visualize the whole experimental setting while reducing the lexical access load. Another important characteristic of the pictorial stimuli was the use of only one display with three characters instead of two pairs of images with the same characters performing the same action with reversed roles (see also Arnon 2005 and Adani 2011 for a criticism of this latter type of stimuli). That the type of task could have played an important role in obtaining improved results receives further support from recent findings on the comprehension of *who*- and *which*- subject and object questions in Romanian. Sevcenco & Avram (2015) and Sevcenco, Măniță & Avram (2015) report overall much lower results for all the types of questions tested in their experiment, both subject and object. Both studies used a sentence-picture selection task in which each test sentence was associated with four pictures (one target and three distractors) and each picture illustrated three to four characters performing the same action (i.e. pull) with reversed roles. Thus, children had to choose not the correct character identified by the wh-question, but the correct picture that matched the description of the action in the question asked by the experimenter. The greater complexity of the material used in this task could potentially account for children's lower accuracy scores.

However, an explanation only in terms of methodology used cannot fully account for the cross-linguistic differences observed between the comprehension of wh-questions in Romanian, Italian and Hebrew, as De Vincenzi et al. (1999) and Friedmann et al. (2009) also used images depicting only three characters (e.g. two dogs and a cat; one dog bites the cat and the cat bites another dog) similar to the animations included in the present study on the comprehension of wh-questions in Romanian.

Rather, the improved results for the comprehension of *which*-questions in Experiment 4 seem more likely due to properties of wh-questions in Romanian which facilitate comprehension of object questions to a greater extent. More specifically, this facilitation might stem from the simultaneous presence of *pe* and of a postverbal subject. These two properties distinguish Romanian wh-questions from both Hebrew and Italian wh-questions. In Hebrew, the wh-object is also preceded by an accusative marker – *et* – similar to *pe* in Romanian, but in all the questions included in Friedmann et al.’s (2009) study the subject appeared in a preverbal position³⁰. In Italian, on the other, the subject appears in a postverbal position in object wh-questions and there is no case marking on the wh-phrase. This leads to the same surface order in both subject and object questions in Italian, rendering the *WH Verb NP* order ambiguous between a subject and object interpretation. Therefore, agreement with the verb is crucial for disambiguating the structure. However, as De Vincenzi et al. (1999) showed, the correct interpretation of both *who* and *which* object questions with a postverbal subject in Italian is greatly delayed when compared to the comprehension of subject wh-questions: Italian-speaking children aged 4 to 5 year-olds comprehended object *who*-questions at a rate of only 56%, and object *which*-questions 38% of the time. De Vincenzi et al.’s results are corroborated by findings from elicited production of wh-questions in Italian (Guasti, Branchini & Arosio 2012) which revealed that adults are more likely to produce questions with the *WH Verb NP* order than children, who produced object questions with this word order only around 30% of the time. That Romanian-speaking children perform better with object *which*-questions than their Hebrew- and Italian-speaking peers could therefore be explained through the additive effect of the case marker *pe* and the postverbal subject. The latter, coupled with the presence of *pe* at the very onset of the wh-question which signals that the phrase should receive an object interpretation, seems to boost children’s comprehension of object wh-questions.

The same reasoning can be applied to explain the results obtained for the comprehension of relative clauses in Romanian, which manifested a much more pronounced subject-object asymmetry than in the case of wh-questions, although the preposition *pe* is present in both A’-constructions. The difference between the test sentences included in the two experiments lies in the position of the subject: whereas only preverbal subjects were used in the object relatives tested in Experiment 3, the object questions in Experiment 4 all

³⁰ Post-verbal subjects in Hebrew are only possible with unaccusative and passive verbs (see Botwinik 2011).

contained subjects in a postverbal position. A comparison between the results of the two experiments suggests that stronger intervention effects hold in relative clauses in Romanian when the subject is preverbal although the relative pronoun is also marked for case just like in wh-questions.

Previous studies on the comprehension of relative clauses in Romanian also showed that an overt subject improves children's performance with object relatives. In a series of experiments, Sevcenco & Avram (2012) examined the role of various disambiguating cues on Romanian children's processing of headed object relative clauses and found that the presence of an overt subject, be it pre- or postverbal, overall improves comprehension of object relatives. Although Sevcenco & Avram's results do not reveal a clear-cut distinction between the use of pre- and postverbal subjects³¹, two important findings emerge from their studies with respect to the presence of an overt embedded subject in headed object relative clauses: (i) contrary to Italian (Arosio et al. 2009, Adani 2011), a postverbal subject is not taxing for comprehension and it helps children disambiguate between a subject and an object relative clause interpretation; (ii) when tested on the comprehension of object relative clauses with a null subject or with a postverbal subject, children give 80% correct responses when an overt postverbal subject appears inside the relative clause, as compared to only 60% comprehension accuracy for object relatives with a null subject³². Note that, in this experiment, direct object relatives with a null subject were disambiguated through number agreement, while those with a post-verbal subject contained a gender mismatch between the subject and object DP. The postverbal subject thus seems to play a critical role in the modulating the comprehension of object A'-dependencies in Romanian.

Evidence in favour of considering the postverbal subject as playing a facilitating role for Romanian-speaking children also comes from production studies. In analyzing children's spontaneous productions based on several corpora of longitudinal data, Sevcenco et al. (2012) show that there is a clear preference for producing direct object relative clauses with postverbal subjects. Children start producing object relatives with a postverbal subject at an

³¹ Sevcenco & Avram (2012) actually report different accuracy scores for direct object relatives with a post-verbal subject across three tasks, namely 63.59%, 65.9%, 80.29% accuracy, as compared to 78.4% accuracy obtained for direct object relatives with a pre-verbal subject. In all these cases, the subject and the object were differentiated either through a number or a gender mismatch. However, when they analyze the results of the same group of children who participated in two of the tasks, they find no difference in response accuracy when the results come from the same subjects (78.8% and 80.29%, respectively).

³² It is worthwhile noting that the higher accuracy rate found by Sevcenco & Avram (2012) with respect to the results presented in Experiment 3 is due to the fact that their accuracy measure consisted in pointing to the correct image and not to the correct character.

intermediate position within the IP domain which is outside the VP and higher than the postverbal subject.

- (39) **[L'opera prima di uno scrittore]_i*, *lui_i la_j* *scrive sempre (volentieri).*
 the-work first of a writer_i, he_i it.F.SG writes always (with pleasure)

‘The first work of a writer, he always writes it with pleasure.’

- (40) *[L'opera prima di uno scrittore]_i*, *la_j* *scrive sempre lui_i.*
 the-work first of a writer_i, it.F.SG writes always he_i

‘The first work of a writer is always written by the writer himself.’

Cecchetto (2000) argues that the CLLD-ed object originates in the argument position of the verb as a Big DP headed by the clitic *la*. The whole DP then undergoes movement to an intermediate position (labelled FP) and it is in this position, which is c-commanded by the preverbal subject but is not c-commanded by the postverbal subject, that the CLLD-ed direct object reconstructs. Consequently, the coindexation between the DP contained in the CLLD-ed object and the preverbal pronominal subject gives rise to a Principle C violation because the referential expression is reconstructed within the c-command domain of the pronoun, as indicated by (41). Conversely, the DP *uno scrittore* can be coindexed with the postverbal subject in (40) without violating Principle C is not violated since the referential expression is reconstructed outside the c-command domain of the postverbal subject, as sketched in (42).

- (41) ~~*L'opera prima di uno scrittore_i*~~, *lui_i* <*l'opera prima di uno scrittore_i*>
 the-work first of a writer_i, he_i <the-work first of a writer_i>

la *scrive sempre (volentieri).*

it.F.SG writes always (with pleasure)

‘The first work of a writer, he always writes it with pleasure.’

- (42) ~~*L'opera prima di uno scrittore_i*~~, <*l'opera prima di uno scrittore_i*> *la*
 the-work first of a writer_i, <the-work first of a writer_i> it.F.SG

scrive sempre lui_i.

writes always he_i

‘The first work of a writer is always written by the writer himself.’

With this in mind, let us go back to the properties of *care*-structures in Romanian. In section 3.3 above I showed that the presence of a clitic pronoun is obligatory with *care*-phrases, but is ungrammatical with *cine*-elements (see examples in (23) and (24)). The absence of Weak Cross-Over effects with *care* object wh-questions is another property that distinguishes them from *cine* object questions. Examples (27a and b), repeated here for convenience as (43a-b), illustrate that the wh-element *pe care băiat* can felicitously bind the pronoun inside the postverbal subject DP, contrary to *pe cine*.

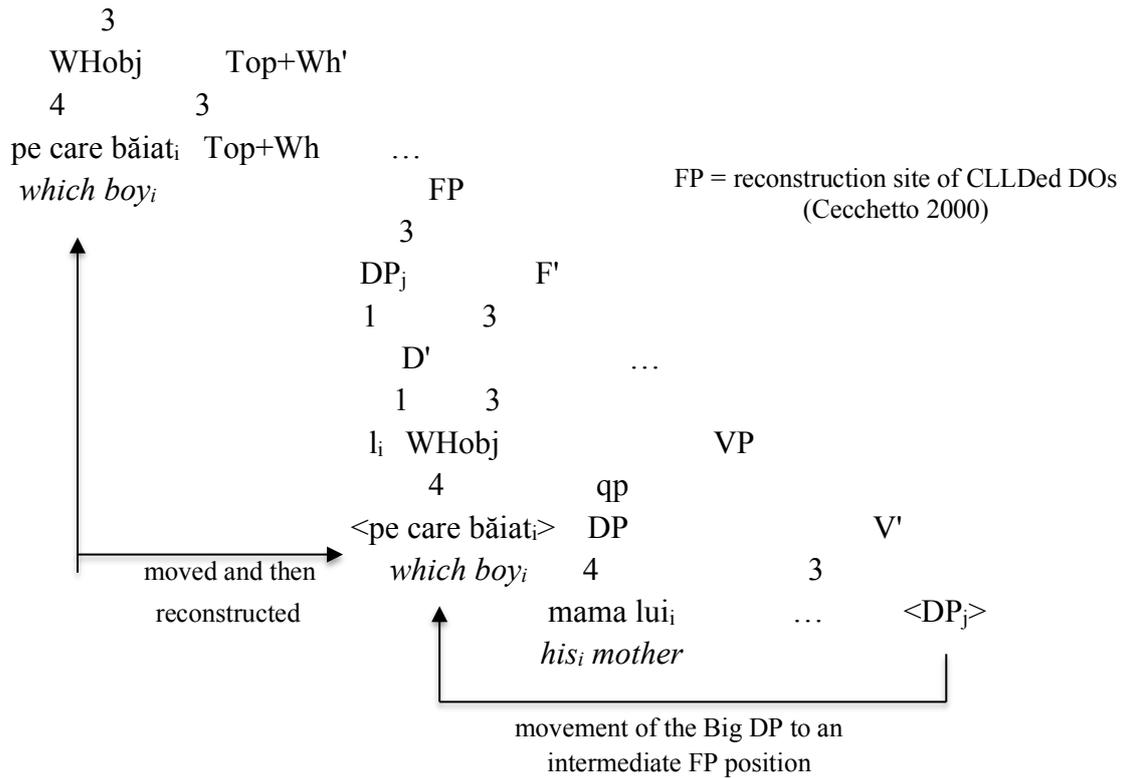
- (43) a. *Pe cine_i a certat mama lui_i ?
 pe.ACC who_i has scolded mother.the.F.SG his_i
 ‘*Who_i did his_i mother scold?’
- b. Pe care băiat_i li-a certat mama lui_i ?
 pe.ACC which boy_i him_i-has scolded mother.the.F.SG his_i
 ‘Which boy_i was scolded by his_i own mother?’

The difference between (43a) and (43b) lies in the fact that movement in the latter case takes place out of a clitic-doubled configuration, which I analyze as a Big DP³³. Along the lines of Cecchetto’s (2000) analysis of CLLD-ed objects, I would like to propose that the absence of WCO effects with *care*-structures can be explained by postulating that the wh-element and the clitic are initially generated as a Big DP in the internal argument position of the verb and undergo a first movement to an intermediate position within the IP domain. Cecchetto (2000) calls this position FP, however the fine details of this intermediate landing site require further investigation³⁴. Once in this intermediate position, the wh-element undergoes A’-movement to the left periphery targeting the specifier position of a Topic+Wh above the landing site of bare *cine* wh-phrases, namely the Specifier Focus position (Laenzlinger & Soare 2005, Soare 2009). In the derivation of (43b), sketched in (44) (irrelevant details omitted in the representation), the wh-phrase is reconstructed above the c-command domain of the pronoun and the coindexation between the referential expression *băiat* and the pronoun *lui* can take place without triggering WCO effects.

³³ Following Belletti (1999 and subsequent work), we consider that the doubled lexical argument appears in the PP complement of the clitic head in the Big DP structure, and not in its specifier position (Uriagereka 1995).

³⁴ See Coene & Avram (2012) for an analysis of the final landing site of the clitic.

(44) Top+WhP



If the derivation in (44) is on the right track, then the presence of a preverbal subject in *care*-structures would lead to WCO effects, since the preverbal subject will appear in a position between the moved wh-phrase and its intermediate reconstruction site inside the IP. Though it is impossible to test this prediction with wh-questions, since wh-elements must be adjacent to the verb, converging evidence comes from relative clauses, which can have both a preverbal and a postverbal subject. While the head of the relative cannot be coindexed with the pronoun *lui* contained within the preverbal subject (as shown in (45)), no WCO effects hold in (46) where the subject is postverbal.

(45) **Băiatul_i pe care mama lui_i l_i-a certat*
 boy-the_i pe.ACC which mother.the.F.SG his_i him_i-has scolded
în curtea școlii e prietenul meu cel mai bun.
 in yard-the school.Gen.SG is friend-the mine best
 ‘The boy_i which his_i mother scolded in the schoolyard is my best friend.’

(46) *Băiatul_i pe care l_i-a certat mama lui_i*
 boy-the_i pe.ACC which him_i-has scolded mother.the.F.SG his_i
în curtea școlii e prietenul meu cel mai bun.
 in yard-the school.Gen.SG is friend-the mine best

‘The boy_i which was scolded by his_i own mother in the schoolyard is my best friend.’

In the case of *cine*-questions, since no clitic is present in the structure, the wh-element does not reconstruct in an intermediate position within the IP, thus giving rise to the prototypical WCO configuration where the pronoun inside the postverbal subject is c-commanded by the operator, but not by the variable.

Such an analysis has the advantage of accounting for the comprehension pattern of object wh-questions that emerges from the findings of Experiment 4. These revealed that both the subject-object asymmetry with *which*-questions and the object *who* – object *which* asymmetry present crosslinguistically are greatly reduced in Romanian. Under the analysis outlined above for Romanian *care* (‘which’) questions, we observe that the only instance in which the lexically NP restricted wh-phrase crosses over the subject is when the Big DP moves to the intermediate IP-internal position preceding the post-verbal subject. The fact that what is moved across the intervening subject is a larger constituent, namely the Big DP containing both the clitic and the +NP wh-double, could alleviate the intervention effects found in object *which*-questions (much like in the case of the smuggling analysis proposed by Belletti & Contemori 2010, Belletti 2014, Contemori & Belletti 2014 for circumventing intervention effects in passive object relatives). In the case of *cine* object questions, no intervention effects hold since the features of the moved A'-object are in a disjunction relation with the features of the intervening postverbal subject.

The contrast with preverbal subjects now becomes even clearer. Although in the first instance of the derivation, the movement of the Big DP could reduce intervention effects, a typical case of inclusion relation arises when the wh-element containing the +NP feature moves out of the intermediate site of the Big DP and targets the Topic+WhP position at the left periphery. The second movement inevitably crosses over the preverbal subject, thus creating an inclusion configuration with the feature of the embedded subject, which also contains a +NP specification. We now have an explanation for the findings of Experiment 3, which only included relative clauses with a preverbal subject and in which the presence of case-marking on the relative pronoun did not reduce the intervention effects found with object headed relative clauses. Notice that such an analysis predicts that object relative clauses with a postverbal subject should be easier to comprehend than object relatives with a preverbal subject. Although the results of Sevcenco & Avram (2012) do not show a clear distinction between the comprehension of relative clauses with a pre or a postverbal subject, the issue

requires further investigation. An experiment investigating Romanian children's comprehension of object relative clauses with a subject in both positions and using the same design and materials as Experiment 4 for *wh*-questions, is currently being prepared.

This brings us to the role that case-marking has on the comprehension of A'-dependencies in Romanian. The findings of the two experiments reported in this chapter suggest that case *per se* does not affect comprehension of relative clauses and *wh*-questions. Case becomes a prominent cue only when associated with a postverbal subject, whereas it cannot override pure intervention effects determined by the presence of a preverbal subject. Therefore, an account based purely on the notion of cues that could modulate intervention/locality is not enough to capture the effects observed in Experiments 3 and 4. Despite the fact that case-marking appears very early on in the structure, both in relative clauses and in *wh*-questions, its effect is not unselective, but depends on the particular syntactic configuration in which it is found.

Let us now turn to the comparison between the results obtained for Romanian *wh*-questions and those reported for Hebrew (Friedmann et al. 2009) and Italian (De Vincenzi et al. 1999; Belletti & Guasti 2015). The comparison with the results for Hebrew becomes more straightforward: while in both languages *which*-elements are preceded by an external case-marker (*et* in Hebrew, *pe* in Romanian), only Romanian *wh*-questions have both a postverbal subject and a clitic. The *wh*-questions tested in Hebrew (Friedmann et al. 2009) all contained preverbal subjects, which I have shown above to give rise to strong intervention effects.

As for the difference found between the comprehension of object *which*-questions in Romanian and Italian, despite the presence of a post-verbal subject in both languages, we can account for it by linking it to the absence of clitic doubling in Italian questions. This entails that the *which*-phrase in Italian cannot undergo reconstruction in an IP internal position and therefore crosses the postverbal subject on its way to the left periphery.

What about the difference with *who* object questions in Italian? These questions also pose greater difficulties for Italian children than *pe cine* object questions in Romanian. Such a difference holds in spite of the fact that the subject and object questions tested in both Italian and Romanian displayed a common structure, namely WH V N. Moreover, in the framework put forth by Friedmann et al. 2009, the case of Italian *who*-object questions remains unaccounted for since such object dependencies are not seen as problematic for children because they do not involve movement of a +NP element across another +NP element. The explanation for the Italian data lies in the presence of interference effects determined by the occurrence of the object in the Agree relation established between AgrS and the postverbal

subject (see Adani 2011; Guasti, Branchini & Arosio 2012; Belletti & Guasti 2015). More specifically, these authors link such interference effects to an analysis of subject-verb agreement put forth in Franck, Lassi, Frauenfelder & Rizzi (2006) and building on insights from Guasti & Rizzi (2002), which views agreement as a two-step process: (i) AGREE (whereby the person and number features of the subject, occupying the specifier of vP position, are copied onto the head AgrS) and (ii) Spec-Head agreement (which occurs when the subject moves from SpecvP to SpecAgrS). While subject-verb agreement is obtained through both AGREE and Spec-Head in sentences with a preverbal subject, it is only realized through AGREE in sentences with a postverbal subject, thus making it more prone to interference from an object moved in SpecAgrOP. Specifically, as detailed in Belletti & Guasti (2015), because the object wh-element in AgrOP is the first element that AgrS finds in its c-command domain, it can trigger an erroneous agreement between the wh-object and AgrS whereby the features of the former value those of AgrS. This results in interpreting the wh-object as the subject and thus assigning a subject interpretation to an object question. Assuming that a similar derivation holds for object wh-questions in Romanian, the specifier position of AgrOP would be occupied by the PP headed by *pe* and with the wh-element in its complement position. As such, the presence of the preposition *pe* could block the transfer of the features of the object to AgrS and, consequently, no erroneous agreement would take place between AgrS and the wh-object. We can thus account for the fact that Romanian children, contrary to their Italian peers, find object *who*-questions with a postverbal subject easy to comprehend despite sharing a similar word order with subject questions.

3.6. Conclusions

The studies presented in this chapter aimed at investigating whether a subject-object asymmetry also surfaces in the comprehension of relative clauses and of *who* and *which*-questions in Romanian, as well as determine whether the [+NP] feature impacts the processing of wh-dependencies even in the absence of an overt lexical restriction or lexical noun on the moved wh-object.

The results for relative clauses showed that neither the presence of the case-marking preposition *pe* in direct object relatives, nor morphological case-marking on the relative pronoun in indirect object relatives, have the potential to modulate children's comprehension of object headed relative clauses. These structures instantiate an inclusion configuration

which triggers intervention effects associated with the presence of a lexical NP restriction on both the moved A'-object and the intervening embedded subject.

For wh-questions, no difference in comprehension emerged from the adult data, but children's results revealed two asymmetries: (i) a subject-object asymmetry in the comprehension of *which*-questions, but no difference in the comprehension of subject and object *who*-questions; (ii) an asymmetry in performance with object *who*-dependencies and object *which*-dependencies, independent of the presence of a full lexical noun after the wh-phrase. That children comprehended *pe care* 'which -NP' questions on a par with *pe care NP* 'which +NP' object questions suggests that the child's grammar system also takes into consideration features which do not have an overt manifestation, but which play a role in the computation of locality. Importantly, the findings for Romanian children's comprehension of *care* 'which' object questions show that the subject-object asymmetry found cross-linguistically is considerably reduced, contrary to what has been reported so far for the comprehension of *which* object questions in Hebrew-speaking and Italian-speaking children, for example. The reduced subject-object asymmetry with *which*-object questions also stands in sharp contrast with the findings of Experiment 3 for relative clauses.

I proposed to account for such differences by postulating an analysis of *care* 'which' object questions by building on the idea that intervention effects can be alleviated in structures with a postverbal subject due to a two-step movement: (i) movement of a Big DP (containing the clitic and the wh-double) over the postverbal subject to an intermediate position internal to the IP, but higher than the subject in the specifier of vP, and (ii) movement of the wh-element to the left-periphery out of this intermediate reconstruction site. Such an analysis also readily explains the comprehension pattern found with relative clauses containing a preverbal subject and which manifested similar intervention effects to those reported crosslinguistically. In these instances, the wh-element obligatorily crosses the subject in a preverbal position, thus giving rise to intervention effects associated with difficulties in comprehension.

“In the beginner’s mind there are many possibilities,
but in the expert’s there are few.”
(Shunzuya Suzuki, quoted in de Boysson-Bardies,
*How Language Comes to Children:
From Birth to Two Years*)

4. THE EFFECT OF ANIMACY AND OF THE NP FEATURE ON THE COMPREHENSION OF A-BAR DEPENDENCIES IN FRENCH

This chapter aims to refine the characterization of the [+NP] feature and of its additional subspecifications that RM is sensitive to, with a special reference to the animacy feature, through a series of experiments on the comprehension of relative clauses and wh-questions in French typically-developing children aged 5 to 11 year-olds. As far as animacy is concerned, a range of studies has shown that it plays a role in the comprehension of complex structures, both for adults and children. The difference between subject and object relative clauses disappears when the object is inanimate and the subject is animate (Mak, Vonk, & Schriefers 2002, 2006; Traxler, Morris, & Seely 2002; Baudiffier, Caplan, Gaonac'h, & Chesnet 2011). Object relatives with an inanimate head and an animate subject also seem to be the most frequent type of object relative clauses found in naturalistic corpora (Mak et al. 2002 for Dutch and German; Belletti & Chesi 2011 for Italian). However, Belletti & Chesi (2011) show that this frequency in the input does not correlate with performance in experimental conditions: their results from an elicited production experiment with Italian-speaking adults revealed that an animacy match or mismatch between the head of the relative and the internal relative clause subject did not favor the production of object relatives.

Concerning children’s comprehension of object relative clauses, some studies indicate that it is influenced by a mismatch in animacy between the arguments of the verb, which seems to facilitate theta-role assignment when the object DP is inanimate and the embedded subject is animate. In these contexts, children find it easier to identify which nominal is the

agent and which is the patient of the action, as revealed by improved performance for object relatives headed by an inanimate DP³⁵ (Corrêa 1995, Brandt, Kidd, Lieven, & Tomasello 2009, Arosio et al. 2010). Children’s performance changes in the case of object relative clauses with an animate object and an inanimate embedded subject. Adani (2012) reports that such a mismatch in animacy does not facilitate comprehension of object relative clauses in an experiment with 4- and 5-year-old German-speaking children and therefore concludes that dissimilarity in the Animacy feature per se does not improve comprehension of object relative clauses. So, although there are indications that animacy may influence the comprehension process in children, there is an ongoing debate of how exactly it affects comprehension, and how it relates to the use of other properties such as structure type and morphosyntactic information.

These findings regarding the role of animacy, coupled with the featural intervention approach to children’s difficulties with headed object A’-dependencies, give rise to a number of further questions: How is the [+NP] specification to be understood exactly? What is the role of animacy? Does an animacy mismatch between the target and the intervener give rise to an intersection configuration in the sense of Belletti et al. (2012), thus improving comprehension? If so, what makes animacy a ‘relevant’ feature for the computation of RM? Does the way in which animacy is expressed in the structure matter?

4.1 Instantiations of animacy in French wh-questions and relative clauses

The studies presented in this chapter focus on the comprehension of wh-questions and relative clauses in French by taking into consideration the manner in which these two constructions instantiate the [+NP] / [-NP] divide, as this interestingly modulates the relevant intervention configuration in ways that implicate the animacy specification as well. Questions in French straightforwardly express the presence or absence of the lexical restriction, both in the animate (*quelle fille* vs *qui* in (1)) and inanimate (*quelle balle* vs *que* in (2)) paradigm:

- (1) a. *Quelle dame* est-ce que la fille embrasse?
which lady ESK the girl kisses
 ‘Which lady is the girl kissing?’

³⁵ Kidd, Brandt, Lieven, & Tomasello (2007) also point out that the animacy of the object relative clause head strongly influences both the frequency with which English and German children produce these structures in spontaneous speech and the successful repetition of relative clause sentences in an experimental setting.

b. *Qui* est-ce que la fille embrasse?

who ESK the girl kisses

‘Who is the girl kissing?’

(2) a. *Quelle balle* est-ce que la fille tape?

which ball ESK the girl hits

‘Which ball is the girl hitting?’

b. *Qu(e)’* est-ce que la fille tape?

what ESK the girl hits

‘What is the girl hitting?’

Things are more complex for headed relatives, as they involve non-lexical heads with the complex pronominal form *celui-celle* in the animate paradigm:

(3) a. Montre-moi *la dame* que la fille embrasse.

show-me *the lady* that the girl kisses

‘Show me the lady that the girl is kissing.’

b. Montre-moi *celle* que la fille embrasse.

show-me *this/that+her* that the girl kisses

‘Show me the one that the girl is kissing.’

These elements cannot stand alone: when they are not followed by a relative clause as in (4a), they obligatorily co-occur with a deictic element, shown in (4b):

(4) a. Voilà deux robes. *Décris-moi *celle*.

here two dresses. describe-me *this/that+her*.

b. Voilà deux robes. Décris-moi *celle-là* / *celle-ci*.

here two dresses. describe-me *this/that+her-there* / *this/that+her-here* .

‘Here are two dresses. Describe to me that one/ this one.’

