The Comprehension of Relative Clauses by Romance Learners of English: Syntactic and Semantic Influences

Published by
LOT
Trans 10
3512 JK Utrecht
The Netherlands

phone: +31 30 253 6111

e-mail: lot@uu.nl
http://www.lotschool.nl

Cover illustration: Marie-Anne C. M. Duffeler

ISBN: 978-94-6093-263-2
NUR 616

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VRIJE UNIVERSITEIT

The Comprehension of Relative Clauses by Romance Learners of English:

Syntactic and Semantic Influences

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad Doctor aan
de Vrije Universiteit Amsterdam,
op gezag van de rector magnificus
prof.dr. V. Subramaniam,
in het openbaar te verdedigen
ten overstaan van de promotiecommissie
van de Faculteit der Geesteswetenschappen
op woensdag 20 december 2017 om 09.45 uur
in de aula van de universiteit,
De Boelelaan 1105

door

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ABSTRACT

Relative clauses have fascinated linguists and psycholinguists for decades and have been the field of investigation of theories in the native language (L1) as well as in the acquisition of the second language (L2). The present thesis builds upon the previous research on relative clauses (RC) and seeks to discover whether the comprehension of RCs by Romance learners of English follows a gradient of difficulty and to determine which variables affect this comprehension. More specifically, it aims to see whether the L2 comprehension of RCs matches Keenan and Comrie's (1977) Noun Phrase Accessibility Hierarchy, which predicts that the comprehension difficulty of subject, object, and oblique RCs is in increasing order, and to detect the influence of L2 syntax, L2 semantics, and cross-linguistic transfer on the L2 comprehension of RCs.

Previous research on RCs has revealed that, in Germanic and Romance languages, some RCs are easier to process by native adults than others, in particular subject RCs that contain animate referents and full noun phrases take less time to process than object ones. In other words, the RC difficulty depends on the syntactic function (subject or object) of the RC, on the semantic animacy of the RC referents (animate or inanimate), and on the semantic category of the embedded nouns (noun phrase or pronoun). This asymmetry between subject and object RCs, however, appears in the processing of RCs by L1 adults, but not in their comprehension. On the other hand, it is unclear whether this asymmetry applies to adult L2 learners because the RC research in L2 acquisition has tested other skills than processing and comprehension and has included languages other than Germanic or Romance languages, for which the subject-object RC asymmetry is still disputed. Therefore, the present research focuses on the comprehension of subject, object, and oblique RCs that contain animate referents and full noun phrases, as in the example Show me the dog that the cat is chasing, by learners of English who have Romance languages as L1, in particular French or Italian, so that the conclusions of L1 research on RCs fully apply to the experiment subjects.

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Three experiments testing the comprehension of subject, object, and oblique RCs by French and Italian learners of English have produced the following results. First, there is a gradient of difficulty in the comprehension of English RCs by Romance learners in the sense that subject RCs are easier to understand than oblique ones, but it does not follow Keenan and Comrie's (1977) NPAH, which predicts the unequal comprehension of subject and object RCs, on the one hand, and of object and oblique RCs, on the other hand. Second, the comprehension of RCs by Romance learners is affected by syntactic as well as semantic factors. The syntactic variables influencing the L2 comprehension of RCs are the syntactic function of the RC and the syntactic placement of prepositions inside the oblique RCs. In particular, subject RCs are understood better than oblique ones, and oblique RCs containing clause-internal, stranded prepositions have a comprehension advantage over RCs featuring fronted, pied-piped prepositions. As far as the semantic influence is concerned, it appears that the semantic content of the prepositions used inside the oblique RCs determines how well the RCs are comprehended by Romance learners of English, and specifically, oblique RCs featuring non-locative prepositions have a comprehension advantage over those containing locative prepositions. Finally, no evidence of cross-linguistic transfer during the L2 comprehension of RCs by intermediate learners of English has been found since Romance learners do not exhibit a better comprehension of oblique RCs with pied-piped prepositions although that RC construction is similar in their L1s.

The experiment results lead to the conclusion, first, that the theoretical accounts that have been formulated to explain RC complexity and that are based exclusively on syntax (such as O'Grady's (1997) Structural Distance Hypothesis, Minimalism according to McDaniel, McKee, and Bernstein (1998), or the frequency of syntactic patterns) or on semantics (such as MacWhinney's (1977) Perspective Hypothesis) cannot be satisfactory since they disregard the influence of factors that have been shown to be important. Consequently, future models of RC comprehension will need to be multi-factorial and include the effect of syntactic as well as semantic variables. Second, the failure to identify a gradient of difficulty corresponding to Keenan and Comrie's (1977) NPAH in the comprehension of RCs by Romance learners of English although that Hierarchy has received support from early research in L2 acquisition highlights the

importance of methodological precision: indeed, the early backing of that gradient was based on acceptance and production data that did not aim to test the psychological validity of the Hierarchy in L2 learners. However, once the skill under investigation is clearly defined, in this case comprehension, and tested, it appears that the NPAH is not a good predictor of RC comprehension, and this conclusion converges with the L1 research finding that subject and object RCs are equally well understood. Finally, the absence of cross-linguistic transfer in the L2 comprehension of RCs contrasts with theories of L2 acquisition, which predict that the development of L2 knowledge is permeated by L1 transfer, but it may be the result of the advanced proficiency level of the participants. Nevertheless, it does indicate that L2 learners behave, at some point, in a way similar to L1 speakers and therefore supports other research findings that have revealed that L2 learners can acquire L2 parsing strategies although they may be influenced by their L1s initially.

IV The Comprehension of Relative Clauses by Romance Learners of English

ACKNOWLEDGEMENTS

Undertaking a doctoral dissertation is quite an endeavor, and several persons have contributed to its completion by being sources of assistance, inspiration, or encouragement.

First and foremost, I would like to express my deepest gratitude to my supervisor, Prof. Martine Coene, and to my co-supervisor, Dr. Nel de Jong, at the Vrije Universiteit Amsterdam. I am grateful to Prof. Martine Coene for accepting to supervise my doctoral project and for letting me conduct my research autonomously while being always available for advice, and to Dr. Nel de Jong for providing me with invaluable criticism, which has contributed to enhance the coherence of the present thesis.

Then, I would like to express my most sincere thanks to Prof. Massimo Zucchetti for letting me test his engineering students at the Politecnico di Torino, Italy; to Prof. Jean-Adolphe Rondal for being available for stimulating discussions about language acquisition; to Prof. Shinichi Izumi for sharing his testing material with me; and to Prof. Martin Solly, Prof. Sandra Campagna, Prof. Flavia Adani, Dr. Petros Karatsareas, and Dr. Francesco Gardani for helping me in my quest for much needed articles. Moreover, I would like to acknowledge Dr. René Bastin for inspiring me and for his words of encouragements when I was still pondering the idea of starting a doctoral thesis.

Finally, I would like to express my deepest gratitude to my family, without whom this research would not have become a reality: Thank you, Fulvio, for your unconditional support, and thank you, Amanda and Emilio, for filling my life with love and laughter.

PREFACE

In 1965, two American physicists, Arno Penzias and Robert Wilson, were working on the development of a highly sensitive antenna at Bell Telephone Laboratories intended to detect radio waves when they noticed the presence of unusual noise in their data. After eliminating all the possible sources of interference, they realized that the noise was microwave radiation coming from the cosmos. The discovery constituted evidence in favor of the Big Bang theory, and in 1978, Penzias and Wilson were awarded the Nobel Prize for Physics.

It would be nice to think that science is all about making the right predictions and testing them, and that formulating carefully-crafted hypotheses leads to new discoveries. Yet, it is not always so. Scientific progress contains a part of chance findings, as the story of Wilson and Penzias reminds us, and at times, scientists have failed to recognize the importance of their own discoveries because they were not ready to change paradigm. Therefore, some of the most important qualities that researchers must possess are probably open-mindedness and curiosity. If the researcher's object of investigation is not to be found, then it is worth investigating the reason for it.

The present thesis is a case in point. Originally, it was meant to study how relative clauses (RC) could be best instructed to second language learners, and the often reported finding in the psycholinguistic literature that subject RCs are easier than object ones constituted the research baseline. However, once French learners of English were tested on their comprehension of RCs and that no asymmetry was evidenced, the goal of the entire research had to be questioned. As a result, the focus of the thesis shifted: instead of building upon the generally acknowledged subject-object RC asymmetry, it asked whether this asymmetry, or a more general gradient of difficulty, was present in the comprehension of RCs by second language learners. Eventually, this research has led to the realization that the general consensus on the subject-object RC asymmetry is due to a lack of methodological precision, and has produced evidence supporting some of the

previous research while at the same time uncovering the influence of a new variable on the comprehension of these clauses.

During the writing of the present thesis, all efforts have been made so that its organization is coherent and its reading fluent. Nevertheless, readers are invited to keep in mind the above-mentioned shift in focus in case they wonder why some hypotheses were not tested right from the start of the research. On the other hand, it is hoped that they will be as thrilled as the author to the perspective of challenging received knowledge and of contributing to a new understanding of RC complexity.

LIST OF ABBREVIATIONS

ANOVA	Analysis of variance
BNC	British National Corpus
CLAWS	Constituent Likelihood Automatic Word-tagging System
COCA	Corpus of Contemporary American English
CP	Complementizer phrase
DO	Direct object
ERP	Event-related potential
GEN	Genitive complement
IO	Indirect object
IP	Inflectional phrase
L1	First language
L2	Second language
NPAH	Noun Phrase Accessibility Hierarchy
OBL	Oblique complement
OBL-PP	Oblique RC with preposition pied-piping
OBL-PS	Oblique RC with preposition stranding
OCOMP	Object of a comparison
OO	Object-modifying object RC
OS	Object-modifying subject RC
OSV	Object subject verb
OVS	Object verb subject
PH	Perspective Hypothesis
RC	Relative clause
SDH	Structural Distance Hypothesis
SO	Subject-modifying object RC
SPLT	Syntactic Prediction Locality Theory
SS	Subject-modifying subject RC
SU	Subject
SVO	Subject verb object
VP	Verb phrase

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CHAPTER 1: INTRODUCTION

Language acquisition is captivating and has captivated linguists for decades. Probably the reason for this fascination lies in the combined simplicity and complexity of the phenomenon. Indeed, children of a particular community acquire a first language quite effortlessly, but the acquisition of a second language is often a long and tedious endeavor. Moreover, while the acquisition of the first language is almost always successful, the outcome of years of learning a second language is often uncertain. Since the resolution of any problem starts with understanding it, any attempt at helping learners in their acquisition of a second language supposes to have insight in that issue, and the only way to achieve it is through research, in particular research on second language acquisition. This issue lies at the heart of the present dissertation.

Since the field of second language (L2) acquisition is far-reaching and research in this discipline has taken distinctive directions, a clear definition of what is meant by "second language acquisition" is needed. In this thesis, Dörnyei's (2009) definition of L2 acquisition is adopted: it is the development of L2 knowledge by learners of a foreign language. In other words, it should not be understood as the representation of the L2 in the brain (how it is formally structured and stored in the brain), nor as the processing of the L2 (which psychological processes underlie L2 comprehension and production).

When acquiring a second language, learners have to come to grasp with various aspects of that language, namely its lexicon, its phonetic system, its morphology, and its syntax. The acquisition of L2 syntax is the focus of the present research, and the decision to research this issue in particular is motivated by its importance in the general process of L2 acquisition. Indeed, while mistakes in morphology, phonology or lexicon made by L2 learners in their attempt to communicate in the L2 can generally be repaired by the interlocutors, errors in syntax are more severe in that they usually lead to a breakdown of the communication between the conversation partners. In English in particular, syntax has maximal importance

due to the rather rigid word order of the language, and it is well known that inverting words in a sentence can alter its meaning completely. As the saying goes, *Dog bites man* is no news, whereas *Man bites dog* is sensational news.

Among the syntactic structures that have generated much interest among linguists and psycholinguists, relative clauses (RCs) occupy a prominent place. This is due to their intrinsic syntactic complexity, their presence in typologically different languages, and their frequency in natural discourse (Izumi, 2003). Researchers in theoretical linguistics who adopt a generative framework have been fascinated by RCs because they are a showcase of computations: according to Chomsky's (1995) Minimalist theory, they are derived by movement and are subject to locality conditions, although their exact analysis is still debated. Then, in psycholinguistics, researchers adopting a functionalist perspective have found that RCs represent fertile ground to test the various features described in the Competition Model (Bates & MacWhinney, 1982), such as perspective shifts and cue strengths, or to measure the influence of prosodic and pragmatic factors (Fox and Thompson, 2007). Finally, researchers studying memory load have also found an interest in RCs because these constructions always suppose that some information has to be held in working memory before the clause can be processed (see Traxler, Morris, & Seely, 2002, for a review of this line of research). In second language acquisition research, RCs have been investigated for some of the same reasons as in L1 research and for others that are specific to the field.

Specifically, L2 authors investigating RCs have been motivated by the following rationales. Some have wanted to determine whether the theories developed in L1 research pertaining to RC complexity can be extended to populations of non-native learners (Cook, 1975; Ohba, 2003; Ozeki & Shirai, 2007; Xu, 2014); some have tried to see whether the acquisition of RCs is subject to cross-linguistic transfer (Gass, 1979; Havik et al., 2009; Hu & Liu, 2007; Lee, 2014) or whether L2 learners process RCs in the same way as native speakers do (Izumi, 2003; Kanno, 2007; Mitsugi et al., 2010; Perpiñan, 2015; Xu, 2014); finally, other scholars have investigated the acquisition of RCs by L2 learners in order to contribute to the advancement of research on language instruction by focusing on the order of RC acquisition (Bardovi-Harlig, 1987; Hawkins, 1989; Kang, 2015; Mazurkewich,

1984) or on the learning generalizations that such an order may engender (Doughty, 1991; Eckman, Bell, & Nelson, 1988; Hamilton, 1994).

As can be seen, the motivations for researching RCs in second language acquisition are plentiful and justified. However, the L2 research that has been carried out on RCs until recently has suffered from some weaknesses. As pointed out by Izumi (2003), the investigation of RCs in L2 acquisition has lacked cohesion in terms of focus because L2 scholars have examined various hypotheses separately, and it has suffered from a lack of diversity in the methodology because, unlike what has happened in L1 research, L2 studies have employed almost exclusively acceptance or production tasks. In addition to Izumi's observation, it should be noted that the second language research devoted to RCs has two additional characteristics: First, many L2 experiments have been inspired by and constructed directly on the basis of conclusions formulated in L1 research on RCs, and second, the methodology used in L2 acquisition studies is not only limited in range, but also dissimilar from the one used in L1 settings. For example, the seminal study by Gass (1979) investigated the possible occurrence of cross-linguistic transfer regarding RCs by checking whether the acceptance and production of RCs by L2 learners matched Keenan and Comrie's (1977) Noun Phrase Accessibility Hierarchy, which was a universal hierarchy of RC complexity emanating from typological research on L1s. However, Gass questioned neither the relevance of this Hierarchy in the L2 nor the methodology that she used. In other words, she did not wonder whether Keenan and Comrie's (1977) Hierarchy predicted the behavior of L2 learners accurately, and if so, which skill it concerned; and she speculated that the results of L2 learners could be compared with those of L1 speakers although the experimental tasks diverged completely. Indeed, Gass tested L2 learners with grammaticality judgment and sentence combination tasks whereas L1 researchers had used methods such as word selection, toy acting, paraphrasing, phoneme monitoring, and self-paced reading. The result was that language processing, acceptance, comprehension, and production were never disambiguated. Afterwards, much of the research that followed Gass' (1979) study was inspired by her results and extended the discussion of the Noun Phrase Accessibility Hierarchy (Keenan and Comrie, 1977) and its implications for language instruction (Adjemian and Liceras, 1984; Bardovi-Harlig, 1987; Dougthy, 1991; Eckman, Bell, & Nelson, 1988; Gass, 1980,

1982; Hamilton, 1994; Hawkins, 1989; Hyltenstam, 1984; Liceras, 1986; Mazurkewich, 1984). It is striking, therefore, that the early research on RCs in L2 acquisition did not try to determine whether the Noun Phrase Accessibility Hierarchy had psychological validity in L2 learners and whether it concerned receptive or productive skills, or both.

More recently, L2 researchers studying RCs have distanced themselves from the early discussion of Keenan and Comrie's (1977) Noun Phrase Accessibility Hierarchy and have tested whether the asymmetries between RC categories predicted by this Hierarchy were supported by empirical findings. They have done so by employing experimental tasks more similar to the ones used in L1 research, such as self-paced reading, verification statements, elicited imitation, and picture selection. Moreover, they have integrated the latest developments of L1 research concerning the processing and comprehension of RCs by controlling variables such as the animacy, frequency, and category of the relativized nouns in the design of test items. The results of the most recent research on RCs in second language acquisition, however, have been anything but clear-cut.

Indeed, the recent research about the acquisition of RCs by L2 learners has not generated consensus because the results from various measures have been divergent, for example the scores coming from processing and comprehension tests have not matched, or the behavior of various groups of L2 learners within the same experiment has been dissimilar. As a result, it is still unclear whether Keenan and Comrie's (1977) Noun Phrase Accessibility Hierarchy is a good predictor of RC acquisition by L2 learners. Moreover, it should be noted that the recent L2 research on RCs has concerned mostly combinations of typologically different languages. Extending L2 experiments to speakers of languages other than Germanic and Romance ones is obviously of great interest, but it also complicates the issue further because it introduces a new, major source of variation between RCs: In Germanic and Romance languages, RCs are post-nominal, whereas they are prenominal in many languages spoken on the Asian continent.

In sum, the early L2 research regarding the acquisition of RCs, which has focused mostly on Germanic and Romance languages, has been incomplete in that is has discussed Keenan and Comrie's (1977) Noun Phrase Accessibility Hierarchy at length without establishing a sound empirical basis for it. On the other hand, the more recent studies devoted to the acquisition of RCs by L2 learners have concerned mostly languages other than Germanic and Romance ones, and they have produced results that diverge depending on the skill targeted (processing, production, or comprehension). As a result, there remains a need for research to elucidate whether the ease of acquisition of post-nominal RCs by learners of languages featuring the same order of RC and noun follows a gradient of difficulty equivalent to Keenan and Comrie's (1977) Hierarchy.

Consequently, the focus of the present research is the acquisition of relative clauses by Romance learners of English, and the specific skill that is investigated is comprehension. This is in part because comprehension has been rather neglected in the L2 research dedicated to RCs, and in part because comprehension subsumes acquisition. Indeed, in the L1, babies are born inside linguistically active communities and understand communicative intentions before they are able to communicate themselves, and in L2 acquisition contexts, it is a well-known fact that the comprehension of learners precedes their production capacities.

Therefore, the present thesis examines the comprehension of relative clauses by Romance learners of English and it pursues three goals. First, it aims to determine whether Romance learners of English understand some RCs better than others, and if so, which ones. Second, it seeks to test the validity of RC complexity theories on populations of non-native speakers by investigating the role of syntax and of semantics on RC comprehension. Finally, it intends to examine the issue of cross-linguistic transfer in the comprehension of RCs by L2 learners. It is hoped that the progress made on these three goals will contribute to the general advancement of L2 acquisition and L2 instruction research, as well as L1 research in general.

The organization of the present dissertation is as follows. Chapter 2 sets the theoretical framework for this research: It provides an introduction on RCs in general and in the three languages of interest to this research (English, French, and Italian), presents theories of second language acquisition, details the state of the art concerning RC research, introduces various theories of RC complexity emanating from L1 research, and finally outlines the research questions at hand and the predictions made according to the various theories. Chapters 3 and 4 report the results of experiments that investigate the comprehension of subject, object, and oblique RCs by two populations of Romance learners of English, namely French and Italian learners, and examines the role of syntax on this comprehension. Chapter 5 presents the results of an RC comprehension experiment that aims to uncover the influence of semantics on RC comprehension by L2 learners. Finally, Chapter 6 discusses the findings of the three experiments in light of previous research and of theories of RC complexity and L2 acquisition, and it offers final conclusions.

CHAPTER 2: THE COMPREHENSION OF RELATIVE CLAUSES

Since the comprehension of relative clauses (RC) by L2 learners stands at the heart of this research, this chapter starts with a general presentation of RCs (section 2.1.), and continues with an overview of L2 acquisition theories and a definition of cross-linguistic transfer (section 2.2.). Then, it summarizes the findings of research dedicated to RCs in L1 as well as L2 (section 2.3.) and describes the theories of RC complexity formulated by researchers to account for empirical results and their predictions regarding the RCs studied in this research (section 2.4.). The final section of this chapter (section 2.5.) details the research questions and the hypotheses tested in this thesis.

2.1. Relative Clauses

2.1.1. Definitions

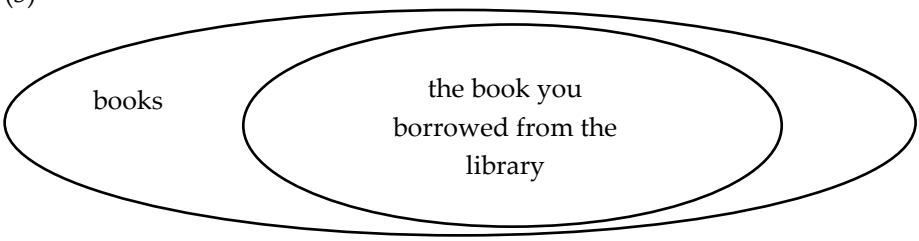
A relative clause (RC) is a type of clause which describes the referent of a head noun or pronoun (Comrie, 1989), as illustrated in (1) and (2). In those sentences, the bracketed elements are relative clauses, which modify the head nouns *the book* and *my brother*.

(1) Where is the book [that you borrowed from the library]?

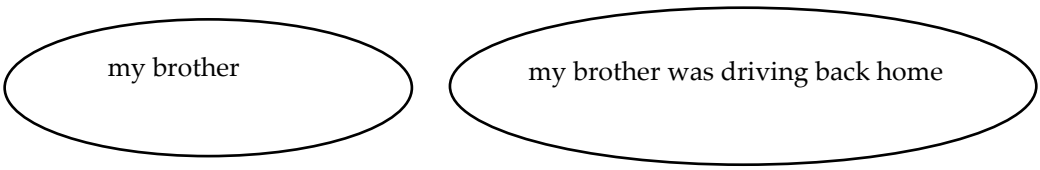
(2) Yesterday I saw my brother, [who was driving back home].