Celui/celle is naturally analyzable as *ce+lui/ce+elle*, i.e. a determiner *ce* plus a pronominal form *lui/elle* (as in Gross, 1978, Kayne, 2010, Kayne and Pollock, 2010), roughly analogous to English *one*, also following the determiner in *the one that the girl is kissing*, etc. In the case of the relative clause headed by a pronominal form, there is a further interesting twist which involves animacy: an animate head necessarily has the complex shape *celui/celle*, whereas an inanimate head can either have the same complex *celui/celle* shape (as in 5b) or it

can have the simple shape *ce*, plausibly analyzable as a bare determiner, hence just D, not D+NP:

- (5) a. Montre-moi *la balle* que la fille tape.
show-me *the ball* that the girl hits.
'Show me the ball that the girl is hitting.'
- b. Montre-moi *celle* que la fille tape.
show-me *this/that+her* that the girl hits.
'Show me what the girl is hitting.'
- c. Montre-moi *ce* que la fille tape.
show-me *what* that the girl hits.
'Show me what the girl is hitting.'

Thus the inanimate paradigm in relative clauses has the possibility of directly instantiating the [\pm NP] divide, much like in the case of questions (as in (2)). As such, the first study included in this chapter opted for the use of *ce* as the inanimate counterpart of *celui/celle* with goal to compare between relative clauses containing +NP constituents and relative clauses containing unequivocally –NP elements (along the lines of the +NP/–NP comparison in *wh*-questions). In addition, as evidenced by example (5b), *celle/celui* can also refer to inanimate antecedents. Note that, in the absence of context, *celle* would be ambiguous between an animate and an inanimate reading. The comparison between *celle/celui* relative clauses with an animate or an inanimate antecedent constitutes the focus of the second experiment, whose goal was to examine whether the animacy feature has the potential to modulate processing of object relative clauses even when this feature is not overtly realized on the noun phrase, while being computed in the featural array of the nominal element.

To summarize, (i) questions are structurally more uniform, and allow to directly assess the role of the [\pm NP] distinction, as in (1-2); (ii) They also allow us to directly address the role of the animacy specification in both the +NP and –NP condition, as in (1) vs (2); (iii) Relatives are structurally more varied, instantiating the case of a D+NP form with a nominal pro-form in the animate paradigm, which allows us to disentangle pure formal (dis-)similarity in the D+NP shape from presence vs absence of lexical restriction with descriptive content. Relatives in the inanimate paradigm can be akin to questions, and instantiate the simple [\pm NP] dissociation, as in (5c). But they can also express the D+NP form, similar to the animate paradigm, which allows to test whether an animacy mismatch modulates

comprehension even in the absence of any obvious syntactic reflex on the inflectional head or on the relativized element.

4.2 Experiment 5: Comprehension of French *wh*-questions and relative clauses with a mismatch in animacy and NP feature

The aim of Experiment 5 was to test (i) how minimality effects are modulated by the nature and properties of a lexical NP feature; (ii) whether features like animacy modulate comprehension; (iii) whether these features have a similar impact across A'-structure types and age groups. Various studies (Avrutin 2000; Friedmann et al. 2009, etc.) have already shown that subject lexically-restricted dependencies yield better performance as compared to object lexically-restricted dependencies (which is precisely what an account in terms of featural intervention predicts). Chapter 2 has also shown this for French. Hence I do not specifically explore the subject/object asymmetry in this study.

4.2.1 Participants

A total of sixty-one typically developing French-speaking children from two primary schools in Geneva, Switzerland, were recruited for this study. They were divided across four age groups, as shown in Table 4.1. Each child was tested separately in a quiet room. No time constraint was imposed during testing and children were rewarded at the end of the session.

Age group	No. of participants	Age range	Mean Age (S.D.)
5 y.o.	14	4;9 – 5;9	5;2 (0.3)
7 y.o.	17	6;7 – 7;5	7;0 (0.3)
9 y.o.	16	8;7 – 10;0	9;1 (0.5)
11 y.o.	14	10;9 – 11;10	11;2 (0.3)

Table 4.1 Participant data per age group (total number, age range, mean age and standard deviation)

4.2.2 *Design and Procedure*

4.2.2.1 Materials

The linguistic material included 12 object wh-questions and 12 object relative clauses, divided across a 2 X 2 design with Lexical Restriction (+NP, –NP³⁶) and Object Animacy (+Animate, –Animate) as independent factors. As for the animate paradigm, I adopt the terminology of previous studies (Friedmann et al., 2009, Belletti et al., 2012) where the +NP feature characterized cases involving the presence of a lexical noun and, accordingly, I initially classify relatives headed by *celui/celle* as –NP. I illustrate below the levels along which wh-questions (examples (6a) to (6d)) and relative clauses (examples (7a) to (7d)) varied:

(6) a. *Object +NP +Animate question*

Quelle **dame** est-ce que la fille embrasse?

which.F.SG lady ESK the.F.SG girl kisses

‘Which lady is the girl kissing?’

b. *Object +NP –Animate question*

Quelle **balle** est-ce que la fille tape?

which.F.SG ball ESK the.F.SG girl hits

‘Which ball is the girl hitting?’

c. *Object –NP +Animate question*

Qui est-ce que la fille embrasse?

who ESK the.F.SG girl kisses

‘Who is the girl kissing?’

d. *Object –NP –Animate question*

Qu’ est-ce que la fille tape?

what ESK the.F.SG girl hits

‘What is the girl hitting?’

³⁶ Here we intend +NP to refer to the presence of a nominal element drawn from the substantive lexicon; as such, in the initial classification of the stimuli, –NP designates both relative clauses with complex pronominal heads like *Montre-moi celle que la dame embrasse*, and relative clauses headed by bare determiners like *Montre-moi ce que la fille frappe*.

(7) a. Object +NP +Animate relative clause

Montre-moi *la dame* que la fille embrasse.
show-me the.F.SG lady that the.F.SG girl kisses
'Show me the lady that the girl is kissing.'

b. Object +NP –Animate relative clause

Montre-moi *la balle* que la fille tape.
show-me the.F.SG ball that the.F.SG girl hits
'Show me the ball that the girl is hitting.'

c. Object –NP +Animate relative clause

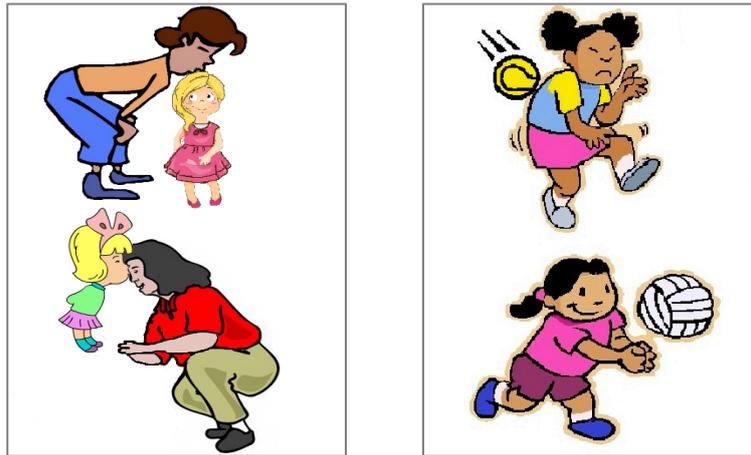
Montre-moi *celle* que la fille embrasse.
show-me this/that + her that the.F.SG girl kisses
'Show me the one that the girl is kissing.'

d. Object –NP –Animate relative clause

Montre-moi *ce* que la fille tape.
show-me that that the.F.SG girl hits
'Show me what the girl is hitting.'

Comprehension of wh-questions and relative clauses was assessed using a character selection task, an adapted version of the task employed in Friedmann et al. (2009). Figure 1 shows examples of pictures used in the experiment. Each picture depicted the same action performed twice with reversed Agent-Patient roles. Given that I only tested object dependencies, the target answer for all the experimental items consisted of pointing to the patient of the action expressed by the verb. Each test sentence was used only once and was associated with a picture which depicted either four animate characters for the animacy match condition (figure (4.1a) or two animate characters and two objects for the animacy mismatch condition (figure (4.1b))³⁷:

³⁷ One potential drawback of this experiment is the use of a slightly infelicitous context (e.g. *Which lady is the girl kissing?* paired with a picture in which there are two girls). The pictorial stimuli replicated the format of other experiments in the literature (see for example Friedmann et al. (2009) who also tested comprehension of relative clauses using two pictures with 4 characters). Since this was a character-selection task, contrary to Friedmann et al. who used an image-selection task, and that children had to point to a specific character and not to an entire image, all the characters in the pictures had to be represented as distinctly as possible. If pragmatics



a. Animacy match

b. Animacy mismatch

Figure 4.1 Pictures used in the character-selection task

All the items contained transitive verbs, as well as two noun phrases matched for number (always singular) and for gender. Half of the nouns used were masculine, half were feminine. The position of the correct character was counterbalanced between the four possible positions. In addition, the target character/object did not appear in the same position on the page (top or bottom) in consecutive trials and there were no two consecutive pictures depicting the same action. The 24 test sentences were randomized across two different lists (see Appendix C) and were interspersed with 16 fillers (sentences such as “Touch the duck with the ice-cream.”) used in order to maintain children’s interest and ensure that they remained attentive throughout the task. Consequently, each child saw a total of 40 sentences and the experiment lasted approximately 20 to 25 minutes.

4.2.2.2 Procedure

The actual experiment was preceded by a warm-up task aimed at familiarizing children with the characters and with precise pointing. The warm-up started with a simple pointing task in which children saw various pictures and had to find and show the specific character or object named by the experimenter as in, for example *Where can you see a grasshopper?*. This was followed by four practice trials, which included pictures similar to those used in the experimental trials. The experimenter explained to the children that they would see two images at a time and that they would have to point to the correct character/object in one of

had influenced children’s answers, we would have expected this to impact results across the various conditions tested. However, the findings show that this is not the case.

these images. Moreover, the experimenter drew children's attention to the fact that they should choose and point out only one of the four possible options given in the images. If children's responses were ambiguous (e.g. pointing to the whole image), the experimenter would pretend that she did not pay attention and would ask the child to identify again the precise character/object. However, this happened very seldom as children were very eager to point to only one character/object. During the test phase, the experimenter first gave the child a short lead-in: "Look! There are two girls and two ladies in this picture!". This was then followed by either a relative clause or a wh-question prompting participants to choose the correct character out of 4 possible options.

4.2.3 Predictions

If the relevant factor that makes the relative head dissimilar from the intervening subject is the lack of a lexical noun endowed with descriptive content, then we expect children to understand structures like (7a), repeated below as (8), significantly better than (7b), illustrated as (9), for the sake of convenience.

(8) Montre-moi *la dame* que la fille embrasse.

show-me *the lady* that the girl kisses

'Show me the lady that the girl is kissing.'

(9) Montre-moi *celle* que la fille embrasse.

show-me *this/that+her* that the girl kisses

'Show me the one that the girl is kissing.'

If what matters is the mere formal (dis)similarity in D+NP shape between the head and the embedded subject, where the NP component can be a lexical form (*fille*) or a pronominal form (*elle*), this entails that comprehension of (8) and (9), both with relative heads structured as D+NP, should be roughly on a par. If animacy modulates comprehension, then we should observe that children perform better in the –Animate conditions as compared to the +Animate conditions, both in the case of +NP and of –NP configurations.

4.2.4 Results

Like in the previous experiments, the dependent measure was response accuracy. An answer was coded as correct if the child chose the right Patient out of four competitors within each

set of pictures. Consequently, the chance level was considered to be 25%. I first present the overall results for wh-questions and then for relative clauses, by looking at the effect of both the [\pm NP] and the [\pm Animate] distinctions. The error bars in all the figures represent the standard error to the mean.

For questions, what determines the status of a wh-phrase as + or -NP is straightforward (*quelle fille* vs *qui*) and we see that children across all the age groups tested comprehended -NP questions crossing a +NP subject more accurately than +NP questions (Figure 4.2).

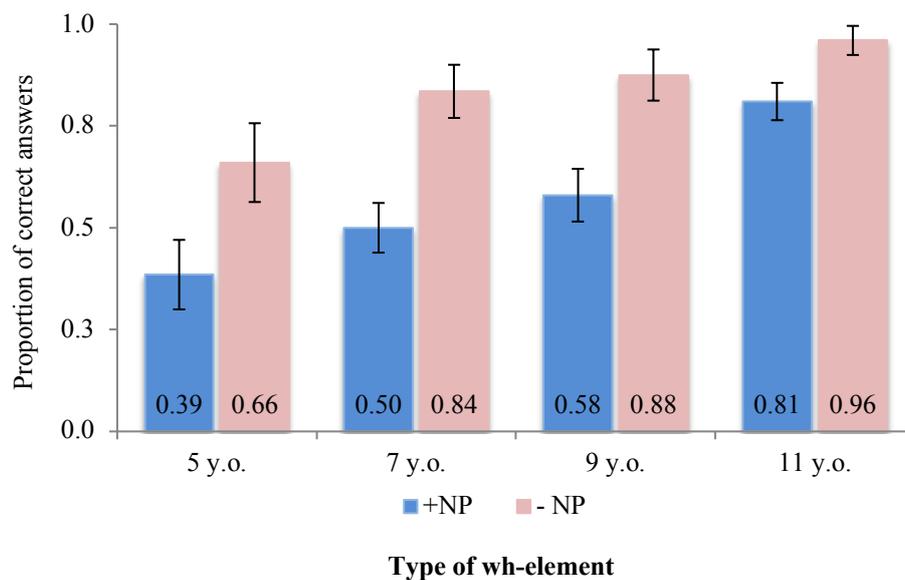


Figure 4.2 Overall proportion of correct answers for +NP vs -NP wh-questions (irrespective of object animacy) in children from age 5 to 11

When analyzing the effect of the match or mismatch in animacy on both +NP and -NP questions, we see a different sensitivity to animacy:

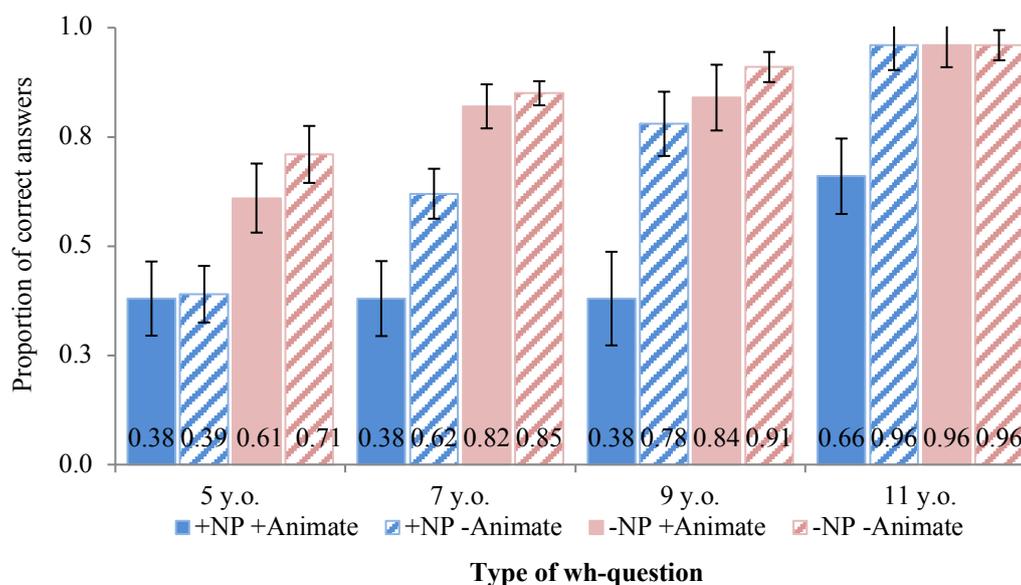


Figure 4.3 Overall proportion of correct answers for object wh-questions with NP (+Animate ‘*quelle fille*’ / – Animate ‘*quelle balle*’) and without NP (+Animate ‘*qui*’ / – Animate ‘*que*’) in children from age 5 to 11

An animacy mismatch significantly improved the comprehension of questions in the +NP condition (i.e. *Which ball is the girl hitting?* was better understood than *Which lady is the girl kissing?*) in the 7, 9 and 11 year-old children, whereas no animacy effect was found in the 5 year-old group. On the other hand, the animacy mismatch in the –NP condition did not significantly improve comprehension in any group (i.e. response accuracy for *What is the girl hitting?* is on a par with that for questions like *Who is the girl hitting?*, in which the subject and the object match in animacy). These asymmetries in comprehension were also reflected in the number of children who performed above chance in the various experimental conditions. Whereas only 31 of 61 children performed above chance with object +NP wh-questions with two animate DPs, when the +NP wh-questions included an animacy mismatch, the number of children who performed above chance raised to 46. Performance improved in object –NP questions, with only 9 children performing below chance. The comprehension scores for wh-questions, when compared to a chance level of 25%, showed that, overall, children performed above chance for these constructions. This suggests that children comprehend these structures, but find them harder than others and this, in turn, leads to asymmetries in comprehension.

Results are less straightforward for relative clauses (Figure 4.4) when we look at the results for the +NP and –NP conditions. For relative clauses with an inanimate head, like in

the case of questions, it is also straightforward what determines the [\pm NP] status of the head noun (*la balle que...* vs *ce que...*); for relative clauses with animate heads, I have initially counted relatives headed by *celui/celle* as –NP, under the assumption that the +NP value is given by the presence of a noun from the substantive lexicon.

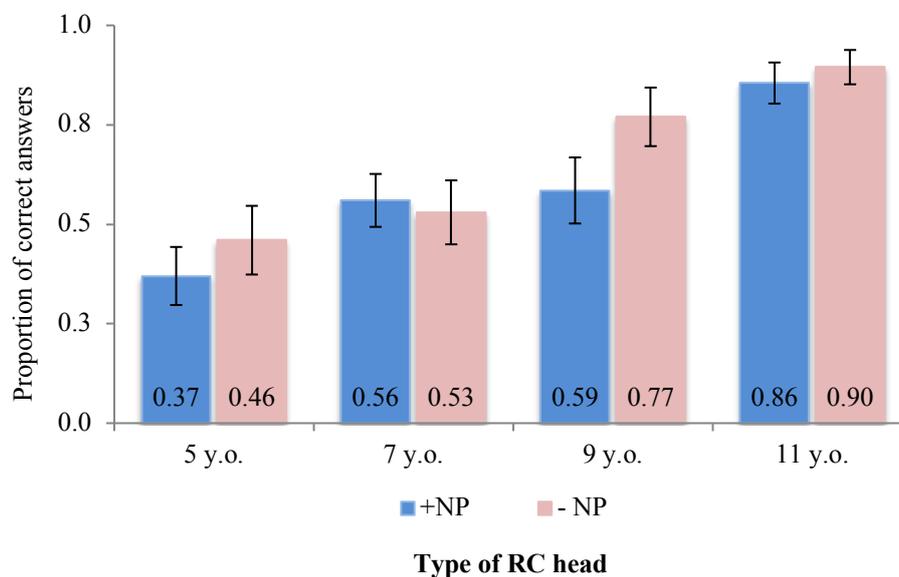


Figure 4.4 Overall proportion of correct answers for +NP vs –NP relatives (irrespective of object animacy) in children from age 5 to 11

If we look more closely at the results for relative clauses (Figure 4.5) and compare +NP and –NP conditions by taking into account the match and mismatch in animacy, one important discrepancy between the relative clauses and questions emerges: –NP relatives with animate pronominal heads (*Montre-moi celle que la fille embrasse.*) yielded lower accuracy scores across all age groups, which points to some special property of *celui/celle* relative clauses. A total of 30 children performed below chance for –NP object relatives headed by *celui/celle* compared to 23 whose performance with +NP object relatives with an animate head was below chance. On the other hand, –NP relative clauses headed by inanimate objects (*Montre-moi ce que la fille frappe.*) led to the highest accuracy scores for all age groups, in line with –NP inanimate questions. The contrast between animate and inanimate pronominally headed relatives (*celui/celle* vs *ce*) thus represents the sharpest contrast in the experimental set. Moreover, the overall results for relative clauses show that only the 9 year-old and the 11 year-old groups performed above chance with *celui/celle* relative clauses, whereas the other conditions yielded above-chance performance in the four age groups tested. The 5- and 7-year-olds' chance performance with the *celui/celle* relative clauses indicates that the younger

children struggle with these constructions, as their response patterns seem to be the result of guessing.

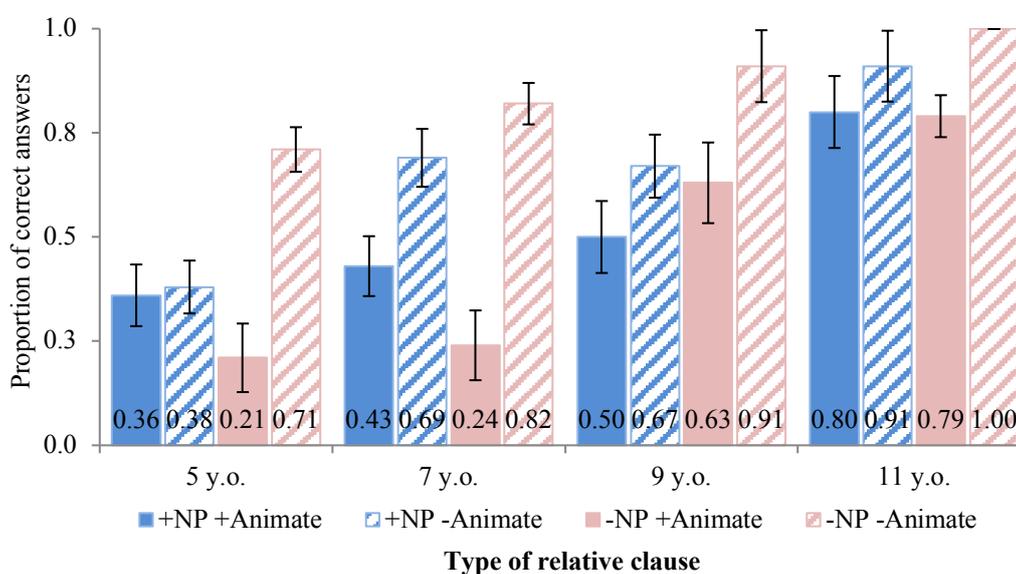


Figure 4.5 Overall proportion of correct answers for object relative clauses with NP (+Animate ‘*la fille*’ / – Animate ‘*la balle*’) and without NP (+Animate ‘*celle*’ / – Animate ‘*ce*’) in children from age 5 to 11

4.2.4.1 Statistical analysis

I consider *wh*-questions to be structurally more uniform whereas relative clauses to be structurally more varied in the way they express the +/-NP divide and therefore I carried out separate analyses for the two structures tested, using as fixed factors (i) Lexical Restriction and (ii) Object Animacy. Like in the other experiments, I fit the data with a mixed logit model. Given the low number of items in the –NP conditions, each factor was coded with a sliding contrast specification. For example, in the current data set, for the Lexical Restriction factor, –NP object questions were coded as +0.5 and +NP object questions were coded as –0.5. With this coding system, the mean of the dependent variable for one level of the categorical variable (i.e. –NP object questions in the case of the Lexical Restriction factor) was compared to the mean of the dependent variable for the other level or +NP object questions. Given this type of contrast coding, the intercept in each model was the Grand Mean or overall mean of the dependent variable. Age was included as a continuous covariate in the models, while subject and items were included as random effects.

Table 4.2 summarizes the results of the full final model for wh-questions. The final model was selected by first including all main effects and covariates, as well as interactions between main effects and covariates. I then removed predictors step by step and calculated the fit of the simpler model as compared to the more complex model (using a chi-square test based on the log likelihood ration statistics) until the fit of the simpler model was not significantly worse than the fit of the larger model. The interaction with Age added significant information to the model ($\chi^2(1) = 10.02, p < .01$), as did the interaction between Lexical Restriction and Animacy ($\chi^2(2) = 4.04, p < .05$).

Fixed effect	Coefficient	SE	Wald Z	p
(Intercept)	0.33	0.48	0.68	>.4
Lexical Restriction = <i>-NP - +NP</i>	1.58	0.25	6.44	<.001***
Object Animacy = <i>+Animate - -Animate</i>	-0.87	0.24	-3.57	<.001***
Age	0.03	0.007	3.94	<.001***
Forward D-span	0.25	0.10	2.46	<.02*
Backward D-span	-0.09	0.12	-0.73	>.4
Interaction = <i>Lexical Restriction & Object Animacy</i>	1.02	0.49	2.08	<.04*
Interaction = <i>Lexical Restriction & Age</i>	0.002	0.010	0.17	>.8

Table 4.2 Fixed effect estimates for mixed logit model of correct answers for wh-questions³⁸

The maximal random effect structure supported by the data included only random intercepts for subjects. This is summarized in Table 4.3 below.

Random effect	s ²	SD
Subject Intercept	0.25	0.50

Table 4.3 Summary of random effects in the mixed logit model for wh-questions

The mixed logit model for wh-questions revealed several main effects and one interaction as significant. In line with previous findings, the absence of lexical restriction (*-NP*) improved children’s comprehension of object questions, as evidenced by the positive coefficient of Lexical Restriction. The negative coefficient for Object Animacy shows that performance was less accurate with object wh-questions with an animacy match between the subject and

³⁸ Final model : Response Accuracy ~ Lexical Restriction * Object Animacy * Age + (1 | Subject); N = 732, AIC = 780.47, BIC = 831.03, log-likelihood = -379.24.

the object. Age also had a significant effect on comprehension: older children performed more accurately in the experimental task. There was no significant interaction between Object Animacy and Age or between Age and the two fixed factors (Lexical Restriction and Animacy) (all $p > .05$).

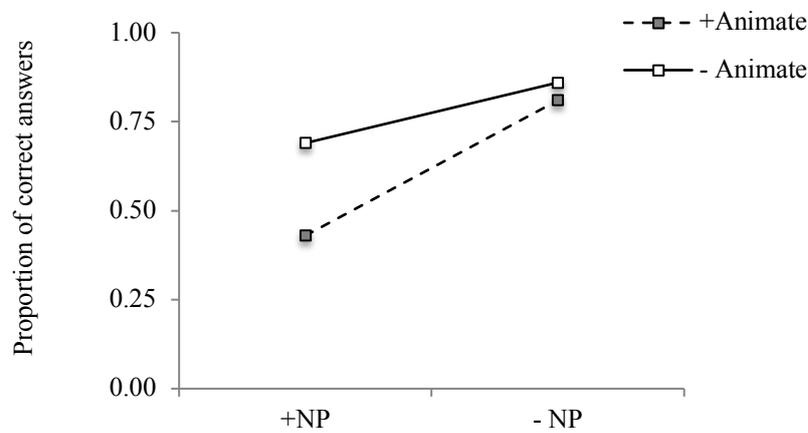


Figure 4.6 Overall proportion of correct answers for wh-questions as a function of lexical restriction (+/-NP) and object animacy (+/-Animate) for all age groups

The interaction between Lexical Restriction and Object Animacy plotted in Figure 4.6 was also significant ($\beta = 1.02$, $SE = 0.49$, $z = 2.08$, $p = < .04$), showing that Object Animacy has a different impact when coupled with –NP questions than when associated with +NP object questions: while Object Animacy affects performance on +NP trials, as children are more accurate with +NP –Animate than with +NP +Animate trials, children’s performance on –NP trials is the same independently of Object Animacy.

I now turn to the results of the mixed logit model for relative clauses. Like in the case of wh-questions, I started the analysis with a model that included all fixed effects, covariates and interactions between them. The final model was again selected by removing factors one at a time until the fit of the smaller model was not significantly worse than the fit of the larger model. This showed that the interaction between Lexical Restriction and Object Animacy was significant ($\chi^2(1) = 17.64$, $p < .001$), as was the interaction with Age ($\chi^2(1) = 7.14$, $p < .01$). Tables 4.4 and 4.5 summarize the fixed effects and random effects of the final full model.

Fixed effect	Coefficient	SE	Wald Z	p
(Intercept)	-0.88	0.55	-1.58	>.1
Lexical Restriction = <i>-NP</i> - <i>+NP</i>	0.15	0.23	2.75	>.05
Object Animacy = <i>+Animate</i> - <i>-Animate</i>	-1.73	0.24	-7.27	<.001***
Age	0.03	0.007	4.08	<.001***
Forward D-span	0.41	0.12	3.46	<.001***
Backward D-span	-0.05	0.13	-0.42	>.6
Interaction = <i>Lexical Restriction & Object Animacy</i>	-1.71	0.47	-3.62	<.001***
Interaction = <i>Lexical Restriction & Age</i>	0.006	0.009	0.62	>.5

Table 4.4 Fixed effect estimates for mixed logit model of correct answers for relative clauses³⁹

Random effect	s ²	SD
Subject Intercept	0.44	0.67

Table 4.5 Summary of random effects in the mixed logit model for relative clauses

-NP object relative clauses yielded slightly higher accuracy scores as compared to +NP object relative clauses, but the effect of the absence of a lexical restriction on the head of the relative clause was not significant, contrary to the results obtained for wh-questions (see Table 4.2 for reference). The [\pm Animate] nature of the object also affected comprehension, as children comprehended object relative clauses headed by a +Animate DP less accurately. There was also a significant interaction between Lexical Restriction and Object Animacy (Figure 4.7), as revealed by the results of the mixed logit model: contrary to the results obtained for wh-questions, the interaction obtained in the case of relative clauses shows that object animacy determines a difference in performance not only on +NP trials, but also on -NP ones. Moreover, we see that a mismatch in animacy leads to a more pronounced difference in the comprehension of -NP conditions (*celui/celle* vs *ce*) than in the comprehension of relative clauses headed by a +NP element.

³⁹ Final model : $\text{ResponseAccuracy} \sim \text{LexicalRestriction} * \text{ObjectAnimacy} * \text{Age} + (1 | \text{Subject})$; N = 732, AIC = 788.79, BIC = 839.34, log-likelihood = -383.40.

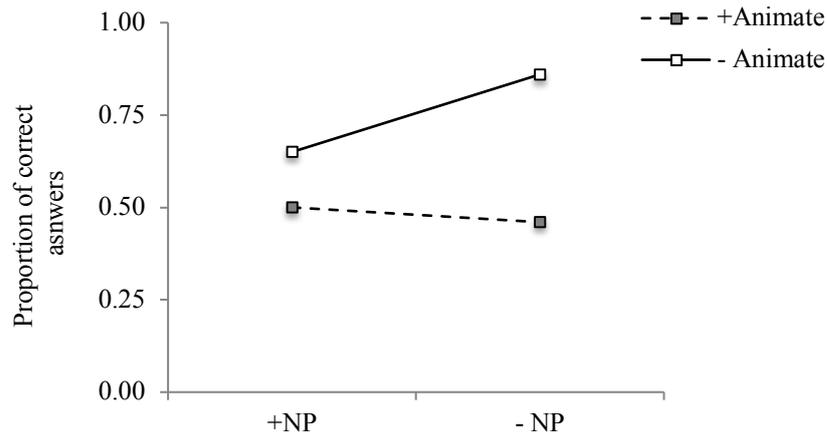


Figure 4.7 Overall proportion of correct answers for relative clauses as a function of lexical restriction (+/-NP) and object animacy (+/-Animate) for all age groups

Like in the case of wh-questions, we observe again a significant effect of Age ($\beta = 0.03$, $SE = 0.01$, $z = 4.08$, $p = <0.001$) as response accuracy was higher in older children.

4.2.5 *Interim discussion*

The present experimental findings demonstrate that the presence of +NP +Animate features on both the intervener and the A'-moved object make it difficult for children to relate the gap to its antecedent.

Let us first consider the results in the case of questions (figure 4.3). We observed a clear distinction in all age groups between the bare and the lexically restricted conditions. The distinction manifested itself most straightforwardly in the 5-year-old group showing that questions with a bare wh (whether animate or not, as in (10)), were understood better than questions with a lexically restricted wh (illustrated in (11)):

- | | | | |
|---------|------|------------|--------------------|
| | +Q | | +NP |
| (10) a. | Qui | est-ce que | la fille embrasse? |
| | who | ESK | the girl kisses? |
| | +Q | | +NP |
| b. | Qu' | est-ce que | la fille frappe? |
| | what | ESK | the girl hits |

- | | | | |
|---------|----------------------------|-----------------|-----------------|
| | +Q+NP | +NP | |
| (11) a. | Quelle dame est-ce que la | fille embrasse? | |
| | which lady | ESK | the girl kisses |
| | | | |
| | +Q+NP | +NP | |
| b. | Quelle balle est-ce que la | fille frappe? | |
| | which ball | ESK | the girl hits |

This is directly in line with the prediction of a featural intervention or RM-based approach to the acquisition of these constructions: configurations like (11) in which the features on the moved object include the [+NP] feature on the intervening subject are harder for young children to deal with than configurations like (10) where the featural sets on the two elements are disjoint.

A contrast between +NP and –NP wh-questions emerged in a different form in the 7-, 9-, and 11-year-old groups. The lexically restricted case was sensitive to animacy, with a significant improvement of comprehension with animacy mismatch (first and second bar in figure 4.2), while the bare wh case was not significantly sensitive to animacy distinctions (third and fourth bar of figure 4.3). Clearly, older children (7 – 11yo) can interpret animacy as a relevant feature and draw upon its presence to distinguish the set of features present on the intervener from those of the A'-object. The mismatch in animacy thus creates an intersection relation between the features entering the computation (Belletti et al., 2012). According to Belletti et al. (2012), a feature can have a facilitating effect inasmuch as it acts as a trigger for movement, a core case being movement to subject position triggered by the Phi feature set expressed in the verbal morphology. Note however that while the animacy effect with lexically restricted [+NP] wh-questions (the first and second bars in figure 4.2) was present in the older age groups, it did not surface in the 5-year-old group. Indeed 5-year-old children did not perform better with A'-dependencies headed by a +NP, –Animate object, showing that they cannot exploit the mismatch in animacy in these contexts. If the animacy feature is relevant in determining an intersection configuration, the fact that younger children have difficulties computing such structures indicates that the intersection relation only becomes relevant at a later time. I will develop these points in more detail back in the General discussion.

Turning now to the case of object relatives (figure 4.5), we observe that the pattern was essentially the same as for object questions in three out of four cases, whereas it clearly

differed in the *celui/celle* case (third bar in figure 4.5). Lexically restricted +NP relatives exemplified in (12) showed an animacy effect favoring the mismatching structure in the 7 and 9-year-old groups, but which was absent from the 5-year-old group. As for the 11-year-olds, there was a clear difference in performance between +NP +Animate and +NP –Animate relative clauses, although this difference did not reach significance.

- | | | | |
|---------|---------------------|---------------|-----------|
| | +R+NP+An | +NP+An | |
| (12) a. | Montre-moi la dame | que la fille | embrasse. |
| | show-me the lady | that the girl | kisses |
| | | | |
| | +R+NP–An | +NP+An | |
| b. | Montre-moi la balle | que la fille | frappe. |
| | show-me the ball | that the girl | hits |

Much like in the case of wh-questions, the low scores of the 5-year-old children with +NP relative clauses, as well as their similar performance on both +Animate and –Animate relative clauses illustrated in (12) can be taken as evidence that younger children have difficulties exploiting the mismatch in animacy in contexts of an intervention configuration. On the other hand, the lack of an effect of animacy in the case of the 11 year-olds can be attributed to the fact that they comprehend +NP +Animate trials very well. In turn, this improved performance considerably reduces the difference with the +NP –Animate trials.

As for the case of relatives headed by a non lexically restricted –NP element, the inanimate *ce* case (*montre-moi ce que la fille frappe*) was the easiest structure for all groups, much as the *que* case in questions (*qu'est-ce que la fille frappe?*). In contrast with questions introduced by *qui*, the animate *celui/celle* case (*montre-moi celle que la fille embrasse*) was significantly more difficult than the inanimate *ce* case for all groups, and was indeed the most difficult case of all for the younger 5 and 7-year-old children. Why do we find such a sharp difference only between *celui/celle* and *ce* and not between *qui* and *que*?

If *celui/celle* vs *ce* were the straightforward relative counterpart of the questions with bare wh *qui* vs *que*, we would expect no significant difference between bars 3 and 4 of figure 4.5, contrary to fact. The difference between *celui/celle* and *ce* lies not only in the fact that the former elements allow an animate interpretation, but also in that they have a distinct internal structure: while *ce* may be analyzed as a bare D, *ce-lui* / *c-elle* clearly have a more complex structure with the determiner *ce* plus a pronominal form (*lui-elle*) which may plausibly be analyzed as a pro-NP form. When one focuses on the formal structure of target

and *intervenir*, an immediate observation is that the relative head has the same D+NP form as the intervening subject (*la fille*):

- | | | | | |
|------|------------------|---------------|-----------------------|--|
| | +R+NP+An | | +NP+An | |
| (13) | Montre-moi celle | | que la fille embrasse | |
| | show-me | this/that+her | that the girl kisses | |

If this way of looking at things is correct, what counts in the calculation of the relevant morphosyntactic configuration may not be the presence of an actual N (noun) from the contentive lexicon heading the lexical restriction, but the formal presence of a D+NP structure. Under this interpretation, (13) would thus instantiate an inclusion configuration.

The inanimate version with *ce* would have a head with no restriction (either from a lexical or a pronominal nominal element):

- | | | | | |
|------|---------------|------|---------------------|--|
| | +R | | +NP | |
| (14) | Montre-moi ce | | que la fille frappe | |
| | show-me | that | that the girl hits | |

Therefore, the difficulty with *ce+lui* / *c+elle* could suggest that the crucial divide is not between a DP with a restriction taken from the contentive lexicon and a DP not so restricted, but between a DP analyzable as D+NP and one analyzable as a bare D. This would give rise to a disjunction configuration in (14), correctly expected to be the most accessible case to the child system. The anomaly of the *celui/celle* case may thus receive an analysis that underscores the importance of the structural configuration of the target and the antecedent in the computation of locality.

Another observation concerning relative clauses introduced by *celui/celle* is that they yield chance-level performance in the 5 and 7-year-old children. This leads to a sharp difference in comprehension accuracy between *celui/celle* and *ce*, but also to an asymmetry between *celui/celle* and relative clauses headed by a full lexical noun. These findings suggest that, as far as these two age groups are concerned, we are dealing with a compounding of effects: on the one hand, the formal structure of *celui/celle* creates an intervention configuration with the embedded subject; on the other hand, there is an added complexity with these structures possibly associated with a difficulty in establishing the reference of *celui/celle*. We could therefore suppose that once children overcome this intrinsic problem with *celui/celle* related to the assignment of a referent, as in the case of the 9 and 11 year-

olds, their results for relative clauses introduced by *celui/celle* would pattern with those for lexically-restricted relative clauses and that this would reduce the difference in performance with *ce* relatives.

The above analysis of *celui/celle* and *ce* also allows us to explain the opposite pattern of the interaction Lexical restriction by Object Animacy found in wh-questions and in relative clauses. While in wh-questions only performance in +NP trials is affected the Animacy match/mismatch, in relative clauses performance in both +NP and –NP trials is affected by the mismatch in Animacy, which also triggers a bigger difference in the case of –NP trials (so *celui/celle* and *ce*). In light of this analysis of *celui/celle* as D+NP and of *ce* as –NP, we see that the improved performance with *ce* relative clauses, as compared to *celui/celle* relative clauses, is driven by the fact that the *ce* structures represent a true case of featural disjunction between the moved object and the intervening subject, while *celui/celle* relative clauses create an intervention configuration in terms of +NP match. The difference between the +Animate *celui/celle* relative clauses and the –Animate *ce* relative clauses therefore stems not only from the difference in object animacy, but also from the difference in the +/- NP specification of the relative head. Consequently, in order to separate the effect of animacy from the effect of lexical restriction, we should investigate children's comprehension of *celui/celle* object relatives with a mismatch in animacy. This is precisely the focus of the study presented in the section 4.3, designed with the aim to investigate in more detail the comprehension of object relatives headed by *celui/celle*, as well as the effect of animacy on this type of relatives.

4.3 Experiment 6: Comprehension of *celui/celle* relative clauses in French with a mismatch in animacy

To recall, Experiment 5 revealed (i) that children had more difficulties comprehending object relatives headed by *celui/celle* than those headed by *ce* and (ii) that the comprehension pattern for *celui/celle* relatives matched the one for object relatives headed by a full lexical nominal element. In the previous experimental setting, *celui/celle* were used to refer uniquely to animate entities, while *ce* represented their inanimate counterpart. The sharp contrast in performance between the two cases was attributed to a structural difference between *celui/celle* and *ce*, namely the form D+NP of *celui/celle*, which matched the structural form of the intervening subject. This suggested that the computation of intervention in the case of

A'-dependencies in child language is not sensitive simply to the overt presence of a lexical noun, but to the presence of a complex D+NP associated with the relative head. Such an analysis readily accounted for children's improved performance with *ce* object relatives, as this element only instantiates the D layer and thus enters into a disjunction configuration with a +NP intervening subject. Children's results with *ce* relatives in Experiment 5 patterned with those for *qui* and *que* wh-questions, which also lack a +NP lexical restriction.

However, as pointed out in the interim discussion (section 4.2.5), the lower performance with *celui/celle* object relatives, as compared to object relatives headed by a full DP, could have also been determined by children's increased difficulties in accessing the discourse referent of demonstratives like *celui/celle*. In order to establish the referential properties of a demonstrative, access to a discourse antecedent is required. The idea, based on assumptions regarding the accessibility of the discourse referent of these expressions (see, for example, Ariel 1990; Gundel, Hedberg, & Zacharski 1993), is that the very usage of one referring expression rather than another one (e.g., *la fille* vs. *celle*) to point to a discourse referent determines performance, even when the given context is held constant across conditions. More specifically, the use of a full DP or of a demonstrative determines a different type of access to their antecedents: whereas a full DP like *la fille* allows direct access to its discourse referent, demonstratives like *celui/celle* access their discourse referents indirectly, meaning that they first need to retrieve an antecedent from the previous context (be this linguistic or visual). In this sense, a demonstrative accesses its discourse referent through a process similar to that of a 3rd person pronoun (see Carminati 2005). This extra step in accessing the discourse referent in the case of demonstrative could be costly for children and could have determined the lower performance with *celui/celle* object relatives as compared to full DP object relatives in Experiment 5.

In addition, one could argue that the animacy of the object or relative clause head played no role in shaping the contrast between *celui/celle* and *ce* cases. The goal of Experiment 6 included in this section was therefore to deal with this potential criticism by investigating French children's comprehension of object relatives headed only by *celui/celle*, but with a mismatch in animacy between the head noun and the embedded subject. As shown in section 4.1, the relative head *celui/celle* can also be inanimate, which is illustrated in the following example:

(15) Context: Speaker A has several paintings. Speaker B wants to see one of them.

Speaker A: Quel tableau est-ce que tu veux que je te montre?

‘Which painting do you want me to show you?’

Speaker B: Montre-moi *celui* que tu as peint le plus récemment.

‘Show me the one that you painted most recently’.

From this point of view, *celui/celle* offer a good testing ground for the role of animacy, since animacy is unexpressed morphologically within the demonstrative pronoun. In addition, having *celui/celle* referring to both animate and inanimate entities (instead of *ce* for the latter) allows to examine (i) whether the difficulties in accessing the discourse referent hold both when the antecedent is animate and also when it is inanimate; (ii) how animacy affects comprehension when the same semantic and pragmatic restrictions apply to the use of the relative clause head. In addition, testing *celui/celle* relatives with an animacy mismatch offers a more direct comparison with the effect of animacy on object relatives headed by a lexically-restricted or +NP element and, as such, taps into the role that this feature plays in modulating the comprehension of object relatives.

4.3.1 Participants

Eighty-four typically developing children (ranging from 5;0 to 11;8, mean age 8;3) participated in the study. Data from four children were not included for further analysis due to failure to complete the whole task, to lack of attention on the part of the child or to experimenter error. Table 4.6 gives the details of the four age groups included in the experiment. The remaining 80 participants saw the totality of the experimental items. All were recruited from a primary school in the Geneva area, Switzerland, and all were native French speakers.

Age group	No. of participants	Age range	Mean Age (S.D.)
5 y.o.	20	5;0 – 5;9	5;5 (0.14)
7 y.o.	20	6;7 – 7;4	7;0 (0.21)
9 y.o.	20	8;7 – 9;6	9;1 (0.25)
11 y.o.	20	10;8 – 11;11	11;1 (0.33)

Table 4.6 Participant data per age group (total number, age range, mean age and standard deviation)

4.3.2 Design and Procedure

4.3.2.1 Materials

The target sentences consisted of 12 object relatives, all headed by *celui* or *celle*. The main factor manipulated in the experiment was the animacy of the object. Like in Experiment 5, the embedded subject was always an animate lexically-restricted nominal element (e.g. *la fille*). Participants saw 6 object relatives with a match in animacy between the relative clause head and the intervening subject, and 6 object relatives with an animacy mismatch between the two DPs. The actions used were transitive reversible actions, the nouns were singular and they matched for gender (half of the experimental trials contained feminine nouns and the other half masculine nouns). Examples of the target sentences are provided in (16) and (17), and a complete list of the trials is given in Appendix C.

(16) Object relative +Animate (Animacy match)

Voilà deux grenouilles.

look two frogs.

Montre-moi *celle* que la princesse arrose.

show-me *this/that+her* that the.F.SG princess splashes

‘Here are two frogs. Show me the one that the princess is splashing.’

(17) Object relative –Animate (Animacy mismatch)

Voilà deux tuyaux.

look two hoses.

Montre-moi *celui* que le garçon arrose.

show-me *this/that+him* that the.M.SG boy splashes

‘Here are two hoses. Show me the one that the boy is splashing.’

As evidenced by the above examples, an introduction of the two possible referents for *celui/celle* preceded each target sentence. This was associated with an image representing the two referents and was intended to make more felicitous the use of *celui/celle* as anaphoric pronouns. The character-selection task used to assess comprehension of object relatives headed by *celui/celle* was identical to the one in Experiment 5. That is, children had to identify the correct Patient of the action described in the target sentence by pointing to the corresponding character or object in an image that illustrated two identical actions with reversed Agent-Patient roles. Figure 4.8 exemplifies the images used for the lead in and the

target item in the animacy match conditions, while Figure 4.9 is an illustration of the type of images used in the animacy mismatch conditions. The target items were interspersed with 12 fillers (sentences such as “Touch the duck with the ice-cream.”) used in order to maintain children’s interest and ensure that they remained attentive throughout the task. Consequently, each child saw a total of 24 sentences and the experiment lasted 10 to 15 minutes.

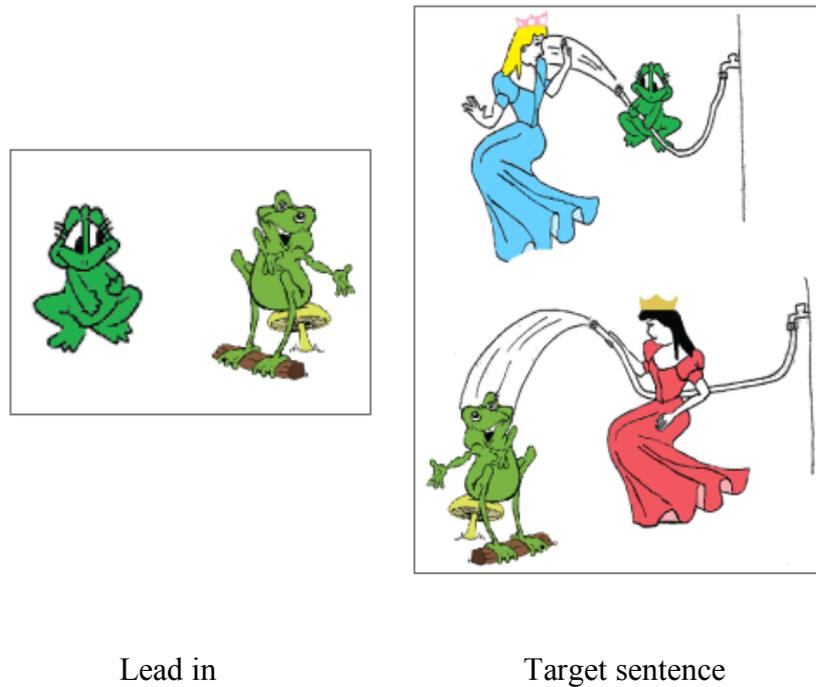


Figure 4.8 Example of pictures used in the animacy match conditions

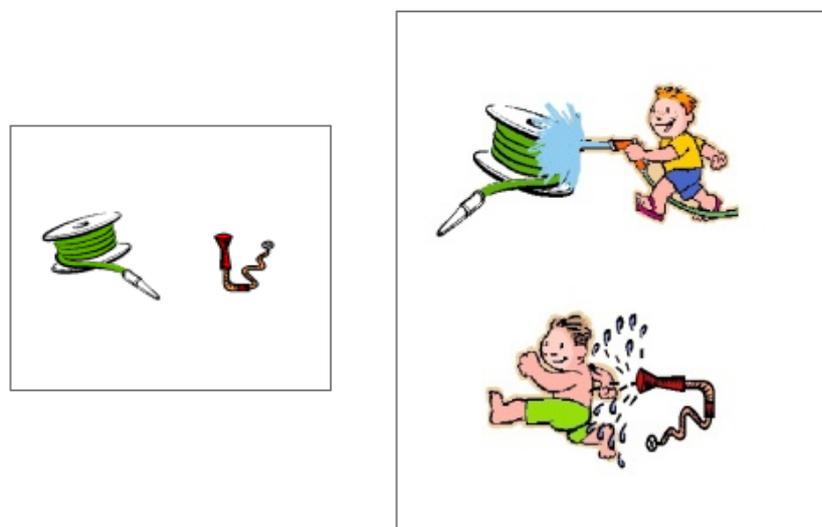


Figure 4.9 Example of pictures used in the animacy mismatch conditions

4.3.2.2 Procedure

Experiment 6 followed the same procedure as the one outlined in the *Procedure* section above for Experiment 5. No time constraints were imposed and the children could stop the experiment at any time.

4.3.3 Predictions

Testing the comprehension of *celui/celle* relatives with both animate and inanimate referents allows to disentangle the role that animacy plays in modulating French children's processing of object relative clauses. Although *celui/celle* come with lexical features such as gender and number, they do not overtly encode any information regarding the animacy of their referents. Moreover, in the experimental design used in this study, the gender and number features of *celui/celle* fully match those of the embedded subject inside the relative clause. When picking up an antecedent for the demonstrative pronoun among the four competitors present in the display (see Figures 4.6 and 4.7), participants also need to rely on the animacy of the antecedent introduced by the lead-in to converge on the correct interpretation for the relative clause head.

If children successfully draw on animacy to establish the reference of *celui/celle* and then use this cue to correctly map thematic roles, then we should observe a contrast between the animate and the inanimate trials. We have also seen that *celui/celle* elements instantiate a D+NP structure, similar to that of a lexically-restricted nominal like *la fille* 'the girl' or *le ballon* 'the ball'. Thus, if relatives headed by *celui/celle* pattern with those headed by an element containing a lexical-restriction, then this predicts again an effect of the animacy mismatch on the comprehension of *celui/celle* relative clauses: children should find it easier to comprehend *celui/celle* object relative clauses in which the intervening subject and the moved object differ in animacy features, than when they match in animacy.

If difficulties with *celui/celle* object relatives are determined not by the featural make-up of the demonstratives, but by the fact that children struggle to access their discourse referents, an operation which requires linking the demonstrative to an antecedent previously mentioned in the context, then we expect similar performance with both animate and inanimate trials: participants should find it equally hard to relate *celui/celle* to an antecedent, both when this is animate or inanimate. Moreover, we should continue to observe lower performance on *celui/celle* relatives (with or without an animacy match) as compared to children's performance in Experiment 5 on relative clauses headed by a full lexical noun.

4.3.4 Results

The results obtained for Experiment 6 are summarized in Figure 4.10, which represents the overall proportion of correct answers for trials with and without a mismatch in animacy between the moved A'-object and the intervening subject. An answer was coded as correct when children identified the right Patient of the action among the four competing characters present in the display. The bars indicate the standard error to the mean.

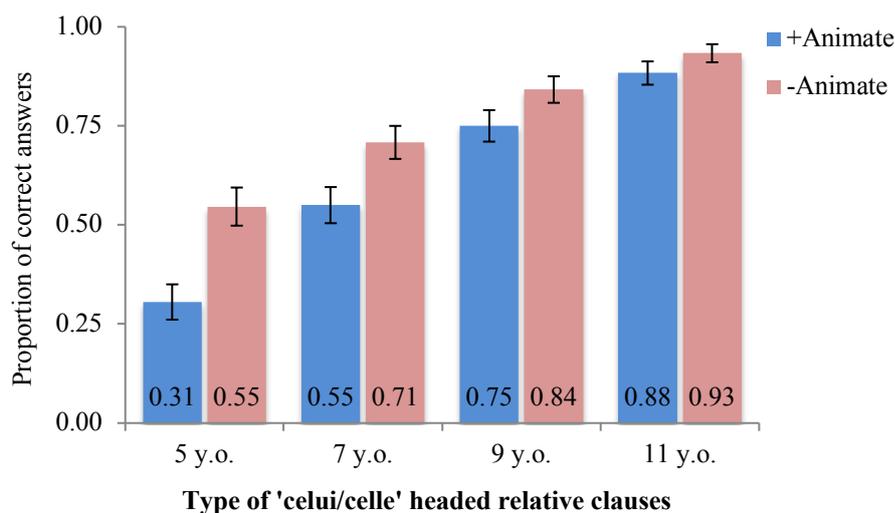


Figure 4.10 Overall proportion of correct answers for object relative clauses headed by +Animate or -Animate *celui/celle* in French children from age 5 to 11

Children's responses to the comprehension task revealed a difference in performance between the +Animate and the -Animate conditions: comprehension accuracy improved in the presence of an animacy mismatch. In other words, children comprehended better object relatives in which the antecedent of the *celui/celle* relative clause head was an inanimate noun, as compared to cases in which *celui/celle* referred back to animate entities. Although these findings were robust across the four age groups tested, we see that the difference between the +Animate and the -Animate trials was greatly reduced with age. The 9 year-old and the 11 year-old children performed better than the younger groups not only with the -Animate, but also with the +Animate conditions. Their improved comprehension of *celui/celle* object relative clauses with a match in animacy thus contributed to diminishing the contrast between the +Animate and the -Animate trials.

4.3.4.1 Statistical analysis

The data from Experiment 6 were also analyzed using a mixed model with response accuracy as dependent variable, Object Animacy as a fixed predictor and Age as a covariate in the model. In order to have a more precise comparison with Experiment 5, I coded the fixed predictor with a sliding contrast specification. This means that the coefficient for fixed factors in final model indicate the difference between the mean of the dependent variable at each level of the factor (+Animate vs –Animate). The maximal random effect structure justified by the data included by-subject and by-item intercepts only.

I used the same procedure as in the statistical analysis of the data in Experiment 5 in order to select the final model. This revealed that the interaction between Object Animacy and Age was not significant ($\chi^2(1) = 0.68, p = .40$). As expected, a main effect of Object Animacy was observed ($\chi^2(1) = 4.70, p < .01$). We also found a significant effect of Age ($\chi^2(1) = 42.22, p < .001$). The fixed effect structure of the full final model is indicated in Table 4.7. The random effect structure is given in Table 4.8.