Relative clauses are sub-divided into two main categories: restrictive (also called defining) and non-restrictive (or non-defining). A restrictive RC is an event-denoting construction that identifies the referent of the word it modifies, whereas the non-restrictive RC does not aid in the identification of the referent and merely provides information about it (Comrie, 1989). Visually, sentence (1) and (2) can be represented with the diagrams (3) and (4).

(3)



(4)



Relative clauses are further classified as headed or free. If they modify and lexically restrict a head, as in sentence (1), they are called headed RCs. Conversely, if they are not attached to any head, as in the example *I know what you think,* they are said to be free, or headless (Friedmann, Belletti, and Rizzi, 2009).

2.1.2. Syntax

Relative clauses can be placed before or after the noun they modify and are thus called prenominal or post-nominal. The placement of the RC depends on the type of language: In so-called head-final languages (such as Chinese, Japanese, Korean, Basque), the RC precedes the noun, whereas in head-initial languages (such as English, German, French, Italian), the RC follows it. Examples of a French prenominal and of a Japanese post-nominal RC (Comrie, 1998) are given in (5) and (6).

(5) le livre [que tu lis]

the book [that-OBJ you-SUBJ read]

"the book [that you are reading]"

(6) [gakusei-ga katta] hon

[student-NOM bought] book

"the book [that the student bought]"

In addition, RCs can be found in various positions inside the matrix sentence. Indeed, they can modify a noun or noun phrase that precedes or that follows the sentence main verb. For instance, in (7), the RC modifies the subject of the sentence and is called subject-modifying, left-branching, or center-embedded, whereas sentence (8) is an example of an RC that modifies the object of the matrix sentence. In that case, it is said to be object-modifying or right-branching.

(7) The horse [that John is riding] won the race a month ago.

(8) John is riding the horse [that won the race a month ago].

The strategies used to join the RC to the main sentence can differ depending on the language considered. The four main relativizing strategies identified by Comrie (1998) are introducing the RC with a relative pronoun, non-reduction, pronoun retention, and gapping. The relative pronoun strategy is commonly found in the languages spoken in the European continent and consists in joining the RC to the main clause with a clause-initial, pronominal element that is marked for case and indicates the function of the head noun inside the RC. Sentence (9) and (10) illustrate this type of RC in French and in English, respectively.

(9) le livre [dont je parlais hier]

the book [that-IND. OBJ. I was speaking yesterday]

"the book [about which I was speaking yesterday]"

(10) the professor [whom you had mentioned].

The second option to introduce an RC is the so-called non-reduction, whereby the head noun is maintained as a full noun phrase inside the RC and repeated inside the matrix sentence using a pronominal or non-pronominal element. Such a strategy is found in languages such as Hindi and Maricopa, and the literal translation of the English RC *the man to whom I was talking will go to India tomorrow* would be "which man I was talking with, he will go to India tomorrow" (Comrie, 1998, p. 62).

Pronoun retention, the third relativization strategy, is rather frequent cross-linguistically and is typical of languages such as Arabic, Hebrew, and Persian. It consists in maintaining a personal pronoun, called a resumptive pronoun, to indicate the relativized element inside the RC. Sentence (11) illustrates such use in Persian (Comrie, 1998, p. 63).

(11) mardhâi	[ke	ketâbhâ-râ	be ân-hâ	dâde	bud-id]
men	that	books-ACC	to them given	were-2SG	

"the men [that you had given the books to -]"

Finally, gapping is a major relativization strategy across world languages and consists in leaving a gap in the position of the relativized constituent inside the RC without making any overt reference to the head noun, as illustrated in sentence (12) from Japanese (Comrie, 1998, p. 63).

(12)	[gakusei ga	katta]	hon
	student-NOM	bought	book

"the book [that the student bought -]"

English can be considered to make use of the gapping strategy when the object RC is not introduced by a case-marked relative marker, such as in *the book [that the student bought -]* or in *the book [the student bought -]* (Comrie, 1998).

From a terminological viewpoint, the relative marker that is unmarked, such as "that" in English or "de" in Chinese, is named a relativizer (Schachter, 1985), whereas it is called a relative pronoun when its form varies to indicate the function of the head noun inside the RC (Quirk, Greenbaum, Leech, and Svartvik, 1985).

2.1.3. Classification

Relative clauses are typically classified depending on the syntactic function of the relativized head noun inside the RC. For example, an RC attached to a noun that functions as the subject of the said RC is termed a subject RC.

In English, six RC types have been identified by Keenan and Comrie (1977): subject, object, indirect object, oblique, genitive, and object of a comparison RCs. Sentences (13) to (18) illustrate these. Note that sentence (18) might seem unusual, but it has usually been included in the literature related to relativizable positions in English.

(13) Here is the dog [that is black]. SUBJECT

(14) Here is the dog [that the cat was chasing]. DIRECT OBJECT

(15) Here is the dog [that the farmer gave a bone to]. INDIRECT OBJECT

(16) Here is the dog [that the cat is playing with]. OBLIQUE COMPLEMENT

(17) Here is the dog [whose leg was broken]. GENITIVE COMPLEMENT

(18) Here is the dog [that the cat is faster than]. OBJECT OF A COMPARISON

Sometimes, a double classification is used to refer to RCs: they are defined in terms of matrix position and RC function. For example, the acronyms SS, SO, OS, and OO are commonly used to denote, respectively, a subject-modifying subject RC, a subject-modifying object RC, an object-modifying subject RC, or an object-modifying object RC.

2.1.4. Generative Analysis

The purpose of this section is to present a brief syntactic analysis of RCs according to the Principles and Parameters of Universal Grammar (Chomsky, 1995), because this analysis underlies the theoretical accounts of RC complexity that will be presented in section 2.4. of this chapter.

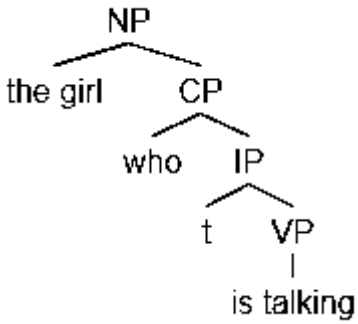
As summarized in White (2003), the processing of an RC in Generative Grammar supposes first the construction of a set of hierarchically organized syntactic representations (CP, IP, VP), then the movement of an operator, which can be overt (a *wh*-operator) or null (such as *that*), to the front of the clause, in so-called "specifier of CP" position. Finally, the operator and the clause-internal gap are linked with the head noun. Sentence (19) illustrates those steps.

(19) a. the girl [CP who [IP [VP wh_i is talking]]]

b. the girl [CP ***wh***$_i$ who [IP [VP $___i$ is talking]]]

c. **the girl**$_i$ [CP ***wh***$_i$ who [IP [VP $___i$ is talking]]]

This sentence can be represented schematically with a syntactic tree, presented in (20). Note that this tree has been slightly simplified: the invisible *wh*-operator has been left out because it is not relevant in the generative accounts of RC complexity that will be presented in section 2.4. In the tree, the letter *t* stands for the trace of the moved constituent.



(20)

More detailed analyses of RC derivations according to Universal Grammar can be found in Hawkins (2001) and Haegeman (2006).

2.1.5. Typological Differences

In this section, the relativization strategies of English, French, and Italian concerning subject, object, and oblique RCs are described since only these three RCs are investigated in the present dissertation. The three languages have in common that RCs are always post-nominal and gapped, but they do differ in terms of joining strategies and word order.

2.1.5.1. RCs in English

Subject RCs are introduced by a relative pronoun, which is marked for animacy, as illustrated in (21). In general, animate arguments are introduced with *who*, whereas subject RCs containing inanimate ones start with *that*.

(21) a. the farmer [who is feeding the cat]

b. the book [that is lying on the table]

In terms of word order, the canonical SVO order of the language (*the farmer is feeding the cat, the book is lying on the table*) is maintained since the head noun, *the book* or *the farmer*, precedes the verb and the subsequent arguments.

Object RCs are joined to the main clause with a case-marked relative pronoun or a relativizer, depending on the animacy of the head noun. Sentence (22a) is an example of object RC with a relative pronoun having an animate antecedent, whereas (22b) illustrates an object RC with a relativizer and an inanimate referent. It should be noted that the relativizer is not necessarily expressed overtly, as exemplified in (22c).

(22) a. the farmer [whom the cat is watching]

b. the book [that the boy is reading]

c. the book [__ the boy is reading]

The word order of object RCs in English varies from the canonical order since it follows an OSV sequence, whereby the object of the verb is placed before the subject and the verb.

Oblique RCs can be introduced with a relativizer or a relative pronoun marked for case and animacy, and the selection of either form is linked to the placement of the preposition inside the RC. When the preposition is fronted (which is said to be pied-piped), a relative pronoun is required, as illustrated in (23), whereas a relativizer is necessary when the preposition stays in clause-internal position (or stranded position), as in (24).

(23) a. the farmer [with whom the boy is working]

b. the ball [with which the boy is playing]

(24) a. the farmer [that the boy is working with]

b. the ball [that the boy is playing with]

It should be noted that, similarly to object RCs, the relativizer in oblique RCs does not need to be overtly expressed, as illustrated in (25).

(25) a. the farmer [__ the boy is working with]

b. the ball [__ the boy is playing with]

In terms of syntactic order, the observation is the same as for object RCs: the derived oblique RC order is OSV, with an added peculiarity since the preposition can stay in its original, clause-internal position or it can be placed in front of the RC.

2.1.5.2. RCs in French

Subject RCs are joined to the main clause with a relative pronoun, which is marked for case, but not for animacy, as can be seen in (26).

(26) a. le fermier [qui nourrit le chat]

the farmer [REL.NOM feeds the cat]

"the farmer who is feeding the cat"

b. le livre [qui se trouve sur la table]

the book [REL.NOM is lying on the table]

"the book that is lying on the table"

The word order in subject RCs is similar to the canonical SVO order (*le fermier nourrit le chat, le livre se trouve sur la table*).

In object RCs, the embedded clause starts with the accusative form of the relative pronoun (*que)*, regardless of the animacy of the head noun, as exemplified in (27). Contrarily to English, however, the relative pronoun may not be omitted.

(27) a. le fermier [que le garçon regarde]

the farmer [REL.ACC the boy watches]

"the farmer that the boy is watching"

b. le livre [que le garçon lit]

the book [REL.ACC the boy reads]

"the book that the boy is reading"

Similarly to English, the word order in object RCs is OSV, since the object of the embedded verb is placed in clause-initial position, followed by the relative pronoun and then the subject and the verb of the RC. However, it is worth mentioning that the word order of French object RCs is less rigid than in English because post-verbal subjects are allowed, as illustrated in (28).

(28) a. le fermier [que regarde le garçon]

the farmer [REL.ACC watches the boy]

"the farmer that the boy is watching"

b. le livre [que lit le garçon]

the book [REL.ACC reads the boy]

"the book that the boy is reading"

Oblique RCs in French are always introduced with an overtly-expressed relative pronoun, which is marked for gender and number, and which is preceded by the oblique RC preposition, as can be seen in (29). In other words, the French preposition is always pied-piped.

(29) a. le fermier [avec lequel le garçon travaille]

the farmer [with REL.SG.MASC the boy works]

"the farmer with whom the boy works"

b. le ballon [avec lequel le garçon joue]

the ball [with REL.SG.MASC the boy plays]

"the ball with which the boy is playing"

Oblique RCs in French are similar to object ones in that their word order is OSV and they also allow post-verbal subjects, as illustrated in (30). In that case, the derived word order is OVS.

(30) a. le fermier [avec lequel travaille le garçon]

the farmer [with REL.SG.MASC works the boy]

"the farmer with whom the boy works"

b. le ballon [avec lequel joue le garçon]

the ball [with REL.SG.MASC plays the boy]

"the ball with which the boy is playing"

2.1.5.3. RCs in Italian

In Italian, subject RCs are joined to the main clause with a case-marked relative pronoun, regardless of the head noun animacy, as exemplified in (31).

The RC word order is similar to the canonical SVO one (*il contadino nutrisce il gatto, il libro sta sulla tavola*).

(31) a. il contadino [che nutrisce il gatto]

the farmer [REL.NOM feeds the cat]

"the farmer who is feeding the cat"

b. il libro [che sta sulla tavola]

the book [REL.NOM is lying on the table]

"the book that is lying on the table"

Object RCs are also introduced with a case-marked relative pronoun, and its form coincides with the nominative case (*che*), as evidenced in (32).

(32) a. il contadino [che il ragazzo sta guardando]
the farmer [REL.ACC the boy is watching]
"the farmer that the boy is watching"
b. il libro [che il ragazzo sta leggendo]
the book [REL.ACC the boy is reading]
"the book that the boy is reading"

The syntactic order of object RCs is OSV, or OVS when the embedded subject is post-verbal, as illustrated in (33).

(33) a. il contadino [che sta guardando il ragazzo]
the farmer [REL.ACC is watching the boy]
"the farmer that the boy is watching"
b. il libro [che sta leggendo il ragazzo]
the book [REL.ACC is reading the boy]
"the book that the boy is reading"

This flexibility in word order can cause ambiguity since object RCs featuring post-verbal subjects cannot be distinguished formally from subject RCs. Indeed, if sentences (31a) and (33a) are compared, it can be noticed that they feature a similar sequence of lexical categories (noun, verb, noun). However, this ambiguity should not be overrated because in oral language, the prosody of the RC indicates whether a subject or an object RC reading is required.

Oblique RCs in Italian are joined to the main clause with a relative pronoun marked for number and gender and preceded by the RC preposition, as illustrated in (34). The relative pronoun can never be omitted and the preposition is

necessarily found in clause-initial (pied-piped) position. It should be added, however, that the relativizer *cui* can be used instead of the relative pronoun.

(34) a. il contadino [con il quale il ragazzo lavora]
the farmer [with REL.SG.MASC the boy works]
"the farmer with whom the boy works"
b. il palloncino [con il quale il ragazzo sta giocando]
the ball [with REL.SG.MASC the boy is playing]
"the ball with which the boy is playing"

As in object RCs, post-verbal subjects are felicitous inside the embedded oblique clause, as can be seen in (35).

(35) a. il contadino [con il quale lavora il ragazzo]
the farmer [with REL.SG.MASC works the boy]
"the farmer with whom the boy works"
b. il palloncino [con il quale sta giocando il ragazzo]
the ball [with REL.SG.MASC is playing the boy]
"the ball with which the boy is playing"

In terms of word order, oblique RCs in Italian feature an OSV or an OVS sequence.

2.2. The L2 Acquisition of Relative Clauses

Second language acquisition occurs whenever a person, after successfully acquiring his or her native language (L1), acquires a foreign one. The acquisition of the second language (L2) can occur through explicit instruction (in school or later in life) or in naturalistic contexts. In section 2.2.1., two theories have been selected and are described to illustrate divergent conceptions of L2 acquisition. It is followed, in section 2.2.2., by a definition of cross-linguistic transfer and its relevance in the comprehension of RCs according to those L2 acquisition theories.

2.2.1. Theories of L2 Acquisition

Many theories have been proposed to account for the development of the L2 competence in learners, but it would be beyond the scope of this thesis to describe them all (see Dörnyei, 2009, for a summary of the main theories). Instead, this section presents two major strands of research that offer divergent views on how the L2 is acquired: the first one, Universal Grammar, is symbolic and nativist, whereas the second one, the usage-based approach, is non-symbolic and constructivist.

The theory of Universal Grammar (Chomsky, 1981, 1995), also known as generative grammar, first emerged in the 1950s and has been an influential framework of reference in linguistics and psycholinguistics. At its core, it offers a symbolic and nativist account of language. To put it briefly, language is conceived as a set of hierarchically organized mental representations, which are involved in computing operations when language is processed. These representations are symbolic in that they embody linguistic categories, such as noun, verb, preposition, adverb, and these are postulated to be innate. In other words, all humans are born with an initial map of grammatical knowledge, called Universal Grammar, which is universal in that it can accommodate the functioning of any world language. Therefore, the acquisition of a particular language is seen as the gradual setting of parameters that are specific to that language.

The focus of generative grammar has been the description of mental representations in the L1, but researchers in second language acquisition have successfully used Universal Grammar as a framework of reference for their work in the L2 (White, 2003). However, since this theory has never been concerned with the acquisition process of a language per se, the conception of second language acquisition is rather static: The development of a foreign language in L2 learners consists in "a movement through successive grammars (interlanguage)" (Dörnyei, 2009). In other words, the goal of L2 researchers working within the generative framework is to describe and explain the interlanguage competence (that is the rule-governed grammar of L2 learners) at different points in time in terms of parameter settings (White, 2015).

Conversely, in usage-based theories, language is seen as the outcome of an emergent process, whereby grammar is constructed by L1 acquirers as they hear language in use (Dörnyei, 2009). The usage-based approach is constructivist, and not symbolic, because it holds that grammar emerges gradually from the processing of L1 input. It is theorized that language acquirers constantly parse the linguistic data and unconsciously search for patterns inside it. They do this by analyzing the distributional frequency of constructions, which are the pairings of form and meaning, or form and function. For example, the *-s* morpheme is a construction because it codes for the plural of a word, and words are clear instances of form-meaning pairings. This pattern-finding mechanism is doubled with another human endowment: the capacity of reading other people's intentions (Tomasello, 2003). In the usage-based approach, these cognitive skills are considered to be general learning mechanisms and are not restricted to the acquisition of language.

Since usage-based theories describe the dynamic process underlying L1 acquisition, they can more readily explain the acquisition of a second language. The same general learning mechanisms operating during the acquisition of the native language are used in the development of the L2. In other words, L2 learners unconsciously analyze the distributional frequency of the L2 input to which they are exposed and gradually construct an emergent, experience-based L2 grammar.

2.2.2. Cross-Linguistic Transfer and the L2 Comprehension of RCs

As explained by Gass (1979), transfer is a concept that derives from the psychology of learning and that describes "the imposition of previously learned patterns onto a new learning situation" (p. 328). Cross-linguistic transfer, or L1 transfer, then refers to the phenomenon of transferring data from the L1 to the L2 when a person acquires a foreign language. Data here is to be understood in a general sense: it can consist of phonetic, lexical, grammatical, or syntactic information. Since cross-linguistic transfer has been defined in different terms by various researchers, the working definition that is adopted here is the one proposed by Gass (1979) in her article investigating the L2 acquisition of RCs and based on Selinker (1966): L1 transfer consists in a "process occurring from the native to the foreign language if frequency analysis shows that a statistically significant trend in the speaker's native language . . . is then paralleled by a significant trend toward the 'same' alternative in the speaker's attempted production of the foreign language" (p. 331).

Note that the role of cross-linguistic transfer differs depending on the L2 learning view adopted. In the generativist theory, all grammars are constrained by Universal Grammar. In other words, the L1 grammar as well as the learners' grammar follow the principles of generative grammar. The question that arises then is to decide whether L2 learners use their L1s as starting point to learn the L2 or whether they have a direct access to Universal Grammar. According to one influential hypothesis, the Full Transfer Full Access one (Schwartz and Sprouse, 1996), the initial interlanguage is the L1 steady state grammar, and L2 learners gradually reset the parameters as they are exposed to L2 input. In other words, L2 learners fully transfer the L1 grammar to the L2 they are acquiring, but they do have full access to Universal Grammar. Consequently, the restructuring of the interlanguage falls within the range of what is permitted by Universal Grammar.

In the usage-based view, cross-linguistic transfer is thought to be pervasive, but for other reasons. Indeed, language is considered to be constructed by language users as they are exposed to linguistic input. This process start very early in life, even before babies are born. Language users, thus, parse the linguistic input for

probabilistic frequencies, and as this process goes along, the most frequent constructions become increasingly resistant to change, or entrenched, in the brain. As a result, when people learn a second language, they already have at their disposal a full-fledged, highly entrenched L1, and this L1 grammar influences the acquisition of the second language, positively or negatively.

The present study is not intent on researching the mechanisms underlying cross-linguistic transfer. However, it aims to detect the possible occurrence of L1 transfer in the comprehension of RCs by Romance learners of English, and oblique RCs are good candidates for such testing. Indeed, as presented in section 2.1.5., the word order of oblique RCs in English can depart radically from that of French and Italian oblique RC. More precisely, oblique RC prepositions in English may be placed either in fronted, pied-piped position or in clause-internal, stranded position. The former placement is similar to that of French and Italian oblique RCs, whereas the latter is disallowed in these Romance languages. Therefore, this divergence between L1 and L2 will serve as basis for formulating hypotheses regarding the influence of the L1 on the comprehension of RCs in the L2, which will be developed in section 2.5.

2.3. Previous Research on Relative Clauses

2.3.1. Introduction

The literature devoted to RCs in L1, L1 acquisition, and L2 acquisition is quite extensive and at times conflicting. Therefore, to make sense of the research that has been carried out so far, this section presents first a historical overview of the research on RCs, then section 2.3.2. details the studies that concern only subject and object RCs, as these have been a major focus of research in L1 research, and section 2.3.3. summarizes the experiments that have investigated the full range of RCs, from subject to oblique and genitive RCs (see RC classification in 2.1.3.).

The first studies on RCs in the L1 go back to the 1970s and early 1980s, when an asymmetrical comprehension or processing of subject and object RCs was

uncovered in native adults and children, with object relatives being more difficult to understand and produce (Cook, 1975; Ford, 1983; Frauenfelder, Segui, & Mehler, 1980; Frazier, 1987; Hakes, Evans, & Brannon, 1976). This subject RC advantage was then re-examined in the late 1980s and early 1990s when new measuring techniques emerged, such as reading times, eye tracking, and ERPs. It was found that, as expected, object RC processing involved longer reading times (Frazier, 1987; King & Just, 1991; Schelstraete & Degand, 1998) and significant differences in ERP measures (King & Kutas, 1995). At the turn of this century, however, new research started to indicate that the robust subject RC advantage was more complex than what had been thought until then. Indeed experiments with adult native speakers of English and Dutch indicated that the object RC processing difficulty was significantly reduced or even disappeared when semantic-pragmatic variables, such as the animacy of the head noun or the embedded noun category (noun or pronoun), was manipulated (Gordon, Hendrick, & Johnson, 2004; Heider, Dery, & Roland, 2014; Johnson, Lowder, & Gordon, 2011; Mak, Vonk, & Schriefers, 2002, 2006; Reali & Christiansen, 2007; Traxler, Morris, & Seely, 2002).

During the first three decades of research on RCs, most of the experiments had been carried out on Germanic and Romance languages (English, Dutch, French), which are all head-initial languages characterized by the post-nominal position of RCs. This changed at the beginning of the new millennium when researchers studying other languages started investigating the phenomenon to see whether similar results could be evidenced in head-final languages. The languages that were then examined were: Basque (Carreiras, Duñabeitia, Vergara, de la Cruz-Pavia, & Laka, 2010), Chinese (Hsiao & Gibbons, 2003; Hsiao & MacDonald, 2013; Lin, 2006; Vasishth, Chen, Li, & Guo, 2013; Wu, Kaiser, & Andersen, 2011), Korean (Kwon, Gordon, Lee, Kluender, & Polinsky, 2010), and Japanese (Ishizuka, 2005; Ueno & Garnsey, 2008). The results from those languages, however, did not all find evidence of the robust subject RC advantage, which made some doubt that it was a universal feature (Carreiras et al., 2010). Moreover, the results inside the pool of head-final languages were quite conflicting: Some found support for the subject RC supremacy while others indicated an object RC advantage or found an equal processing difficulty between subject and object RCs. Currently, no

consensus has been reached as to whether subject RCs are processed more easily than object ones in head-final languages.

In the area of L1 acquisition, which has concerned mostly head-initial languages, a comparable evolution is visible. While early research on the comprehension of RCs by native children was carried out in the 1970s and confirmed the subject RC advantage, more recent studies have found that the comprehension of object RCs can be modulated by factors such as case marking, number or gender agreement (Adani, van der Lely, Forgiarini, & Guasti, 2010; Guasti, Stavrakaki, & Arosio, 2012), and RC headedness (Friedmann, Belletti, & Rizzi, 2009). Moreover, the experiments that have replicated the manipulation of semantic-pragmatic variables from L1 research (Brandt, Kidd, Lieven, & Tomasello, 2009; Kidd, Brandt, Lieven, & Tomasello, 2007) have obtained similar results: no subject-object RC asymmetry has been found in native children when the referents are inanimate or when pronouns are introduced in the RCs.

Finally, in the field of second language acquisition, the progression of research has followed a rather different path. In the 1970s and 1980s, L2 researchers investigated RCs to find evidence that a theory of RC complexity, Keenan and Comrie's (1977) Noun Phrase Accessibility Hierarchy (which will be presented in detail in section 2.4.1.), originating from L1 typological research, could be extended to L2 populations, and to see whether this evidence could have implications for L2 instruction. Instead of researching only subject and object RCs, they studied the whole range of them, from subject to genitive RCs (see the RC classification in section 2.1.3.), and generally found support for this Hierarchy. This early research concerned mostly the acquisition of Germanic and Romance second languages. Then, the debate lost momentum as some of the theoretical constructs, such as Implication Generalization and Markedness, fell out of favor. In the past decade or so, L2 researchers have experienced a renewed interest in RCs, but this time, they have turned their attention to languages other than Germanic and Romance ones, and they have investigated mostly subject and object RCs. In general, they have cast doubt on the robustness of the subject-object RC asymmetry (Aydin, 2007; Hu & Liu, 2007; Havik, Roberts, van Hout, Schreuder, & Haverkort, 2009; Izumi 2003; Kang 2015; Lee, 2014; Mitsugi,

MacWhinney, & Shirai, 2010; Xu 2014) and have confirmed that second language learners, like native speakers, are sensitive to manipulations of head noun animacy and embedded noun category inside the RCs.

After this brief historical overview, it is clear that the early confidence concerning the gradient of RC difficulty has given way to a more subtle debate and to a lack of consensus among researchers. This divergence of views is all the greater that the research dedicated to RCs spans several fields and features a broad range of methods and test designs. Therefore, for clarity purposes, the results of earlier studies on RC complexity will be summarized in the next two sections, and the upcoming tables will include data concerning variables that have been shown to be relevant: in particular, they will specify the language(s) tested, the type and place of the RC inside the matrix sentence (center-embedded or right-branching RC, subject or object RC), the animacy of the head noun (animate or inanimate), and the embedded noun category (full noun or pronoun).

2.3.2. The Subject-Object RC Asymmetry

2.3.2.1. Native Adults

Since the research on RCs carried out with native adults is vast and concerns typologically diverse languages, it is presented in two tables: one concerning head-initial languages with post-nominal RCs (Table 1), and the other one regarding head-final languages featuring prenominal RCs (Table 2).

Table 1 presents the studies carried out in head-initial languages (English, French, Dutch, and Portuguese). In this table, it can be seen that the early experiments that support the subject-object RC asymmetry (Cook, 1975; Ford, 1983; Frauenfelder, 1980; Frazier, 1987; Hakes et al., 1976; King and Kutas, 1995; Schelstraete and Degand, 1998) are all studies that include animate referents and full noun phrases, variables which have been shown more recently to affect negatively the processing or comprehension of object RCs (Gordon et al., 2004; Heider et al., 2014; Mak et al., 2002; Reali & Christiansen, 2007; Traxler et al., 2002). On the other

hand, the experiments where the head noun animacy or the embedded noun category have been intentionally manipulated indicate that object RCs are processed as fast as subject RCs (Heider et al., 2014; Mak et al., 2002, 2006; Reali & Christiansen, 2007). Beside animacy and noun category, another factor has been shown to influence the processing of RCs, namely the frequency of the noun in discourse. Indeed, Johnson, Lowder, and Gordon (2011) have reported that when object RCs feature a low-frequency head noun followed by a high-frequency embedded one, they are read faster.

In terms of methodology, a broad range of testing techniques have been used in the RC research in head-initial languages, from word selection tasks to self-paced reading measures and ERPs. It has to be noted that the majority of studies have examined the processing of subject and object RCs (Frazier, 1987; Gordon et al., 2004; Hakes et al., 1976; Heider et al., 2014; Johnson et al., 2011; King & Just, 1991; King & Kutas, 1995; Mak et al., 2002, 2006; Reali & Christiansen, 2007; Schelstraete & Degand, 1998; Traxler et al., 2002), while only few have investigated their comprehension (Costa, Lobo, and Silva, 2011; Cook, 1975), usually in complement of processing measures (Gordon et al., 2004; Hakes et al., 1976; King & Just, 1991; Schelstraete & Degand, 1998). Moreover, it is noteworthy that all the processing studies mentioned above converge and report a processing asymmetry between subject and object RCs when these contain animate referents and full noun phrases, whereas the comprehension results tend to diverge. Indeed, some authors report an equal understanding of subject and object RCs: for example, Costa et al. (2011) have measured that native speakers of Portuguese understand both RCs equally well in a picture selection test, and King and Just (1991) indicate that the comprehension difference between subject and object RCs in the verification statement test used in complement of their processing measures is not significant. On the other hand, other researchers point at an asymmetrical understanding of subject and object RCs (Cook, 1975; Gordon et al., 2004; Hakes et al., 1976; Schelstraete and Degand, 1998). However, their conclusions call for caution because of methodological issues: in particular, Cook's (1975) word selection test seems to contain a subject RC bias (which will be described in more detail in section 2.3.2.3.) and has not been used since; Hakes et al. (1976) does not measure the comprehension of subject and object RCs directly; and Gordon et al.

(2004) report a significant subject-object RC comprehension difference only half the time (in two out of four measures).

In sum, the research on RCs carried out with native speakers of head-initial languages reveals that subject RCs featuring animate referents and full noun phrases are processed faster than object ones but has not yet presented convincing evidence that this processing advantage translates into a comprehension one. In addition, this research suggests that several factors influence the processing and comprehension of RCs, among which the head noun animacy, category, and frequency in discourse.

Table 1

Summary of studies concerning the RC asymmetry in L1 adult speakers of head-initial languages

AUTHORS	METHOD	LG	MATRIX PLACE	ANIMACY OF THE HEAD	NP TYPE	SR > OR?
Cook 1975	word-selection task	EN	SS + SO	animate	full NP	yes
Ford 1983	continuous lexical decision	EN	SS + SO	animate	full NP	yes
Frauenfelder et al. 1980	phoneme monitoring	FR	SS + SO	animate	full NP	yes
Frazier 1987	self-paced reading	NL	OS + OO	animate	full NP	yes
Hakes et al. 1976	phoneme monitoring + paraphrasing	EN	SS +SO + OS + OO	animate	full NP	yes
King & Kutas 1995	ERP	EN	SS + SO	animate	full NP	yes
Schelstraete & Degand 1998	self-paced reading + verification statement	FR	SS + SO/SOp	animate	full NP	yes
Gordon et al. 2004	self-paced reading + verification statement	EN	SS + SO	animate	full NP + PRO	yes but
Johnson et al. 2011	eye-tracked reading	EN	SS + SO	animate	full NP	yes but
King & Just 1991	self-paced reading + verification statement	EN	SS + SO	animate	full NP	yes but
Traxler et al. 2002	eye-tracked reading	EN	SS + SO	animate + inanimate	full NP	yes but
Costa et al. 2011	picture-selection task	PT	OS + OO	animate	full NP	no
Heider et al. 2014	corpus study + self-paced reading	EN	SS + SO	inanimate	PRO	no
Mak et al. 2002, 2006	corpus study + self-paced and eye-tracked reading	NL	SS + SO	animate + inanimate	full NP	no
Reali & Christiansen 2007	corpus study + self-paced reading	EN	SS + SO	animate	PRO	no

EN, English, FR, French, NL, Dutch, LG, language, PT, Portuguese, SS, subject-modifying subject RC, SO, subject-modifying object RC, OS, object-modifying subject RC, SOp, subject-modifying object RC with post-verbal subject, OO, object-modifying object RC, NP, noun phrase, PRO, pronoun.

In Table 2, which summarizes the literature carried out on RCs in head-final languages (Korean, Chinese, Japanese, and Basque), it can be seen that the subject RC processing advantage claimed by researchers of head-initial languages is quite controversial. Indeed, while about half the studies reports faster processing times for subject RCs (Ishizuka, 2005; Kwon, Gordon, Lee, Kluender, and Polinsky, 2010; Lin, 2006; Ueno & Garnsey, 2008; Vasishth, Chen, Li, & Guo, 2013), the other half indicates that object RCs are as easy (Hsiao & MacDonald, 2013; Wu, Kaiser, and Andersen, 2011) or even easier than subject ones (Carreiras, Duñabeitia, Vergara, de la Cruz-Pavia, and Laka, 2010; Hsiao and Gibbons, 2003). On the other hand, similarly to what has been evidenced in head-initial languages, the manipulation of the head noun animacy affects the processing of subject and object RCs (Hsiao & MacDonald, 2013; Wu, Kaiser, and Andersen, 2011).

From the methodological viewpoint, it appears that the research on RCs in head-final languages has focused mostly on measuring the processing of RCs, using eye-tracking, self-paced reading, and ERPs. Comprehension, on the other hand, has been investigated with complementary tests, consisting in verification statements. As mentioned previously, the results from processing experiments are quite conflicting, but the comprehension scores converge and indicate unanimously that subject and object RCs are equally well understood (Hsiao & Gibbons, 2003; Ishizuka, 2005; Lin, 2006; Ueno & Garnsey, 2008; Vasishth, Chen, Li, & Guo, 2013).

Table 2

Summary of studies concerning the RC asymmetry in L1 adult speakers of head-final languages

AUTHORS	METHOD	LG	MATRIX PLACE	ANIMACY OF THE HEAD	NP TYPE	SR > OR?
Kwon et al. 2010	eye-tracked reading	KOR	SS + SO + OS + OO	animate	full NP	yes
Ishizuka 2005	self-paced reading + verification statement	JAP	OS + OO	inanimate	full NP	yes but
Lin 2006	self-paced reading + verification statement	CH	SS + SO + OS + OO	animate	full NP	yes but
Ueno & Garnsey 2008	self-paced reading + ERP's + verification statement	JAP	SS + SO	animate	full NP	yes but
Vasishth et al. 2013	self-paced reading + verification statement	CH	SS + SO	animate	full NP	yes but
Carreiras et al. 2010	self-paced reading + ERP	BAS	SS + SO	animate	full NP	no
Hsiao & Gibbons 2003	self-paced reading + verification statement	CH	SS + SO	animate	full NP	no
Hsiao & MacDonald 2013	corpus study + Simple Recurrent Network	CH	SS + SO + OS + OO	animate + inanimate	full NP	no
Wu et al. 2011	self-paced reading	CH	SS + SO	animate + inanimate	full NP	no

BAS, Basque, CH, Chinese, JAP, Japanese, KOR, Korean, LG, language, SS, subject-modifying subject RC, SO, subject-modifying object RC, OS, object-modifying subject RC, OO, object-modifying object RC, NP, noun phrase.

In sum, the studies summarized in Table 2 indicate that the processing of subject and object RCs in head-final languages (Korean, Chinese, Japanese, and Basque) is subject to controversy: it is still unclear which of the two RCs has a processing advantage. On the other hand, all the comprehension measures point at an equal comprehension of subject and object RCs.

It should be noted that the head-initial or head-final classification is useful for expository purposes, but that it might bundle together languages that can be quite dissimilar. Indeed, among the languages reviewed in Table 2, Basque is a morphology-marked ergative language (Carreiras et al., 2010), Korean and Japanese have SOV word order and a rich case-marking system, whereas Chinese is an SVO language with no cases (Hsiao and MacDonald, 2013).

The lack of consensus on research in head-final languages, however, is not relevant to the present work because the aim of this research is to investigate the comprehension of English RCs by speakers of Romance languages, which are all head-initial languages. Nevertheless, the conclusions that can be drawn from observing the results of studies with native adults in general are, first, that the processing of subject and object RCs is asymmetrical when these RCs feature animate referents and full noun phrases, and second, that the processing asymmetry does not necessarily imply a difference in comprehension.

2.3.2.2. Native Children

The research on RCs that has been carried out with native-speaking children is presented in Table 3. Inspection of this table leads to the following methodological observations. First, a wide range of languages have been tested, but they are all head-initial languages: English, Dutch, German, Italian, Portuguese, Greek, and Hebrew. Second, no processing data is available: all the experiments are comprehension studies, and the testing techniques used are rather uniform, namely picture selection, toy selection, and elicited imitation.

As far as the subject-object RC asymmetry is concerned, it is present in the comprehension results of native children (Adani, 2011; Adani, van der Lely, Forgiarini, and Guasti, 2010; Cook, 1975; Costa, Lobo, and Silva, 2011; Diessel & Tomasello, 2005; Friedmann, Belletti, and Rizzi, 2009; Guasti, Stavrakaki, and Arosio, 2012; Volpato & Adani, 2009). As evidenced by research with native

adults of head-initial languages, subject RCs are the better understood construction, and this asymmetry appears only under certain conditions: the RCs have to contain animate referents and full noun phrases. On the other hand, as expected, the experiments that have manipulated the head noun animacy and embedded noun category fail to report a subject-object RC asymmetry in comprehension (Brandt, Kidd, Lieven, and Tomasello, 2009; Kidd, Brandt, Lieven, and Tomasello, 2007).

Interestingly, the research with L1 children reveals that other variables besides noun animacy and category affect the comprehension of RCs. Specifically, the factors that facilitate the comprehension of object RCs are number and gender agreement (Adani, van der Lely, Forgiarini, and Guasti, 2010), case marking (Guasti, Stavrakaki, and Arosio, 2012), and RC headedness (Friedmann, Belletti, and Rizzi, 2009). Specifically, Friedmann et al. report that, when free-headed RCs are compared (free RCs modify a relative operator instead of a head noun and do not contain a lexical restriction, see section 2.1.1.), the comprehension of object RCs is almost at par with that of subject RCs.

Finally, one study in Table 3, Sheldon's (1974), needs commenting because it is often cited as one of the early experiments that has evidenced children's difficulty to understand object RCs. However, Sheldon does not draw that conclusion, and this is why, in Table 3, it is grouped with the experiments that fail to report a subject-object asymmetry. Indeed, Sheldon indicates that "if identical noun phrases have the same function in their respective clauses the sentence is significantly easier to understand" (p. 272). In other words, she observes that subject-modifying subject RCs (SS) and object-modifying object RCs (OO) are significantly easier to process than subject-modifying object RCs (SO) and object-modifying subject RCs (OS), and she concludes, after performing an analysis of variance contrasting subject and object RCs, regardless of their position in the matrix sentence, that there is no statistically reliable effect of word order due to the relativization type.

Table 3

Summary of studies concerning the RC asymmetry in L1 child speakers of head-initial languages

AUTHORS	METHOD	LG	MATRIX PLACE	ANIMACY OF THE HEAD	NP TYPE	SR > OR?
Adani 2011	picture-selection task	IT	OS + OO + OOp	animate	full NP	yes
Cook 1975	toy-acting task	EN	SS + SO	animate	full NP	yes
Costa et al. 2011	picture-selection task	PT	OS + OO	animate	full NP	yes
Diessel & Tomasello 2005	elicited imitation	EN + DT	OS + OO	animate	full NP	yes
Volpato & Adani 2009	picture-selection task	IT	OS + OO + OOp	animate	full NP	yes
Adani et al. 2010	picture-selection task	IT	SO	animate	full NP	yes but
Friedmann et al. 2009	picture-selection task or toy-selection task	HEB	OS + OO	animate	full NP + PRO	yes but
Guasti et al. 2012	picture-selection task	IT + GK	OS + OO	animate	full NP	yes but
Brandt et al. 2009	toy-selecting task	EN + DT	OS + OO	animate + inanimate	full NP + PRO	no
Kidd et al. 2007	corpus + elicited imitation	EN + DT	OS + OO	animate + inanimate	full NP + PRO	no
Sheldon 1974	toy-acting task	EN	SS + SO + OS + OO	animate	full NP	no

DT, German, EN, English, GK, Greek, HEB, Hebrew, IT, Italian, LG, language, PT, Portuguese, SS, subject-modifying subject RC, SO, subject-modifying object RC, OS, object-modifying subject RC, OO, object-modifying object RC, OOp, object-modifying object RC with post-verbal subject, NP, noun phrase, PRO, pronoun.

In sum, the research on the acquisition of RCs by native children has shown that subject RCs are understood more easily than object ones, but it has not supported this finding with processing measures. Moreover, L1 acquisition researchers have indicated that, besides noun animacy, category, and frequency, other variables influence the comprehension of subject and object RCs, namely number and gender agreement, case marking, and RC headedness.

2.3.2.3. Second Language Learners

In Table 4, the research on RCs carried out with L2 learners is summarized. At once, it can be noticed, on the one hand, that the test designs in second language acquisition differ from the ones typical of L1 research in that acceptance and production tasks are used besides comprehension and processing measures, and on the other hand, that the combinations of L1s and L2s include head-initial as well as head-final languages. These differences in experimental settings and language categories make comparisons more arduous but nevertheless lead to the following observations.

First, the well-established subject-object RC asymmetry evidenced in processing studies in L1 research receives only limited support from L2 research. Indeed, the study by Mitsugi, MacWhinney, and Shirai (2010) investigates the processing of RCs by English and Korean learners of Japanese and reports that only one group of learners, namely the Korean one, processes object RCs more slowly than subject ones. Then, the experiment by Xu (2014), which examines the acquisition of Chinese by English learners, indicates that the processing preference for subject RCs is weak and interacts with the Chinese demonstrative-classifier. Finally, the processing measures reported by Havik, Roberts, van Hout, Schreuder, and Haverkort (2009) are problematic because they do not hold across participants: only some of the German learners of Dutch read object RCs more slowly than subject ones.

Second, the absence of comprehension asymmetry between subject and object RCs found in the research with native adults seems to be confirmed by the studies

in L2 acquisition. Indeed, among the studies that have investigated the comprehension of RCs by L2 learners, only three of them (Cook, 1975; Izumi, 2003; Mitsugi, MacWhinney, and Shirai, 2010) can be compared with the L1 research as they are the only ones that contain animate referents and full noun phrases in their test designs. Except for Cook (1975), these experiments report that subject and object RCs are equally well understood. In particular, the absence of asymmetry between subject and object RCs is reported by Izumi (2003), who tested learners of English having various L1 backgrounds with a picture selection test, and by Mitsugi et al. (2010), who measured the comprehension of RCs by English and Korean learners of Japanese with verification statements. As far as Cook's (1975) results are concerned, they indicate the opposite, namely that subject RCs are easier to comprehend than object ones, but, as mentioned in section 2.3.2.1., his methodology may have favored the comprehension of subject RCs. Indeed, in Cook's (1975) experiment, participants had to listen to test sentences containing either subject or object RCs and circle, in a list of four words, the agent of the RC and draw an arrow towards its patient. Besides being a cognitively challenging task, it contained a bias in favor of subject RCs because, inside a subject RC, the agent is enunciated before the patient, while the reverse is true inside an object RC. As a result, participants could listen to subject RCs and circle the words in the order in which they were mentioned, whereas in the case of object RCs, they had to wait for the end of the clause and then remember who the agent and patient of the action were in order to circle the correct terms. For this reason, Cook's evidence in favor of an asymmetrical understanding of subject and object RCs ought to be regarded with circumspection. Concerning the other studies that have investigated the comprehension of RCs, their results are difficult to interpret because of the numerous inconsistencies. Specifically, Aydin (2007) reports a subject RC preference in intermediate learners of Turkish, but not in beginners; Havik et al. (2009) do not provide any statistical analysis of their comprehension accuracy scores; and Kang (2015) does not control the category of embedded nouns used in the test items. On the other hand, it is worth noting that Lee's (2014) results confirm the equal comprehension of subject and object RCs even when the animacy configuration is not the right one. In other words, in Lee's (2014) experiment, English learners of Korean score equally well on subject and object RCs even when these feature inanimate referents.

Table 4

Summary of studies concerning the RC asymmetry in adult L2 learners

AUTHORS	METHOD	LG	MATRIX PLACE	ANIMACY OF THE HEAD	NP TYPE	SR > OR?
Cook 1975	word-selection task	EN L2; various L1	SS + SO	animate	full NP	yes
Aydin 2007	picture-selection task	TUR L2; EN, KOR, JP L1	OS + OO	animate	full NP	yes but
Havik et al. 2009	self-paced reading + verification statement	NL L2; DT L1	OS + OO	animate	full NP	yes but
Izumi 2003	sentence combination + GJT + picture-selection task	EN L2; various L1	SS + SO + OS + OO	not controlled + animate	not controlled + full NP	yes but
Kang 2015	elicited imitation + GJT	EN L2; KOR L1	OS + OO	animate	not controlled	yes but
Mitsugi et al. 2010	self-paced reading + verification statement	JAP L2; EN, KOR L1	SS + SO	animate	full NP	yes but
Xu 2014	self-paced reading + GJT	CH L2; EN L1	SS + SO	animate	full NP + proper noun	yes but
Hu & Liu 2007	GJT	CH L2; EN, KOR L1	SS + SO + OS + OO	inanimate + animate	full NP + PRO	no
Lee 2014	picture-selection task	KOR L2; EN L1	OS + OO	animate + inanimate	full NP	no

EN, English, CH, Chinese, KOR, Korean, JAP, Japanese, LG, language, TUR, Turkish, NL, Dutch, DT, German, SS, subject-modifying subject RC, SO, subject-modifying object RC, OS, object-modifying subject RC, OO, object-modifying object RC, NP, noun phrase, PRO, pronoun.