Fixed effect	Coefficient	SE	Wald Z	p
(Intercept)	-4.49	0.75	-5.94	<.001***
Object Animacy: –Animate - +Animate	0.99	0.39	2.48	<.01*
Age	0.06	0.009	7.14	<.001***

Table 4.7 Fixed effect estimates for mixed logit model of correct answers for object relative clauses headed by +Animate or –Animate *celui/celle*⁴⁰

Random effects	s ²	SD
Subject Intercept	6.36	2.52
Item Intercept	0.37	0.61

Table 4.8 Summary of random effects in the mixed logit model for object relative clauses headed by +Animate or –Animate *celui/celle*

A statistically significant difference emerged when comparing the mean of the dependent variable at the –Animate level to the mean of the dependent variable at the +Animate level of

⁴⁰ Final model : ResponseAccuracy ~ ObjectAnimacy + Age + (1| Subject) + (1|Item); N = 960, AIC = 858.37, BIC = 906.79, log-likelihood = -419.18.

the fixed factor, as indicated by the coefficient for Object Animacy ($\beta = 0.99$, $SE = 0.39$, $z = 2.48$, $p = < .01$). The positive value of this coefficient also shows that response accuracy improved with –Animate trials, so whenever the relative clause head *celui/celle* referred back to an inanimate antecedent thus creating an animacy mismatch between the moved A'-object and the intervening subject. The effect of Age on the comprehension of object relatives headed by *celui/celle* was also significant ($\beta = 0.06$, $SE = 0.009$, $z = 7.14$, $p = < .001$): older children gave more correct responses than the younger children in the experimental task. The fact that the interaction between Object Animacy and Age was not significant indicates that the impact of the Object Animacy factor does not depend on Age. In other words, although comprehension improves with age, the difference between the +Animate and the –Animate trials is preserved within each of the 4 age groups tested.

In order to see how the results of Experiment 6 compare to those obtained in Experiment 5 for the comprehension of object relatives, I ran two additional models by analyzing the +Animate and the –Animate trials separately. More specifically, I first compared children’s comprehension scores for the +Animate conditions of Experiment 5 (so relative clauses headed by full lexical nouns like *la fille* and relative clauses headed by *celui/celle*) to children’s accuracy scores for the +Animate *celui/celle* trials of Experiment 6. The model included response accuracy for the +Animate trials as a dependent variable, Object Type (Full Noun vs Celui/Celle5 vs Celui/Celle6⁴¹) was introduced as a fixed factor using a sliding contrast specification and Age was included as a covariate. The maximal random effect structure justified by model comparison contained by-subject and by-item random intercepts only, as well as by-subject random Object Type slopes.

The fixed effects, summarized in Table 4.9, estimate the Grand Mean of the dependent variable (intercept) and (A) the differences between +Animate *celui/celle* trials of Experiment 6 and Experiment 5, as well as (B) the differences between +Animate *celui/celle* trials of Experiment 6 and the full DP or lexically-restricted trials of Experiment 5. The variance components of the model are given in Table 4.10 below.

Fixed effect	Coefficient	SE	Wald Z	p
(Intercept)	-4.18	0.54	-7.71	<.001***
Object Type: <i>Celui/celle6</i> - <i>Celui/Celle5</i>	1.60	0.41	3.87	<.001***
Object Type: <i>Full DP</i> - <i>Celui/celle6</i>	-1.06	0.41	2.59	<.01**

⁴¹ Celui/Celle5 designates the results obtained for *celui/celle* headed relative clauses in Experiment 5, whereas Celui/Celle6 designates the results obtained for *celui/celle* headed relative clauses in Experiment 5.

Age	0.04	0.005	8.63	<.001***
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Table 4.9 Fixed effect estimates for mixed logit model of correct answers for object relative clauses with an animacy match (Experiments 5 and 6)⁴²

Random effects	s ²	SD	Correlation with random effect for Intercept
Subject Intercept	0.16	0.40	
Object Type A ⁴³	5.85	2.41	0.03
Object Type B	4.72	2.17	0.00
Item Intercept	0.20	0.45	

Table 4.10 Summary of random effects in the mixed logit model for object relative clauses with an animacy match (Experiments 5 and 6)

Comparison A indicates that children’s comprehension of *celui/celle* relative clauses with a +Animate referent improved in Experiment 6 with respect to Experiment 5 ($\beta = 1.60$, $SE = 0.41$, $z = 3.87$, $p = < .001$). Comparison B reveals a significant difference between the accuracy scores for relative clauses headed by a +Animate full lexical noun (Experiment 5) and relative clauses headed by a +Animate *celui/celle* in Experiment 6: performance is lower with the +Animate full NP trials than with +Animate *celui/celle* ($\beta = -1.06$, $SE = 0.41$, $z = 2.59$, $p = < .01$). Recall, however, that the number of items differed across the two experiments. There were only two *celui/celle* trials and four full DP trials in Experiment 5, whereas there were six trials per condition in Experiment 6. The small number of trials for the animacy match conditions of Experiment may have masked participants’ abilities to comprehend such object relatives. Note also that the use of a demonstrative is associated with a highly salient referent in the discourse (see Gundel et al. 1993; Ariel 2001). The difference in performance between the two studies might have also been caused by the higher degree of saliency of the referents in the second experiment. Whereas the lead-in for Experiment 5 consisted of introducing all four characters at once (*Il y a ici deux filles et deux dames*. ‘Here are two girls and two ladies’), the lead-in for Experiment 6 made the discourse referents of

⁴² Final model : ResponseAccuracy ~ ObjectType + Age + (1+ObjectType|Subject) + (1|Item); N = 834, AIC = 923.35, BIC = 975.34, log-likelihood = -450.67.

⁴³ Object Type A and Object Type B refer to the comparisons between adjacent levels of the Object Type factor : Object Type A refers to the comparison between *Celui/Celle5* and *Celui/Celle6* ; Object Type B refers to the comparison between *Full Noun* and *Celui/Celle6*.

celui/celle more salient by introducing only these two before the child heard the target sentence (i.e. *Voilà les deux grenouilles. Montre-moi celle que la princesse embrasse.* ‘Here are the two frogs. Show me that/the one which the princess is kissing.’). This, together with the larger number of children tested, might have contributed to the improved accuracy scores obtained in Experiment 6.

Age also had a significant effect, showing that performance improves with age, however the interaction between Object Type and Age did not bring significance to the model ($\chi^2(6) = 10.23, p = .11$). The important thing to keep in mind is that, although the overall results for +Animate *celui/celle* headed relative clauses were higher than those found for the +Animate relative clause trials of Experiment 5, they still follow the same response pattern as the latter in that they are more difficult to compute than their inanimate counterparts, to which I turn next.

The picture is slightly different when we compare children’s scores for the –Animate trials across the two experiments (Table 4.11). Table 4.12 shows the random effect structure of the final model. The fixed effect structure for the –Animate trials (table 4.11) also included two comparisons, one between (A) –Animate *celui/celle* trials of Experiment 6 and –Animate *ce* trials of Experiment 5, and one between (B) –Animate *celui/celle* trials of Experiment 6 and the –Animate lexically-restricted trials of Experiment 5.

Fixed effect	Coefficient	SE	Wald Z	p
(Intercept)	-2.47	0.58	-4.26	<.001***
Object Type: <i>Celui/celle6</i> vs <i>Ce</i>	-1.00	0.65	-1.53	<.05*
Object Type: <i>Full DP</i> vs <i>Celui/celle6</i>	-0.48	0.49	-1.57	=.11
Age	0.04	0.005	7.76	<.001***

Table 4.11 Fixed effect estimates for mixed logit model of correct answers for object relative clauses with an animacy mismatch (Experiments 5 and 6)⁴⁴

Random effects	s ²	SD	Correlation with random effect for Intercept
Subject Intercept	0.14	0.37	
Object Type <i>A</i> ⁴⁵	6.18	2.48	-1.00

⁴⁴ Final model : ResponseAccuracy ~ ObjectType + Age + (1+ObjectType|Subject) + (1|Item); N = 834, AIC = 794.77, BIC = 846.75, log-likelihood = -386.38.

Object Type <i>B</i>	5.01	2.24	0.95
Item Intercept	0.38	0.62	

Table 4.12 Summary of random effects in the mixed logit model for object relative clauses with an animacy mismatch (Experiments 5 and 6)

In the case of the –Animate trials, we notice a significant difference between –Animate *celui/celle* headed relative clauses and *ce* relative clauses. Children’s comprehension scores were lower in the former case, as illustrated by the negative coefficient ($\beta = -1.00$, $SE = 0.65$, $z = -1.53$, $p = < .05$). Performance was also lower with the –Animate full NP trials of Experiment 5 as compared to the –Animate *celui/celle* relative clauses of Experiment 6, but these two conditions did not reach a significant difference. These results suggest that the comprehension of –Animate lexically-restricted and *celui/celle* relative clauses is on a par, and that children have the least difficulties with *ce* object relatives. Such an outcome is entirely expected under the view that *celui/celle* instantiate a D+NP structure and should therefore be harder for children to compute given the overlap in +NP features between the relative clause head and the embedded subject. *Ce*, on the other hand, can be analyzed as a bare D which does away with the potential intervention effects triggered by the presence of a +NP subject. I will come back to this in the general discussion part. Once again we find a significant effect of Age, but not a significant interaction between Object Type and Age ($\chi^2(6) = 4.88$, $p = .56$).

4.3.5 Interim discussion

The aim of Experiment 6 was to examine in more detail the way in which the animacy feature modulates the comprehension of object relatives in French. Specifically, the study investigated whether children are sensitive to this feature even when it is not overtly expressed on the relative clause head. Whereas animacy is straightforwardly expressed in the nominal element in examples like *la fille* ‘the girl’ or *le ballon* ‘the ball’ or in the form of bare wh-pronouns such as *qui* ‘who’ and *que* ‘what’, there is no such apparent distinction in the form of *celui/celle* demonstrative pronouns, which can be used to refer to both animate and inanimate antecedents in the discourse. The present study made use of this property of

⁴⁵ Object Type *A* and Object Type *B* refer to the comparisons between *Celui/Celle6* (*celui/celle* from Exp. 6 with inanimate referents) and *Ce* (Exp. 5); Object Type *A* refers to the comparison between *Full Noun* (Exp. 5) and *Celui/Celle6* (Exp. 6).

French to test children's comprehension of object relatives headed by *celui* and *celle* and whose referents were either animate or inanimate. Although these elements also encode morphosyntactic features like gender and number (i.e. *celui* is masculine singular and *celle* is feminine singular), children could not have drawn on these features for interpretation as the embedded subjects always matched in gender and number features with the antecedents of the two referential elements *celui* and *celle*. As such, the animacy of the antecedent represented the most reliable disambiguating cue that children could exploit in order to arrive at the correct interpretation for the object relative clause.

The findings confirm that participants successfully use animacy in the comprehension of object relatives headed by *celui/celle*. They showed better performance with trials in which the referent of *celui/celle* was –Animate. The mismatch in animacy between the relative clause head and the embedded subject had a facilitating role on children's processing of object relatives. On the other hand, results revealed that the comprehension of *celui/celle* object relative clauses with a +Animate referent lags behind, reinforcing the idea that the presence of a moved A'-object and an intervening subject sharing similar morphosyntactic features hinders children's performance with object relative clauses. As evidenced by the graph in figure 4.10, the effect of animacy was salient across all the four age groups included in the experiment. The contrast between the animate and inanimate conditions surfaced to a greater degree in the 5 year-olds, the youngest group, who seemed to have more difficulties with the comprehension of +Animate trials. Older children perform better with +Animate trials, but the difference between these and the –Animate trials is still present, showing that a mismatch in animacy facilitates relative clause processing even at an older age when children's responses are more adult like. The fact that –Animate object relatives were comprehended better than +Animate object relatives brings support to the idea that children are sensitive to the animacy feature and use it to map between the arguments of the verb and the syntactic structure deployed by object relative clauses. The first prediction is thus borne out.

As for the second prediction of the study – that children should perform on a par with both +Animate and –Animate trials if they have difficulties in accessing the antecedent of *celui/celle* – we see that it does not hold. This prediction was linked to children's poorer performance with +Animate *celui/celle* object relatives observed in Experiment 5 and which could be accounted for by postulating that children find it harder to access the discourse referent of demonstrative pronouns like *celui* and *celle*, as compared to cases in which a full

NP is used instead of a demonstrative. If this were indeed the case, then we would expect children to struggle with the comprehension of *celui/celle* relatives irrespective of the nature of their antecedents. The referent is introduced in the immediately preceding discourse and has the same degree of recency and familiarity in both +Animate and –Animate conditions. However, children’s comprehension of *celui/celle* relative clauses is facilitated by a mismatch on animacy, suggesting that comprehension is enhanced when the moved object and the subject inside the relative clause differ in at least one relevant feature.

4.4 General discussion

The two studies presented in this chapter sought to refine our understanding of RM effects in child grammar through an analysis of the role that certain crucial morphosyntactic features play in triggering intervention in A’-dependencies. This was empirically pursued by investigating the comprehension of object wh-questions and relative clauses in French-speaking children between 5 and 11 years old. Experiment 5 tested both wh-questions and relative clauses and focused on the moved object by manipulating two sets of features ([±NP]; [±Animate]), while the intervener (the embedded subject) was invariably +NP +Animate. For wh-questions, I compared the processing of questions introduced by lexically restricted wh-phrases like *quelle fille* ‘which girl’ and *quel ballon* ‘which ball’ to bare or –NP wh-words like *qui* ‘who’ and *que* ‘what’. In the case of relatives, I analyzed relative clauses headed by a full lexical noun (e.g. *la fille* ‘the girl’ and *le ballon* ‘the ball’) in comparison with relative clauses headed by *celui/celle* (roughly translated as ‘the one’) as the –NP counterpart of animate NPs like *la fille* and with relative clauses headed by *ce* (‘that’) as the –NP counterpart of inanimate nouns like *le ballon*. Experiment 6 also manipulated the [±Animate] feature on the moved object, but looked exclusively at the comprehension of object relatives headed by the demonstrative pronouns *celui* and *celle*. The particularity of these elements is that they can be used to refer to both animate and inanimate nouns without overtly encoding this difference in animacy features in their form. Both animate and inanimate antecedents were used for the demonstrative pronouns in Experiment 6.

The findings of the two studies lend support to the featural intervention hypothesis (Friedmann et al. 2009) which claims that processing of object A’-dependencies should be adult-like when the features on the intervening subject and the target (i.e. the antecedent of the gap) are in a *disjunction* relation. This is confirmed by the results of Experiment 5

(figures 4.2 and 4.3) showing that already at the age of 5 children give highly accurate responses for –NP wh-questions like *Qui est-ce que la mère embrasse?* (‘Who is the mother kissing?’) and *Qu’est-ce que la fille tape?* (‘What is the girl hitting?’), as well as for –NP relatives headed by *ce* ‘that’, such as *Montre-moi ce que la fille tape* ‘Show me what the girl is hitting’. Note that the featural disjunction between the intervening subject and the A’-object is created by the absence of a +NP feature on the moved elements. As indicated in section 4.2.5, the moved constituents (*qui*, *que* and *ce*) only have a +Q or a +R specification, whereas the subjects contain a lexical NP restriction.

The featural intervention hypothesis postulates as well that computing object A’-dependencies becomes problematic for children when an inclusion relation holds between the sets of features present on the embedded subject and the target or the moved A’-object. Children’s comprehension scores for +NP wh-questions like ‘*Quelle fille est-ce que la mère embrasse?* (‘Which girl is the mother kissing?’) and *Quelle balle est-ce que la fille tape?* (‘Which ball is the girl hitting?’) showed a pronounced asymmetry with respect to the scores for –NP questions. This holds across the four age groups tested and reveals that the presence of a +NP feature on both the target and the embedded subject triggers intervention effects in wh-questions. The same asymmetry appears when comparing relative clauses headed by a full lexical noun, as in *Montre-moi la fille que la mère embrasse* (‘Show me the girl that the mother is kissing’) and *Montre-moi la balle que la fille tape* (‘Show me the ball that the girl is hitting’), with relative clauses headed by *ce*, exemplified in the above paragraph.

Children’s processing of object relatives introduced by *celui/celle* like *Montre-moi celle que la mère embrasse* (‘Show me the one that the mother is kissing’) also point to the existence of intervention effects. Although in Experiment 5 these relative clauses were initially classified as –NP on a par with *ce* relatives, due to the fact that these elements do not contain an overt lexically-restricted noun, their structure is more complex. When analyzing *celui/celle* and *ce* in more detail, we see that they differ in several respects: (i) they are anaphoric expressions due to the pronominal part *lui/elle* which assigns an anaphoric interpretation to the whole constituent, (ii) they permit an animate interpretation, and (iii) they have a different internal structure (while *ce* may be analyzed as a bare D, *ce-lui / c-elle* clearly have a more complex structure with the determiner *ce* plus a pronominal form (*lui-elle*) which may plausibly be analyzed as a pro-NP form. This is only a first approximation. If we take into account a richer cartography of the DP, *lui-elle* may well pronominalize a higher functional layer of the DP, possibly parallel to the layer pronominalized by English *one* in

DPs like *the one which...*. The crucial point is that the *celui-celle* structure involves an overt complement of D, much as the DP structure of *la fille*, etc. This is the formal parallelism that the discussion capitalizes on. Children's difficulties with assigning the correct interpretation to *celui/celle* relatives can therefore be attributed to the structural shape of the head noun which, in the case of *celui/celle* relative clauses, takes the complex form D+NP, thus creating an inclusion relation with the +NP feature present on the intervening subject. As a result, we find a pronounced difference in processing, especially at a younger age, since children struggle more with the comprehension of *celui/celle* headed object relatives as compared to relatives introduced by *ce*.

Critically, the findings of Experiment 6 reinforce the idea that object relatives headed by *celui/celle* with an animate referent trigger intervention effects in comprehension. Children's response accuracy scores for *celui/celle* relative clauses with an animacy match were significantly lower than their scores for *celui/celle* relative clauses containing a mismatch in animacy. When comparing the results of the two experiments, a significant difference emerges between *celui/celle* relative clauses with an inanimate referent and relative clauses headed by *ce*, also referring to an inanimate antecedent. The same gradient in comprehension appears in Experiment 5 for both relative clauses and wh-questions containing a lexically-restricted A'-object and those lacking such an element. This suggests that children's processing of *celui/celle* relative clauses patterns with that of relative clauses headed by a noun from the contentive lexicon.

Note also that in Experiment 6, both animate and inanimate trials made use of the same referring expressions (*celui* or *celle*) and in both cases there was a similar degree of accessibility of their discourse referents. Nonetheless, we still observed a difference in performance between the two conditions, which should not be the case if children had equal difficulties accessing the referent of *celui/celle*. When comparing the results of the two studies, we found higher accuracy scores in Experiment 6 for *celui/celle* relative clauses with an animate referent than in Experiment 5 for relative clauses headed by a full DP. In addition, no difference in comprehension appeared between relative clauses headed by *celui/celle* (Experiment 6) and relative clauses headed by a full DP (Experiment 5) when the object was inanimate. Again, this is not what we would expect based on the assumption that the processing of demonstratives should be more costly than that of a full DP as the latter allows direct access to its discourse referent, whereas the former requires indirect access (an additional retrieval step in which the demonstrative is linked to its antecedent).

Let us now turn to the role that the mismatch in animacy plays on the comprehension of A'-dependencies. Although an animacy effect was present in both Experiment 5 and 6, it had a selective impact on the structures and the age groups tested in Experiment 5. Specifically, an animacy mismatch between the moved object and the intervening subject yielded higher accuracy scores in the case of wh-questions with a lexically-restricted +NP element in all age groups, except for the 5-year-old children. On the other hand, the animacy of the object did not affect performance on bare -NP wh-questions in any of the four age groups. As for the object relatives tested in Experiment 5, the animacy mismatch improved comprehension of relative clauses headed by a full DP in the 7 and 9 year-old children, but not in the 5 and the 11-year-olds. Contrary to wh-questions, the results for *celui/celle* and *ce* headed relatives (both classified initially as -NP) revealed a very sharp difference in performance across all age groups. Two factors seem to have contributed to this pronounced asymmetry in comprehension: on the one hand, the animacy of their referents, as *celui/celle* was used for animate entities and *ce* was used for inanimate antecedents; on the other, the difference in their structural form (D+NP for *celui/celle* and D for *ce*). Experiment 6 was intended to tease apart these two factors by looking at the comprehension of *celui/celle* object relative clauses with and without a mismatch in animacy. The findings of Experiment 6 illustrate that an effect of animacy was present on the comprehension of *celui/celle* relative clauses. When retrieving the antecedent of the demonstrative, one also needs to encode the animacy feature associated with its discourse referent. Although this feature is not morphologically expressed on *celui/celle*, children can encode it and use it in processing the reference of the object relative clause head. In addition, they are able to draw on the mismatch in animacy between the moved A'-object and the intervening subject to assign the correct interpretation to the object relative.

The mismatch in animacy creates an intersection relation (Belletti et al., 2012) in cases where the moved A'-object contains a +NP specification, so lexically-restricted wh-questions and relative clauses, as well as *celui/celle* relative clauses. These findings have implications for the characterization of the features that can impact the computation of intervention. In discussing the different effect of the gender feature in Hebrew and Italian, Belletti et al. (2012) put forth the idea that features not functioning as attractors “in the inflectional head of the clause are disregarded in the computation of the set theoretic relation relevant for Relativized Minimality.” (2012: 1064). In other words, only the features that are overtly manifested on the verbal inflection have the potential to modulate comprehension.

According to Belletti et al. (2012), a feature can facilitate A'-processing if it acts as a trigger for movement, as in the case of the gender feature expressed in the verbal morphology in Hebrew and which triggers movement of the subject. Animacy effects of the kind emerging from the current data suggest that features morphologically unrealized on the clausal inflectional head can nevertheless be taken into consideration in the calculation of intervention effects. If we assume featural RM to be the formal intervention principle, then such effects are entirely expected under the core theory of RM (Rizzi 1990, 2004), primarily designed to capture violations of weak islands in adult grammars. Under the standard assumptions of RM, intervention effects are induced by attracting features that belong to the same featural class (i.e. Argumental, Quantificational, Modifier, Topic). The fundamental case is the deviant extraction from a wh-island, in which the feature involved is Q, or other A'-features, features typically not expressed in the verbal morphology. Clearly, the crucial property which makes a feature visible for the computation of RM is its capacity to trigger movement, not the fact that it is morphologically expressed on V and such features are not typically expressed in the verbal morphology. The morphological expression of a feature on the inflectional head might be a sufficient criterion for this feature to be taken into account by RM, as in the discussion of the gender feature in Hebrew in Belletti et al. 2012, but it clearly is not a necessary one.

However, can one maintain that the only features taken into account in the calculation of locality are those that have an active role in triggering movement? Bianchi (2006) argues, based on the so-called Person-Case constraint in Romance languages (which determines ordering restrictions in clitic sequences), that even non-animacy based languages⁴⁶ like Italian encode an animacy hierarchy in a system of Person heads against which all pronominal

⁴⁶ Research in comparative linguistics has shown on independent grounds that variations in animacy are associated with variations in syntax, such as differential case-marking and voice selection in certain languages (Aissen, 2003, Comrie, 1989), restrictions on pronoun coordination (Cardinaletti & Starke 1999), restrictions on clitic sequences (Bianchi 2006). Additional evidence for the hypothesis that animacy of the NP is a grammatical feature that plays a role in triggering movement comes from languages in which animacy impacts subject-verb agreement. For example, Arosio et al. (2010 : footnote 1) cite examples from Georgian (Harris 1981:149) in which number agreement between the verb and the subject only holds when the subject is animate (i), but not when it is an inanimate (ii).

- (i) Knutebi goraven
Kittens roll-3PLUR
'The kittens are rolling'
- (ii) Burtebi goravs
Balls roll-3SING
'The balls are rolling'

arguments must license their person feature. Therefore it is plausible to assume that animacy (or perhaps, animate person) plays a crucial role in triggering movement also in our languages, and perhaps universally, even though its effects are easier to detect in some languages than in others. If this is so, the relevance of animacy for the calculation of RM would be expected.

A less selective perspective to the identification of features favoring the resolution of A'-dependencies is adopted by the so-called "similarity-based" approach to interference (Gordon et al. 2004, Lewis et al. 2006, Van Dyke & McElree 2006, 2011), according to which any featural dissimilarity between the target and the intervener is of help (i.e. dissimilarity not just in morphosyntactically relevant features, but also in purely semantic, or purely phonological features; see Belletti et al. (2012) for discussion). In that approach, animacy impacts performance because it acts as a semantic cue and therefore facilitates theta-role assignment, quite irrespective of the structural realization and role of the feature.

The present results may bear on the controversy between structurally selective and unselective approaches here. If the child paid attention to such cues merely to overcome a memory problem for the proper assignment of theta roles, as in the unselective approaches, we would expect similar performance regardless of the structural realization of the animacy cue: the mere semantic mismatch in animacy would suffice to accurately parse the structure and arrive at the correct assignment of theta roles. Although this analysis may be intuitively appealing, it cannot account for all of the results obtained. All featural differences do not seem to be on a par as global interpretive properties of the two nominal expressions involved.

Crucially, a mismatch in animacy did not significantly improve comprehension at any age in –NP questions with *qui* (*who*) and *que* (*what*) (see Experiment 5). From the viewpoint of an unselective approach, this is unexpected, since *qui* and *que* semantically contrast in animacy as much as *quelle fille* (*which girl*) and *quelle balle* (*which ball*) do. Therefore, the contrastive feature would be expected to yield a similar result in facilitating comprehension, contrary to fact.

On the other hand, if one pays attention to the locus where the animacy feature is formally expressed, a clear difference emerges. Animacy is directly expressed by the wh-determiner in *qui* / *que*, while it is expressed by the lexical restriction in *quelle fille* / *quelle balle*, much as in the intervening subject (*la fille*) in examples (19) through (22) below. This suggests that the system compares strictly parallel features as far as their structural encoding is concerned. One possible implementation would involve a featural hierarchy of the

following kind, which is referred to when featural structures are compared:

- (18) +Q
 |
 +NP
 |
 +Animate

So, when *quelle balle* and *la fille* are compared in the following,

- +Q+NP–An +NP+An
 (19) *Quelle balle est-ce que la fille frappe?*
 ‘Which ball is the girl hitting?’

they differ in the [+Q] feature of *quelle balle*, but they are both classified as [+NP]. At this point the comparison goes on through the hierarchy in (18) and the –Animate feature in *quelle balle* is compared with the +Animate feature in *la fille* (+An); this yields an intersection situation (*quelle balle* is [+Q +NP –Animate], while *la fille* is [+NP +Animate]). As expected under Belletti et al.’s interpretation of the different set theoretic relations between the featural specifications of the target and the intervener (summarized in the introduction), the child understands better the intersection relation in (19) than the inclusion relation of the following:

- +Q+NP+An +NP+An
 (20) *Quelle dame est-ce que la fille embrasse?*
 ‘Which lady is the girl kissing?’

Let us now consider the cases of a bare wh-element, exemplified in (21) and (22):

- +Q–NP+An +NP+An
 (21) *Qui est-ce que la fille embrasse?*
 ‘Who is the girl kissing?’

- +Q–NP–An +NP+An
 (22) *Qu’ est-ce que la fille frappe?*
 ‘What is the girl hitting?’

Assuming the hierarchy in (18) as a guideline for the comparison, here the wh-word is [+Q – NP], while the intervening subject is [+NP]. The +/- animacy feature is not uniformly expressed in the target and the intervener and, as such, it is not taken into account under the assumption that only features structurally encoded in a parallel fashion are compared. Consequently, we end up with a disjunction configuration ([+Q –NP] vs. [+NP]) in both (21) and (22), the easiest configuration to deal with, which is in fact quite well understood by children in all age groups regardless of the animacy specification. The selective effect of animacy supports a selective approach to the identification of the features relevant for locality, one in which it is precisely the structural role and the locus of encoding of a feature that matters and not just its semantic import.