Finally, no solid conclusions can be drawn from L2 experiments that have included acceptance or production measures of subject and object RCs as they are few and differ on too many counts. Indeed, in Izumi (2003), the noun animacy and category were not controlled in the sentence combination and in the

grammaticality judgment test; in Kang (2015), the grammaticality judgment test contained full nouns as well as pronouns; in Xu (2014), a combination of common and proper nouns were used in the test sentences; and in Hu and Liu (2007), the test items contained a sequence of inanimate and animate referents expressed with a full noun phrase and a pronoun.

In sum, the research devoted to subject and object RCs in L2 acquisition has not produced any convincing evidence that subject RCs are processed faster than object ones by L2 learners, unlike the results of L1 studies, but it tends to corroborate the L1 research finding that the comprehension of subject RCs by L2 learners is at par with that of object RCs. It has to be added, however, that conclusions are hard to draw on the basis of the results coming from the L2 research on RCs, because it lacks homogeneity in terms of test design. Indeed, variables such as head noun animacy or embedded noun category are not always controlled although they have been shown to influence the processing or comprehension of RCs (see section 2.3.2.1.); the experimental tasks include grammaticality judgment tests that are difficult to compare with equivalent research in L1; and the combinations of L1s and L2s that belong to various language groups (head-initial or head-final) obstruct any logical conclusion because the conclusions from RC research in L1 diverge precisely depending on the type of language examined.

2.3.3. The "Other" RCs

As has been described in section 2.3.2., scholars in L1 research have investigated almost exclusively the subject-object RC asymmetry and have neglected the "other" RCs, namely indirect object, oblique, genitive, and object of a comparison RCs. On the other hand, L2 researchers have investigated the whole range of RCs, but their research perspectives and the theoretical frameworks within which they have tested their hypotheses have been quite different from L1 researchers'.

The first study on the full range of RCs was by Gass (1979). In it, the author tested L2 learners to determine whether they accepted and produced RCs following the

gradient of difficulty described by Keenan and Comrie (1977), the so-called Noun Phrase Accessibility Hierarchy. This Hierarchy will be explained more thoroughly subsequently (see section 2.4.1.), but it is summarized briefly now. The Noun Phrase Accessibility Hierarchy (NPAH) describes a crescent order of difficulty among RCs and states that subject RCs are the most accessible RCs, followed respectively by object RCs, indirect object RCs, oblique RCs, genitive RCs, and object of a comparison RCs. After testing participants with a grammaticality judgment and a sentence combination test, Gass concluded that the NPAH model was generally supported by her L2 results. Note, however, that the author's main goal was to discover whether cross-linguistic transfer was at play in L2 acquisition, and so she used the NPAH as basis for comparison, but she did not submit the learners' RC production scores to statistical analysis.

Afterwards, the research that ensued focused on testing a specific hypothesis deriving from the NPAH, namely the Implication Generalization. The Implication Generalization means that L2 instruction at a level lower down in the NPAH allows learners to progress at higher levels of that Hierarchy. For example, if L2 learners receive instruction on how to relativize oblique RCs, they will be able to relativize oblique RCs but also subject, direct object, and indirect object ones, since these occupy a higher rank than oblique RCs inside the NPAH. The Implication Generalization hypothesis is closely linked to the theory of markedness, which classifies constructions as marked or unmarked from a typological or a generative perspective, and according to the Implication Generalization, proficiency on a marked construction implicates proficiency on an unmarked one. In the 1980s and early 1990s, most second language researchers investigating RCs examined the issue of the directionality of the Implication Generalization (see Hamilton, 1994, for a review). Some authors claimed that it was unidirectional (Eckman, Bell, & Nelson, 1988; Gass, 1980, 1982; Hyltenstam, 1984), while others questioned it (Doughty, 1991; Hamilton 1994).

Parallelly the markedness theory was extended to account for the acquisition of two distinct oblique RC constructions: Oblique RCs having pied-piped prepositions and those having stranded prepositions. Preposition-stranded oblique RCs were considered to be the marked construction and therefore were

not likely to be transferred into the L2. That hypothesis was examined by several authors (Adjemian & Liceras, 1984; Bardovi-Harlig, 1987; Liceras, 1986; Mazurkewich, 1984) and tested with L2 learners of English, Spanish, or French, but the results were rather inconclusive. In 1989, Hawkins challenged the markedness theory and suggested that the RC difficulty was linked to the linear ordering of constituents. In the end, markedness theory fell out of favor.

In recent years, RCs have become again the focus of research in second language acquisition, and this time, they have been tested with experimental methods more similar to the ones used in L1 research, but since the studies have concentrated on the subject-object RC asymmetry (see section 2.3.2.3.), the "other" RCs have been somewhat neglected. Nevertheless, the L2 acquisition of subject, object, and oblique RCs has been investigated by Izumi (2003) and Ozeki and Shirai (2007), while the acquisition of oblique RCs has been examined by Ohba (2003) and Perpiñan (2015). As far as subject, object, and oblique RCs are concerned, the experiment results are conflicting. Indeed, Ozeki and Shirai (2007) come to the conclusion that the NPAH does not predict adequately the order of RC acquisition difficulty, while Izumi (2003) finds some support for it. However, the experiments might not be comparable because the L2 investigated by Ozeki and Shirai (2007) is Japanese, while the one examined by Izumi (2003) is English, and those languages belong to different classes (head-final and head-initial, respectively).

Regarding oblique RCs, no conclusion can be drawn as the study by Ohba (2003) compares the acquisition of preposition stranded and pied-piped oblique RCs in L2 English, while Perpiñan (2015) looks at the reverse configuration, namely the use of pied-piping in L2 Spanish. Nevertheless, it is worth mentioning that Ohba (2003) noticed that Japanese learners of English, who were tested with RC acceptance and production tasks, acquired preposition stranding before pied-piping and concluded along the lines of McDaniel, McKee, and Bernstein (1998) that pied-piping was a prescriptive artifact that L1 speakers learn at school. On the other hand, Perpiñan (2015), who measured the acceptance, production, and processing of pied-piped oblique RCs by English and Arabic learners of Spanish, came to the conclusion that the target construction, namely pied-piped oblique RCs, was acquired before the non-target one (preposition stranding). In addition,

she observed that the participants' performance in sentence production and acceptance differed from that of native speakers, while their processing behavior was native-like, and so she concluded that sentence processing and production tap into different cognitive systems.

In sum, the early research on the L2 acquisition of the "other" RCs has investigated head-initial languages with research methods unlike the ones used in L1 research and has focused the debate on the implications of Keenan and Comrie's (1977) NPAH without really establishing a sound empirical basis for it. On the other hand, the recent studies on the issue have assimilated the L1 research methods, but they are scarce and have concerned mostly head-final languages. As a result, there is a need for research to determine whether the NPAH is a valid framework in the L2 acquisition of RCs, and this is the goal of the present thesis.

Summarizing the findings of the research presented in this state of the art leads to the following highlights. First, the studies on RCs that have been carried out with native speakers of head-initial languages reveal that subject RCs are more difficult to process by adults and to understand by children, but the processing difficulty in adults does not translate into a comprehension one. Moreover, in head-final languages, the subject-object RC processing asymmetry is still controversial. Second, various factors have been identified, which alleviate the processing or comprehension of object RCs, among which noun animacy, category, and frequency, as well as number and gender agreement, case marking, and RC headedness. Third, although the research on RCs in L2 acquisition settings has been rather inconclusive due a lack of cohesion in research goals and methods, it indicates that subject RCs are understood as well as object ones, while in production and acceptance, subject RCs may have an advantage. Finally, the few studies dedicated to the L2 acquisition of oblique RCs has reported that English oblique RCs with stranded prepositions are acquired more easily by L2 learners than their pied-piped equivalents.

2.4. The Complexity of Relative Clauses: Theoretical Accounts and Predictions

Several theories and hypotheses have been formulated by researchers to account for the subject-object RC asymmetry. In this section, the most influential theories concerning RC complexity are presented. Section 2.4.1 introduces a theory that aims to describe the difficulty linked to the full range of RCs, namely from subject RCs to object of a comparison ones. Section 2.4.2 presents four accounts that explains why subject RCs have a processing or comprehension advantage over object ones. Finally, section 2.4.3 summarizes the generative account of the difficulty to acquire oblique RCs featuring pied-piped prepositions.

2.4.1. A General Account of RC Difficulty: The Noun Phrase Accessibility Hierarchy

The Noun Phrase Accessibility Hierarchy (NPAH) is the result of typological work performed by Keenan and Comrie (1977), who observed that languages of the world have different strategies to relativize elements inside a sentence and that a certain hierarchy among the "relativizable" positions can be formulated. The NPAH is expressed in (36):

(36) SU > DO > IO > OBL > GEN > OCOMP

In this hierarchy, SU stands for subject RC, DO for direct object RC, IO for indirect object RC, OBL for oblique RC, GEN for genitive RC, and OCOMP for object of a comparison RC.

This hierarchy means that a language disposing of a strategy to relativize one of the functions listed in it also has a strategy to relativize all the functions higher up in that classification. In other words, languages that have a strategy to relativize the object of a comparison (OCOMP) can also relativize all the positions to the left of OCOMP, namely genitive (GEN), oblique (OBL), indirect object (IO), direct object (DO), and subject (SU) RCs. However, the reverse is not true: A language that has strategies to relativize oblique complements does not necessarily have the means to relativize genitive ones nor objects of a comparison.

Since the NPAH derives from the study of world languages, it is claimed to be universal, and Keenan and Comrie (1977) also suggest that, besides being descriptive, the NPAH has psychological validity in that it "directly reflects the psychological ease of comprehension" (p. 88).

2.4.2. Accounts of the Subject-Object RC Asymmetry

2.4.2.1. Perspective Hypothesis

In the Perspective Hypothesis account, the processing difficulty linked to RCs arises from the pragmatic environment. Indeed, according to MacWhinney's (1977) Perspective Hypothesis (PH), listeners actively construct a perspective from the input they hear and the first words that listeners attend to constitute their initial perspective on a perceptual reality.

It follows from the PH that subject RCs are easier to process or understand because they entail less perspective-switching than object RCs. Indeed, no perspective shift is needed in the case of a subject RC whereas two shifts are required to process an object one. Since shifting perspective has a cost, it means that processing object RCs is more taxing cognitively.

Sentences (37) and (38) illustrate this point. In sentence (37), which is a subject RC, the listeners start with the dog as initial perspective, then they processes the RC and the rest of the sentence from that perspective. On the other hand, in sentence (38), which is an object RC, the listener has to shift attention from the initial perspective of the dog (the agent) to attend to the cat (the patient) and then switch again perspective to the dog (the agent) in order to process first the RC and then the sentence.

(37) The dog [that is chasing the cat] is black.

(38) The dog [that the cat is chasing] is black.

It should be noted that the increased processing difficulty of shifting perspective holds regardless of the position of the RC inside the matrix sentence. Sentences (39) and (40) exemplify two right-branching RCs.

(39) The dog is chasing the cat [that was watching the mouse].

(40) The dog is chasing the cat [that the mouse was watching].

In sentence (39), which contains a subject RC, the sequence of perspective is the following: dog, cat. On the other hand, in sentence (40), which features an object RC, the sequence is: dog, cat, mouse. As a result, object RCs always involve a supplementary shift in perspective compared to their subject counterparts.

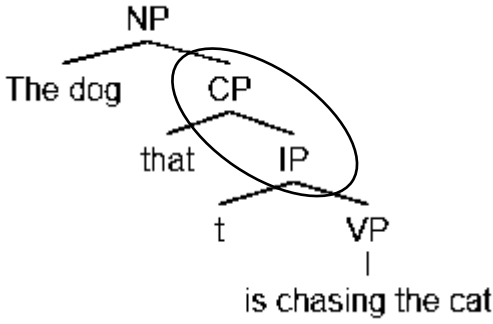
2.4.2.2. The Structural Distance Hypothesis

In 1997, O'Grady developed the Structural Distance Hypothesis (SDH), in which language is viewed as a set of hierarchically organized syntactic representations. Relative clauses are built by moving the RC-internal, invisible *wh* operator to the left of the RC (which creates a gap inside the latter) and linking this operator to the head noun. Concretely, the syntactic representations of sentences (37) and (38) are given in (41) and (42).

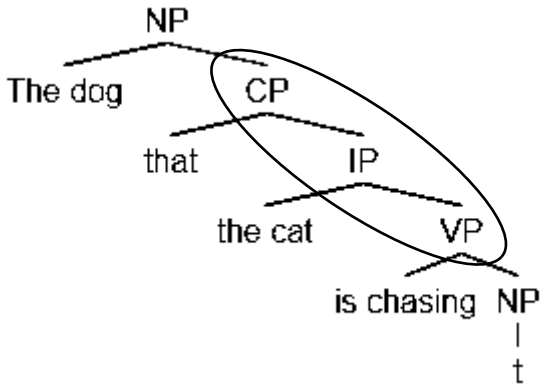
(41) The dog$_i$ [$_{CP}$ *wh*$_i$ that [$_{IP}$ _$_i$ [$_{VP}$ is chasing the cat]]] is black.

(42) The dog$_i$ [$_{CP}$ *wh*$_i$ that [$_{IP}$ the cat [$_{VP}$ is chasing _$_i$]]] is black.

The schematic syntactic trees corresponding to sentences (41) and (42) are given in (43) and (44). The constituents that are circled symbolize the distance between the RC gap and the head noun.



(43)



(44)

When comparing both syntactic trees, one sees immediately that the distance between the gap (symbolized by the letter *t* in the syntactic tree) and the head noun is greater in an object RC than in a subject one because more nodes separate the gap from the moved constituent. Therefore, the gap in the object RC is said to be embedded more deeply than in the subject counterpart. Alternatively, it is said that the structural distance between gap and relativized head noun is greater in the object RC, and this increased distance accounts for its difficult processing.

2.4.2.3. Memory-Based Accounts

One of the major theories based on memory constraints is Gibson's Syntactic Prediction Locality Theory (1998), SPLT hereafter. In this theory, as in O'Grady's SDH, language consists of hierarchically organized syntactic representations. However, the difficulty in processing RCs arises not from the structural distance between constituents, but from the combined process of integrating and storing information. Integrating data requires computational power and storing it necessitates memory resources. Since the brain has limited computational resources and memory, the processing of a sentence or of an RC has a cost: an "integration cost" and a "memory cost".

In SPLT, locality is a key concept that influences both integration and memory costs. Indeed the longer a syntactic dependency has to be remembered, the greater the memory cost; and the greater the distance between a new incoming word and the head to which it is attached, the greater the integration cost.

The SPLT provides an explanation for the increased difficulty of processing object RCs. Concretely, when the parser arrives at the verb in the object RC, it has to perform two integration steps: The first one consists in attaching the verb to its nearby thematic agent and the second, in attaching the verb to the empty category serving as patient of the verb and co-indexing it with the relative pronoun. These operations are more costly than in the case of the subject RC, where the RC-internal verb can be attached to the agent without crossing any new referent.

2.4.2.4. Frequency of Occurrence

In frequency-based theories, the processing decisions made by a person when hearing linguistic input are heavily influenced by previous exposures to similar input, and more generally, the analyses that occur most frequently in the language are favored. Moreover, when encountering structural ambiguities, the person's stored records of how that ambiguity was resolved in the past influence the present resolution of the ambiguity (Mitchell, Cuetos, Corley & Brysbaert, 1995).

One key concept in exposure-based theories however is the grain of the analysis, in other terms what exactly is stored in memory. Fine-grained analyses hold that lexical entries are recorded and stored for future retrievals whereas coarse-grained accounts retain broader structural information. In other words, a coarse-grained analysis looks at the recurrence and retention of data at a level higher than the lexical one, for example syntactic patterns.

In the case of RCs, it is inferred that the high frequency of occurrence in the language results in their easier processing. Indeed, corpus studies have revealed that object RCs occur more frequently with an inanimate head (Mak et al., 2002; Wu et al., 2011) and with pronouns rather than full NPs (Reali and Christiansen, 2007), and empirical findings have shown that the difficulty of processing object RCs is significantly reduced or disappears when the "right" test sentences are used in experimental settings (Gordon et al., 2004; Kidd et al., 2007; Mak et al., 2002; Traxler et al., 2002; Wu et al. 2011). In this context, "right" means that it is found in natural discourse, and in the case of RCs, it means that object RCs feature an inanimate head followed by an animate referent or that they contain personal pronouns. Consequently, when participants are tested on their processing or comprehension of object RCs that are less frequent than the subject counterparts, they perform less well.

2.4.3. An Account of the Oblique RC Complexity

While the subject-object RC asymmetry has been at the core of research on RCs and has been interpreted within a variety of theoretical frameworks, the complexity of oblique RCs has received relatively little attention or explanation. The complexity of oblique RCs in English resides in the duality of construction: oblique RCs can be built with stranded or with pied-piped prepositions (see section 1.5.1 for more detail).

One influential account of this complexity is the one formulated by McDaniel, McKee, and Bernstein (1998) and inspired by Chomsky's Minimalist theory (1995). The authors adopt a generative view of language, whereby language consists of representations and derivations, and consider that the more steps a derivation involves, the more complex it is.

In the case of English oblique RCs, two derivations are in competition, as illustrated in (45) and (46).

(45) the boy$_i$ [$_{CP}$ *wh*$_i$ that [$_{IP}$ the farmer [$_{VP}$ is talking [$_{PP}$ to _$_i$]]]

(46) the boy$_j$ [$_{CP}$ [$_{PP}$ *wh*$_i$ to whom _$_j$] [$_{IP}$ the farmer [$_{VP}$ is talking [$_{PP}$ _$_i$]]]]

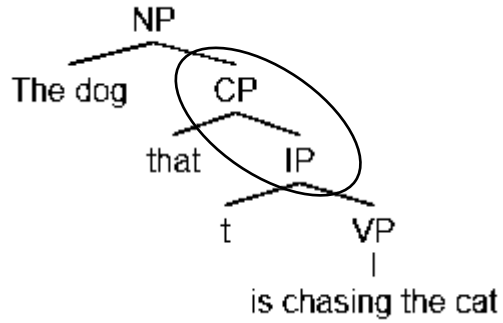
In (45), which is a preposition-stranded RC, the relativized head noun *the boy* moves from its canonical position to the left of the RC and a *wh* operator is linked to the moved constituent. In contrast, in (46), which is a pied-pied RC, the whole PP moves to the left of the RC and subsequently, the NP *the boy* is moved out of the PP and placed to the left of the CP, in SpecCP position. Therefore, since a pied-piped oblique RC requires more derivations than a preposition-stranded one, it is more complex.

2.4.4. Predictions Concerning the Comprehension of Subject, Object, and Oblique RCs

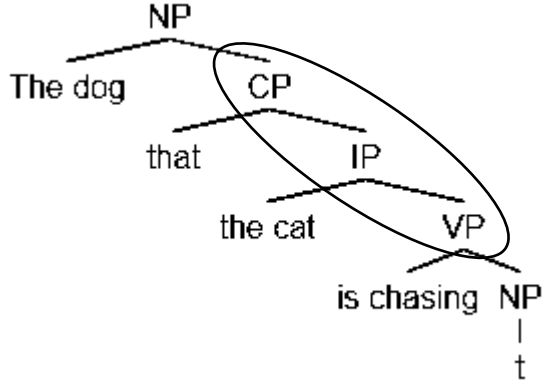
Various theories make different predictions concerning the comprehension of RCs. Therefore, this section describes the predictions made by three influential accounts: Structural Distance Hypothesis (SDH) / Minimalism, frequency of occurrence, and Perspective Hypothesis (PH). Note that the SDH and Minimalism are grouped together because they both belong to the generative school of thought. These predictions concern the object investigated in the present thesis (which will be described in detail in section 2.5.), namely the comprehension of RCs that vary in syntax (RC function, placement of oblique prepositions) and in semantics (content of oblique prepositions). Specifically, the three accounts ought to predict how subject, object, and oblique RCs are understood, and whether the comprehension of oblique RCs varies when they contain stranded or pied-piped prepositions and when they feature locative or non-locative prepositions.

2.4.4.1. Predictions According to the SDH / Minimalism

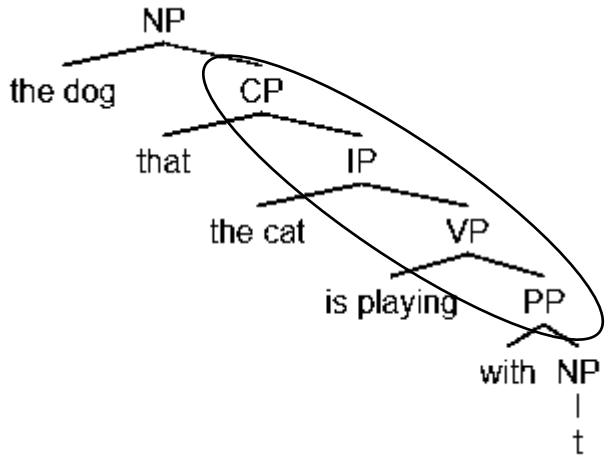
In the Structural Distance Hypothesis (O'Grady, 1997), the processing difficulty is linked to the number of nodes separating the gap from the relativized head noun (see section 4.2.2). The syntactic trees (47) to (50) represent the level of embedding of subject, object, and oblique RCs (with stranded and pied-piped prepositions).