The results obtained in Experiment 6 for the comprehension of *celui/celle* object relatives further underline this conclusion. These elements have been analyzed as D+NP elements and, as such, the animacy feature is associated with an overt +NP complement of D in the target and in the intervener. We can now draw a parallel between *celui/celle* relative clauses and, for example, the questions illustrated in (19) and (20).

- | | | | |
|--|----------|--------|--|
| | +R+NP+An | +NP+An | |
|--|----------|--------|--|
- (23) Voilà deux grenouilles. Montre-moi celle que la princesse arrose.
‘Here are two frogs. Show me the one that the princess is splashing.’

- | | | | |
|--|----------|--------|--|
| | +R+NP–An | +NP+An | |
|--|----------|--------|--|
- (24) Voilà deux tuyaux. Montre-moi celui que le garçon arrose.
‘Here are two hoses. Show me the one that the boy is splashing.’

The comparison of featural sets in (23) and (24) brings us back to the to the proposed featural hierarchy in (18). For ease of representation, I only show the +NP feature without the D component. Both the target and the intervener bear a +NP specification. In order to distinguish between the two, other features in the hierarchy must be taken into account, in this case [\pm Animate]. When comparing the two elements in terms of the animacy feature, different relations hold between the sets of features in (23) and (24). An inclusion configuration holds for (23) as both the target (*celle*) and the intervener (*la princesse*) are classified as +Animate, while (24) instantiates an intersection situation due to the presence of a –Animate feature on the target and a +Animate feature on the intervener. data show that children comprehend object relative clauses headed by –Animate *celui/celle* better than object relative clauses headed by +Animate *celui/celle*. This is in line with the idea put forth

in Belletti et al.'s (2012) according to which intersection relation in (24) is easier for children to compute than the inclusion relation in (23).

A further point I would like to address is the difference in performance with respect to animacy between the 5 year-old groups included in the two studies. Whereas the 5y.o. group that took part in Experiment 6 showed sensitivity to the mismatch in animacy and successfully used it in the interpretation of object relatives, the 5 year-olds from Experiment 5 were not able to draw on the difference in the animacy feature and performed similarly on the +Animate and –Animate trials for both wh-questions and relative clauses. Several explanations come to mind when trying to account for this asymmetry in comprehension. That the difference in performance is not a simple artifact of this experiment is also shown by the results of Adani (2012) who reports that 5-year-old German children find object relative clauses with an inanimate head to be as difficult as object relative clauses with two animate nouns. One possible reason for children's different behavior in the two studies could be that the animacy feature is made more salient in the interpretation of relative clauses headed by *celui/celle*. Specifically, in interpreting *celui/celle* relative clauses, children first need to access and retrieve the discourse referent of the demonstrative. Already at this stage they need to encode the + or – Animate specification of the antecedent. This additional step might increase awareness to the animacy feature in the context of *celui/celle* relatives and yield better comprehension scores in cases of an animacy mismatch. Another possible explanation could be related to children's working memory (WM) abilities. An assessment of children's WM could reveal that children with higher WM scores find it easier to select and compute the different morphosyntactic features associated with the relative clause head and the intervener. Children with lower WM abilities would have more problems computing features that are deeply embedded in a hierarchy like the one illustrated in (18) above. We may speculate that children with limited processing resources will struggle to activate, select, maintain, and manipulate the full array of morphosyntactic features required to distinguish the intervening subject from the moved object (Garraffa & Grillo 2008, Grillo 2008). If children are not able to compute the [\pm Animate] feature, the representation is one of inclusion, a difficult one to process for the young child. A (non-exclusive) alternative is that it may simply be the case that the intersection configuration may be a difficult configuration to compute, possibly not accessible to the youngest children and those with lower WM (see Belletti et al. 2012 for discussion).

4.5 Conclusions

The present studies were concerned with the features that impact the processing of object A'-dependencies, as well as the conditions under which they do so. The results on object questions and on object relatives headed by *ce* clearly point to the critical role of the lexical restriction (the +NP feature) in modulating comprehension. This is expected under the RM approach: when the A'-moved element is not lexically restricted, the A'-dependency is more easily computed by the child across a +NP subject, a disjunction configuration in the adopted system. The experimental findings also show that minimality effects still appear in object relative clauses headed by *celui/celle*, which instantiate the effects of lexical restriction despite the absence of a noun from the contentive lexicon. This suggests that the notion of lexical NP feature needs to be further refined, as it seems to be too coarse to capture the difficulties that French-speaking children have with these constructions. Therefore, intervention should be defined so as to accommodate the formal presence of a D+NP structure (or a more complex structure) and not just the presence of a noun from the contentive lexicon heading a lexical restriction.

The general pattern obtained across age groups and across A'-dependencies shows that children perform best with configurations containing a disjunction in the NP feature on the target and the intervener. The most problematic configurations for children are those in which the features on the intervener (NP, Animacy) are included in the set of features present on the target. When an inanimate, lexically restricted object is moved across an animate subject, the resulting intersection configuration improves comprehension. In this perspective, disjunction, intersection, inclusion and identity can be looked at as involving different degrees of distinctness between target and intervener (maximal with disjunction, minimal with identity, and with intersection and inclusion expressing two different intermediate degrees). It is thus natural to expect that the highest degree of distinctness, disjunction, will be properly computed earlier than the immediately lower degree, intersection, which will be in turn properly computed earlier than the next degree, inclusion (whereas identity remains strictly excluded in both child and adult systems).

Moreover, the mismatch in Animacy does not significantly improve comprehension in bare questions with *who* and *what* in any age group. I interpret this as supporting the view that the animacy effect depends on the locus where the feature is expressed (whether it is

associated or not with a +NP feature), in line with the expectations of a restrictive, structure-sensitive approach to intervention in early systems.

“Mad Hatter: *Have you guessed the riddle yet?*
the Hatter said, turning to Alice again.
No, I give it up, Alice replied. *What’s the answer?*
I haven’t the slightest idea, said the Hatter.”
(Lewis Carol, *Alice in Wonderland*)

5. THE ROLE OF REFERENTIAL PROPERTIES ON THE COMPREHENSION OF A-BAR DEPENDENCIES IN FRENCH

The previous chapters focused on uncovering the impact that various morphosyntactic cues have on modulating intervention/locality effects in children’s comprehension of relative clauses and wh-questions. In doing so, I focused on the featural intervention account which identifies the source of children’s difficulties with intervention effects determined by moving an A’-object containing a lexical NP restriction across a subject sharing the same feature (Friedmann et al. 2009, Belletti et al. 2012). The assumption is that children’s selective difficulties with object dependencies arise from the morphosyntactic featural specification of the moved element and the intervener and that it is only a mismatch in syntactically active features triggering movement that can modulate intervention effects in A’-dependencies. This approach, however, has been challenged by accounts claiming that object dependencies are more problematic because they are associated with an increased processing load determined by properties that are not necessarily specifically linguistic, such as the mechanism of set-restriction. Chapter 5 taps into this debate by investigating the effect that properties like set-restriction of the moved element or of the intervener, have on the comprehension of object dependencies. The two studies presented in this chapter aimed to assess whether structural similarity as a source of difficulty is overridden by properties like specificity or set-restriction.

If we take, for example, the case of object wh-questions with a more or less specific wh-element (*which lady* vs *which person*), we see that, from a syntactic point of view, they

both require an NP as an answer. The questions introduced by these two wh-elements will also have similar logical forms, something like:

- (1) Which lady did the girl hug?
For which x, x is a lady, the girl hugged x.

- (2) Which person did the girl hug?
For which x, x is human, the girl hugged x.

Wh-phrases of the type in (1) and (2) have been termed as D(iscourse)-linked (Pesetsky 1987, 2000) since answering such questions implies a choice from “a set of individuals previously introduced into the discourse” or “from a set that is presumed to be salient to both speaker and hearer” (Pesetsky 2000:16). Although both wh-words create a set of potential referents, *which person*, by being less specific, does not limit this set as much as *which lady*, a more specific expression. From this point of view, *which person* is closer in meaning to a bare wh-phrase like *who*, although the latter does not presuppose the availability of a given set of referents in the discourse context. With this in mind, Experiments 7 and 8 looked at the comprehension of wh-questions and relative clauses in which either the A'-object or the intervener were less specific nouns like *person* and *animal*.

This chapter is structured as follows. In the remainder of the introduction, I will review a different account that explains children's patterns of comprehension with object dependencies by appealing to the notion of set-restriction. I will then present the two experimental studies, which tap into this debate by investigating French-speaking children's comprehension of object wh-questions and object relative clauses in which the lexical descriptive content of either the object or of the intervener were manipulated. Finally, I will discuss the findings in light of the predictions put forth by the two approaches.

5.1. A non-syntactic view of the comprehension of A'-dependencies

Goodluck (2010) raised the question of whether a solely syntactic view, taking the mere presence of an NP restriction as crucial for triggering intervention effects, is sufficient to capture children's difficulties with A'-dependencies. She questioned the featural intervention account in light of preliminary evidence provided by Goodluck (2005). In an experiment with 14 English-speaking children (mean age 4;8), Goodluck (2005) assessed their performance

with *who* and *which* questions, including *which* elements with different levels of descriptive content, i.e. a constituent with more specific referential features (*which dog*) versus a more generic one (*which animal*). Whereas an approach appealing to intervention effects of a Relativized Minimality (RM) type predicts that the two types of *which* phrases should be equally difficult since they both contain a [+NP] feature, the children in Goodluck's study find questions of the type *Which animal did the tiger push?* as easy as questions introduced by *who* (*Who did the tiger push?*), but they have more difficulties with questions like *Which dog did the tiger push?* In addition, a follow-up study (Goodluck 2010) revealed that even in the case of subject questions, where no intervention effects arise, more specific wh-elements (*which dog*) yielded poorer performance than less specific ones (*which animal*).

Goodluck (2010) argued that these effects couldn't be captured in terms of RM. Instead, she suggests that children's difficulties with object *which*-questions are determined both by the length of syntactic movement (*which dog/which animal* are extracted from the more distant position of object of the verb *push*) and by the more costly operation of set-restriction. That is, in order to correctly interpret *which dog*, children have to restrict the set of potential referents only to *dogs* and then understand *which dog* is being referred to. This operation of set-restriction is less costly in the case of the more generic constituent *which animal*, potentially because these elements do not require choosing a specific subset from a contextually determined set of entities. Taking this reasoning further, Goodluck & Zweig (2013) suggest that children's difficulties with object *which*-questions result from the pressure exerted by certain computations on their limited processing abilities and this pressure is not necessarily grounded in structural sources, but may rather be brought about by mental computations such as the operation of set-restriction that distinguishes between questions introduced by *which dog* and those introduced by *which animal* (see Goodluck and Zweig 2013).

That set-restriction is a costly operation even for adults, has been revealed by a self-paced reading study in Dutch by Donkers, Hoeks & Stowe (2013). Donkers et al. found that object questions introduced by *who* and *which person* displayed faster reading times than *which N* questions (where N represents a noun that has a more specific reference than *person*). They take this as evidence for a higher processing cost associated with *which N* questions, as their interpretation requires access to a more restrictive set than *who* or the generic *which person*. Goodluck & Zweig (2013) interpret this result as reflecting the distinction between a set-restriction operation applicable to *which N* questions and a syntactic mechanism differentiating between *who* and *which person/which N*. Note, however, that the

reason why set-restriction is such a complex operation, and one which yields worse results in the event of object-chains than subject chains, is not clearly detailed in the literature.

Somewhat contradictory evidence for the approach outlined above comes from Gordon, Hendrick & Johnson (2004) who examined reading times for subject (3) and object (4) relative clauses in English-speaking adults.

(3) *The salesman/the person* that contacted *the person/the accountant* spoke very quickly.

(4) *The salesman/the person* that *the person/the accountant* contacted spoke very quickly.

In their study, the presence of a noun like *the person*, which conveys weaker descriptive information, did not significantly reduce the processing difficulty of object relatives with respect to subject relatives. Nonetheless, it is interesting to note that the three types of object relative clauses they tested yielded different reading times. Gordon et al. (2004) found that the reading times at both critical regions (the embedded verb *contacted* and the main verb *spoke*) were faster for object relatives headed by the more generic noun *the person* as compared to object relatives headed by a more specific expression, irrespective of the type of embedded subject (*the accountant/the person*). The online results were corroborated by participants' scores on the comprehension questions, which also revealed higher accuracy for object relative clauses headed by *the person*. From this perspective, Gordon et al.'s results can be put on a par with those in Donkers et al (2013), thus showing that the absence of an operation of set-restriction facilitates at least the encoding of the A'-filler in filler-gap dependencies in adults.

Taken together, these observations point to the necessity of investigating the link between the set-restriction properties of the two NPs and intervention in child grammar. In this chapter I will look at the comprehension of object A'-dependencies in French-speaking children and address the debate between structural and non-structural accounts by studying (i) the effect of the set-restriction properties of the A'-object, as well as (ii) the impact of a less specific intervener, while holding constant the structural properties relevant for syntactic intervention.

5.2. Experiment 7: Comprehension of French wh-questions and relative clauses with a non-set-restricted object

The first experiment presented in this chapter (Experiment 7) focused on the properties of the moved object. The test items included object wh-questions and object relatives which varied according to the lexical descriptive features of the A'-filler: this was either a descriptively impoverished, more generic noun (like *person* or *animal*) or a descriptively rich, more specific noun (such as *lady* or *dog*). While there is evidence that the use of a less specific noun like *animal* affects comprehension of wh-questions in English (Goodluck 2005, 2010), it is yet to be determined what effect such nouns have on the comprehension of both wh-questions and relative clauses in French. For ease of reference, I will refer to the account put forth in Goodluck (2015) as the set-restriction account. Consequently, I will also label less specific nouns like *person/animal* as –Set-restricted, and more specific nouns like *lady/dog* as +Set-restricted.

5.2.1 Participants

A total of 134 typically developing French-speaking children (71 girls and 63 boys) aged 4;8 to 12;1 (mean age = 8;1; SD = 2.23) took part in the study. All the children were recruited from two schools in the Geneva area, Switzerland. The participants were distributed across 4 age groups. Table 5.1 indicates the specific details for each age group (total number of children, age range, mean age and standard deviation).

Age group	No. of participants	Age range	Mean Age (S.D.)
5 y.o.	30	4;8 – 5;11	5;2 (0.4)
7 y.o.	38	6;2 – 7;7	6;11 (0.3)
9 y.o.	32	8;7 – 10;0	9;2 (0.5)
11 y.o.	34	10;5 – 12;1	11;1 (0.4)

Table 5.1 Participant data per age group (total number, age range, mean age and standard deviation)

5.2.1. Design and Procedure

5.2.1.1. Materials

Children were tested on 16 items, half of which were wh-questions and half relative clauses, with Set-restriction (+Set-restricted/ –Set-restricted) as a between-subject variable. The nouns that designated the object filler in the +set-restricted condition were replaced with two nouns in the –Set-restricted condition (*personne* ‘person’ and *animal* ‘animal’). All nouns used were in the singular form and they were matched for gender (there were always two masculine or two feminine noun phrases). Since *personne* ‘person’ is feminine in French, this was paired with feminine subject nouns. *Animal* ‘animal’, which is masculine, was used with masculine subject noun phrases. This helped us neutralize the use of the gender mismatch as a cue for comprehension. The target sentences are given in Appendix D. (5) and (6) are examples of wh-questions and relative clauses used throughout the experiment: (5a) and (6a) represent the items for the +Set-restricted condition; (5b) and (6b) exemplify items in the –Set-restricted condition.

(5) a. Object +Set-restricted question

Quelle **dame** est-ce que la fille embrasse?
which.F.SG lady ESK the.F.SG girl kisses
‘Which lady is the girl kissing?’

b. Object –Set-restricted question

Quelle **personne** est-ce que la fille embrasse?
which.F.SG person ESK the.F.SG girl kisses
‘Which person is the girl kissing?’

(6) a. Object +Set-restricted relative

Montre-moi **l’ours** que le chien soulève.
show.me the.SG bear that the.M.SG dog lifts
‘Show me the bear that the dog is lifting.’

b. Object –Set-restricted relative

Montre-moi **l’animal** que le chien soulève.
show.me the.SG animal that the.M.SG dog lifts
‘Show me the animal that the dog is lifting.’

Set-restriction was a between-subjects factor, but the two groups of children were tested using the same pictures. The only difference consisted in the type of noun used to refer to the A'-object and which was +Set-restricted (i.e. the dog) for one group of participants and –Set-restricted (i.e. the animal) for the other group.

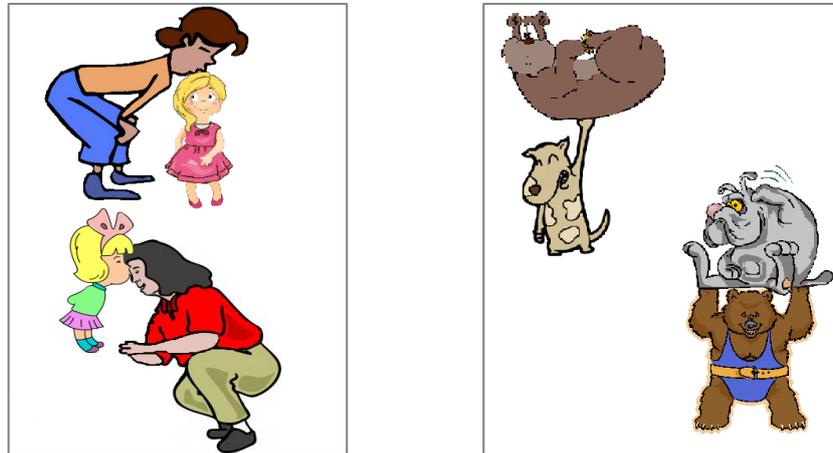


Figure 5.1 Pictures used in the character-selection task

The experiment also included 12 filler items to ensure that participants did not develop answer strategies and to control for their level of attention throughout the task. These were questions like “Where is the elephant with the headphones?” associated with pictures in which several characters were performing various actions. The fillers also prompted the child to point to a specific character which was identified through the use of a prepositional phrase modifier. Therefore, each child heard a total of 26 sentences, including the two practice items preceding the actual experimental phase.

5.2.1.2. Procedure

Children were tested individually in a separate room at their schools. They were equally divided into two groups: one that only saw trials with a match in set-restriction between subject and object, and one which only saw trials with a set-restriction mismatch. The experimental procedure was the same for both groups of participants. Each testing session lasted about fifteen to twenty minutes. At the beginning of each session, there was a warm-up phase during which the experimenter explained the task to the child and practiced precise pointing. This ensured that children were familiar with the characters presented in the experiment. The warm-up was followed by two practice sentences and then by the actual experimental trials. Like in the other experiments reported in this thesis, the comprehension

task used was modulated on Friedmann et al.'s (2009) design for Hebrew, with the difference that in the present task children were required to point to the correct character and not to the correct picture. The experimental material consisted of sets of pictures representing different pairs of human and animal characters and depicting reversible transitive actions (e.g. a lady kissing a girl and a girl kissing a lady). The presence of two entities of each kind (e.g. two ladies and two girls) made the use of relative clauses and of *which N* questions pragmatically felicitous. Each set of images was associated with only one target item, so children never saw the same picture twice. I randomized the order of presentation of the trials, as well as the direction of the actions and the position of the target character across conditions. Before every trial, the experimenter provided a lead-in to the child by describing the actions depicted in the pictures without using relative clauses: "Look! There are some people, two ladies and two girls! Here the lady is kissing the girl. And here the girl is kissing the lady." The child then heard an object wh-question or relative clause and had to point to the correct character. Children received positive feedback after each trial, irrespective of whether their response was correct or not. The experimenter recorded each answer on a response sheet.

5.2.2. *Predictions*

The featural intervention account and the set-restriction account along the lines of Goodluck (2010) make different predictions with respect to the structures under investigation in Experiment 7. More precisely, both approaches predict weaker performance for +Set-restricted questions and relatives (*Quelle dame est-ce que la fille embrasse?* 'Which lady is the girl kissing?'/ *Montre-moi la dame que la fille embrasse.* 'Show me the lady that the girl is kissing. '), but different factors determine the source of difficulties within each approach.

For the featural intervention account, based on Friedmann et al.'s (2009) development of the RM approach, the difficulty associated with these structures stems from the presence of intervention effects determined by the similarity between the object filler and the intervening subject in terms of their featural specification – that is, both elements contain a lexical NP restriction. In more recent work (Belletti et al 2012), this is refined to refer to the Phi feature set triggering movement, such as that expressed in the verbal morphology, i.e. here person and number. Crucially, the notion of similarity throughout this framework is defined in strictly morphosyntactic terms. Since the grammatical feature specification does not change when switching to *quelle personne* 'which person'/ *quel animal* 'which animal', as these elements still contain a lexical NP *person/animal*, the featural intervention approach

continues to predict poor performance with –Set-restricted questions due to the presence of an NP feature on both the object filler and the intervening subject.

On the other hand, the set-restriction account argues that the source of difficulties lies in the application of a set-restriction operation, which is costly for both children and adults. This approach postulates that +Set-restricted questions should show lower comprehension scores due to the impact of two factors: the length of movement of an element and the requirement to apply a set-restriction operation which involves choosing a subset from a contextually determined set of entities. Under this view, processing of –Set-restricted wh-elements such as *quelle personne* ‘which person’/ *quel animal* ‘which animal’ should be easier than processing of +Set-restricted *which N* phrases as the former refer to a set of potential referents which is less limited than the one presupposed by +Set-restricted *which N* elements.

This same reasoning applies to the equivalent relative clause structures.

5.2.3. *Results*

Figure 5.2 summarizes the results obtained for object wh-questions, while those for object relative clauses are given in Figure 5.3. In each case I plot the overall proportion of accurate responses in each experimental condition (i.e. the mean number of correct responses) and for all the age groups tested. An answer was coded as accurate whenever the child pointed to the correct character, that is, to the correct referent of the wh-element or of the relative head. In order to reply correctly, children had to be able to identify first the image that contained the same agent-patient mapping as the one expressed in the test sentence and then identify the correct character affected by the action in the corresponding image. The bars represent standard errors to the mean.

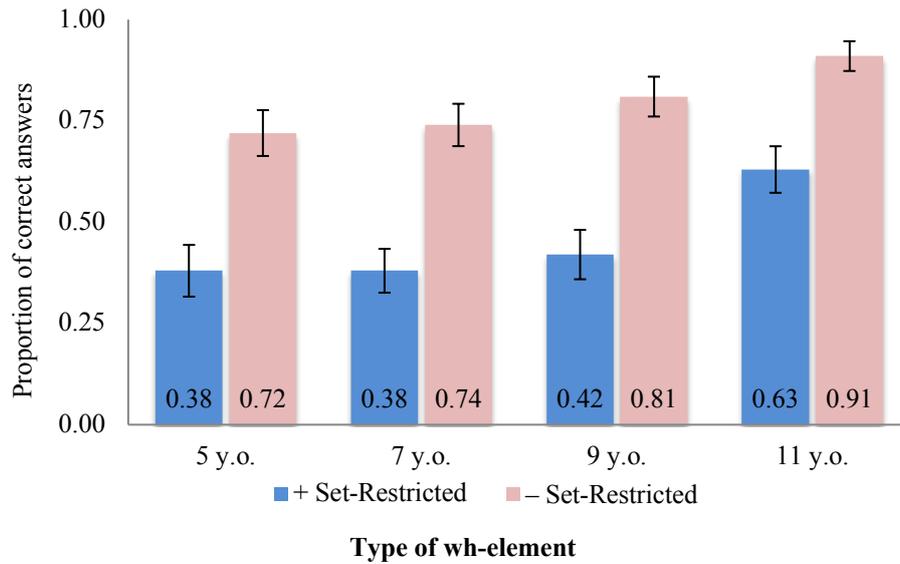


Figure 5.2 Overall proportion of correct answers for wh-questions with a +/- Set-restricted object in four age groups (5 y.o. to 11 y.o.)

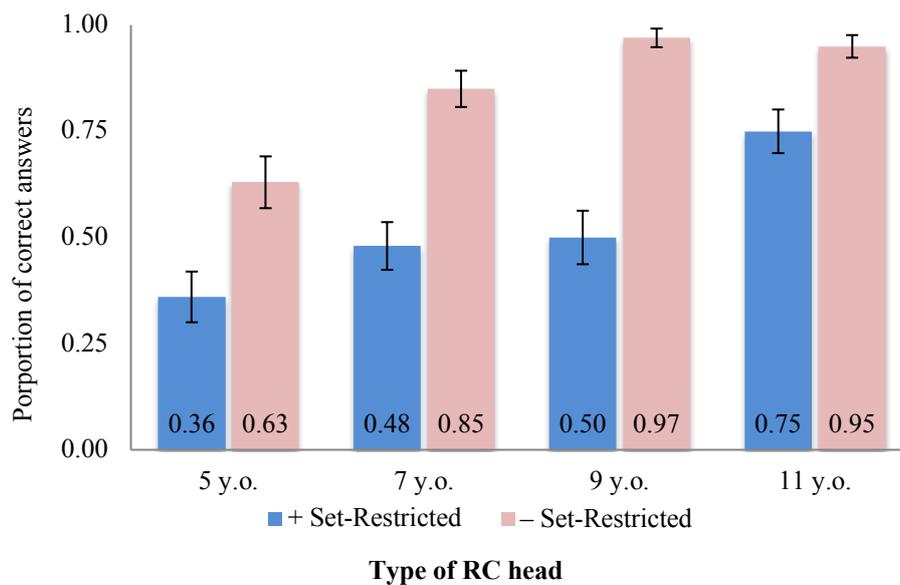


Figure 5.3 Overall proportion of correct answers for relatives with a +/- Set-restricted object in four age groups (5 y.o. to 11 y.o.)

The configurations that pose the most difficulties to children are those in which both the intervening subject and the A'-filler are +Set-restricted. Younger children's accuracy with these structures is at 36%, for relatives, and 38% for wh-questions. This difficulty persists beyond the age of 9, remaining clearly observable even in the 11-year-old children who are otherwise at ceiling for the other condition tested. Like in the previous experiments on the comprehension of filler-gap dependencies in French, I considered the chance level to be 25%.

The idea behind considering a chance level of 25% is not only that children had to point to one of four characters present in the visual display, but also that, whenever children cannot analyze the structure and they attempt to interpret the structure unsuccessfully, they will choose a character at random out of the four characters present in a picture. The scores obtained in Experiment 7 for the +Set-restricted conditions, when compared to a chance level of 25%, show that all the children performed above chance for both wh-questions and relative clauses. Although this is an indication that children comprehend such structures, children struggle more with the interpretation of these trials as compared to the –Set-restricted ones. Children’s accuracy scores sharply increase when the object is –Set-restricted. In this case, performance improves to 63% accuracy on relatives and 72% accuracy on wh-questions already at the age of 5 years old and goes up to 90% for the 11 year-olds.

The measure of the number of children who performed above chance for *which*-questions and headed relative clauses with a –Set-restricted moved object further indicates that these structures much easier for children to comprehend than those in which the moved object and the subject intervener were both +Set-restricted: 21 5-year-old children performed above chance on object wh-questions and relatives with a –Set-restricted object, as compared to only 8 for dependencies with a +Set-restricted moved object. This asymmetry in performance holds across the other age groups tested: 30 of the 7-year-olds, 31 out of a total of 32 9-year olds, and all of the 11-year-old children scored above chance level on the comprehension of –Set-restricted object dependencies, whereas only 10 7-year-olds, 10 9-year-olds, and 23 out of 34 11-year-olds did so for the +Set-restricted object dependencies.

5.2.3.1. Statistical analysis

In order to investigate differences between the two +Set-restricted and –Set-restricted groups, the data were analyzed using a logistic mixed effects model. Like in the previous experiments, I fit separated models to the results obtained for wh-questions and relatives. The fixed predictors were (i) Object Type (+*Set-restricted* vs –*Set-restricted*) and (ii) Age Group. Both fixed predictors were coded using a sliding contrast specification. To recall, in this coding system the intercept is the overall mean of the dependent variable and the slopes indicate the differences between adjacent factor levels. Age was included as a between-subjects variable in order to compare performance across the four age groups tested. Subjects and items were modeled as simultaneous random effects.

The analysis for wh-questions revealed that the interaction Set-restriction by Age Group was not significant ($\chi^2(3) = 0.57, p = .90$) and that there was a significant effect of both Object Type ($\chi^2(1) = 46.86, p < .001$) and Age Group ($\chi^2(3) = 5.32, p < .001$). The maximal random effect structure (Table 5.2) justified by model comparison included by-subject and by-items intercepts.

Random effect	s ²	SD
Subject Intercept	0.21	0.46
Item Intercept	0.19	0.44

Table 5.2 Summary of random effects in the mixed logit model for wh-questions

The results of the final model for wh-questions (Table 5.3) showed that children performed significantly better with structures in which the object was –Set-restricted than when it was +Set-restricted ($\beta = 1.62, SE = 0.23, z = 7.02, p = < .001$). This suggests that the Set-restriction factor enhanced children’s comprehension of object wh-questions. Comprehension also improved with age, as evidenced by the positive coefficients when looking at the difference in performance between the 7- and 5-year-olds and between the 9- and the 7-year-olds, but the effect of age on children’s performance with wh-questions only reached significance when comparing the results of the 11- to those of the 9-year-olds ($\beta = 0.75, SE = 0.33, z = 2.26, p = < .05$)).

Fixed effect	Coefficient	SE	Wald Z	p
(Intercept)	0.70	0.25	2.82	<.01**
Object Type = –Set-restricted - +Set-restricted	1.62	0.23	7.02	<.001***
Age Group = 7 y.o. – 5 y.o.	0.11	0.32	0.36	>.7
Age Group = 9 y.o. – 7 y.o.	0.30	0.31	0.96	>.3
Age Group = 11 y.o. – 9 y.o.	0.75	0.33	2.26	<.05*

Table 5.3 Fixed effect estimates for mixed logit model of correct answers for wh-questions⁴⁷

In the case of relative clauses, there was again no significant interaction between Object Type and Age Group ($\chi^2(3) = 6.99, p = .08$), while both Object Type ($\chi^2(1) = 51.13, p < .001$) and Age ($\chi^2(3) = 33.57, p < .001$) significantly improved comprehension of object relatives. The

⁴⁷ Final model: Response Accuracy ~ Object Type * Age Group + (1 | Subject) + (1 | Item); N = 536, AIC = 562.24, BIC = 591.55, log-likelihood = -274.12.

maximal random effect structure (Table 5.4) justified by model comparison included only by-subject intercepts.

Random effect	s ²	SD
Subject Intercept	0.90	0.95

Table 5.4 Summary of random effects in the mixed logit model for relative clauses

As for the fixed effect structure (Table 5.5), there was a significant difference in performance between relatives headed by a –Set-restricted element and those headed by a +Set-restricted NP. Like in the case of wh-questions, accuracy was higher when the relative head was–Set-restricted ($\beta = 2.21$, $SE = 0.31$, $z = 7.07$, $p = < .001$)

Fixed effect	Coefficient	SE	Wald Z	p
(Intercept)	1.18	0.15	7.47	<.001***
Object Type = –Set-restricted - +Set-restricted	2.21	0.31	7.07	<.001***
Age Group = 7 y.o. – 5 y.o.	1.09	0.39	2.83	<.01**
Age Group = 9 y.o. – 7 y.o.	0.54	0.39	1.36	>.1
Age Group = 11 y.o. – 9 y.o.	0.88	0.45	1.97	<.05*

Table 5.5 Fixed effect estimates for mixed logit model of correct answers for relative clauses⁴⁸

Comprehension of relative clauses also increased with age. The 7 year-old children comprehended object relatives better than the 5-year-old group ($\beta = 1.09$, $SE = 0.39$, $z = 2.83$, $p = < .01$). The 9 year-olds also performed better than the 7 year-olds, as shown by the positive coefficient, but this difference was not statistically significant. The comparison of the mean of the dependent variable between the 11 year-olds and the 9 year-olds indicates that the former comprehended relatives more accurately than the latter.

5.2.4. Interim discussion

The predictions for the featural intervention account in terms of the impact of the NP feature led us to expect poor performance for A'-dependencies headed by *quelle/la personne* 'which/the person' / *quel/l'animal* 'which/the animal', due to the presence of a lexical NP

⁴⁸ Final model: Response Accuracy ~ Object Type* Age Group + (1 | Subject); N = 536, AIC = 533.47, BIC = 559.02, log-likelihood = -260.73.

restriction on both the moved object and the intervening subject. In contrast, the set-restriction approach predicts that those fronted NPs involving the operation of set-restriction should yield poorer results than the ones which do not, because the operation of set-restriction is a complex one and higher processing costs are predicted to be associated with the harder, + set-restricted object headed structures.

The findings of Experiment 7 show that the predictions of the latter account are borne out. Despite the presence of the NP feature on the moved object, these dependencies are easier for comprehension. As Goodluck (2010) pointed out, the superset relations in the case of *animal/bear* and in the instances discussed by Friedmann et al. (2009) are different. In the former case, it is a semantic relation and in the latter it involves grammatical features. This difference may be responsible for the different results. Nonetheless, the featural intervention approach cannot account for the improvement obtained in this study with object dependencies in which the head of the chain is a less specific constituent.

Still, while an approach in terms of set-restrictiveness appears to fare better, it is not entirely clear why set-restriction makes processing more difficult; one might equally have thought that the restricted set would make identifying the appropriate referent easier. In addition, if children's selective difficulties with object dependencies are due to the complexity of applying the operation of the set-restriction, then such an account would predict that children also find comprehend better object dependencies in which the intervening subject is –set-restricted. This is the focus of the study presented in the next section.

5.3. Experiment 8: Comprehension of French wh-questions and relative clauses with a –Set-restricted intervener

Experiment 8, a follow-up study to Experiment 7, compared French children's performance with object wh-questions and relatives in which I manipulated the properties of the intervening subject with respect to the object A'-filler. The latter element was a set-restricted animate DP, while the subject intervener was a lexical element like *personne* 'person' or *animal* 'animal', which does not require an operation of set-restriction to establish its reference. This manipulation of the referential properties of the intervening DP goes in line with adult processing studies (Warren & Gibson, 2002; Gordon, Hendrick & Johnson, 2002)

showing that the difficulty associated with object relatives is modulated by the type of NP acting as intervener.

5.3.1. *Participants*

The participants in the second study were 80 typically developing French-speaking children (41 girls and 39 boys) aged 4;11 to 12;7 (mean age = 8;0; SD = 2;29). The children were all recruited from the same school and, like in Experiment 7, they were grouped according to age, as follows:

Age group	No. of participants	Age range	Mean Age (S.D.)
5 y.o.	20	4;11 – 5;8	5;2 (0.20)
7 y.o.	20	6;7 – 7;4	7;0 (0.25)
9 y.o.	20	8;7 – 9;6	9;1 (0.30)
11 y.o.	20	10;8 – 12;7	11;3 (0.43)

Table 5.6 Participant data per age group (total number, age range, mean age and standard deviation)

5.3.2. *Design and Procedure*

5.3.2.1. *Materials*

Children were tested on 12 experimental items, 6 object wh-questions and 6 object relative clauses. All items contained two animate DPs, which were mismatched for Set-restriction: the moved object filler was a +Set-restricted element (e.g. *la fille* ‘the girl’), while the intervening subject was –Set-restricted (e.g. *personne* ‘person’, *animal* ‘animal’). This is exemplified in (7) for wh-questions and in (8) for relatives. Like in Experiment 7, only singular nouns were included and gender was controlled for, such that all items had either two feminine or two masculine noun phrases. Appendix D lists all the target items in Experiment 8.

(7) *Object question with a –Set-restricted subject*

Quelle fille est-ce que *la* *personne* embrasse?
 which.F.SG girl ESK the.F.SG person kisses

‘Which girl is the person kissing?’

(8) *Object RC with a –Set-restricted subject*

Montre-moi l’ours que l’animal soulève.

show.me the.SG bear that the.M.SG animal lifts

‘Show me the bear that the animal is lifting.’

Each target sentence was associated with a picture showing two pairs of characters involved in the same action. The same images as in Experiment 7 were used, so I refer the reader to Figure 5.1 above.

5.3.2.2. Procedure

The procedure of Experiment 8 was identical to that outlined for Experiment 7 (section 5.1.1.2).

5.3.3. *Predictions*

While the manipulation of set-restriction on the crossing element and the intervener should not affect comprehension under the featural intervention account – for which the crucial ingredient is the presence or absence of a +NP feature on the subject or the object DP – it should facilitate comprehension from the perspective of the set-restriction account since the structures tested in Experiment 8 do not involve set-restriction on both DPs. Although the latter account does not explicitly deal with configurations in which it is the second nominal or the intervener that does not require a costly, set-restriction operation, the natural prediction is that children should experience less processing load and thus their performance should be similar to that of corresponding object structures in which the first nominal is –set-restricted and the subject is +set-restricted.

5.3.4. *Results*

The results of Experiment 8 (Figure 5.4) indicate a similar performance for both object wh-questions and object relatives with a less specific intervening subject across all the age groups tested. In addition, children aged 5 and 7 years-old find these structures harder to comprehend than the 9- and 11-year-old children participating in the experiment. This is also confirmed by the number of children who performed above chance within each age group: 5 of the 5-year-old children, 5 of the 7-year-olds, 12 9-year-olds, and 14 among the 11-year-old children

comprehended wh-questions above chance level. Children performed similarly with relative clauses: 6 5yo, 6 7yo, 10 9yo and 17 11yo were above chance level for the comprehension of relatives.

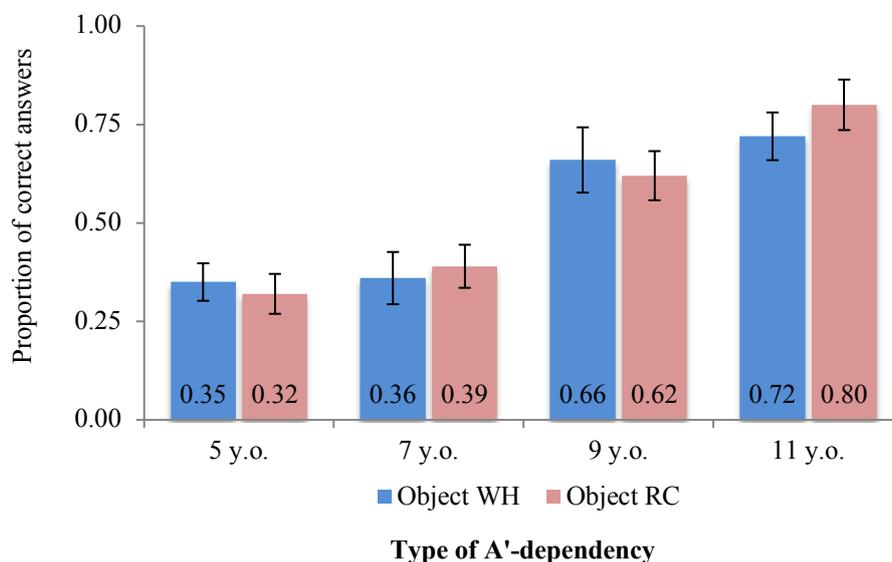


Figure 5.4 Overall proportion of correct answers for object wh-questions and relative clauses with a –Set-restricted intervener in four age groups (5 y.o. to 11 y.o.)

Table 5.5 compares the results in Experiment 8 to those already obtained in Experiment 7. These results clearly indicate that *which*-object questions and headed object relatives with a lexically-restricted +Set-restricted object and a –Set-restricted subject are also problematic for children, much like object dependencies in which both the object and the subject are +NP +Set-restricted (first column in Table 5.4). The results in Table 5.5 show that both object wh-questions and object relatives can be understood well only when the moved object is referentially less specific or –Set-restricted. This improvement in performance occurs even though the object is of the same type as the crossed element in terms of lexical NP restriction.

Structure	Age	Experiment 7		Experiment 8
		+Set-restricted OBJ +Set-restricted SUBJ	–Set-restricted OBJ +Set-restricted SUBJ	+Set-restricted OBJ –Set-restricted SUBJ
WH- questions	5 y.o.	0.38	0.72	0.35
	7 y.o.	0.38	0.74	0.36
	9 y.o.	0.42	0.81	0.66
	11 y.o.	0.63	0.91	0.72

Relative clauses	5 y.o.	0.36	0.63	0.32
	7 y.o.	0.48	0.85	0.39
	9 y.o.	0.50	0.97	0.62
	11 y.o.	0.75	0.95	0.80

Table 5.7 Proportion of correct responses by age group for wh-questions and relatives in Experiments 7 and 8

5.3.4.1. Statistical analysis

Experiment 8 examined whether object dependencies headed by a +Set-restricted nominal and containing a –Set-restricted intervening subject yielded similar or better results with respect to Experiment 7 which tested object wh-questions and relatives either with two +Set-restricted DPs or with a –Set-restricted DP object and a +Set-restricted subject. As the main interest was interested in comparing children’s performance with the different structures tested in Experiment 7 and 8, and given that no other factor was manipulated in Experiment 8, the data from the two experiments was analyzed together by fitting them to a logistic mixed effects model. Response accuracy (i.e. pointing to the correct character) was the dependent variable. The fixed factors were Set-restriction and Age Group and they were both coded with a sliding contrast specification. Two separate models were fitted for wh-questions and relatives. For ease of presentation and comparison, I indicate both the results of the final models for wh-questions and for relatives in Table 5.8.

The interaction Set-restriction by Age Group did not add significance either to the model for wh-questions ($\chi^2(6) = 5.38, p = .49$) or to the model for relatives ($\chi^2(6) = 8.43, p = .20$). Set-restriction had a significant effect for both wh-questions ($\chi^2(2) = 67.11, p < .001$) and relatives ($\chi^2(2) = 65.79, p < .001$), as did Age ($\chi^2(3) = 34.52, p < .001$ for wh-questions; ($\chi^2(3) = 62.58, p < .001$, for relatives).

The comparison between the results in Experiment 7 and those in Experiment 8 (Table 5.8) clearly indicates no difference in comprehension between object dependencies without a mismatch in set-restriction between the two DPs (represented as +*Set-restricted Subj* in Table 5.8) and those with a mismatch in which the subject was –Set-restricted. Children also find wh-questions and relatives with a –set-restricted object and +set-restricted intervener easier to comprehend than object dependencies in which the subject is –set-restricted. This is illustrated by the statistically significant difference between –*Set-restricted Obj* and –*Set-restricted Subj* for both wh-questions and relative clauses (marked as RC) in the

table below. As for the effect of Age, the positive coefficients of the comparison between the means of response accuracy for adjacent age group levels show again that older children comprehended object dependencies better than the younger children. The difference in performance was statistically significant for all age groups in the case of relatives, while in the case of wh-questions, there was a difference in comprehension accuracy between the 9 year-olds and the 7 year-olds, between the 11-year-olds and the 9 year-olds, but no difference in response accuracy between the 7-year-old and the 5 year-old children.

	Fixed effect	Coefficient	SE	Wald Z	p
WH	(Intercept)	0.50	0.16	3.21	<.01**
	Set-restriction:				
	– <i>Set-restricted Subj</i> - + <i>Set-restricted Subj</i>	0.19	0.30	0.62	>.5
	– <i>Set-restricted Obj</i> - – <i>Set-restricted Subj</i>	1.54	0.32	4.83	<.001***
	Age Group = 7 y.o. – 5 y.o.	0.14	0.25	0.54	>.5
	Age Group = 9 y.o. – 7 y.o.	0.70	0.24	2.87	<.01**
	Age Group = 11 y.o. – 9 y.o.	0.66	0.25	2.36	<.01**
RC	(Intercept)	0.90	0.12	7.27	<.001***
	Set-restriction:				
	– <i>Set-restricted Subj</i> - + <i>Set-restricted Subj</i>	0.04	0.26	0.14	>.8
	– <i>Set-restricted Obj</i> - – <i>Set-restricted Subj</i>	2.28	0.31	7.26	<.001***
	Age Group = 7 y.o. – 5 y.o.	0.84	0.31	2.70	<.01**
	Age Group = 9 y.o. – 7 y.o.	0.75	0.31	2.38	<.05*
	Age Group = 11 y.o. – 9 y.o.	1.11	0.34	3.20	<.01**

Table 5.8 Fixed effect estimates for mixed logit models of correct answers for wh-questions⁴⁹ and relatives⁵⁰

The maximal random effect structure justified by the data included by-subject and by-item intercepts (Table 5.9).

	Random effect	s²	SD
WH	Subject Intercept	0.43	0.66

⁴⁹ Final model: Response Accuracy ~ Set-restriction * Age Group + (1 | Subject) + (1 | Item); N = 982, AIC = 1090.25, BIC = 1128.67, log-likelihood = -537.13.

⁵⁰ Final model: Response Accuracy ~ Set-restriction * Age Group + (1 | Subject) + (1 | Item); N = 982, AIC = 1073.04, BIC = 1112.15, log-likelihood = -528.52.

	Item Intercept	0.12	0.35
RC	Subject Intercept	0.48	0.70
	Item Intercept	0.20	0.30

Table 5.9 Summary of random effects in the mixed logit model for relative clauses

5.4.1 *Interim discussion*

The main result of Experiment 8 was that the same difficulty found in the comprehension of *which*-questions and headed relatives with a set-restricted object DP moved across a subject DP that shares the same set-restriction properties is also maintained when the set-restricted object DP crosses a less specific or –set-restricted intervener like *la personne* ‘the person’ or *l’animal* ‘the animal’. Despite the mismatch in set-restriction properties of the two DPs, the structures tested in Experiment 8 are harder for children to process than those tested in Experiment 7 in which the moved object DP was –set-restricted and the subject was set-restricted.

This suggests that comprehension of object A’-dependencies does not improve irrespective of the direction of the mismatch in set-restriction between the two nominals. If children’s problems with object dependencies were caused by the difficulty to apply the operation of set-restriction, then we should have seen that the presence of an element which does not entail linking to a less restrictive set as opposed to a more restricted set should facilitate comprehension independently of whether the less set-restricted element appears in the subject or in the object position. As a consequence, the operation of set-restriction *per se* does not seem sufficient to account for the asymmetries found in the comprehension of object A’-dependencies.

5.4. General discussion

The studies reported in this chapter were designed to investigate whether features other than morphosyntactic features, such as the more or less specific nature of the referent or set-restriction (to use Goodluck’s (2010) terminology) affect the comprehension of A’-dependencies in French. As such, these studies tap into the notion of *similarity* as defined by the presence of an NP restriction by assessing how *set-restriction* of the moved object or of the intervener contributes to modulating the comprehension of object A’-dependencies.

Experiment 7 focused on the moved object and compared the comprehension of wh-questions and relative clauses in which the object was a more or less specific nominal, while the intervening subject was always a more specific DP. From the point of view of the operation of set-restriction, I classified more specific nouns like *dame* ‘lady’ or *ours* ‘bear’ as +Set-restricted, since they presuppose restricting the set of referents to a greater extent than less specific or generic DPs like *personne* and *animal*, which were thus labeled –Set-restricted. Experiment 8 investigated the role played by the set-restriction properties of the intervening subject on the processing of A’-dependencies. In this study the manipulation of set-restriction was achieved by using a nominal like *personne* or *animal*, not requiring the same degree of set-restriction to establish its reference, as subject intervener, while the object was always +Set-restricted.

When comparing the results of the two experiments, the following pattern emerges for the comprehension of object dependencies: children perform more accurately when the object DP denotes a nominal referring to a less restrictive set (e.g. *L’animal que le chien soulève*. ‘The animal that the bear is lifting’), rather than when both the intervening subject and the A’-object belong to a more restrictive class of referents (e.g. *L’ours que le chien soulève*. ‘The bear that the dog is lifting’). This effect surfaces to the same degree in both wh-questions and relative clauses. The presence of a –Set-restricted noun in subject position does not seem to impact comprehension, as the accuracy scores for these configurations are similar to those found for object dependencies in which both the subject and the object are two +Set-restricted expressions.

In what follows I will discuss the data from the present experiments in light of the two approaches, featural intervention (Friedmann et al. 2009, Belletti et al. 2012) and set-restriction (Goodluck 2010, Goodluck & Zweig 2013), that were outlined at the beginning of the chapter. Children’s comprehension of dependencies in which both the subject and the object were +Set-restricted and of dependencies with a +Set-restricted object and a –Set-restricted subject is in line with the featural intervention account. Recall that this account links the problematic A’-dependencies to the presence of a similar +NP element (the subject) in the interpretive chain formed by the moved object with the gap appearing in a postverbal position and which gives rise to intervention effects of a Relativized Minimality type (Rizzi 2004, Starke 2001) similar to those found in adult grammar. As both nouns like *personne/animal* and nouns like *lady/dog* contain a lexical NP restriction, the difficulty with structures in which the subject was less specific finds a straightforward explanation within the featural intervention account. However, the overall enhanced performance in Experiment

7 with object dependencies introduced by –Set-restricted constituents, but which also have a lexical NP restriction, does not follow from this account. From the point of view of their syntactic complexity, there is no difference among the structures tested in the two experiments, in the sense that they are all object A'-dependencies in which a constituent bearing a lexical NP restriction moves from the embedded object position to the left-periphery of the clause. According to the featural intervention account, children should have equal difficulties processing this movement, as well as resolving the A'-dependency. Experiment 7 showed that the manipulation of the referential properties of the two DPs (i.e. the fact that their reference can be more or less specific) clearly affects processing in children even in cases in which the NP feature is held constant. While children struggle with configurations in which both the moved object and the subject are +NP +Set-restricted, as predicted by the featural intervention account, they perform significantly better when the A'-object is less specific or –Set-restricted, despite the presence of a lexical NP restriction. If children only paid attention to the presence of the NP feature of the two elements, then such results are not expected since these structures should have created an inclusion configuration as far as the featural specifications of the subject and the object are concerned, and therefore lead to problems in comprehension similar to those found for dependencies in which both elements are +NP +Set-restricted. The enhanced performance in instances in which the referential properties of the moved object are manipulated suggests that a characterization of children's selective difficulties only in terms of absence or presence of a lexical NP restriction is too coarse to capture all the effects observed in Experiment 7.

The results obtained in Experiment 7 pattern with those reported by Goodluck (2005, 2010) who also found that 5-year-old English children comprehend object questions introduced by the more generic expression *which animal* better than those introduced by the more specific *which dog*. In addition, the present study extends Goodluck's findings to relative clauses and shows that these results also hold when a different generic noun, such as *personne* 'person' is used in object position. Goodluck (2010) and Goodluck & Zweig (2013) attribute children's enhanced performance with these structures to the mechanism of set-restriction, "a mental computation that is not specifically linguistic". Object A'-dependencies in which the target of movement is a –Set-restricted nominal such as *la personne* 'the person' or *l'animal* 'the animal' are easy because these elements do not require restricting the set of referents to the same degree as +Set-restricted elements like *la dame* 'the lady' or *l'ours* 'the bear'. The observation regarding the set-restriction properties of the two types of elements is particularly interesting given the experimental setting, which links both the +Set-restricted

and –Set-restricted nominal expressions to a context with a limited number of referents. Therefore, both expressions imply identifying a subset from a contextually determined set of entities. What distinguishes them is the amount of descriptive content conveyed and which is richer and more specific in the case of *la dame* or *l'ours*, while it is more impoverished and less specific in the case of *la personne* or *l'animal*. According to the set-restriction account, what seems to challenge children is the difficulty to construct the representation of the +set-restricted element as this comes at an increased processing cost. In the absence of this set-restriction operation, children are capable to assign the correct syntactic representation to the object dependency and link the moved constituent to the object gap position of the verb.

Moreover, the prediction made by the set-restriction account is that the absence of a set-restriction operation on either of the two DPs should modulate comprehension: if the set-restriction operation is what impacts children's performance, then continuing to alleviate the child's system of the need to apply this costly operation for one of the DPs, should yield good performance. The data from Experiment 8 make it possible to evaluate this prediction, since the experimental items were object wh-questions and relative clauses with a +Set-restricted object DP and a –Set-restricted subject. Contrary to the predictions of the set-restriction account, the comprehension scores for object dependencies in which the intervener was a less specific noun like *personne* / *animal* were lower as compared to their scores for object dependencies with a –Set-restricted object and a +Set-restricted subject. Children showed poor comprehension with the former structures despite being alleviated of the operation of set-restriction for one of the NPs. These scores patterned with those obtained for dependencies in which both elements were +Set-restricted. Hence, the data from the second study do not support the set-restriction account and shows that the notion of set-restriction by itself is insufficient to explain the overall findings that come out from the two studies.⁵¹

Both the featural intervention approach and the set-restriction approach can only provide an account for part of, but not for the entire dataset described in this chapter. What the data reveal is that not all types of mismatches help modulate children's comprehension of object A'-dependencies. The direction of the mismatch plays an important role because when all the other syntactic properties are kept constant (i.e. object extraction, presence of a lexical NP restriction, match in gender and number, match in animacy), the referential specificity of the nominal element matters more when associated with the target of movement than when

⁵¹ One potential criticism of the results in Experiment 8 could be that children scored badly because the items containing *person* and *animal* in the subject position sounded odd. That this is not the case is confirmed by the judgements of 5 adult French native speakers who, when tested on the same experimental materials, found these sentences natural in the particular discourse conditions under which they were presented.

associated with the intervener. A closer look at the cross-linguistic findings reported for the comprehension of object A'-dependencies reveals that variations at the level of the target yield clear asymmetries, as in the well-attested case of bare or –NP questions (*who*) versus lexically-restricted or +NP questions (*which N*). Variations at the level of the intervener, on the other hand, are not so straightforward. Take, for example, the comprehension of relative clauses with a pronoun intervener. While a 1st or 2nd-person pronoun in the embedded subject position reduces processing difficulties for both children and adults (Arnon 2010; Haendler, Kliegl, & Adani 2015; Gordon et al. 2001; Warren & Gibson 2002, 2005), a 3rd-person pronoun intervener is more problematic for children. Haendler et al. (2015) found that object relative clauses with a lexically restricted DP head and a 3rd-person pronoun as embedded subject, given in (9), are harder for children to process than object relatives with two full DPs or object relatives with a 1st-personal pronoun intervener⁵².

- (9) Welche Farbe hat der Hase, den es jagt?
 what color has the bunny who it chases
 ‘What colour is the bunny that he chases?’

Going back to our findings, the question still remains as to what drives the asymmetry in comprehension between dependencies with a less specific/less restricted object and a more specific subject, on one hand, and dependencies in which the subject is the less specific element, on the other. Note that we can easily discharge an explanation linked to the fact that children cannot establish the reference of *personne* or *animal* in Experiment 8, since the same difficulty should be expected to hold when these expressions appear in object position.