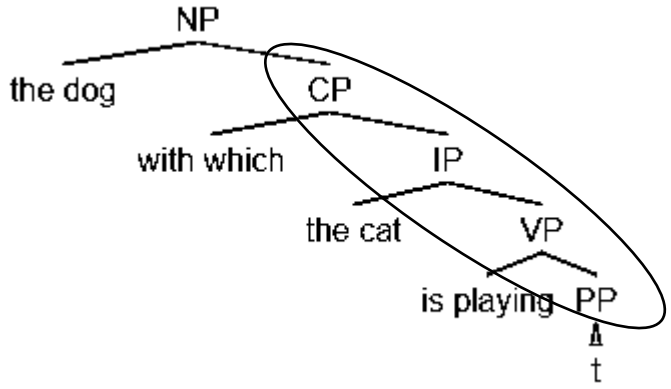
(47) Subject RC



(48) Object RC



(49) Oblique RC with preposition stranding



(50) Oblique RC with pied-piping

As can be seen from the syntactic trees, the structural distance between the gap and the relativized head noun (*the dog*) amounts to two nodes in the subject RC,

three nodes in the object RC, and four nodes in the oblique RC. As a result, the subject RC is the easiest clause to process, followed by the object RC, and the oblique RC is last.

As the SDH does not make any specific prediction regarding the comprehension of oblique RCs, it can be complemented with McDaniel et al.'s (1998) interpretation of the Minimalist framework (Chomsky, 1995) (see section 4.3). Since criteria of economy apply to grammatical derivations and representations, McDaniel et al. (1998) conclude that stranding prepositions in oblique RCs represents the minimal derivation, while pied-piping is a grammatically costly operation because it involves an additional movement of constituents. Therefore, oblique RCs featuring stranded prepositions represent the less complex construction and ought to be understood better by learners of English.

In sum, combining the SDH and Minimalism (Chomsky, 1995) results in the following order of increasing comprehension difficulty: subject RCs, object RCs, oblique RCs with stranded prepositions, oblique RCs with pied-piped prepositions. As far as the semantic content of the prepositions featured inside the oblique RCs is concerned, it is not included in the theory, so that no prediction is made concerning the comprehension of oblique RCs with locative or non-locative prepositions.

2.4.4.2. Predictions According to the Frequency-Based Accounts

In frequency-based accounts, the RC difficulty is linked to its frequency of occurrence in the input. In order to make predictions about which RC type is easier to understand, a corpus search has been carried out in the British National Corpus (BNC) and the Corpus of Contemporary American English (COCA), both of which are available online through Brigham Young University (http://corpus.byu.edu/bnc). The BNC (1970s-1993) contains 100 million words while the COCA (1990-2015) totals over 520 million words. Both include spoken and written genres of English and are tagged with CLAWS 7. Since the corpora

are not parsed, queries can be done using exact words, wildcards, parts of speech, or a combination of these.

In order to analyze the frequency of the various types of RCs, the syntaxes (51) to (54) have been used. These are sequences of parts of speech and exact terms. Each syntax has been crafted so as to parallel the test sentences used in the present research and in similar studies. Syntax (51) corresponds to a subject RC, (52) to an object RC, (53) to an oblique RC with a pied-piped preposition, and (54) to an oblique RC with a stranded preposition.

(51) the [nn*] that|who [v*]

(52) the [nn*] that|who the [nn*] [v*]

(53) the [nn*] [i*] which|whom the [nn*] [v*]

(54) the [nn*] that|who the [nn*] [v*] [i*]

It can be noted that, since only restrictive RCs are investigated in this research, each syntactic query starts with the definite article *the,* followed by a noun. The noun can be any noun (nn*) because this search does not discriminate between animate and inanimate nouns. The relative pronoun used inside the syntax reflects this animacy uncertainty, so that the third slot can be filled with either *that* or *who*. Admittedly, object and oblique RCs whose relativizers are not overtly expressed are ignored in this search. However, the motivation for leaving out these RCs is that they are not included in this research design: all the object and preposition-stranded oblique RCs that will be tested contain an overtly expressed relative pronoun. Moreover, the relative pronoun used in object RCs to refer to an inanimate antecedent (syntax 52) is *that*, and not *which*, in order to parallel the pronoun used in the test sentences. In (51), which spells out a subject RC, the relative pronoun is directly followed by any verb (v*), while in (52), an object RC, the relative pronoun is followed by a definite noun phrase (*the*, nn*) and any verb (v*). In (53) and (54), the oblique RC preposition (i*) is placed either before the relative pronoun or at the end of it to mirror the syntax of a pied-piped or of a preposition stranded RC, respectively. The relative pronouns included in the

syntax for a pied-piped oblique RC are the exact terms *which* or *whom*, while their equivalents in a preposition-stranded RC are *that* or *who*. Again, no animacy constraint is expressed concerning the relative pronouns. Finally, the oblique RC pattern found after the relative marker is the definite article (*the)* followed by any noun (nn*) and by any verb (v*).

Table 5 Comparison of the frequency of subject, object, and oblique RCs

Corpus study: Frequency of the various RC types in a British (BNC) and American (COCA) corpus					
		SR	OR	OBL-PP	OBL-PS
BNC					
	tokens	33205	3919	2525	405
	per million	344.94	40.71	26.23	4.21
COCA					
	tokens	490610	26550	4150	1410
	per million	919.11	49.74	7.77	2.64

SR, object RC; OR, object RC; OBL-PP, oblique RC with pied-piped preposition; OBL-PS, oblique RC with stranded preposition

The results of the corpus search are presented in Table (5) and are expressed in absolute numbers (tokens) and in ratios (per million). It is noteworthy that, in both British and American corpora, the most frequent RCs are by far subject RCs. Object RCs come in second place, well behind subject RCs, and then oblique RCs come in third place. As far as the placement of the preposition in oblique RCs is concerned, it turns out that pied-piping is a more frequent construction than preposition stranding. The overwhelming superiority in count of subject RCs compared to object RCs is in line with the results of Reali and Christiansen (2007) and Heider, Dery, and Roland (2014), and the dominance of pied-piping among oblique RCs has also been confirmed by Hoffman (2005), who noticed that "pied

piping is by far the more frequent variant in written and spoken English" (p. 257). Since the higher frequency of pied-piped oblique RCs in natural discourse might seem counterintuitive to the reader, and since it is often considered that pied-piping is less used in spoken English, a second table is inserted below, which details the frequency of both constructions in oral and spoken corpora of English. Table (6) reveals unequivocally that in British English, pied-piping is more frequent than preposition stranding in both oral and written registers, and in American English, pied-piping occurs more often in the written register, while in the oral language, there is a slight preference for preposition stranding.

Table 6 Frequency of pied-piped and preposition stranded oblique RCs

Corpus frequency of oblique RCs with pied-piped (PP) and stranded (PS) prepositions in a British (BNC) and American (COCA) corpus			
SPOKEN CORPORA			
		OBL-PP	OBL-PS
BNC	*tokens*	49	23
	per million	4.92	2.31
COCA	*tokens*	319	396
	per million	2.92	3.62
WRITTEN CORPORA			
		OBL-PP	OBL-PS
BNC	*tokens*	2476	382
	per million	28.69	4.43
COCA	*tokens*	3831	1014
	per million	9.03	2.39

In conclusion, the results of a corpus search on two corpora of English, a British and an American one, indicate, first, that subject RCs are more frequent than

object RCs, which in turn are more recurrent than oblique RCs, and second, that oblique RCs featuring pied-piped prepositions are used more often than their preposition stranded counterparts. Therefore, the predicted, increasing gradient of RC comprehension difficulty based on the frequency of occurrence is the following: subject RCs, object RCs, oblique RCs with pied-piping, and oblique RCs with preposition stranding. Note that this frequency-based prediction is based on a mixed-grained approach. In other words, the corpus searches have looked for the frequency of exact words and formal syntactic categories organized in a certain sequence, but the resulting count reveals the frequency of the syntactic patterns investigated in this research. Since the frequency of lexical items inside RCs has not been included in the present analysis, no prediction is made concerning the comprehension of oblique RCs containing semantically varied prepositions (locative or non-locative).

2.4.4.3. Predictions According to the PH

In the Perspective Hypothesis (MacWhinney, 1977), shifting perspective from one referent to another one inside a sentence has a cost. As a result, the Perspective Hypothesis (HP) predicts that subject RCs are understood more easily than object ones because the perspective of the agent is maintained throughout its processing. On the other hand, object RCs involve a perspective shift from the patient to the agent, so that the comprehender has to adopt a total of two perspectives.

As far as oblique RCs are concerned, the number of referents remains unchanged compared to object RCs. Indeed, in the object RC *the dog that the cat is chasing*, two perspectives are taken by the comprehender: the dog's and the cat's. In the oblique RC *the dog that the cat is speaking with*, the viewpoints are the same: the dog's and the cat's. Therefore, the PH predicts an equal comprehension of object and oblique RCs by listeners.

The PH does not make any prediction concerning the placement of the preposition inside the oblique RCs, but it does forecast a difference between the comprehension of oblique RCs containing locative prepositions and those having

non-locative prepositions. Indeed, locative prepositions are used to indicate the position of one referent from the perspective of another referent. For example, in the sentence *the dog is standing over the cat*, the preposition *over* can be understood only in reference to *the cat*. This spatial referencing is called intrinsic because it is centered on the object of reference (Levinson, Kita, Haun, and Rasch, 2002). This means that oblique RCs containing locative prepositions contain a supplementary shift in perspective compared to oblique RCs having non-locative prepositions, as illustrated in (55) and (56).

(55) This is the dog that the cat is speaking with.

(56) This is the dog that the cat is jumping over.

In sentence (55), the listener adopts first the perspective of the patient (*the dog*) and then that of the agent (*the cat*), whereas in sentence (56), the listener shifts perspective from the patient (*the dog*) to the agent (*the cat*), and back to the patient (*the dog*) in order to process the locative preposition. In other words, oblique RCs containing non-locative prepositions suppose two perspectives, while oblique RCs with locative prepositions require to adopt three viewpoints, which makes them more difficult to understand.

In sum, the following predictions are made according to the PH. First, subject RCs are expected to be easier to understand than object RCS, while object and oblique RCs are hypothesized to be equally difficult. Second, oblique RCs featuring non-locative prepositions ought to be easier to understand than oblique RCs containing locative prepositions. On the other hand, no prediction is made concerning the placement of the preposition inside the oblique RCs.

2.5. The Present Study: Research Questions and Hypotheses

As mentioned in Chapter 1, the research on RCs in L2 acquisition either has been carried out within specific theoretical perspectives with research methods quite unlike the ones used in L1 research or it has adopted L1 experimental designs but with a reduced scope of investigation (only subject and object RCs) and in languages typologically different from the ones initially studied. In general, the

second language acquisition research on RCs, and in particular on the comprehension of RCs, has led to inconclusive results. The present research, therefore, aims to investigate the comprehension of restrictive RCs by learners of English having Romance languages as L1.

In this research on the L2 comprehension of RCs, the pool of clauses studied is restricted to three: subject, object, and oblique RCs, and in the case of oblique RCs, they are further sub-divided depending on the syntactic placement of the preposition (in pied-piped or stranded position) and on the semantic content of the preposition (locative or non-locative). As far as the tested population is concerned, two groups of Romance learners have been selected, namely native French and Italian speakers.

Since the object of investigation is the comprehension of RCs by Romance learners of English, a clear working definition of comprehension is needed before describing the research questions in more detail. Hence, in this thesis, language comprehension refers to the capacity of humans to extract intended meaning from oral or written linguistic input. Comprehension is the end result of language processing, which can be defined as the mental activity preceding and leading to language comprehension. It includes, among other things, syntactic parsing and lexical retrieval.

The research questions asked in the present thesis are the following. First, is there a gradient of difficulty in the comprehension of RCs by Romance learners of English? And if so, does it correspond to Keenan and Comrie's (1977) Noun Phrase Accessibility Hierarchy? Second, does syntax affect this comprehension, in particular the function of the RC and the placement of the preposition inside oblique RCs? Third, does semantics influence this comprehension, specifically the semantic content of the oblique RC prepositions? Finally, does the learners' L1 have an effect on this comprehension?

In order to answer the research questions, the following three hypotheses are formulated. Note that the second hypothesis covers two research questions: it aims to determine whether the comprehension of RCs is influenced by syntax, on the one hand, and by cross-linguistic transfer, on the other hand. Specifically, the necessity to pied-pipe the prepositions in oblique RCs in Romance languages is hypothesized to facilitate the comprehension of the equivalent RC construction in the L2.

Hypothesis # 1: The comprehension of subject, object, and oblique RCs by Romance learners of English is affected by the syntactic function of the RC, and it follows Keenan and Comrie's (1977) NPAH. In other words, the comprehension of subject, object, and oblique RCs follows an increasing gradient of difficulty.

Hypothesis # 2: The comprehension of oblique RCs by Romance learners of English is influenced by the syntactic placement of the preposition inside the RC, and oblique RCs containing pied-piped prepositions are better understood than those having stranded prepositions.

Hypothesis # 3: The comprehension of oblique RCs by Romance learners of English is affected by the semantic content of the preposition, and oblique RCs containing non-locative prepositions are better understood than those featuring locative prepositions.

CHAPTER 3: The Comprehension of RCs by French Learners of English

Since the comprehension of restrictive RCs by Romance learners of English is investigated in the present research, this chapter presents the results of a comprehension experiment with the first group of Romance learners that has been selected, namely native French speakers. As a reminder, comprehension has been defined in Chapter 2 as the human capacity to extract intended meaning from linguistic input. In this experiment, the comprehension of oral language is under investigation. This chapter is organized as follows: First, the goals and hypotheses of the experiment as well as a summary of previous research are described in section 3.1, then the method used in this experiment is detailed in section 3.2 and the experiment results are presented in 3.3. Finally, the results are discussed in light of previous research and theories of RC complexity in section 3.4, which is followed by conclusions in section 3.5.

3.1. Aim

The RCs that are investigated in this chapter are subject, object, and oblique RCs, and the two hypotheses that are tested are the following (see Chapter 2.5.). The first hypothesis holds that the comprehension of subject, object, and oblique RCs by Romance learners of English is affected by the syntactic function of the RC. Moreover, this comprehension is expected to follow the gradient of difficulty described in Keenan and Comrie's (1977) Noun Phrase Accessibility Hierarchy (NPAH henceforth). Concretely, subject RCs are expected to be understood better than object ones, which in turn are predicted to be comprehended better than oblique ones (see Chapter 2.4.1 for a more detailed account of the NPAH).

The motivation for expecting the RC function to bear on the comprehension of RCs by Romance learners of English stems from the vast body of literature which has been devoted to RC processing and comprehension in the field of L1 and L1 acquisition, and which has evidenced that, in general, subject RCs featuring animate referents and full noun phrases are processed faster by adults and are understood better by children, at least in head-initial languages (see the state of the art in Chapter 2.3). Moreover, it is expected that the comprehension of RCs by

Romance learners of English follows the NPAH because this Hierarchy has received general support from several studies in L2 acquisition (Doughty, 1991; Eckman et al., 1988; Gass, 1979, 1980). It should be noted, however, that these studies have tested only L2 production and acceptance, not comprehension.

The second hypothesis concerns the comprehension of oblique RCs. As explained in Chapter 2.1.5.1, the word order of oblique RCs in English can vary: they can feature fronted, pied-piped prepositions or clause-internal, stranded ones. Therefore, the comprehension of oblique RCs is hypothesized to be affected by the syntactic placement of the preposition inside the RCs. In addition, oblique RCs featuring pied-piped prepositions are predicted to be understood better than their preposition-stranded counterparts.

The syntactic placement of the oblique RC prepositions (in pied-piped or stranded position) is expected to affect the RC comprehension because previous research in L2 acquisition has indicated that L2 learners always have a preference for one or the other construction (Bardovi-Harlig, 1987; Mazurkewich, 1984; Ohba, 2003), although there is disagreement as to which placement is preferred. On the other hand, the expectation that oblique RCs featuring pied-piped prepositions are better understood than preposition stranded ones is motivated by theoretical considerations. Since L2 theories predict that cross-linguistic transfer operates during the process of L2 acquisition (see Chapter 2.2.2.) and since pied-piping is the only oblique RC construction allowed in the participants' L1, namely French (see typological differences in Chapter 2.1.5.2), it follows that French learners of English ought to be influenced by their L1 and thus understand oblique RCs with pied-piped prepositions better than those featuring stranded prepositions.

3.2. Method

3.2.1. Participants

The participants to this experiment were 59 native French speakers studying engineering at a Belgian university, aged 21.03 on average (*SD* = 1.16). Their

general level of English proficiency was lower intermediate and corresponded to a B1 in the Common European Framework of Reference for Languages. That level was measured by the university at the start of the academic year with a commercial placement test (Oxford Quick Placement Test, Pen and Paper version) combined with an in-house listening comprehension activity. The students volunteered to take the test and signed an informed consent form. On average participants had studied English for 7.12 years (*SD* = 2.36), mostly in secondary school.

3.2.2. Materials

In order to test the comprehension of subject, object, and oblique RCs by French learners of English, a picture selection test was designed. It consisted in listening to pre-recorded oral stimuli and selecting a character inside a vignette. There were a total of 56 vignettes printed inside a paper booklet. Of the 56 test items, 16 were fillers: half of these contained subject RCs featuring animate referents, of which one was human (for example, *the girl who is brushing the horse*), while the other half had adverbial gap RCs introduced by *where* and featured a sequence of inanimate and animate referent (for example, *the hill where the elephants are walking*).

The target sentences were distributed as follows: Sixteen subject RCs, eight object RCs, eight oblique RCs with stranded prepositions, and eight oblique RCs with pied-piped prepositions. The RCs were always placed in object-modifying position inside the test sentences. The verbs used in transitive subject and object RC's were the following: *bite, brush, follow, hit, lift, pull, push, watch*, while those used in oblique relatives were: *jump over, look at, run behind, run in front of, step over, walk behind, walk in front of*.

The vignettes corresponding to the target sentences depicted only animate characters, all of which were animals. All the test sentences contained full noun phrases and referred to one particular animal inside the vignettes, which was performing some action relative to another animal, as in the example *Show me the dog that the cat is pulling*. Inside the vignettes participants had the possibility either to circle the right character, or to make a role reversal error, or to misunderstand

the RC type. For example, after hearing the stimulus *Show me the dog that the cat is pulling*, participants could circle the right dog, which is the correct answer, or they could circle the cat, in which case it is a role reversal error because they have inverted the agent and patient in the scene, or they could select the wrong dog, which leads to an RC type error because the object RC has been interpreted as a subject one.

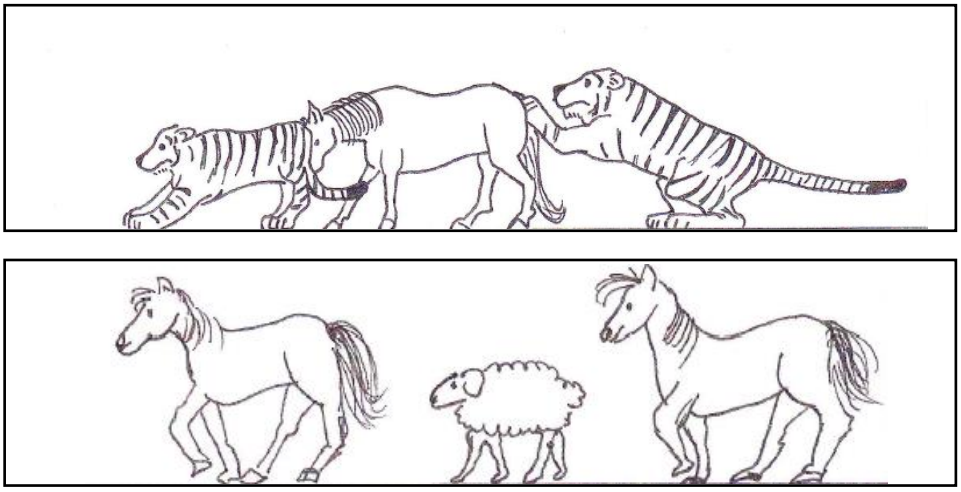


Figure 1. Test items: Examples of vignettes used in the picture selection test. The corresponding stimuli are *Show the tiger that is pushing the horse* and *Show me the horse in front of which the sheep is walking*.

The vignettes always contained three characters. However, a fourth character was introduced in six vignettes in order to depict a plausible reality because the corresponding test sentences had the verbs *lift*, *jump over*, or *step over*. Therefore, since it was impossible to draw an animal lifting, jumping, or stepping over another one that would be jumping or stepping over a third one, a fourth animal was added, and the vignette was adapted to portray two sets of animals interacting with each other. The fourth character could be selected by participants, but the possible interpretations of the target sentences remained unchanged: correct, incorrect with a role reversal error, or incorrect with an RC type error.

Examples of test items are given in Figure (1), and the complete list of test sentences can be found in Appendix (A).

3.2.3. Procedure

Participants were given a context prior to starting the listening comprehension activity: They were told that animals in Fantasy Land were preparing for the Fantasy Land Games and so were depicted running and playing with each other. They received oral and written instructions concerning the test, which consisted in listening to the pre-recorded oral stimuli and circling the character that had just been described. An interval of five seconds separated the listening of each stimulus. Two warm-up items were included prior to starting the picture selection test. In the instructions participants were encouraged to circle a character in the vignette even if they were not sure of the answer.

During the scoring only correct answers were taken into consideration: A score of one was attributed to the correct identification of the character described in the stimulus and a score of zero was given in case of role reversal or RC type error.

3.3. Results

3.3.1. Comprehension of Subject, Object, and Oblique RCs

In order to investigate the possible influence of syntactic function on the comprehension of RCs by French learners of English, the participants' correctness scores on subject, object, and oblique RCs are compared. As can be seen in Figure (2), the comprehension scores are generally high. In particular, the mean comprehension score on subject RCs is 93.86% (*SD* = 10.60), that of object RCs is 95.13% (*SD* = 9.85), and that of oblique RCs (compounding results on both subtypes, that is pied-piped and preposition-stranded) is 88.35% (*SD* = 11.80).