The idea I would like to pursue is that the improvement found with dependencies

⁵² Haendler et al.’s results seem to contradict previous findings on the comprehension of object relatives with intervening pronouns. Friedmann et al. (2009) reported that the presence of a *pro* element as an intervener in Hebrew object relatives facilitates parsing and they take the absence of an NP feature on the intervening element to be responsible for the improved comprehension with this type of object relative clauses. However if one analyzes the relevant construction in more detail, the *pro* form displays important differences with the lexically-restricted DP head. Most importantly, it is a null impersonal *pro* with arbitrary interpretation and, as evidenced by the verbal inflection, refers to a plural. Hence, it also differs in terms of number from the head of the chain. These properties make it difficult to compare with pronominals that also match for number. Indeed, Bentea (2012) tested the comprehension of object relatives in Romanian, in which the embedded subject was either a full nominal expression, or a null *pro* subject whose *phi*-features matched those present on the object DP head. Her results were in line with those recently reported by Haendler et al. (2015) for overt 3rd-person pronoun subjects in German and showed that Romanian children (aged 4 to 6) found object relative clauses with a null *pro* subject, matching in gender and number with the head noun, harder to comprehend than object relatives with two full DPs.

containing a less specific DP object is due to the fact that specific elements are more felicitous in a subject position and are therefore more likely to be linked to the subject gap position than more generic nouns. This difference between the two expressions could be linked to a scope-discourse interpretive property, namely *aboutness*. Rizzi (2005) argues that *aboutness topicality* is the core interpretive property of clausal subjects⁵³. However, *aboutness* is not restricted to clausal subjects (as in instances of topicalized objects, which can be both aboutness topics and D-linked, like e.g. *this chapter, I wrote last week*), nor do all subjects express *aboutness* (e.g. expletives). Thus, the fact that an element fulfills this particular semantic requirement of *aboutness* might make it more or less suited to act as subject of the clause. Now, a more detailed analysis of the less specific NPs included in the Experiments 7 and 8 reveals that they do not lend themselves well to topicalization. Consider the contrast in (10a) and (10b):

- (10) Context: You are at a party and you spot a man and woman standing in a corner of the room. You turn to your friend and say:
- a. *La femme, je me demande qui va lui parler.*
‘As for the lady, I wonder who is going to talk to her.’
 - b. **La personne, je me demande qui va lui parler.*
*As for the person, I wonder who is going to talk to her.

While the first sentence containing a more specific expression *la femme* ‘the lady’ is perfectly acceptable, a noun like *personne* ‘person’ is less felicitous in a topic position. This might suggest that less specific expressions, contrary to more specific expressions like *la femme* ‘the lady’, lack this special interpretive property, *aboutness*, and as such, they are less likely to be interpreted as subjects. If less specific elements lack the special interpretive property common to subjects, then we can argue that they would not trigger a subject/agent-first bias and that children would be less likely to assign a subject interpretation to head of the dependency. On the other hand, in the conditions in which the head of the dependency was a more specific element, e.g. *la dame* ‘the lady’, these would again be more likely to receive a subject interpretation given their more topic-like nature.

This view is supported by the errors children make in the various experimental

⁵³ In a cartographic view of sentence structure, this semantic property of subjects is linked to a specific projection, namely SubjP, the landing site of movement of the subject. This position higher than IP, shares with CP the ‘dedicated character to scope discourse types of properties’ (Rizzi, 2005: 213).

conditions. One of children's most common mistakes when interpreting object *which*-questions or headed object relative clauses is the so-called Reversed Role error (see Arnon 2005, Adani 2010, a.o.; see also Chapter 3), whereby children assign the wrong thematic role to the head of the dependency (i.e. they interpret it as the Agent and link it to the subject gap even when the head of the dependency should be assigned an object interpretation). The Reversed Role error thus illustrates children's propensity to first interpret the head noun as the subject of the embedded verb. A closer look at this type of error in Experiments 7 and 8 reveals that the items in which the moved DP object was more specific yielded 36% of Reversed Role errors⁵⁴ in Experiment 7 and 38% such errors in Experiment 8. The rate of these errors dropped to 6% for the items containing a less specific DP object, suggesting that the subject/agent-first bias does not arise in these instances.

In a similar vein, Hamann & Tuller (2015) argue that the topic-worthiness of a constituent can account for data from elicited production of relatives. Specifically, Belletti (2014), Belletti & Guasti (2015), Contemori & Belletti (2014) and related works, show that children avoid intervention effects in object relatives by producing passive object relatives (e.g. *The boy that is woken up by the mother*)⁵⁵, that is, they transform the elicited active object relative into a subject relative in the passive. Hamann & Tuller (2015) put forth the idea that children's tendency to produce passive relatives in which the relativized NP is the subject stems from the particular discourse context which favours the analysis of this relativized NP as the salient discourse topic and, consequently, its encoding as the subject (which is realized through passivization). If indeed passive object relatives are produced because children tend to turn topics into subjects and if more generic nouns like 'person/animal' are not good topics, then the prediction would be that children should not produce passive object relatives with 'person/animal' as these nouns are not coded as subjects. Such an experiment is yet to be done.

Thus, the gist of the proposal outlined above is that the presence of an object with less specific referential properties reduces comprehension difficulties in object A'-dependencies because such elements might not share the same *aboutness* property with subjects and, therefore, this might make them less likely to be assigned a subject interpretation. These structures are easy for children and this appears to be related to not committing to a subject-verb-object analysis of the structure, which stems from certain interpretive properties of the

⁵⁴ These percentages were calculated from the total number of responses obtained for a specific condition.

⁵⁵ The context provided in these elicited production tasks was the following: "There are two boys. The alarm clock wakes up one boy. The mother wakes up one boy. Which boy would you rather be?"

moved element. In instances in which these interpretive properties make the lexically-restricted A'-constituent a good candidate for the subject position, a comparison between the target and the intervener is triggered. At this point, it is only an intersection relation determined by a featural mismatch in relevant morphosyntactic features (i.e. gender, number, animacy) that can distinguish between the two elements, as evidenced by all previous studies showing that mismatches in syntactic features matter in this case.

5.5. Conclusions

The results of the two studies demonstrate that the interpretive properties of the A'-element modulate children's comprehension of object A'-dependencies. An explanation purely in terms of complexity of syntactic structure is not sufficient to capture the effects observed. Inclusion of the NP feature on both the fronted object A'-element and the intervening subject does not necessarily entail difficulties for children, as would be expected under the featural intervention approach. An account which draws on the cost associated with the operation of set-restriction, present with more specific DPs and absent with less specific nominals, is also insufficient to capture the findings of both studies, as object dependencies with a –set-restricted DP subject continue to yield poor performance, on a par with dependencies in which both DPs are +set-restricted. The pattern we find for the comprehension of the object dependencies tested in these studies seems to be a consequence of a special interpretive property of subjects, namely *aboutness* (Rizzi 2006). The idea put forth in this chapter is that generic nominals of the type used in these studies might not share this property with subjects, therefore making object dependencies introduced by these elements less likely to be interpreted as subject dependencies.

“Grown-ups never understand anything by themselves,
and it is tiresome for children to be always and forever
explaining things to them.”
(Antoine de Saint-Exupéry, *Le Petit Prince*)

6. CONCLUSIONS

The goal of this dissertation was to understand how the comprehension of relative clauses and wh-questions unfolds in children and to assess whether children’s selective difficulties with these A’-structures can be related to intervention effects amenable to the locality principle of Relativized Minimality also present in adult grammar, an account which I labelled the featural intervention account (Friedmann et al. 2009, Belletti et al. 2012). This account postulates that children’s problems with specific movement configurations stem from intervention effects determined by moving the object across a subject sharing a NP lexical restriction, along the lines of the locality principle of Relativized Minimality operative in adult grammar (Rizzi, 1990, 2004, 2013; Starke, 2001). Thus, children have difficulties with configurations that instantiate an *inclusion* relation between the features of the intervening subject and the A’-moved object, whereas they perform considerably better with dependencies that display non-inclusion configurations: either (i) a **disjunction** relation between the relevant featural specifications of the two elements or (ii) an **intersection** relation in which the intervener differs from the A’-element in at least one ‘relevant’ feature. To recall, a feature is relevant in the computation of locality if it belongs to the feature set triggering movement by being morphologically encoded in the finite verb inflection (Belletti et al. 2012).

As a case study, this dissertation concentrated on French and Romanian speaking children’s comprehension of A’-dependencies, with a particular focus on the processing of object dependencies, and took advantage of various morphosyntactic properties specific to the two languages to shed light on the role that such properties play in modulating the locality

intervention effects attested cross-linguistically. Specifically, it manipulated the morphosyntactic characteristics of the subject and object DPs in order to investigate whether these manipulations hinder or improve the establishment of the correct syntactic relation between the moved constituent and its original argumental position. Furthermore, I extended the investigation to properties that are not necessarily morphosyntactic, such as the more or less specific reference conveyed by either the moved object or the intervening subject in both object wh-questions and relative clauses. The experimental investigation in both French and Romanian made use of a character-selection task. That is, children were presented either with images or animations depicting two or three characters performing the same action with reversed Agent-Patient roles and were then prompted to choose/point to the correct character through the use of a relative clause or a wh-question. The next section summarizes the major empirical findings and specific conclusions of this dissertation.

6.1. Summary of empirical findings and specific conclusions

The starting point of our investigation was to examine to what extent the intervention effects observed cross-linguistically for the comprehension of certain object dependencies can be modulated by language-specific structural properties. Experiments 1 and 2 (Chapter 2) examined the comprehension of subject and object relative clauses and wh-questions in French typically developing children in order to understand whether the *que/qui* alternation in the form of the complementizer in relative clauses and the different question formation strategies in object wh-questions, modulate children's processing of these dependencies. In addition, Experiment 1 also looked at the impact that a number mismatch between the subject and object DP, with and without an overt manifestation of number agreement on the verb, has on the comprehension of relative clauses.

The results reveal that children find subject relatives easier than object relatives and that the change in the form of the complementizer (*qui* in subject relatives vs *que* in object relatives) does not eliminate the subject-object asymmetry found in languages like English and Italian in which the shape of the complementizer does not disambiguate between a subject and an object reading. The mismatch in number features between the subject and the object in relative clauses improved comprehension of object relatives with respect to subject relatives, both when number agreement was audible on the verb and when it was not. However, this effect was only observed in the older age group tested, the 6-year-old children.

In the case of *wh*-questions, the asymmetry between subject and object questions was modulated by two factors: (i) the presence of an in-situ or an ex-situ *wh*-object and (ii) the presence (+NP) or absence (–NP) of a lexical restriction on the moved object. Children comprehended *wh* in-situ questions better than *wh* ex-situ questions regardless of the featural make-up of the *wh*-element and also found –NP ex-situ and *est-ce que* questions easier to process than +NP ex-situ and *est-ce que* questions. Like in relative clauses, the presence of *est-ce que* indicating an object interpretation did not facilitate comprehension of questions in which the moved object was a +NP lexically-restricted element. Taken together, the findings of Experiments 1 and 2 show that what hinders children’s comprehension of object dependencies is the inclusion relation that holds between the intervening subject and the A’-constituent when both elements share a lexical NP feature. A disjunction in NP feature eliminates comprehension difficulties, while an intersection relation determined by a mismatch in number features facilitates processing, but only for older children. That this improvement was not found the 5 year-old group may suggest that younger children are only sensitive to disjunction and that, contrary to older children, they cannot yet take into account the finer distinction between intersection and inclusion.

Experiments 3 and 4 (Chapter 3) examined the comprehension of relative clauses and *wh*-questions in typically-developing Romanian children and zoomed in on a language-specific mode of disambiguation, namely the presence of case-marking on the relative pronoun in object relatives and on the *wh*-element in object questions. Alongside case-marking, object relatives and lexically-restricted *which*-questions are also characterized by the obligatory use of object clitics, another cue which could help children disambiguate between a subject and an object interpretation. As such, Experiment 3 tested Romanian children’s comprehension of subject, as well as direct and indirect object relative clauses, and showed that, like their French peers, Romanian children comprehend subject relatives better than object relatives, despite the presence of the case-marking preposition *pe* in direct object relatives or of morphological case-marking on the relative pronoun in indirect object relatives (in line with Sevcenco & Avram 2012). The results show no improvement across the three types of object relatives tested (direct object relatives with and without *pe*⁵⁶ and indirect object relatives, all containing an overt pre-verbal subject). The use of the clitic in object relatives did not facilitate comprehension either. This argues in favour of associating children’s difficulties with object relative clauses to intervention effects driven by the

⁵⁶ Recall that omission of *pe* is very frequent in spoken varieties of Romanian.

presence of a lexical NP subject which intervenes in the A'-chain formed by the moved object with its gap in the internal argument position of the embedded verb and can therefore hinder the establishment of the correct dependency between the object and the gap.

Experiment 4 looked at the Romanian children's comprehension of subject and object wh-questions with and without a lexical NP restriction and exploited the option of forming *which*-questions in Romanian without having an overt full lexical noun follow the wh-word (i.e. these questions are the equivalent of *which one* questions in English). The aim of this manipulation was to investigate whether children are sensitive to presence of a +NP specification even when it is not overtly marked on the wh-phrase. Two important findings need to be highlighted. First, the [+NP] feature affects children's comprehension of wh-questions in Romanian even when it is not overtly expressed on the wh-element. Experiment 4 revealed that children comprehend subject and object *cine* 'who' questions on a par, but they find subject *care* 'which' questions easier than object *care* 'which' questions. They also perform better with object *who*-dependencies than with object *which*-dependencies, independent of the presence or absence of a full lexical noun after the wh-phrase. Second, the results illustrate that Romanian children comprehend object *which*-questions considerably better than Hebrew-speaking and Italian-speaking children (see Friedmann et al. 2009 for Hebrew and De Vincenzi et al. 1999 for Italian). I associated this improved performance with a language-specific property, namely the presence of a post-verbal subject, and put forth the idea post-verbal subjects modulate intervention effects in *care* 'which'-questions because these structures involve a two-step movement: first, a Big DP formed of the clitic and the wh-word cross the subject on the way to an intermediate position internal to the IP (along the lines of Cecchetto's 2000 analysis of doubling structures), but higher than the subject in the specifier of vP; second, the wh-element moves out of this intermediate reconstruction site to a position at the left-periphery of the clause, without crossing any lexical NP intervener. Children's low accuracy scores with object relative clauses in Experiment 3, which only used pre-verbal subjects, further support this analysis. In structures with a pre-verbal subject, the A'-object obligatorily crosses the subject in a preverbal position during the second movement step and, as such, gives rise to intervention effects similar to those found cross-linguistically.

The goal of Chapter 4 was to refine our understanding of the atoms of intervention in object A'-dependencies. To this effect, Experiments 5 and 6 investigated not only the impact of the NP feature, but also the effect that a mismatch in animacy between the subject and the object has on the processing of object dependencies. Experiment 5 assessed French-speaking children's comprehension of object wh-questions and relative clauses in which the subject

was always an animate lexically-restricted noun, while the object varied along two dimensions: presence or absence of lexical restriction (+NP vs –NP) and animacy (+Animate vs –Animate).

The picture that emerges from this study points again to the crucial role that the NP feature or lexical restriction plays in modulating comprehension. Configurations in which the moved object is –NP (bare *qui* ‘who’ and *que* ‘what’ questions, as well as relatives introduced by *ce* ‘that’) are the easiest structures for children to compute as they create a disjunction relation between the NP features on the target (i.e. the moved object) and the intervener. The most problematic configurations for children are those in which the features on the intervener (NP, Animacy) are included in the set of features present on the target. The case of object relatives introduced by the demonstrative *celui/celle* (‘the one’) is particularly interesting in this context. Although these elements do not contain a noun from the contentive lexicon, they still give rise to intervention effects similar to those found in relative clauses in which the moved object contains a full lexical NP. A closer look at the internal structure of *celui/celle* allowed us to conclude that the complex structure of these elements, *ce-lui / c-elle*, can be analyzed as a pro-NP form, with the determiner *ce* plus a pronominal form (*lui-elle*). If this analysis is correct, it follows that the relative head has the same D+NP form as the intervening subject (*la fille* ‘the girl’, for example), which results as well in an inclusion configuration between the target and the intervener, a configuration which children find the most difficult to compute.

As for the effect of animacy, Experiment 5 showed that moving an inanimate DP object across an animate subject improves comprehension, as it instantiates an intersection relation between the features expressed on the moved object and the intervener. No significant improvement was found with bare *qui* ‘who’ and *que* ‘what’ questions in any of the age groups tested. I interpret this as evidence in favour of the view that animacy has a different effect depending on whether it is associated or not with a +NP feature. Based on the findings from Experiment 5 with respect to *celui/celle* elements and to the effect of animacy, Experiment 6 examined the comprehension of object relatives headed by *celui/celle* both with an animate and with an inanimate referent. This allowed us to investigate the role of animacy in the absence of any morphological reflex either on the relative head or on the verb. The results obtained reinforced the idea that *celui/celle* have a more complex structure, as children continue to show the same difficulties in processing these structures as in the case of object relatives headed by a full lexical NP object. The mismatch in animacy, on the other hand, facilitates comprehension, although not to the same extent as *ce* in Experiment 5. This points

to a gradience in performance with disjunction being the easiest for children to compute, followed by intersection and then by inclusion, which leads to most difficulties in comprehension. Furthermore, when the findings of Experiment 6 are taken together with that of Experiment 5, we see that it is not only the features overtly expressed on the verbal inflection have the potential to modulate comprehension (Belletti et al. 2012). Rather, the current data suggest that features not morphologically realized on the clausal inflectional head impact the calculation of intervention effects. Hence, the morphological expression of a feature on the inflectional head might be a sufficient criterion for this feature to be taken into account by RM, as proposed for the gender feature in Hebrew in Belletti et al. (2012), but not a necessary one.

Finally, Experiments 7 and 8 (Chapter 5) expanded the scope of the investigation by assessing the role of the referential properties of the subject and object DP on object A'-dependency comprehension, while keeping constant the complexity level of these structures. That is, they all involved movement of a lexically-restricted NP constituent across an intervening subject sharing the same feature. Experiment 5 manipulated the properties of the target and compared structures in which the object was a more specific noun, associated with descriptively richer lexical content (for example *la fille* 'the girl'), with structures in which the object was a less specific noun, paired with descriptively impoverished lexical content, such as *personne* 'person' and *animal* 'animal'. The properties of the subject were kept constant: this was always a more specific nominal. In Experiment 6, on the other hand, the object was more specific, whereas the subject was either *personne* 'person' or *animal* 'animal'. Following the terminology put forth by Goodluck (2010) and Goodluck & Zweig (2013), I labeled more specific nouns as +set-restricted and less specific nouns –set-restricted, in order to capture the idea that less specific nouns do not require restricting the set of referents to the same degree as more specific ones.

The data obtained showed that children comprehend very well both object wh-questions and object relative clauses in which the target is a less specific or –set-restricted nominal. Children's accuracy scores for these structures are in fact similar to the scores obtained for object dependencies in which the moved element did not contain a lexical restriction, as in Experiment 5, for example. However, this facilitating effect is only present when the less specific nominal occupies the target position and not when it occupies the intervener position. Indeed, the results obtained for object dependencies with a less specific subject like *person* or *animal* pattern with those for object dependencies in which both the subject and the object are specific elements sharing a lexical NP restriction. Both the featural

intervention account and the set-restriction account can only explain part of the effects observed in both studies: while the results of Experiment 8 can be easily accommodated under a featural intervention account, they do not follow from a set-restriction account. The reverse pattern holds for the findings of Experiment 7. In order to explain the whole data set emerging from the two studies, I suggested to appeal to the discourse properties of subjects and, more specifically, to the special interpretive property of *aboutness*. The idea I put forth is that less specific nouns might not share this property with subjects, which makes them less likely to be interpreted as potential subjects of the incoming verb and therefore children would find it easier to converge on the correct interpretation for object dependencies. When no such mismatch in higher-level discourse properties arises between the target and the intervener, children need to compute the differences in morphosyntactic features between the two constituents, an operation which is more or less costly depending on the type of relation that holds between these elements, that is, whether it is disjunction, intersection or inclusion.

In summary, the findings reported in this dissertation lend support to the featural intervention account. The general picture observed throughout the A'-structures and the various age groups tests reveals that children perform best with configurations containing a disjunction in the NP feature on the target and the intervener. The configurations that pose the most problems for comprehension are those in which an inclusion relation holds between the features of the element heading the A'-dependency (the target) and the subject of the relative clause or of the wh-question (the intervener). We have also shown that the notion of lexical NP feature needs to be further refined, as it seems to be too coarse to capture difficulties with *celui/celle* constructions and that intervention should be defined so as to accommodate the formal presence of a D+NP structure (or a more complex structure) and not just the presence of a noun from the contentive lexicon heading a lexical restriction. Such intervention effects can be modulated either by language-specific properties, which allow to by-pass intervention effects (i.e. the presence of a post-verbal subject in Romanian), or by mismatches in morphosyntactic features which can impact the calculation of intervention effects (i.e. number, animacy). However, the effect of animacy suggests that a feature need not necessarily be expressed on the verbal inflection to be relevant for the computation of locality. In addition, the experimental findings show that it is not only the syntactic complexity of A'-structures that affects children's comprehension, but that the discourse properties of the target and the intervener also play an important role in modulating intervention effects.

6.2. Food for future thought

The experimental findings presented in this dissertation open the way to new investigations in the acquisition of *wh*-questions and relative clauses in French and Romanian, some of which have already been mentioned throughout the paper.

Let us start with the study on the effect of the number mismatch on the comprehension of subject and object relative clauses in French (Chapter 2). This revealed that the mismatch in number between the subject and object DP improved the processing of object relatives in the 6-year-old group, but had no effect on comprehension in the 5-year-old group. Arosio et al. (2010) found that, despite the fact that children make mistakes in the comprehension of object relatives disambiguated by number agreement, as shown by offline accuracy measures, online measures like listening times reveal that children do process number agreement, as evidenced by longer listening times at the verb in the presence of a number mismatch. Therefore, an online study using the preferential-looking task and measuring children's eye-movements would be very insightful in order to understand whether younger children are able to process number agreement or if they completely ignore this cue and cannot use it to assign the correct interpretation to the object relative.

A further development for the study on number would be to compare the role of number mismatch to the role that gender mismatch has on the comprehension of object dependencies. Adani et al. (2010) showed that Italian children draw more on a mismatch in number than on a mismatch in gender when processing center-embedded relative clauses. These results, taken together with those of Belletti et al. (2012) who showed that the gender mismatch alleviates intervention effects in Hebrew but not in Italian, predict that French should pattern with Italian in that only a number mismatch, but not a gender mismatch should affect comprehension of relative clauses.

The explanation outlined in Chapter 3 for the comprehension of *wh*-questions in Romanian predicts that the presence of a post-verbal subject in object relative clauses should improve comprehension with respect to object relative clauses with a pre-verbal subject. Thus, a natural follow-up is to test such structures by using the same experimental materials as in the experiment for *wh*-questions. The role of the lexical NP restriction can also be further explored in Romanian. More specifically, apart from the *wh*-structures included in Experiment 4, Romanian also has the option of forming *wh*-questions by using the *wh*-word *ce* 'what' followed by a full DP, as illustrated in (1):

- (1) Ce fată ai întâlnit?
what girl have.2.SG met
'What girl have you met?'

Although these *wh*-constituents contain a full lexical NP, they pattern in meaning and syntactic behavior with bare *cine* 'who' elements. If children are sensitive to these properties of *ce* 'what' elements, then they should interpret these questions on a par with *cine* 'who' questions. This would go against the predictions of the featural intervention account, which takes the presence of an NP feature to be crucial for triggering intervention effects, and would therefore predict that these structures would pattern with *care* 'which' structures.

As far as animacy is concerned, another way to investigate the effect of animacy would be to test the comprehension of object *wh*-questions and relative clauses with an animate object and an inanimate embedded subject, along the lines of Adani (2012). Crucially, Adani (2012) did not find an effect of this mismatch in animacy on the comprehension of object relative clauses in 4- to 5-year-old German-speaking children. This could be interpreted as evidence against the extension of the featural intervention approach to the animacy specification. Note, however, that the results obtained in Experiment 5 also show that the younger children in our experiment (i.e. the 5-year-olds) could not exploit the mismatch in animacy tested, showing that they have difficulties computing the whole array of morphosyntactic features required to distinguish the intervening subject from the moved object. Therefore, it would be relevant to assess whether a mismatch in animacy similar to the one tested in Adani (2012) has an effect in older children as well and, furthermore, whether it surfaces even in younger children with finer-grained experimental techniques (i.e. eye-tracking), along the lines of what I suggested above for number.

In considering discourse features as pertinent for determining the similarity or difference between the head of the object dependency and the subject position, the discussion in Chapter 5 also highlighted a possible follow-up study, which could reinforce the idea put forth in the discussion. That is, if children tend to turn topics into subjects and if less specific nouns like 'person/animal' are not good topics, then children should be less prone to assign a subject interpretation to these elements. An elicited production study prompting children to use such nominal expressions in the relative head position should be very insightful here. As Hamann & Tuller (2015) pointed out, the overwhelming production of passive object relatives in elicited production experiments might have been driven by the fact that the head of the object relative is made very salient as a topic and therefore assigned a subject

interpretation. If indeed nouns like ‘person/animal’ are not good topics, then the prediction would be that children should not produce passive object relatives with ‘person/animal’ as these nouns would be less likely to be coded as subjects. Online studies, such as eye-tracking, that look at how children process these structures in real time would also be very insightful here in order to uncover the eye-movement patterns associated with the encoding of the reference for more specific as compared to less specific nouns. Such a study should reveal that when the head of the dependency is a more specific noun like ‘lady’ or ‘dog’, children should look more at character that is the subject or agent of the action. On the other hand, if children do not commit to an initial subject interpretation in the presence of a generic head noun, then upon hearing a noun like *person/animal* they should not manifest the same subject-agent preference as in the case of more specific nouns.

Furthermore, several studies (Arosio et al. 2010, Haendler et al 2015, a.o.) have shown that the computation of object dependencies requires memory resources to access previous input and to build the correct dependency between the verb and its arguments. Psycholinguistic models that investigate the way adults process such complex sentences have also shown that the greater the structural and semantic similarity between the extracted element and other units present in memory is, the harder it is to retrieve the moved element from memory and build the correct dependency (McElree, Foraker, & Dyer 2003; Lewis, Vasishth, & Van Dyke 2006). Villata, Omaki, Rizzi & Franck (2013) and Villata, Rizzi, OMaki & Franck (2014) have exploited the fine-grained assumptions of formal syntax to enrich the memory-based explanation put forth for adults. Given the gradience observed in children’s ability to compute featural relations, a natural development would be to look into the link between the processing of these structures and memory abilities, by evaluating the role that working memory and cognitive control play in modulating the intervention effects observed. Such investigations could help us examine more closely the constraints that both linguistic knowledge and cognitive mechanisms like attention and memory impose on language processing. This would provides useful insights to theories of both sentence processing mechanisms and language acquisition.

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APPENDIX A

List of test items for Experiment 1. The lead-in for all the sentences was “Show me ...”