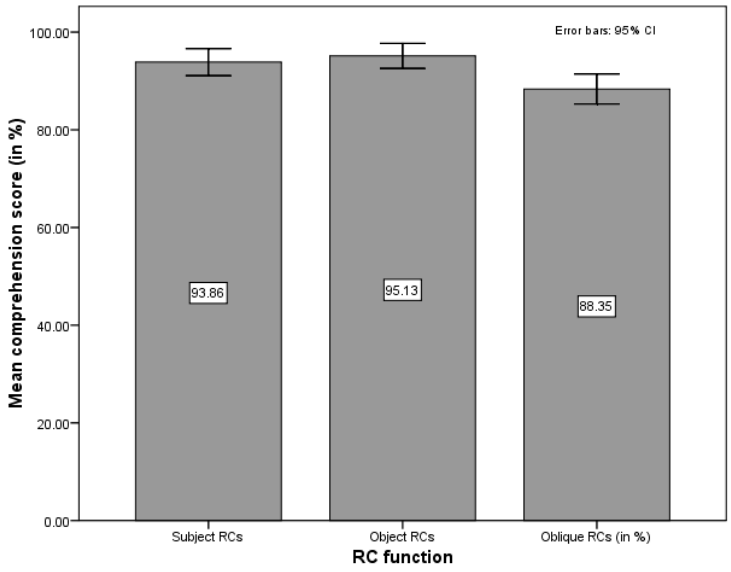


Figure 2. Comprehension of subject, object, and oblique RCs by French learners of English. Bars indicate mean comprehension scores (in percentage) on subject, object, and oblique RCs.

Since the visual inspection of the data and the normality test reveal that the data is not normally distributed (D(59) = 0.34, $p < .001$ for subject RCs; D(59) = 0.43, $p < .001$ for object RCs; and D(59) = 0.22, $p < .001$ for oblique RCs), it is further analyzed with non-parametric tests. First, Friedman's ANOVA indicates that there is a significant difference between the three RC comprehension scores, $\chi^2(2) = 30.26$, $p < .001$. Second, Wilcoxon's signed-rank test is used to follow up this finding, and a Bonferroni correction is applied, so that significance level is reported at .025. It appears that subject and object RCs are equally well understood (z = -0.62, $p = .53$, $r = -.057$) while scores on subject and object RCs are significantly higher than those on oblique RCs (z = -3.52, $p < .001$, $r = -0.32$ and z = -4.43, $p < .001$, $r = -.41$ respectively). In sum, the correctness scores on subject, object, and oblique RCs indicate that the comprehension of RCs by French learners of English is affected by the syntactic function of the RC and that it follows the NPAH to some extent.

3.3.2. Comprehension of Oblique RCs with Pied-Piped and Stranded Prepositions

In order to test the second hypothesis, which predicts that the syntactic placement of the preposition inside the oblique RC influences the RC comprehension by French learners of English and that oblique RCs featuring pied-piped prepositions are better understood, the comprehension scores of both oblique RC constructions are compared.

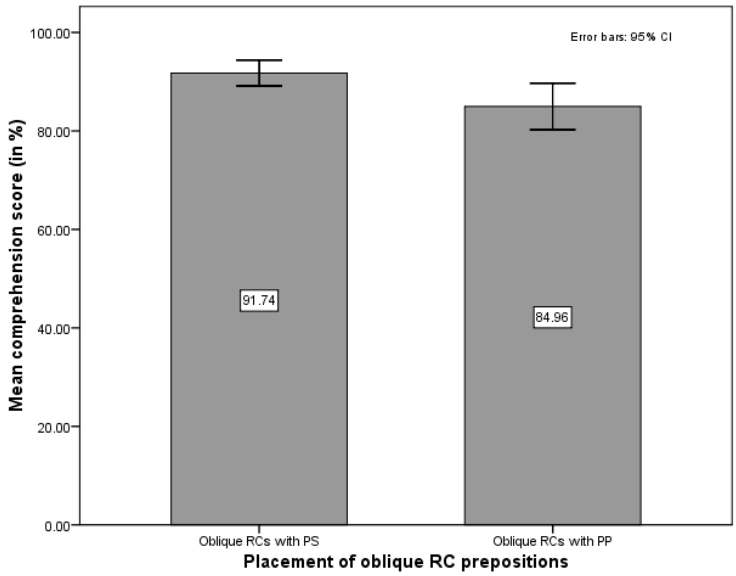


Figure 3. Comprehension of oblique RCs by French learners of English. Bars indicate mean comprehension scores (in percentage) on oblique RCs with preposition stranding (PS) and pied-piping (PP).

From Figure (3), it emerges that the mean score on oblique RCs with stranded prepositions is 91.74% (*SD* = 10.01) and that on pied-piped oblique RCs is 84.96% (*SD* = 18.10). Since the data is non-normally distributed ($D(59) = 0.30$, $p < .001$ for oblique RCs with preposition-stranding; $D(59) = 0.25$, $p < .001$ for oblique RCs with

pied-piping), scores are compared using Wilcoxon signed-rank test. It turns out that oblique RCs with stranded prepositions are significantly better understood that those with pied-piped prepositions ($z = -2.90$, $p = .004$, $r = -.27$). Therefore, results indicate that the comprehension of oblique RCs is affected by the syntactic placement of the preposition and that oblique RCs featuring stranded prepositions have a comprehension advantage over the pied-piped ones.

3.4. Discussion

3.4.1. The Comprehension of Subject, Object, and Oblique RCs

On the basis of the comprehension results of the French learners of English on subject, object, and oblique RCs, it is now possible to examine the prediction of the first hypothesis, namely that the syntactic function of the relativized head noun affects the RC comprehension in the L2. The results to this first experiment clearly indicate that it is the case. Indeed, French learners of English score better on subject and object RCs than on oblique ones. This influence of the RC function is in line with several studies in L2 production (Gass, 1979; Pavesi, 1986; Eckman et al., 1988; Doughty, 1991), as well as numerous experiments in L1 processing by adults (Ford, 1983; Frauenfelder et al., 1980; Frazier, 1987; Hakes et al., 1976; King & Just, 1991; King & Kutas, 1995; Schelschraete & Degand, 1998) and in L1 comprehension by children (Adani, 2011; Cook, 1975; Costa et al., 2011; Volpato & Adani, 2009). It should be mentioned, however, that the L1 research has focused almost exclusively on subject and object RCs.

The second part of the first hypothesis concerns how the influence of the syntactic function of the RC manifests itself, and it predicts that L2 learners' comprehension of RCs follows the gradient of difficulty expressed in Keenan and Comrie's (1977) NPAH. In particular, it is hypothesized that the comprehension of subject, object, and oblique RCs by French learners of English follows a decreasing gradient of ease. This prediction, however, is only partially confirmed by the results of the first experiment. Indeed, when tested on their comprehension of subject, object, and oblique RCs, French learners of English score better on subject and object RCs than on oblique ones, but they understand subject and object RCs equally well.

The absence of asymmetry in the comprehension of subject and object RCs by L2 learners contrasts with some research findings in the L1, but before these can be addressed, it is important to rule out any possible ceiling effect in the results of the present experiment.

Ceiling effects arise when the variance of a variable escapes detection due to the limitations of the research design or of the measurement tools. For example, a portion of the subjects participating in an entrance test to a university could reach the highest possible score and thus form a category of eligible candidates with the maximum score. However, among those subjects, some might be more advanced or capable than others, but that information is lost because the entrance test has been designed to test up to a certain limit. Another example of ceiling effect is found in response time studies, where participants have to press a key as response to a stimulus. If the stopwatch, which measures response times, has limited sensitivity, it will lead to a clustering of response time scores around a certain minimum score, making it impossible to know whether that clustering represents the participants' lowest response time or the incapacity of the stopwatch to measure the participants' response more precisely.

In the present RC comprehension experiment, participants have been asked to select the right character in a vignette in response to a stimulus, which consisted in listening to syntactically varied RCs. The participants' comprehension is measured in terms of correctness scores: the more correct answers are given to a certain RC type, the better the comprehension of that RC type is. The limitations of this test design, thus, are the number of test items included in the test and the number of choices given to the participants in each vignette. It can be noticed that, in this comprehension experiment with French learners of English, the comprehension scores of subject and object RCs are high: 93.86% and 95.13% respectively. These high scores can either be due to a ceiling effect or they represent a true measurement of comprehension. If a ceiling effect is suspected, it means that the number either of test items or of possible choices is not high enough to detect potential comprehension differences. However, there is no reason to think that increasing the number of test items would lead to major precision in the measurement. If participants have answered correctly after

listening to eight stimuli, they are likely to respond just as well on the next one. On the other hand, augmenting the number of test items would make the comprehension test lengthier, and that would introduce a new, unwanted variable in the test design, namely fatigue. The fatigue of participants during the comprehension test would lead to an increased number of errors due, not to the misunderstanding of RC types, but to a lack of attention. Therefore, there is a tradeoff between increasing the accuracy of the measurement through the inclusion of a higher number of test items and avoiding noise in the data due, for example, to fatigue. A quick review of previous studies that have employed picture selection tasks successfully to investigate RCs shows that the number of subject and object RCs tested varies generally varies between four and eight (Adani, 2011; Aydin, 2007; Cook, 1975; Guasti et al., 2012; Volpato and Adani, 2009). Since eight test sentences were used in the present experiment, its design can be considered as quite in line with general practice. As far as the number of choices in the vignettes is concerned, the same observation can be made: most of the time, subjects have to choose one among three options, and as a matter of fact, the authors who have included a greater number of test items (Costa et al., 2011; Friedmann et al., 2009) have done so because their picture selection activity was reduced to choosing one of two characters. In conclusion, since the test design of the present experiment aligns itself with general practice and since it has brought to light comprehension differences between oblique RCs and subject/object ones, on the one hand, and between oblique RCs featuring pied-pied and stranded prepositions (this will be discussed subsequently), on the other hand, the high comprehension results to subject and object RCs are interpreted as a likely reflection of the participants' equal comprehension capacity with regard to the two RCs.

Now that ceiling effects have been addressed, the comprehension results of the French learners of English can be discussed. As mentioned earlier, the L2 comprehension of subject and object RCs is on par, whereas that of oblique RCs is significantly lower. The absence of subject-object asymmetry in the comprehension of RCs may seem to contradict the often repeated claim in the psycholinguistic literature that subject RCs are easier than their object counterparts. However, once experiment designs are scrutinized and that only comprehension studies containing animate referents and full noun phrases are

considered, since these conditions have been shown to make object RCs harder to process (see the state of the art in Chapter 2.3.), it appears that subject RCs are not easier to understand than object ones. Indeed, the evidence comes from the L1 and the L2 acquisition literature. Specifically, in second language acquisition, the comprehension of subject and object RCs is reported to be equal by Mitsugi et al. (2010) and Izumi (2003), who tested L2 learners respectively with a verification statement test and a picture selection one. A third study (Aydin, 2007) has also presented evidence against any subject-object RC asymmetry, but the results ought to be considered with caution because they do not hold across participants. In L1 research, the evidence for the absence of subject-object RC asymmetry in comprehension stems from the numerous processing experiments that have included verification statements. Interestingly, while all the processing results indicate a processing advantage for subject RCs, the comprehension accuracy scores, on the other hand, reveal that subject and object RCs are equally well understood (Gordon et al., 2004; Hsiao & Gibbons, 2003; Ishizuka, 2005; King & Just, 1991; Lin, 2006; Ueno & Garnsey, 2008; Vasishth, Chen, Li, & Guo, 2013). These results are in contrast with those of Cook (1975), who tested both native speakers of English and L2 learners. However, his methodology is questionable because it is cognitively demanding and contains a bias in favor of subject RCs. Indeed, it consisted in circling, in a list of four words, the one word corresponding to the agent of the sentence heard and drawing an arrow from the agent to the word corresponding to the patient of the action. In other words, when participants heard "the dog pushes the horse", they had to circle *dog* and draw an arrow towards *horse*. Needless to say, the task is more demanding than a picture selection task, especially when the stimuli are object RCs since these do not follow the canonical word order and imply a perspective shift. It should be noted that this test design has not been used since in RC comprehension research. In sum, the comprehension results from adult native speakers and adult L2 learners, including the present French learners of English, point to an equal comprehension of subject and object RCs.

While L1 and L2 adults understand subject and object RCs equally well, the research concerning the comprehension of RCs by native children reveals that subject RCs have a comprehension advantage over object ones (Adani, 2011; Cook, 1975; Costa et al., 2011; Diessel & Tomasello, 2005; Volpato & Adani, 2009).

It seems, therefore, that there is a qualitative difference in the processing and comprehension of RCs by adults and by children since adults, native and non-native alike, process object RCs more slowly than subject ones but understand them equally well, while children understand object RCs less well than subject ones (no processing data is available to date). A possible explanation for the divergence between adults and children might be that only major processing differences lead to comprehension breakdown. Therefore, children, who experience greater processing difficulty than adults when encountering object RCs, misinterpret object RCs, whereas adults, whose processing variation of subject and object RCs remains minimal, understand object RCs as well as subject ones. Expressing this in terms of Keenan and Comrie's (1977) NPAH, it could be said that the comprehension of RCs follows the NPAH gradient of difficulty, but that significant differences occur only between non-adjacent NPAH categories. As a reminder, the Hierarchy categories are the following: subject, direct object, indirect object, oblique object, genitive object, and object of a comparison. Therefore, if comprehension varies only between non-adjacent NPAH categories, differences ought to be found between subject and indirect object RCs and between direct object and oblique RCs, but not between subject and object RCs. As a matter of fact, this corresponds to the comprehension performance of the French learners of English tested in the present experiment: Their comprehension of subject and direct object RCs, two adjacent NPAH categories, is similar, whereas their comprehension of subject and object RCs surpasses that of oblique RCs, which are non-adjacent in the Hierarchy.

In sum, the comprehension scores from French learners of English indicate that subject and object RCs are equally well understood while oblique RCs are harder to comprehend. This confirms the hypothesis that the L2 comprehension is influenced by the syntactic function of the RC. On the other hand, the absence of subject-object RC asymmetry, which confirms the results of previous research devoted to the comprehension of RCs by adults in L1 and L2 contexts, reveals that processing difficulties do not necessarily translate into comprehension breakdown and leads to the conclusion that the comprehension of RCs by French learners of English follows Keenan and Comrie's (1977) NPAH only partially since comprehension differences occur between non-adjacent NPAH categories only.

The results of the experiments can now be confronted with commonly accepted theories used to account for the RC comprehension or processing variations. The first account is O'Grady's (1997) Structural Distance Hypothesis (SDH), which is based on the assumption that language is a set of hierarchically organized representations and which links the difficulty of processing or understanding RCs with the mental computations necessary to process their structure (see Chapter 2.4.2.2. for a more detailed account). From this hypothesis, it follows that RCs that are lower down in the NPAH are harder to comprehend because they involve a major number of computations to link the gap with the moved constituent. Indeed, the SDH predicts that the comprehension of subject, object, and oblique RCs follows a gradient of increasing difficulty because the distance between the gap and the moved constituent is of two nodes in the case of subject RCs, of three nodes in object RCs, and of four nodes in oblique RCs. While this account confirms that the syntactic role of the RC exerts an influence on its comprehension by L2 learners, it falls short of explaining why the comprehension differences evidenced in the present experiment have been found only between non-adjacent categories of the NPAH.

The second theory is the frequency-based account. According to this theory, the difficulty to understand a syntactic structure is linked to its frequency of occurrence in the input. As illustrated in Chapter 2.4.4.2., the frequency of subject RCs found in corpora of British and American English is much higher than that of object RCs, while the frequency of oblique RCs is lowest. As a result, in the frequency-based theory, subject RCs are expected to be understood better than object and oblique RCs, and object RCs better than oblique ones. This prediction, however, is not borne out by the results of the comprehension experiment with French learners of English. Indeed, although object RCs are correctly hypothesized to have a comprehension advantage over oblique ones, the absence of comprehension asymmetry between subject and object RCs does not match the greatly dissimilar frequencies of subject and object RCs in natural discourse.

Finally, in MacWhinney's (1977) Perspective Hypothesis (PH), the comprehension difference between RCs derives from the shifts in perspective. Since listeners have to adopt one perspective when they listen to a subject RC and two perspectives when they hear an object or an oblique RC, they are expected to

understand subject RCs significantly better than object or oblique ones, and no comprehension difference ought to be observed between object and oblique RCs (see Chapter 2.4.4.3.). The performance of French learners of English in the present experiment, however, disconfirms this hypothesis since the opposite pattern is found: no comprehension asymmetry is reported between subject and object RCs while object RCs are understood better than oblique ones.

In sum, none of the three theories expounded can explain the comprehension results of French learners of English. On the one hand, the SDH and frequency theories correctly predict that oblique RCs are understood less well than the other RC types, but they are incapable to account for the participants' equal comprehension of subject and object RCs. On the other hand, the PH can neither justify the absence of comprehension asymmetry between subject and object RCs, nor the presence of a comprehension difference between object and oblique RCs.

3.4.2. The Comprehension of Oblique RCs with Pied-piped and Stranded Prepositions

According to the second hypothesis tested in this experiment, French learners of English are expected to be affected by the syntactic placement of the preposition inside the oblique RCs and to understand oblique RCs featuring pied-piped prepositions better than those with stranded prepositions. The comprehension advantage linked to pied-piping is hypothesized to be the result of cross-linguistic transfer. Indeed, since pied-piping is the only felicitous oblique RC construction in the participants' L1, French, and since L2 acquisition is predicted to be influenced by L1 transfer (see Chapter 2.2.2.), French learners of English are expected to understand oblique RCs with pied-piped prepositions better than their preposition-stranded counterparts.

The results to the present oblique RC comprehension experiment clearly indicate that the syntactic placement of the preposition inside the oblique RC influences its comprehension by French learners of English. This influence has been confirmed by all the studies that have investigated oblique RCs although they

have been concerned not with comprehension, but with production or acceptance of pied-piping and preposition stranding. Indeed, L2 learners always display a preference for one or the other placement of the oblique RC preposition (Bardovi-Harlig, 1987; Mazurkewich, 1984; Perpiñan, 2015; Ohba, 2003). However, the preposition placement that enjoys a comprehension advantage is not pied-piping, as expressed in the second hypothesis. On the contrary, French learners of English understand oblique RCs with stranded prepositions better. This observation coincides with the findings of other studies. Indeed, Bardovi-Harlig (1987) has shown that adult learners of English with various L1 backgrounds acquire preposition stranding before pied-piping, and Ohba (2003) reports that Japanese learners of English produce oblique RCs preferentially with stranded prepositions. In addition, the researchers who have investigated the reversed combination of languages, namely the acquisition of a Romance language allowing only pied-piping, seem to come to a similar conclusion: the English learners of French or Spanish reject the non-native, preposition stranding construction in a grammaticality judgment task (White, 1987) and produce target, pied-piped oblique RCs in an elicited production task (Perpiñan, 2015). Only one production study (Mazurkewich, 1984) provides contradictory results and reports that French learners of English acquire pied-piping before preposition stranding, but the evidence is subject to caution because the study investigates the production of *wh*-questions, not the comprehension of RCs.

Consequently, it seems that the evidence emerging so far from this and from previous research on oblique RCs indicates that Romance learners of English accept, understand, and produce native-like oblique RCs with stranded prepositions. This native-like behavior, however, contradicts the commonly accepted view that L2 acquisition is influenced by the L1 (see Chapter 2.2.). Indeed, it seems that the comprehension of oblique RCs by French learners of English is not affected by cross-linguistic transfer. This absence of L1-L2 transfer, however, might be linked to the proficiency level of the participants. As noted by Erlam (2006), relative clauses are considered to be acquired at the intermediate and advanced level of L2 proficiency, and oblique RCs in particular are typical of higher language register. Considering, on the one hand, that cross-linguistic transfer has been observed in numerous studies (for a review, see Nitschke et al., 2010), and on the other hand, that it has been shown not to hinder the acquisition

of L2 processing strategies (Nitschke et al., 2010), it can be concluded that the absence of L1 transfer evidenced in the present experiment regarding the comprehension of oblique RCs with stranded prepositions is due to the participants' higher level of L2 proficiency. This is all the more likely that the comprehension scores observed in the test are high.

In sum, the second hypothesis examined in the present research has been only partially confirmed. On the one hand, the comprehension of oblique RCs by French learners of English is affected by the syntactic placement of the preposition. On the other hand, oblique RCs with pied-piped prepositions are not the better understood construction. On the contrary, French learners of English comprehend oblique RCs featuring stranded prepositions better. This suggests that these L2 learners are not influenced by their L1, and the absence of cross-linguistic transfer may be due to the participants' higher proficiency level of English.

The present experiment results can now be confronted with theories explaining oblique RC complexity. First, in the theory of Minimalism as interpreted by McDaniel et al. (1998), processing language means operating syntactic computations, and the more derivations a construction implies, the more complex it is. In the case of oblique RCs, since pied-piping prepositions involves more derivations than stranding them (see Chapter 2.4.3.), it is therefore predicted that oblique RCs with pied-piped prepositions are more difficult to understand than their preposition stranded equivalents. McDaniel et al.'s (1998) application of Minimalism to oblique RCs provides an account that can explain both the influence of the syntactic placement of the oblique RC preposition on the RC comprehension by French learners of English and the better comprehension of oblique RCs containing stranded prepositions by the same learners.

The second account, the frequency-based one, links the comprehension performance on RCs with the frequency of occurrence of those syntactic constructions in natural discourse (see Chapter 2.4.4.2.). Since frequency counts

in a British and American corpus have revealed that oblique RCs containing pied-piped prepositions are much more frequent than those featuring stranded prepositions, pied-piped oblique RCs are hypothesized to have a comprehension advantage over their preposition-stranded counterparts. Since the present oblique RC comprehension experiment has yielded opposite results, namely that the less frequent preposition stranded oblique RCs are easier to understand, it has to be concluded that the frequency theory is not a good predictor of oblique RC comprehension by L2 learners of English.

3.5. Conclusions

The aim of this chapter has been to present and discuss the results of a comprehension experiment with French learners of English, which targeted the influence of syntax on the L2 comprehension of subject, object, and oblique RCs and of two subtypes of oblique RCs.

The experiment results have shown, first, that the syntactic function of the RC (subject, object, or oblique) affects the RC comprehension by French learners of English and that this increasing gradient of RC comprehension difficulty mirrors Keenan and Comrie's (1977) NPAH only to the extent that comprehension differences arises between non-adjacent NPAH categories. Concretely, French learners of English at intermediate proficiency level understand subject and object RCs better than oblique ones, but no comprehension asymmetry is detected between subject and object RCs. In terms of theoretical implications, neither O'Grady's (1997) SDH, nor the frequency theory can explain all the results: While both theories predict the influence of the RC function on comprehension, they cannot account for the equal comprehension of subject and object RCs. As far as MacWhinney's (1977) PH is concerned, it fails to justify the absence of a comprehension asymmetry between subject and object RCs as well as the presence of a comprehension difference between object and oblique ones.

Second, this experiment has produced evidence that the syntactic placement of the preposition inside the oblique RC affects the RC comprehension by French

learners of English and that oblique RCs featuring stranded prepositions are better understood than their pied-pied counterparts, although the latter are the only felicitous construction in the participants' L1. The weaker comprehension of pied-piped oblique RCs indicates an absence of cross-linguistic transfer, which may be explained by the participants' advanced level of proficiency. From a theoretical point of view, the results can be explained by Minimalism as interpreted by McDaniel et al. (1998), which links the oblique RC comprehension difficulty to the number of syntactic derivations required by the RC, whereas they contradict the frequency of occurrence account, which makes the inverse prediction, namely that oblique RCs with pied-piped prepositions are better understood.

Before closing the chapter, a final conclusion is in order and concerns the experimental method. Although the design of the comprehension test adopted in the present aligns itself with general practice, it has generated high comprehension scores, especially in the case of subject and object RCs. Since the presence of high scores is undesirable because of their ambiguous interpretation, a second measure of RC comprehension will be included in the design of the successive experiments.

CHAPTER 4: The Comprehension of RCs by Italian Learners of English

In chapter 3, the first group of Romance learners of English, the French one, has been tested. In the present chapter, the comprehension of the second group of Romance learners, namely native speakers of Italian, is investigated. Chapter 4 is organized as follows: The hypotheses and the state of the art are presented in 4.1., the experiment method and results are detailed in sections 4.2. and 4.3. respectively, then the results are discussed in 4.4., and they are followed by conclusions in 4.5.

4.1. Aim

In Chapter 3, the results of a comprehension experiment with French learners of English has revealed, first, that their comprehension of subject, object, and oblique RCs varies with the syntactic function of the RC, but that it follows Keenan and Comrie's (1977) NPAH only partially, and second, that their comprehension of oblique RCs is affected by the syntactic placement of the preposition inside the RC, but that pied-piping is not the better understood construction, suggesting that French learners with an intermediate level of English proficiency are not influenced by their L1.

The present chapter investigates whether the comprehension of RCs by Italian learners of English parallels that of French learners. As a reminder, comprehension has been defined in Chapter 2.5.1. as the human capacity to extract intended meaning from linguistic input. The two hypotheses tested in this chapter are, therefore, identical to the ones mentioned in Chapter 3. In other words, according to the first hypothesis, the comprehension of subject, object, and oblique RCs is expected to be influenced by the syntactic function of the RC and to follow the order of difficulty described in Keenan and Comrie's (1977) Noun Phrase Accessibility Hierarchy (NPAH). (See Chapter 2.4.1. for a detailed account of the NPAH.) As far as the second hypothesis is concerned, it predicts that the comprehension of oblique RCs by Italian learners of English is affected by the

syntactic placement of the preposition inside the RC and that oblique RCs featuring pied-piped prepositions are better understood than the preposition stranded ones as a result of cross-linguistic transfer. Note that oblique RCs in French and Italian are extremely similar typologically (see Chapter 2.1.5.), so that L1 transfer would result in a preference for the same RC construction, namely oblique RCs featuring pied-piped prepositions.

The motivations for formulating these two hypotheses have been described in Chapter 3.1. but are summarized briefly here. First, the comprehension of RCs is expected to be influenced by the syntactic function of the RC because research in head-initial languages has shown that object RCs are more difficult to process by L1 adults and to understand by L1 children (see Chapter 2.3.). Moreover, the NPAH has received general support from studies in L2 acquisition concerned with RC acceptance and production (Doughty, 1991; Eckman et al., 1988; Gass, 1979, 1980, 1982). Second, the comprehension of oblique RCs is hypothesized to be affected by the syntactic placement of the preposition because L2 acquisition studies have reported that learners prefer one placement over the other (Bardovi-Harlig, 1987; Mazurkewich, 1984; Ohba, 2003), and pied-piping is expected to have a comprehension advantage because L2 acquisition is subject to cross-linguistic transfer (see Chapter 2.2.2.).

4.2. Method

4.2.1. Participants

The participants to the present experiment were 91 native Italian speakers, aged on average 19.3 years (*SD* = 0.84), studying engineering at an Italian university. The participants volunteered to take the test and signed an informed consent form. At the end of the comprehension test, they completed a questionnaire and assessed their own level of comprehension by selecting one of four categories: beginner, lower-intermediate, higher-intermediate, and advanced. The distribution of self-reported proficiency levels was the following: 4 beginners, 30 low-intermediate, 52 high-intermediate, and 5 advanced learners of English. On average, participants had studied English for 8.42 years (*SD* = 2.26).

4.2.2. Materials

In order to investigate the comprehension of RCs by Italian learners of English, two tests were designed: a picture selection test and an elicited imitation one. The picture selection test was almost identical to the one administered to the French learners of English while the elicited imitation test was added to this experiment because it was concluded at the end of Chapter 3 that a second measure of RC comprehension was desirable in order to avoid ambiguous interpretations of high comprehension scores (see the discussion of ceiling effects in Chapter 3.4.1.).

Description of the Picture Selection Test

The picture selection test administered to the Italian learners of English was an enhanced version of the one used with the French participants and described in Chapter 3.2.1. It consisted in listening to 48 pre-recorded stimuli containing various RCs and to circle, inside a paper booklet containing vignettes, the character that had been described. An interval of five seconds separated the listening of each stimulus, and three warm-up items were presented before starting the comprehension activity. Of the total 48 test sentences, 16 were fillers. Half of these were subject RCs containing animate referents, of which one was human (for example, *the girl who is brushing the horse*), while the other half were adverbial RCs introduced by *where* and featuring a sequence of inanimate and animate referents (such as *the hill where the elephants are walking*).

The target sentences totaled 32 and were distributed as follows: 8 subject RCs, 8 object RCs, 8 oblique RCs with stranded prepositions, and 8 oblique RCs with pied-piped prepositions. The transitive verbs used in subject and object RCs were the same as the ones used in Chapter 3: *brush, pull, watch, hit, push, lift, follow, bite,* while those employed in oblique RCs were slightly different: *jump over, listen to, look at, play with, point at, run behind, smile at, wave at*. The verbs in the oblique RCs were modified so as to avoid repeating some of them. Obviously, the vignettes were adapted to match the new verbs, and an example of vignette is illustrated in Figure 4.

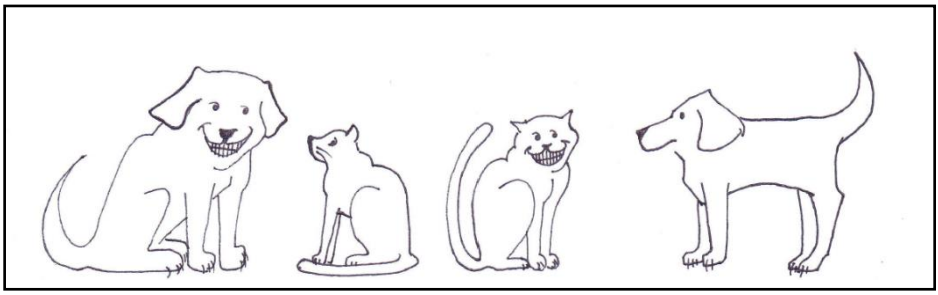


Figure 4. Test item: Example of vignette used in the picture selection test. The corresponding stimulus is *Show me the dog that the cat is smiling at.*

Description of the Elicited Imitation Test

The second test was an elicited imitation one. The tenet underlying elicited imitation is that "when stimuli are sufficiently long and complex, participants cannot memorize them holistically, but have to employ their own grammar to recreate them" (Eisenbeiss, 2010, p. 25). Erlam (2006) argues that, besides its advantageous practicality, the elicited imitation task is a good measure of implicit language knowledge and is reconstructive in nature because subjects have to hear and process the input, create a mental representation, hold it in working memory, and reproduce it using their interlanguage grammar. Among the good practices to design elicitation imitation tests, she lists the need to focus participants' attention on meaning, to create a delay between the presentation of the stimulus and its repetition, and to add time pressure. As far as the length of the stimulus is concerned, she adds that it is relative and varies with the type of targeted construction and the participants' level of L2 proficiency. In the literature the offered stimuli usually vary between 8 and 15 syllables.

Although the elicited imitation technique has limitations, such as the blurry line between language comprehension and production, it was used in this experiment in order to provide a complementary measure of language comprehension and to determine whether possibly high comprehension scores coming from the picture selection task are due to ceiling effects or not. It should be noted that the elicited imitation technique has been employed successfully in RC comprehension

research (Diessel and Tomasello, 2005; Kidd, Brandt, Lieven, and Tomasello, 2007; Kang, 2015).

In the present experiment, the design of the elicited imitation test differed somewhat from other studies in that it was performed in writing. This variant was chosen in part because it allowed to test the same participants in a single session and in part because it prevented articulatory errors from biasing the scoring of responses: in other words, L2 learners were asked to write the stimuli they had heard, rather than repeat them orally, so that the possibly faulty L2 pronunciation did not become a source of ambiguity during scoring. Obviously, spelling was disregarded during the rating phase (which will be described in more detail in section 4.2.3.). Concretely participants were told to listen to the pre-recorded stimuli and to write them down in a paper booklet. The test sentences were recorded at normal conversational speed and were played only once. Following Erlam (2006), subjects were asked to focus on meaning during the test instructions and were given 40 seconds to write the test sentences. This interval gave enough time for participants to write the test items legibly while it provided some time pressure. However, no delay or interruption was inserted between the presentation of the stimuli and their transcription by participants because of the written nature of this elicited imitation test. Indeed, delays are normally introduced in elicited imitation tests in order to avoid rote repetition. However, in the present test, participants could not rely on rote repetition to reproduce the test items because they had to hold them in working memory for the whole time that they were writing them down.

The elicited imitation test comprised 25 sentences, 17 of which were fillers. The fillers contained five simple sentences with no RCs and 12 sentences with various RCs. In the fillers as well as in the target sentences, the referents were always animate and described with full noun phrases. The target sentences consisted of four subject and four object RCs and had a syntax similar to the one used in the picture selection test, as in the example *Look at the rabbit that the cat is following*. None of the test items used in the picture selection test, however, was repeated in the elicited imitation one. The verbs used in the stimuli were: *follow, hunt, bite, kick, ride*, and *see*. The test sentences were carefully controlled to have identical length

(12 syllables) and the same number of words (between 9 and 11). See Appendix (B) for a complete list of test sentences.

4.2.3. Procedure

Testing Procedures

Both tests, the picture selection test and the written elicited imitation one, were administered in a single session. The procedure for the picture selection test was the same as for the first experiment with French learners of English (see Chapter 3.2.3.). Specifically, participants received oral and written instructions to complete the picture selection test. They were given a paper booklet containing vignettes and were asked to circle, inside the vignettes, the character corresponding to the pre-recorded description. Prior to starting the activity, participants were provided with a context: they were told that animals in Fantasy Land were preparing for the Fantasy Land Games. Three warm-up items were presented at the beginning of the test, and intervals of five seconds separated the presentation of each stimulus.

The elicited imitation test was administered after the picture selection one. Participants received oral and written instructions. They were asked to listen to the recorded stimuli, to wait for the end of each recording, and to write down the sentence they had just heard. Intervals of 40 seconds separated each test item. Participants were instructed to focus on meaning rather than on spelling and to write down whichever part of the sentence they had understood.

Scoring

The scoring of the picture selection test was identical to the one used in the experiment with French learners of English. Concretely, a binary scale was used, with zero standing for an incorrect answer, and one for a correct response. Scores of correct answers were then computed for each RC type (subject RCs, object RCs, oblique RCs with stranded prepositions, and oblique RCs with pied-piped prepositions).

The scoring of the elicited imitation test was based on a similar binary scale so that its results could be compared with those of the picture selection test. Therefore, Diessel and Tomasello's (2005) scoring method, which includes half points for minor mistakes, was not adopted, and instead the scoring followed Grant, Valian, and Karmiloff-Smith (2002). In other words, the imitated sentences were rated as acceptable or erroneous by two raters (inter-rater reliability $\kappa = 0.76$), who gave a score of one to acceptable sentences and a score of zero to erroneous or incomplete sentences.

In order for imitation responses to be acceptable, they had to conserve the structure and meaning of the original stimulus. Correct imitations were analyzed in more detail and classified into one of four categories: verbatim repetition, repetition with minor syntactic change, repetition with minor morphological change, or repetition with minor lexical change. Verbatim repetition meant that the imitated response was identical to the stimulus. Repetition with minor syntactic change included sentences where the original relative pronoun had been substituted with another correct form (for example *who* instead of *that* when referring to the target animal) or where the copula verb had been omitted (for example *this the cat* instead of *this is the cat*). Repetition with minor morphological change referred to sentences containing a change in number, tense or aspect. Finally, repetition with minor lexical change comprised imitations where the determiner had been changed (for example, *this* instead of *the*) or where a noun had been substituted with a semantically (such as *child* instead of *boy*) or acoustically (for example *fight* instead of *bite*) close one. Imitated sentences containing errors others than the above-mentioned ones were rated as erroneous, as were incomplete responses. In the end, total correctness scores were computed for subject and object RCs. An overview of the scoring procedures for the picture selection and the elicited imitation test is provided in Table (7).

Table 7 Scoring of the picture selection and elicited imitation tests

Overview of Scoring and Error Types

Scoring	Test type	
	Picture selection test	Elicited imitation test
Correct (1)	right character selected in vignette	verbatim repetition
		repetition with minor syntactic change
		repetition with minor morphological change
		repetition with minor lexical change
Incorrect (0)	role reversal error	repetition with major change
	RC type error	incomplete response

It is worth mentioning that the scoring of the written elicited imitation was no easy task. Indeed, the raters had to judge whether the imitated sentences were true to the original, and there were moments when judging the written responses was arduous. As mentioned earlier, spelling was disregarded, but at times, some misspelled responses could be interpreted as orthographically incorrect or as evidence of miscomprehension. For instance, one test sentence contained the embedded verb *ride*. In one imitated response, that verb was transcribed as *raid* and thus was accepted, but it was changed into *writing* by another participant, who misspelled the verb and put it in the progressive form (an accepted morphological change). Since the rest of the imitation was correct (the object RC word order was maintained, the relative pronoun was correct, and the sentence was complete), it was simply disregarded as a spelling mistake, but this example illustrates how delicate it may be to categorize deviations from the original. On the other hand, the irregular orthography of the English language could actually be claimed to be an advantage in the present written elicited imitation task because it discouraged any kind of phonetic transcription. Therefore, the written elicited imitation task was less prone to "rote repetition", as can be the case when the task is performed orally.

4.3. Results

4.3.1. Comprehension of Subject, Object, and Oblique RCs

In order to assess the influence of the syntactic function of the RC on its comprehension by Italian learners of English, participants' correctness scores on subject, object, and oblique RCs are analyzed. The results from the picture selection test are presented first, followed by those coming from the elicited imitation one. All the scores are summarized in Figure (5).

In Figure (5), it can be seen that the correctness scores coming from the picture selection test are the following: 97.66% (*SD* = 8.52) for subject RCs, 96.02% (*SD* =10.01) for object RCs, and 94.44% (*SD* =8.51) for oblique RCs (oblique RCs with pied-piped and stranded prepositions). Since the data is non-normally distributed, $D(91) = 0.498$, $p < .001$ for SR, $D(91) = 0.446$, $p < .001$ for OR, and $D(91) = 0.293$, $p < .001$ for oblique RCs, it is further analyzed with non-parametric tests. Friedman's ANOVA reveals that scores on the three RC types are significantly different, χ^2 (2) = 27.84, $p < .001$. This finding is followed up with pairwise comparisons using Wilcoxon's signed rank test and adding a Bonferroni correction, so that significance levels are reported at .016. It appears that no significant difference is found between scores on subject and object RCs ($z = -1.91$, $p = .056$, $r = -.14$) and between object and oblique RCs ($z = -1.80$, $p = .073$, $r = -.13$). On the other hand, scores on subject RCs are significantly higher than those on oblique RCs ($z = -3.94$, $p < .001$, $r = -.29$).

In sum, the comprehension results from the picture selection test indicate that subject RCs are understood better than oblique RCs, but that no comprehension asymmetry is found between subject and object RCs and between object and oblique RCs.

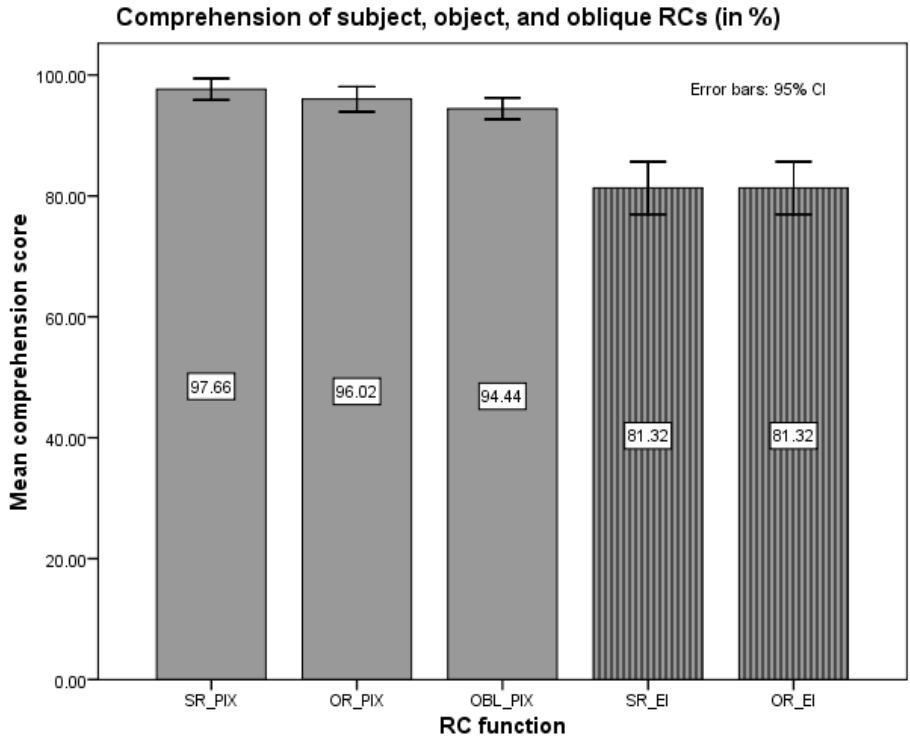


Figure 5. Comprehension of subject, object, and oblique RCs by Italian learners of English. Bars indicate mean comprehension scores (in %) on subject (SR), object (OR), and oblique RCs (OBL) in a picture selection (PIX) and an elicited imitation (EI) test.

Concerning the comprehension results from the written elicited imitation task, it can be seen in Figure (5) that participants' scores are 81.32% (*SD* = 20.95) on both subject and object RCs. Due to the non-normal distribution of the data, *D* (91) = 0.30, $p < .001$ for subject RCs and *D* (91) = 0.29, $p < .001$ for object RCs, the non-parametric Wilcoxon's signed rank test is used to compare the means. It appears that subject and object RCs are equally well understood by participants, z = -0.021, $p = .98$, $r = -.001$. In conclusion, the comprehension scores from the elicited

imitation test confirm the absence of comprehension asymmetry between subject and object RCs measured in the picture selection test.

4.3.2. Comprehension of Oblique RCs with Pied-Piped and Stranded Prepositions

In order to assess the influence of the syntactic placement of the preposition on the comprehension of oblique RCs by Italian learners of English, the comprehension results from the picture selection test are analyzed and presented in Figure (6).

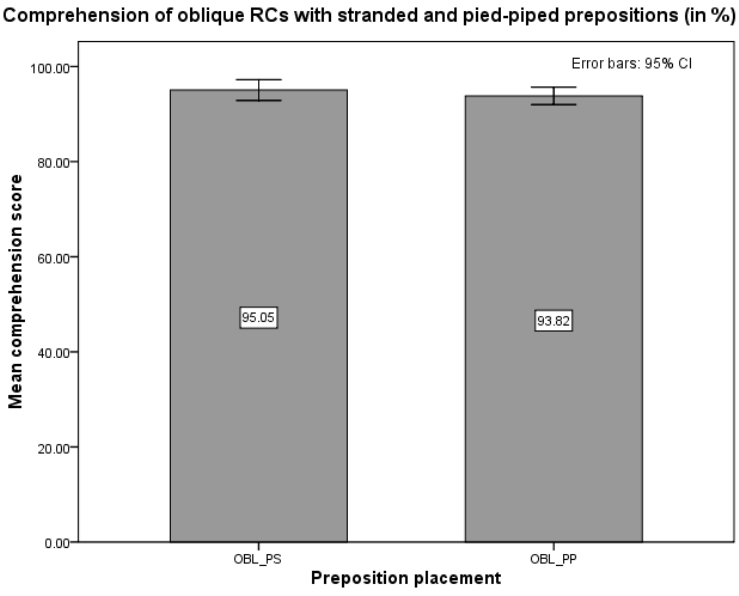


Figure 6. Comprehension of oblique RCs by Italian learners of English. Bars indicate mean comprehension scores (in %) on oblique RCs with stranded (OBL-PS) and pied-piped (OBL-PP) prepositions in a picture selection task.

The mean correctness score for oblique RCs with stranded prepositions is 95.05% (*SD* = 10.52) and that for oblique RCs with pied-piped prepositions is 93.82% (*SD* = 8.81). Since visual inspection of the data indicates a non-normal distribution, which is confirmed by significant normality tests, D (91) = 0.43, $p < .001$ for preposition stranding and D (91) = 0.39, $p < .001$ for pied-piping, Wilcoxon's signed rank test is used to compare scores. The latter reveals that the comprehension of oblique RCs with pied-piped prepositions by Italian learners of English is not significantly different from that of oblique RCs with stranded prepositions, z = -1.16, $p = .24$, $r = -.08$.

4.4. Discussion

4.4.1. The Comprehension of Subject, Object, and Oblique RCs

The first hypothesis formulated concerning the RC comprehension by Italian learners of English is that it is affected by the syntactic function of the relativized head noun. This hypothesis is borne out by the experiment results since subject RCs are significantly better understood than oblique RCs. This is in line with the results obtained with the French learners of English in the experiment described in Chapter 3 and with the findings of other studies in SLA (Gass, 1979, 1980, 1982; Dougthy 1988, 1991; Eckman et al., 1988) as well as in L1 adult processing (Ford, 1983; Frauenfelder et al., 1980; Frazier, 1987; Hakes et al., 1976; King & Just, 1991; King & Kutas, 1995; Schelschraete & Degand, 1998) and in L1 child comprehension (Adani, 2011; Cook, 1975; Costa et al., 2011; Volpato & Adani, 2009).