Sentences	Condition
le garçon qui couvre l'éléphant 'the boy that is covering the elephant'	Subj Singular
la grande-mère qui couvre la fille 'the grandmother that is covering the girl'	Subj Singular
le chat qui mord le chien 'the cat that is biting the dog'	Subj Singular
le garçon qui lave l'éléphant 'the boy that is washing the elephant'	Subj Singular
le garçon qui photographie le grand-père 'the boy that is photographing the grandfather'	Subj Singular
le policier qui pousse l'astronaute 'the policeman that is pushing the astronaut'	Subj Singular
l'éléphant qui mouille le garçon 'the elephant that is wetting the boy'	Subj Singular
le chat que le garçon lave 'the cat that the boy is washing'	Obj Singular
le monstre que le crocodile mord 'the monster that the crocodile is biting'	Obj Singular
le monstre que le crocodile poursuit 'the monster that the crocodile is chasing'	Obj Singular
le chien que le garçon pousse 'the dog that the boy is pushing'	Obj Singular
la princesse que la grenouille arrose. 'the princess that the frog is wetting'	Obj Singular
le chien que le chat tape 'the dog that the cat is hitting'	Obj Singular
la fille que la grand-mère coiffe 'the girl that the grandmother is combing'	Obj Singular
les souris qui applaudissent la grenouille 'the mice that are applauding the frog'	Subj Plural
les grand-parents qui coiffent la fille	Subj Plural

‘the grandparents that are combing the girl’ les éléphants qui couvrent le garçon	Subj Plural
‘the elephants that are hiding the boy’ les monstres qui mordent le crocodile	Subj Plural
‘the monsters that are biting the crocodile’ les grand-parents qui dessinent le garçon	Subj Plural
‘the grandparents that are painting the boy’ les peintres qui poussent le policier	Subj Plural
‘the painters that are pushing the policeman’ les souris qui tiennent les grenouilles	Subj Plural
‘the mice that are holding the frogs’ la souris que les éléphants chassent	Obj Plural
‘the mouse that the elephants are chasing’ le garçon que les éléphants mouillent	Obj Plural
‘the boy that the elephants are wetting’ la princesse que les grenouilles dessinent	Obj Plural
‘the princess that the frogs are painting’ le chat que les garçons lavent	Obj Plural
‘the cat that the boys are washing’ le chat que les souris mordent	Obj Plural
‘the cat that the mice are biting’ le chat que les chiens nourrissent	Obj Plural
‘the cat that the mice are feeding’ le chat que les chiens mordent	Obj Plural
‘the cat that the dogs are biting’	

List of test items for Experiment 2

Sentences	Condition
qui couvre l’éléphant ? ‘who is covering the elephant?’	Subj <i>qui</i>
qui lave l’éléphant ? ‘who is washing the elephant?’	Subj <i>qui</i>
qui applaudit la grenouille ? ‘who is cheering the frog?’	Subj <i>qui</i>
qui peigne le petit-garçon ?	Subj <i>qui</i>

‘who is combing the little boy ?’	
qui la grenouille arrose ?	Obj ex-situ <i>qui</i>
‘who is the frog wetting?’	
qui le petit garçon pousse?	Obj ex-situ <i>qui</i>
‘who is the little boy pushing?’	
qui l’éléphant arrose ?	Obj ex-situ <i>qui</i>
‘who is the elephant washing ?’	
qui le chien mord?	Obj ex-situ <i>qui</i>
‘who is the dog biting ?’	
le crocodile mord qui ?	Obj in-situ <i>qui</i>
‘the crocodile bites who?’	
la grand-mère coiffe qui ?	Obj in-situ <i>qui</i>
‘the grand-mother is combing who ?’	
l’éléphant poursuit qui ?	Obj in-situ <i>qui</i>
‘the elephant is chasing who?’	
le petit garçon lave qui ?	Obj in-situ <i>qui</i>
‘the little boy is washing who?’	
qui est-ce que le chien mord ?	Obj ESK <i>qui</i>
‘who ESK the dog is biting?’	
qui est-ce que l’éléphant cache?	Obj ESK <i>qui</i>
‘who ESK is the elephant hiding?’	
qui est-ce que la girafe couvre?	Obj ESK <i>qui</i>
‘who ESK is the giraffe covering?’	
qui est-ce que le pompier mouille?	Obj ESK <i>qui</i>
‘who ESK is the firefighter wetting?’	
quelle petite fille couvre la grand-mère?	Subj <i>quel(le)</i>
‘which little girl is covering the grand-mother?’	
quel petit garçon photographie le grand-père ?	Subj <i>quel(le)</i>
‘which little boy is photographing the grand-father?’	
quelle grand-mère coiffe la petite fille ?	Subj <i>quel(le)</i>
‘which grand-mother is combing the little girl?’	
quel peintre pousse le policier ?	Subj <i>quel(le)</i>
‘which painter is pushing the policeman?’	
quel petit garçon le chat lave ?	Obj ex-situ <i>quel(le)</i>
‘which little boy is the cat washing?’	
quel éléphant le petit garçon arrose ?	Obj ex-situ <i>quel(le)</i>

‘which elephant is the boy wetting?’ quelle princesse la grenouille dessine?	Obj ex-situ <i>quel(le)</i>
‘which princess is the frog drawing?’ quel éléphant le chat nourrit?	Obj ex-situ <i>quel(le)</i>
‘which elephant is the cat feeding?’ le chien tape quel chat ?	Obj in-situ <i>quel(le)</i>
‘the dog is hitting which cat?’ la souris tient quelle abeille?	Obj in-situ <i>quel(le)</i>
‘the mouse is holding which bee?’ le chat mord quel chien?	Obj in-situ <i>quel(le)</i>
‘the cat is biting which dog?’ le crocodile poursuit quel monstre ?	Obj in-situ <i>quel(le)</i>
‘the crocodile is chasing which monster?’ quelle abeille est-ce que la sauterelle tient?	Obj ESK <i>quel(le)</i>
‘which bee ESK the grasshopper is holding?’ quel garçon est-ce que le grand-père dessine ?	Obj ESK <i>quel(le)</i>
‘which boy ESK the grand-father is drawing?’ quel crocodile est-ce que le monstre mord?	Obj ESK <i>quel(le)</i>
‘which crocodile ESK the monster is biting?’ quel astronaute est-ce que le policier pousse?	Obj ESK <i>quel(le)</i>
‘which astronaut ESK the policeman is pushing?’	

APPENDIX B

List of test items for Experiment 3. The lead-in for all the sentences was *Arată-mi* “Show me ...”

	Sentences	Condition
1a	câinele care urmărește calul ‘the dog that is following the horse’	SR
1b	câinele pe care calul îl urmărește ‘the dog that the horse is following’	DORpe
1c	câinele care calul îl urmărește ‘the dog that the horse is following’	DOR
2a	fata care schimbă zâna	SR

	‘the girl that is changing the fairy’	
2b	fata pe care zâna o schimbă. ‘the girl that the fairy is changing’	DORpe
2c	fata care zâna o schimbă. ‘the girl that the fairy is changing’	DOR
3a	găina care trage rața ‘the hen that is pulling the duck’	SR
3b	găina pe care rața o trage ‘the hen that the duck is pulling’	DORpe
3c	găina care rața o trage ‘the hen that the duck is pulling’	DOR
4a	elefantul care udă crocodilul ‘the elephant that is wetting the crocodile’	SR
4b	elefantul pe care crocodilul îl udă ‘the elephant that the crocodile is wetting’	DORpe
4c	elefantul care crocodilul îl udă ‘the elephant that the crocodile is wetting’	DOR
5a	capra care împinge vaca ‘the goat that is pushing the cow’	SR
5b	capra pe care vaca o împinge ‘the goat that the cow is pushing’	DORpe
5c	capra care vaca o împinge ‘the goat that the cow is pushing’	DOR
6a	tigrul care mușcă leul ‘the tiger that is biting the lion’	SR
6b	tigrul pe care leul îl mușcă ‘the tiger that the lion is biting’	DORpe
6c	tigrul care leul îl mușcă ‘the tiger that the lion is biting’	DOR
7a	lupul care urmărește ursul ‘the wolf that is following the bear’	SR
7b	lupul pe care ursul îl urmărește ‘the wolf that the bear is following’	DORpe
7c	lupul care ursul îl urmărește. ‘the wolf that the bear is following’	DOR
8a	șoarecele care hrănește iepurele	SR

	‘the mouse that is feeding the rabbit’	
8b	șoarecele pe care iepurele îl hrănește ‘the mouse that the rabbit is feeding’	DOR _{pe}
8c	șoarecele care iepurele îl hrănește ‘the mouse that the rabbit is feeding’	DOR
9a	fata care îi dă o periută de dinți mamei. ‘the girl who gives her mother a toothbrush’	SR
9b	fata căreia mama îi dă o periută de dinți ‘the girl to whom the mother is giving a toothbrush’	IOR
10a	pisica care îi aruncă o banană maimuței ‘the cat that is throwing a banana to the monkey’	SR
10b	pisica căreia maimuța îi aruncă o banana ‘the cat to whom the monkey is throwing a banana.’	IOR
11a	vulpea care îi cântă un cântec găștei ‘the fox that is singing a song to the goose.’	SR
11b	vulpea căreia gâsca îi cântă un cântec ‘the fox to whom the goose is singing a song’	IOR
12a	pisica care îi aduce o minge găinei. ‘the cat that is bringing a ball to the hen’	SR
12b	pisica căreia găina îi aduce o minge. ‘the cat to whom the hen is bringing a ball’.	IOR

List of test items for Experiment 4

	Sentences	Condition	
1a	cine a împins ursul? ‘who pushed the bear?’	Subject	<i>cine</i>
1b	pe cine a împins ursul? ‘who did the bear push?’	Object	<i>cine</i>
1c	care elefant a împins ursul? ‘which elephant pushed the bear?’	Subject	<i>care NP</i>
1d	pe care elefant l-a împins ursul? ‘which elephant did the bear push?’	Object	<i>care NP</i>
1e	care a împins ursul? ‘which one pushed the bear?’	Subject	<i>care</i>
1f	pe care l-a împins ursul?	Object	<i>care</i>

	‘which one did the bear push?’		
2a	cine a lovit pisica? ‘who hit the cat?’	Subject	<i>cine</i>
2b	pe cine a lovit pisica? ‘who did the cat hit?’	Object	<i>cine</i>
2c	care girafa a lovit pisica? ‘which giraffe hit the cat?’	Subject	<i>care NP</i>
2d	pe care girafa a lovit-o pisica? ‘which giraffe did the cat hit?’	Object	<i>care NP</i>
2e	care a lovit pisica? ‘which one hit the cat?’	Subject	<i>care</i>
2f	pe care a lovit-o pisica? ‘which one did the cat hit?’	Object	<i>care</i>
3a	cine a tras câinele? ‘who pulled the dog?’	Subject	<i>cine</i>
3b	pe cine a tras câinele? ‘who did the dog pull?’	Object	<i>cine</i>
3c	care kangur a tras câinele? ‘which kangaroo pulled the dog?’	Subject	<i>care NP</i>
3d	pe care kangur l-a tras câinele? ‘which kangaroo did the dog pull?’	Object	<i>care NP</i>
3e	care a tras câinele? ‘which one pulled the dog?’	Subject	<i>care</i>
3f	pe care l-a tras câinele? ‘which one did the dog pull?’	Object	<i>care</i>
4a	cine a mușcat leul? ‘who bit the lion?’	Subject	<i>cine</i>
4b	pe cine a mușcat leul? ‘who did the lion bit?’	Object	<i>cine</i>
4c	care crocodil a mușcat leul? ‘which crocodile bit the lion?’	Subject	<i>care NP</i>
4d	pe care crocodil l-a mușcat leul? ‘which crocodile did the lion bit?’	Object	<i>care NP</i>
4e	care a mușcat leul? ‘which one bit the lion?’	Subject	<i>care</i>
4f	pe care l- a mușcat leul?	Object	<i>care</i>

	‘which one did the lion bit?’		
5a	cine a mângâiat fetița?	Subject	<i>cine</i>
	‘who patted the little girl?’		
5b	pe cine a mângâiat fetița?	Object	<i>cine</i>
	‘who did the little girl pat?’		
5c	care bunică a mângâiat fetița?	Subject	<i>care NP</i>
	‘which grandmother patted the little girl?’		
5d	pe care bunică a mângâiat-o fetița?	Object	<i>care NP</i>
	‘which grandmother did the little girl pat?’		
5e	care a mângâiat fetița?	Subject	<i>care</i>
	‘which one patted the little girl?’		
5f	pe care a mângâiat-o fetița?	Object	<i>care</i>
	‘which one did the little girl pat?’		
6a	cine a ridicat băiatul?	Subject	<i>cine</i>
	‘who lifted the boy?’		
6b	pe cine a ridicat băiatul?	Object	<i>cine</i>
	‘who did the boy lift?’		
6c	care bunic a ridicat băiatul?	Subject	<i>care NP</i>
	‘which grandfather lifted the boy?’		
6d	pe care bunic l-a ridicat băiatul?	Object	<i>care NP</i>
	‘which grandfather did the boy lift?’		
6e	care a ridicat băiatul?	Subject	<i>care</i>
	‘which one lifted the boy?’		
6f	pe care l-a ridicat băiatul?	Object	<i>care</i>
	‘which one did the boy lift?’		
7a	cine a atins vrăjitoarea?	Subject	<i>cine</i>
	‘who touched the witch?’		
7b	pe cine a atins vrăjitoarea?	Object	<i>cine</i>
	‘who did the witch touch?’		
7c	care prințesa a atins vrăjitoarea?	Subject	<i>care NP</i>
	‘which princess touched the witch?’		
7d	pe care prințesa a atins-o vrăjitoarea?	Object	<i>care NP</i>
	‘which princess did the witch touch?’		
7e	care a atins vrăjitoarea?	Subject	<i>care</i>
	‘which one touched the witch?’		
7f	pe care a atins-o vrăjitoarea?	Object	<i>care</i>

	‘which one did the witch touch?’		
8a	cine a pocnit regele?	Subject	<i>cine</i>
	‘who punched the king?’		
8b	pe cine a pocnit regele?	Object	<i>cine</i>
	‘who did the king punch?’		
8c	care doctor a pocnit regele?	Subject	<i>care NP</i>
	‘which doctor punched the king?’		
8d	pe care doctor l-a pocnit regele?	Object	<i>care NP</i>
	‘which doctor did the king punch?’		
8e	care a pocnit regele?	Subject	<i>care</i>
	‘which one punched the king?’		
8f	pe care l-a pocnit regele?	Object	<i>care</i>
	‘which one did the king punch?’		
9a	cine a lovit calul?	Subject	<i>cine</i>
	‘who hit the horse?’		
9b	pe cine a lovit calul?	Object	<i>cine</i>
	‘who did the horse hit?’		
9c	care panda a lovit calul?	Subject	<i>care NP</i>
	‘which panda hit the horse?’		
9d	pe care panda l-a lovit calul?	Object	<i>care NP</i>
	‘which panda did the horse hit?’		
9e	care a lovit calul?	Subject	<i>care</i>
	‘which one hit the horse?’		
9f	pe care l-a lovit calul?	Object	<i>care</i>
	‘which one did the horse hit?’		
10a	cine a împins elefantul?	Subject	<i>cine</i>
	‘who pushed the elephant?’		
10b	pe cine a împins elefantul?	Object	<i>cine</i>
	‘who did the elephant push?’		
10c	care câine a împins elefantul?	Subject	<i>care NP</i>
	‘which dog pushed the elephant?’		
10d	pe care câine l-a împins elefantul?	Object	<i>care NP</i>
	‘which dog did the elephant push?’		
10e	care a împins elefantul?	Subject	<i>care</i>
	‘which one pushed the elephant?’		
10f	pe care l-a împins elefantul?	Object	<i>care</i>

	‘which one did the elephant push?’		
11a	cine a pălmuit camila? ‘who slapped the camel?’	Subject	<i>cine</i>
11b	pe cine a pălmuit camila? ‘who did the camel slap?’	Object	<i>cine</i>
11c	care pisica a pălmuit camila? ‘which cat slapped the camel?’	Subject	<i>care NP</i>
11d	pe care pisica a pălmuit-o camila? ‘which cat did the camel slap?’	Object	<i>care NP</i>
11e	care a pălmuit camila? ‘which one did the camel slap?’	Subject	<i>care</i>
11f	pe care a pălmuit-o camila? ‘which one did the camel slap?’	Object	<i>care</i>
12a	cine a gădilat zebra? ‘who tickled the zebra?’	Subject	<i>cine</i>
12b	pe cine a gădilat zebra? ‘who did the zebra tickle?’	Object	<i>cine</i>
12c	care țestoasa a gădilat zebra? ‘which turtle tickled the zebra?’	Subject	<i>care NP</i>
12d	pe care țestoasa a gădilat-o zebra? ‘which turtle did the zebra tickle?’	Object	<i>care NP</i>
12e	care a gădilat zebra? ‘which one tickled the zebra?’	Subject	<i>care</i>
12f	pe care a gădilat-o zebra? ‘which one tickled the zebra?’	Object	<i>care</i>
13a	cine a îmbrățișat bunicul? ‘who hugged the grandfather?’	Subject	<i>cine</i>
13b	pe cine a îmbrățișat bunicul? ‘who did the grandfather hug?’	Object	<i>cine</i>
13c	care doctor a îmbrățișat bunicul? ‘which doctor hugged the grandfather?’	Subject	<i>care NP</i>
13d	pe care doctor l- a îmbrățișat bunicul? ‘which doctor did the grandfather hug?’	Object	<i>care NP</i>
13e	care a îmbrățișat bunicul? ‘which one hugged the grandfather?’	Subject	<i>care</i>
13f	pe care l-a îmbrățișat bunicul?	Object	<i>care</i>

	‘which one did the grandfather hug?’		
14a	cine a mângîiat bunica? ‘who pat the grandmother?’	Subject	<i>cine</i>
14b	pe cine a mângîiat bunica? ‘who did the grandmother pat?’	Object	<i>cine</i>
14c	care fata a mângîiat bunica? ‘which girl pat the grandmother?’	Subject	<i>care NP</i>
14d	pe care fata a mângîiat-o bunica? ‘which girl did the grandmother pat?’	Object	<i>care NP</i>
14e	care a mângîiat bunica? ‘which one pat the grandmother?’	Subject	<i>care</i>
14f	pe care a mângîiat-o bunica? ‘which one did the grandmother pat?’	Object	<i>care</i>
15a	cine a p�almuit calul? ‘who slapped the horse?’	Subject	<i>cine</i>
15b	pe cine a p�almuit calul? ‘who did the horse slap?’	Object	<i>cine</i>
15c	care castor a p�almuit calul? ‘which castor slapped the horse?’	Subject	<i>care NP</i>
15d	pe care castor l-a p�almuit calul? ‘which castor did the horse slap?’	Object	<i>care NP</i>
15e	care a p�almuit calul? ‘which one slapped the horse?’	Subject	<i>care</i>
15f	pe care l-a p�almuit calul? ‘which one did the horse slap?’	Object	<i>care</i>
16a	cine a g�adilat �estoasa? ‘who tickled the turtle?’	Subject	<i>cine</i>
16b	pe cine a g�adilat �estoasa? ‘who did the turtle tickle?’	Object	<i>cine</i>
16c	care girafa a g�adilat �estoasa? ‘which giraffe tickled the turtle?’	Subject	<i>care NP</i>
16d	pe care girafa a g�adilat-o �estoasa? ‘which giraffe did the turtle tickle?’	Object	<i>care NP</i>
16e	care a g�adilat �estoasa? ‘which one tickled the turtle?’	Subject	<i>care</i>
16f	pe care a g�adilat-o �estoasa?	Object	<i>care</i>

	‘which one did the turtle tickle ?’		
17a	cine a atins regele? ‘who touched the king ?’	Subject	<i>cine</i>
17b	pe cine a atins regele? ‘who did the king touch ?’	Object	<i>cine</i>
17c	care baiat a atins regele? ‘which boy touched the king ?’	Subject	<i>care NP</i>
17d	pe care baiat l-a atins regele? ‘which boy did the king touch ?’	Object	<i>care NP</i>
17e	care a atins regele? ‘which boy touched the king ?’	Subject	<i>care</i>
17f	pe care l-a atins regele? ‘which one did the king touch ?’	Object	<i>care</i>
18a	cine a pocnit cangurul? ‘who hit the kangaroo ?’	Subject	<i>cine</i>
18b	pe cine a pocnit cangurul? ‘who did the kangaroo hit ?’	Object	<i>cine</i>
18c	care leu a pocnit cangurul? ‘which lion hit the kangaroo ?’	Subject	<i>care NP</i>
18d	pe care leu l-a pocnit cangurul? ‘which lion did the kangaroo hit ?’	Object	<i>care NP</i>
18e	care a pocnit cangurul? ‘which lion hit the kangaroo ?’	Subject	<i>care</i>
18f	pe care l- a pocnit cangurul? ‘which one did the kangaroo hit ?’	Object	<i>care</i>

APPENDIX C

List of test items for Experiment 5.

WH-questions

Sentences	Condition
quelle fille est-ce que la dame maquille? ‘which girl is the lady putting make up on?’	+NP +Animate

quelle princesse est-ce que la grenouille embrasse?	+NP +Animate
‘which princess is the frog kissing?’	
quel lapin est-ce que le chat frappe?	+NP +Animate
‘which rabbit is the cat punching?’	
quel canard est-ce que le lapin caresse?	+NP +Animate
‘which duck is the rabbit petting?’	
quelle balançoire est-ce que la fille frappe?	+NP –Animate
‘which swing is the girl hitting?’	
quelle balle est-ce que la poule suit?	+NP –Animate
‘which ball is the hen following?’	
quel tuyau est-ce que l’éléphant arrose?	+NP –Animate
‘which hose is the elephant splashing?’	
quel ballon est-ce que le garçon tape?	+NP –Animate
‘which ball is the boy hitting?’	
qui est-ce que la giraffe lèche? (la vache)	–NP +Animate
‘who is the giraffe licking?’ (the cow)	
qui est-ce que le pompier mouille? (le garçon)	–NP +Animate
‘who is the firefighter splashing?’ (the boy)	
qu’est-ce que la fille frappe? (la porte)	–NP –Animate
‘what is the girl hitting?’ (the door)	
qu’est-ce que l’enfant salit? (le camion)	–NP –Animate
‘what is the boy dirtying?’ (the truck)	

Relative clauses (The lead-in for all the relative clauses was “Show me ...”)

Sentences	Condition
la fille que la grand-mère sèche.	+NP +Animate
‘the girl that the lady is drying.’	
la dame que la petite-fille embrasse.	+NP +Animate
‘the lady that the girl is kissing.’	
le chameau que le zèbre suit.	+NP +Animate
‘the camel that the zebra is following.’	
le cochon que l’enfant salit.	+NP +Animate
‘the pig that the boy is dirtying.’	
la pelote que la chatte suit.	+NP –Animate
‘the ball of yarn that the cat is following.’	

la casserole que la dame salit. 'the pot that the lady is dirtying.'	+NP –Animate
le tuyau que le garçon arrose. 'the hose that the boy is splasing?'	+NP –Animate
le vélo que le chien pousse. 'the bike that the dog is pushing.'	+NP –Animate
celle que la reine photographie. (la fille) 'the one that the queen is photographing.' (the girl)	–NP +Animate
celui que le cheval suit. (le bébé) 'the one that the horse is following.' (the baby)	–NP +Animate
ce que la fille touche (la boule de neige) 'what the girl is touching?' (the snowball)	–NP –Animate
ce que l'éléphant écrase. (l'arbre) 'what the elephant is crushing?' (the tree trunk)	–NP –Animate

List of test items for Experiment 6.

Sentences	Condition
Voilà les hommes. Montre-moi celui que le cheval bat. 'the girl that the lady is drying.'	Animacy Match
Voilà les pompiers. Montre-moi celui que le garçon mouille. 'the lady that the girl is kissing.'	Animacy Match
Voilà les garçons. Montre-moi celui que le grand-père photographie. 'the camel that the zebra is following.'	Animacy Match
Voilà les chèvres. Montre-moi celle que la princesse filme. 'the pig that the boy is dirtying.'	Animacy Match
Voilà les grenouilles. Montre-moi celle que la princesse arrose. 'the ball of yarn that the cat is following.'	Animacy Match
Voilà les filles. Montre-moi celle que la grand-mère coiffe. 'the pot that the lady is dirtying.'	Animacy Match
Voilà les tuyaux. Montre-moi celui que le garçon arrose. 'the hose that the boy is splasing?'	Animacy Mismatch
Voilà les vélos. Montre-moi celui que le chien pousse. 'the bike that the dog is pushing.'	Animacy Mismatch
Voilà les arbres. Montre-moi celui que l'éléphant écrase. 'the one that the queen is photographing.' (the girl)	Animacy Mismatch

Voilà les boules de neige. Montre-moi celle que la fille touche. 'the one that the horsey is following.' (the baby)	Animacy Mismatch
Voilà les portes. Montre-moi celle que la fille frappe. 'what the girl is touching?' (the snowball)	Animacy Mismatch
Voilà les casseroles. Montre-moi celle que la dame salit. 'what the elephant is crushing?' (the tree trunk)	Animacy Mismatch

APPENDIX D

List of test items for Experiment 7.

WH-questions

Sentences	Condition
quelle fille est-ce que la dame maquille? 'which girl is the lady putting make up on?'	+Set-restricted
quelle princesse est-ce que la grenouille embrasse? 'which princess is the frog kissing?'	+Set-restricted
quel lapin est-ce que le chat frappe? 'which rabbit is the cat punching?'	+Set-restricted
quel canard est-ce que le lapin caresse? 'which duck is the rabbit petting?'	+Set-restricted
quelle personne est-ce que la dame maquille? 'which person is the lady putting make up on?'	-Set-restricted
quelle personne est-ce que la grenouille embrasse? 'which person is the frog kissing?'	-Set-restricted
quel animal est-ce que le lapin caresse? 'which animal is the rabbit petting?'	-Set-restricted
quel animal est-ce que le chat frappe? 'which animal is the cat punching?'	-Set-restricted

Relative clauses (The lead-in for all the relative clauses was "Show me ...")

Sentences	Condition
la fille que la grand-mère sèche.	+Set-restricted

‘the girl that the lady is drying.’	
la dame que la petite-fille embrasse.	+Set-restricted
‘the lady that the little girl is kissing.’	
le chameau que le zèbre suit.	+Set-restricted
‘the camel that the zebra is following.’	
le cochon que l’enfant salit.	+Set-restricted
‘the pig that the boy is dirtying.’	
la personne que la grand-mère sèche.	–Set-restricted
‘the person that the grandmother is drying.’	
la personne que la petite-fille embrasse.	–Set-restricted
‘the person that the little girl is kissing.’	
l’animal que le zèbre suit.	–Set-restricted
‘the animal that the zebra is following.’	
l’animal que l’enfant salit.	–Set-restricted
‘the animal that the boy is dirtying.’	

List of test items for Experiment 8.

WH-questions

Sentences

quelle fille est-ce que la personne maquille? (la dame)
‘which girl is the person putting make up on?’ (the lady)
quelle grenouille est-ce que la personne embrasse?’ (la princesse)
‘which frog is the person kissing?’ (the princess)
quel lapin est-ce que l’animal frappe? (le chat)
‘which rabbit is the animal punching?’
quel canard est-ce que l’animal caresse? (le lapin)
‘which duck is the animal petting?’
quel pompier est-ce que l’animal mouille? (l’éléphant)
‘which firefighter is the animal wetting?’ (the elephant)
quelle fille est-ce que la personne coiffe? (la dame)
‘which girl is the person combing?’ (the lady)

Relative clauses (The lead-in for all the relative clauses was “Show me ...”)

Sentences

la fille que la personne sèche. (la grand-mère)

‘the girl that the person is drying.’ (the grandmother)

la dame que la personne embrasse. (la petite-fille)

‘the lady that the person is kissing.’ (the little girl)

le chameau que l’animal suit. (le zèbre)

‘the camel that the animal is following.’ (the zebra)

le garçon que l’animal salit. (le cochon)

‘the boy that the animal is dirtying.’ (the pig)

la chèvre que la personne filme. (la princesse)

‘the goat that the person is filming.’ (the princess)

le bébé que l’animal suit. (le cheval)

‘the baby that the animal is following.’ (the horse)