Conversely, the prediction of the first hypothesis, which states that the gradient of RC comprehension difficulty corresponds to Keenan and Comrie's (1977) NPAH, is disconfirmed by the experiment results since no comprehension difference is evidenced between subject and object RCs, on the one hand, nor between object and oblique RCs, on the other hand. Before discussing the absence of comprehension asymmetry between RC categories, a word needs to be said about ceiling effects.

In the experiment with French learners of English, the comprehension scores on subject and object RCs were on par, but they were quite high (see Chapter 3.3.), so that the absence of comprehension difference between subject and object RCs could be interpreted as the result of a ceiling effect. This assessment was rejected because it was argued that the design of the comprehension test followed common practice and that such a method had been used successfully to demonstrate asymmetrical understanding of RCs in other populations (Diessel and Tomasello, 2005; Kidd, Brandt, Lieven, and Tomasello, 2007). Nevertheless, it was concluded that the inclusion of a second measure of RC comprehension in future experiments was desirable in order to exclude ceiling effects definitely. In the present experiment with Italian learners of English, two measures of RC comprehension have been taken: one with a picture selection test, the other one with an elicited imitation test. Interestingly, both measures report an equal comprehension of subject and object RCs by Italian learners of English, and, while the scores of the picture selection test are high, those coming from the elicited imitation one are not. As a consequence, considering that the absence of comprehension asymmetry between subject and object RCs is evidenced in both populations of L2 learners (French and Italian), that it has been measured with two different methods (picture selection and elicited imitation), and that the design of the picture selection task is similar to the one used by other researchers who have demonstrated asymmetries between subject and object RCs, it can be concluded that the equal understanding of subject and object RCs by Romance learners of English is not due to a ceiling effect.

As a matter of fact, the absence of comprehension asymmetry between subject and object RCs observed in the present experiment should not come as a surprise considering that it has been reported by other researchers who have investigated RCs containing animate referents and full noun phrases. As mentioned in Chapter 3.3., the recent studies that have investigated the comprehension of RCs by L2 learners (Izumi, 2003; Mitsugi, MacWhinney, and Shirai, 2010) or by L1 speakers (Gordon et al., 2004; Hsiao & Gibbons, 2003; Ishizuka, 2005; Lin, 2006; Ueno & Garnsey, 2008; Vasishth, Chen, Li, & Guo, 2013) with picture selection tests or verification statements have all failed to report a comprehension difference between the two RC types. Therefore, considering the evidence from the literature and from the comprehension results of the French and Italian learners of English

in this research, it can be safely concluded that, although the L2 comprehension of RCs is affected by the syntactic function of the RC, it does not follow the gradient of difficulty described in Keenan and Comrie's (1977) NPAH. This observation, together with the results of numerous studies whose processing and comprehension data diverge (Gordon et al., 2004; Hsiao & Gibbons, 2003; Ishizuka, 2005; Lin, 2006; Ueno & Garnsey, 2008; Vasishth, Chen, Li, & Guo, 2013), strengthens the claim made in the previous chapter that language processing and comprehension are two different cognitive activities and that variations in processing do not necessarily translate into comprehension breakdown. A certain threshold may need to be reached before processing differences start to affect comprehension. If this is correct, it could explain why native children have trouble understanding object RCs: they would make comprehension errors because their processing of various RCs is highly dissimilar. This could be the focus of future research as, to the best of the author's knowledge, no data concerning the processing of RCs by native children is available.

On the other hand, the refutation of Keenan and Comrie's (1977) NPAH as a predictor of RC comprehension by L2 learners has several implications. First, the suggestion made in Chapter 3.3. that the comprehension of RCs follows the NPAH to the extent that non-adjacent categories are concerned is invalidated since the Italian learners of English tested in this research understand object and oblique RCs equally well although they are non-adjacent RC types. Second, the support found in the second language acquisition literature for the NPAH needs to reconsidered. Indeed, the studies that concluded that the NPAH was generally present in second language learners (Gass, 1979; Doughty, 1991; Eckman, Bell, and Nelson, 1988) need to be credited for extending Keenan and Comrie's model to the L2 acquisition field. However, they were all production or acceptance studies, and they were not intent on verifying the psychological validity of the NPAH. Actually, they had other aims, such as investigating language transfer effects or the generalization of instruction regarding RCs, so that their confirmation of the Hierarchy was not based on rigorous statistical analyses of the learners' performance on each RC type, but on general, numerical trends. Therefore, the mention in more recent research that there is consensus in the psycholinguistic community concerning the subject RC advantage in L2 acquisition (Kang, 2015; Mitsugi et al., 2010; Xu, 2014) is misleading because it

fails to distinguish between the different competences (processing, comprehension, and production) and it leaves out the studies that have questioned or found only partial support for the NPAH (Izumi, 2003; Kanno, 2007; Ozeki & Shirai, 2007). Consequently, it is to be hoped that the future L2 research investigating RCs will take into account the more recent results of L2 studies on RCs and will disambiguate the skills under study.

From a theoretical point of view, the three accounts, O'Grady's (1997) Structural Distance Hypothesis (SDH), the frequency of occurrence, and MacWhinney's (1977) Perspective Hypothesis (PH), predict the syntactic influence of RC function on the RC comprehension by Italian learners of English. Indeed, the SDH claims that the greater the number of mental computations necessary to process a syntactic structure, the more complex that structure (see Chapter 2.4.2.2.). Consequently, object RCs are harder to understand than subject ones because the distance between the object gap and the moved constituent is greater than in the case of subject RCs, and oblique RCs are, in turn, more complex than object RCs for the same reason. According to the frequency of occurrence theory, the RC complexity is relative to its occurrence in natural discourse (see Chapter 2.4.2.4.). Since corpus studies have evidenced that subject RCs are more common than object ones, which are in turn more frequent than oblique ones (see Chapter 2.4.4.), it follows that the ease with which native speakers or L2 users understand subject, object, and oblique RCs decreases from subject to oblique RCs. Finally, according to the PH, the RC complexity is linked to the number of perspectives that the listener has to adopt when hearing the clause (see Chapter 2.4.2.1.). Hence, subject RCs are easier to understand than object ones because the perspective of the agent is taken in a subject RC and it does not change, whereas an object RC supposes a perspective shift from agent to patient. On the other hand, no additional perspective shifting is necessary to understand an oblique RC, so that object and oblique RCs are expected to be equally difficult. In sum, although their theoretical underpinnings are divergent, the three accounts foresee that the syntactic function of the RC affects its comprehension and that the comprehension of subject RCs ought to be easier than that of oblique RCs.

On the other hand, the other expectations from the theories under considerations are disconfirmed. Indeed, no comprehension asymmetry between subject and object RCs, on the one hand, or between object and oblique RCs, on the other hand, is evidenced in the comprehension of RCs by Italian learners of English, as assumed by the SDH, the frequency of occurrence theory, or the PH. Therefore, the three accounts seem to be incomplete in that they are right to predict the general influence of syntax, and of RC function in particular, on RC comprehension, but they make the wrong predictions concerning the relative difficulty of each RC type.

4.4.2. The Comprehension of Oblique RCs

According to the second hypothesis concerning the comprehension of RCs by Italian learners of English, the placement of the preposition inside the oblique RC affects its comprehension, and oblique RCs with pied-piped prepositions are expected to be better understood than the preposition-stranded counterparts as a result of cross-linguistic transfer. Indeed, since the acquisition of the L2 is pervaded by L1 transfer and since oblique RCs in Italian require the placement of the prepositions in pied-piped position (see Chapter 2.1.5.), this placement ought to be preferred by Italian learners of English.

The results from the present experiment with Italian learners of English contradict the second hypothesis on both counts. Indeed, no comprehension asymmetry between the two kinds of oblique RCs emerges from the participants' comprehension scores, so that the syntactic placement of the oblique preposition cannot be said to affect the oblique RC comprehension, and oblique RCs with pied-piping are clearly not better understood than their preposition stranded counterparts.

The absence of preference for one oblique RC over the other one is surprising because it contradicts the results of the comprehension experiment carried out with French learners of English as well as other studies investigating the production or acceptance of oblique RCs (Mazurkewich, 1984; Bardovi-Harling,

1987; Ohba, 2003). In the case of experiments that have measured skills other than RC comprehension, it can be argued the divergent results are the result of various test designs. On the other hand, the dissimilar comprehension scores between the experiment with French and with Italian learners requires closer scrutiny. A comparison of the two studies leads to the conclusion that the divergent oblique RC comprehension scores can be caused by variations either in population or in test design. First, the populations tested in the two experiments diverge on two counts: their native language and their L2 proficiency levels. In the first experiment, native speakers of French having a lower-intermediate level of English are tested. In the second experiment, participants are native speakers of Italian with L2 proficiency levels ranging from beginner to advanced, but the majority of them have a self-reported higher-intermediate level of English. In the participants' L1s, French and Italian, the construction of oblique RCs is similar: oblique RC prepositions are always placed in fronted, pied-piped position and preposition stranding is infelicitous (see RC typology in Chapter 2.1.5.). Therefore, the absence of comprehension advantage between the two types of oblique RC evidenced in the scores of Italian learners of English is unlikely to stem from typological differences between the native languages of the participants. Concerning variations in proficiency, the Italian learners' more advanced level of L2 proficiency can explain why the comprehension scores are globally higher in the experiment with Italian subjects than in that with French participants. However, that explanation fails to account for the absence of comprehension asymmetry between oblique RCs with pied-piped and stranded prepositions in Italian learners of English and the comprehension advantage of preposition-stranded oblique RCs evidenced in the French population. Therefore, it has to be deduced that the discordant results of the French and Italian participants do not arise from variations in L2 proficiency.

The second possible source of discrepancy is the change in test design. As a reminder, the comprehension test used with French and Italian learners of English consists in a picture selection task. In both experiments, the test design requires participants to listen to eight doublets of oblique RCs, once with the preposition in pied-piped position, once in stranded position, and to select the appropriate character inside a vignette. The syntax of the oblique RCs is identical in the two experiments and is illustrated in (55).

(55) a. Circle the lion that the horse is jumping over.

b. Circle the lion over which the horse is jumping.

While syntax remains constant in the test with French and with Italian learners, the test items differ in their selection of verbs and prepositions. In the experiment with French learners of English, the following combinations of verb and preposition were used*: jump over, look at, run behind, run in front of, step over, walk behind, walk in front of*, while the experiment with Italian learners of English contained the following expressions: *jump over, listen to, look at, play with, point at, run behind, smile at, wave at*. A striking difference between the two lists is that the first experiment contains a majority of locative prepositions, whereas the second one includes mostly non-locative one. Therefore, it can be hypothesized that the change in semantic content of the oblique RC prepositions is the source of variation in comprehension results between French and Italian learners of English. This hypothesis, however, will need to be tested in a subsequent experiment.

In sum, contrary to the second hypothesis which states that the comprehension of oblique RCs is affected by the syntactic placement of the oblique RC preposition, the results of the comprehension experiment with Italian learners of English reveal no syntactic influence of the preposition placement on the oblique RC comprehension. Furthermore, the divergent comprehension scores between the French and Italian learners of English are hypothesized to be due to the change in test design between the two experiments, in particular the variation in the semantic content of the oblique RC prepositions.

On the other hand, the absence of comprehension advantage displayed by oblique RCs with pied-piped prepositions in the present experiment is in line with the comprehension results of the French learners of English and with the findings of L2 studies (Bardovi-Harlig, 1987; Ohba, 2003; Perpiñan, 2015; White, 1987). This observation adds weight to the conclusion formulated in Chapter 3.4. that the comprehension of oblique RCs by Romance learners of English is not affected by cross-linguistic transfer, and that this absence of influence is due to the

participants' high proficiency level. This is a reasonable explanation if one considers, on the one hand, that L1 transfer does not prevent the acquisition of L2 processing strategies (Nitschke, Kidd, & Serratrice, 2010) and on the other hand, that native-like behavior regarding the placement of oblique RC prepositions has been shown to increase with the L2 proficiency level (Perpiñan, 2015). Finally, it should be added that Erlam's (2006) ranking of RCs as a structure acquired at the intermediate or advanced level of L2 proficiency may be an underestimation since the scores coming from the experiments with French and Italian learners of English indicate that RCs are already mastered at the lower-intermediate level, at least as far as comprehension is concerned.

In conclusion, neither the lack of syntactic influence exerted by the placement of the preposition on the oblique RC comprehension nor the absence of comprehension advantage for oblique RCs with pied-piped prepositions evidenced in the present experiment can be explained by McDaniel et al.'s (1998) interpretation of Minimalism or by the frequency of occurrence account. Indeed, both hypotheses predict a preference for one or the other preposition placement inside the oblique RC, which, however, is not present in the comprehension results of Italian learners of English.

Before closing this discussion, a word has to be said about the methodology used in the present study. Two comprehension tests have been used: a picture selection test and an elicited imitation one. The picture selection technique has been used widely in experiments testing RC comprehension, in L1 as well as L2 contexts (Adani, 2011; Adani van der Lely, Forgiarini, & Guasti, 2010; Aydin, 2007; Costa, Lobo, & Silva, 2011; Friedmann et al., 2009; Guasti, Stavrakaki, and Arosio, 2012; Izumi, 2003; Lee, 2014; Volpato & Adani, 2009), while elicited imitation has been employed successfully but less frequently (Diessel & Tomasello, 2005; Kidd, Brandt, Lieven, & Tomasello, 2007). In the present experiment, the elicited imitation task has been adapted to the context of L2 learners: in order to test the same population in a single session and in order to circumvent possible articulatory problems, namely faulty non-native pronunciation, the elicited imitation task has been performed in writing instead of orally. Naturally, orthography has been disregarded as errors in spelling should not be interpreted

as evidence of miscomprehension. To the author's best knowledge, no other studies have employed this variant of the elicited imitation task, so that an assessment of the technique is in order. First, it should be mentioned that elicited imitation seems to be quite a valid technique to test language comprehension although it involves a language production component. According to Erlam (2006), there is growing evidence that elicited imitation is a reconstructive task that taps into implicit knowledge and any successful imitation presupposes comprehension of the stimulus. In the present study, elicited imitation has been used to complement a first measure of RC comprehension, and the results it has produced have corroborated those measured with the picture selection test. Second, the written modality of the elicited imitation test has presented advantages and disadvantages. On the one hand, having participants write the responses instead of repeating them orally offers the advantage that raters do not need to judge whether mispronounced responses are correct or not. In this way, the errors in rating due to non-native pronunciation are avoided, and the assessment of responses is more objective. Another benefit of the written modality is that it discourages repetition devoid of comprehension: since the spelling of the English language is highly unpredictable, test takers cannot be tempted to write the stimuli phonetically without having understood them first. Finally, the practicality of the written elicited imitation test should not be underestimated: it allows to test a large number of participants in a relatively short period of time, and the larger population sample makes the test more reliable statistically. Nevertheless, it should be mentioned that the written modality of this test can give rise to doubts concerning the type of error encountered. In other words, it can be hard for raters to decide whether a response is simply misspelled, in which case the spelling error is disregarded, or whether the misspelling originates in the poor comprehension of the stimulus, in which case the wrongly imitated answer is rated as incorrect. Therefore, it is crucial for raters to have clear guidelines that they apply when they judge the answers. However, this remark also applies when the elicited imitation task is performed orally. In conclusion, the written elicited imitation task seems to be a valid and practical test to measure comprehension in complement of another comprehension technique.

4.5. Conclusions

The aim of this experiment with Italian learners of English has been to verify two hypotheses. The first hypothesis holds that the comprehension of RCs by Italian learners of English is affected by the syntactic function of the relativized head noun and that the gradient of comprehension difficulty follows Keenan and Comrie's (1977) NPAH. The second hypothesis predicts that the syntactic placement of the preposition inside oblique RCs affects the RC comprehension by Italian learners of English and that oblique RCs with pied-piped prepositions are understood better than preposition-stranded ones as a result of cross-linguistic transfer.

The experiment results have shown, first, that the comprehension of oblique RCs by Italian learners of English is indeed affected by the syntactic function of the RC (subject, object, or oblique), but that it does not follow the NPAH. In other words, while subject RCs are understood better than oblique ones, no comprehension asymmetries are evidenced between subject and object RCs and between object and oblique RCs, as predicted by the NPAH. From a theoretical point of view, O'Grady's (1997) SDH, the frequency of occurrence theory, and MacWhinney's (1977) PH all predict the influence of syntactic function on the RC comprehension. However, none of these theories can account for the equal comprehension of subject and object RCs on the one hand, nor of object and oblique RCs on the other hand.

Second, this experiment has failed to provide evidence that the syntactic placement of the preposition influences the comprehension of oblique RCs by Italian learners of English. The comprehension scores in the present experiment contradict those coming from French learners of English although the two test designs were identical, except for the selection of the prepositions used in the oblique RCs. It is thus suggested that the semantic content of the oblique RC prepositions may affect the comprehension of oblique RCs, and this requires further investigation. Moreover, this study has shown that Italian learners of English do not understand oblique RCs featuring pied-piped prepositions better than their preposition-stranded counterparts although the former are the only

allowed construction in the participants' L1. This absence of cross-linguistic transfer confirms the results of the experiment with French learners of English and is interpreted as being due to the participants' high proficiency level in the L2. Finally, the results of the present experiment contradict the predictions made by Minimalism as interpreted by McDaniel et al. (1998) and by the frequency of occurrence account since both theories assume some asymmetry between the comprehension of oblique RCs with pied-piped and with stranded prepositions.

CHAPTER 5: The Influence of Syntax and Semantics on the L2 Comprehension of Oblique Relative Clauses

In Chapters 3 and 4, two experiments with Romance learners of English were described. They concerned, on the one hand, the comprehension of subject, object, and oblique RCs and, on the other hand, the comprehension of two oblique RC constructions, namely oblique RCs with pied-piped and with stranded prepositions. The present chapter reports the results of an experiment with Italian learners of English, which deals exclusively with the comprehension of oblique RCs. It is organized as follows: The aim and hypotheses of the present experiment are described in 5.1., followed by information concerning the experiment method in 5.2. Then, the comprehension results are detailed in 5.3. and discussed in 5.4. Finally, the conclusions are reported in 5.5.

5.1. Aim

In Chapter 3 and 4, it has been shown that the comprehension of RCs by Romance learners of English is affected by syntax. In the present thesis, comprehension is defined as the human capacity to extract intended meaning from language (see Chapter 2.5.1.). Indeed, the syntactic function of the RC (subject, object, or oblique complement) as well as the syntactic placement of the preposition inside oblique RCs (in pied-piped or stranded position) determines how well the RC is understood. This finding concerning the L2 comprehension of RCs is in line with the results of abundant research demonstrating the influence of syntax on RC processing in the L1 and on RC production in the L2. However, while the role of syntax on RC comprehension has been established, its working remains unclear, and the syntax-driven theories that have been examined in Chapters 3 and 4 fail to explain all the empirical results. In particular, the absence of comprehension asymmetries between subject and object RCs, on the one hand, and between object and oblique RCs, on the other hand, contradict the predictions of O'Grady's (1997) Structural Distance Hypothesis and of the frequency of occurrence theory (see Chapter 2.4). In addition, the equal comprehension of oblique RCs having pied-piped or stranded prepositions by Italian learners of English conflicts with the assumptions made by Minimalism according to McDaniel et al. (1998), and the

better comprehension of preposition-stranded oblique RCs by French learners of English runs against the frequency of occurrence account (see Chapter 2.4.). Therefore, the doubt has arisen that syntax might not be the only variable to affect RC comprehension, and two elements favor the hypothesis that another source of influence is at work. First, several studies in L1 processing and L2 acquisition have evidenced that RC complexity depends on other variables than syntax, in particular the animacy of the referents and the category of the embedded noun (see the state of the art in Chapter 2.3.). Second, a minor change in test design between the experiment with French learners of English and that with Italian learners generated divergent comprehension results that could not be explained by typological or proficiency differences between the two test populations. As a result, it was hypothesized at the end of Chapter 4 that this variation, which affected the semantic content of the oblique RC prepositions, was the source of discrepancy.

In sum, while the influence of syntax on RC comprehension in the L2 has been established, it has been concluded that it is not unique. As a result, it has been hypothesized that the RC comprehension by Romance learners of English is also affected by semantics, in particular by the semantic content of the prepositions used in oblique RCs. Chapter 5, therefore, looks into this new hypothesis.

As a reminder, in the experiment concerning the comprehension of oblique RCs by French learners of English (see experiment details in Chapter 3.2.2.), the prepositions used in combination with movement verbs were mostly locative ones: *jump/step over, run /walk behind, run/walk in front of*. On the other hand, the majority of the preposition and verb sequences employed in the experiment carried out with Italian learners of English did not contain spatial referencing (see Chapter 4.2.2.): *listen to, look at, play with, point at, smile at, wave at*. Therefore, the semantic variation between the two experiments was the inclusion of locative or non-locative prepositions in oblique RCs.

The literature regarding spatial prepositions and cognition is really vast and, according to Tranel and Kemmerer (2004), "it would resist even book-length review" (p. 720). For the purpose of the present experiment, however, it is enough to bear in mind that spatial referencing can be relative, intrinsic, or absolute. It is relative when it corresponds to the speaker's perspective (for example, *the dog is to the left of the cat*), intrinsic when it is centered on the object of reference (for example, *the dog is in front of the cat*), and absolute when it refers to absolute coordinates, such as cardinal points (for example, *the dog is north of the cat*) (Levinson, Kita, Haun, and Rasch, 2002). In addition, the cognitive load associated to spatial sentences is higher than that of non-spatial sentences and it is independent of the context in which the stimuli are presented, namely verbal or visual-spatial (Noordzij, Neggers, Ramsey, and Postma, 2008).

Therefore, the aim of the present experiment is to test the influence of syntax and of semantics on the comprehension of oblique RCs by Romance learners of English. The population selected to represent Romance learners is a group of native Italian speakers since they were the participants who reached equal comprehension scores on the two oblique RC constructions in Chapter 4. In particular, the following two hypotheses are formulated: First, the comprehension of oblique RCs by Italian learners of English is expected to be influenced by the syntactic placement of the preposition inside oblique RCs, and oblique RCs with pied-piped prepositions are assumed to be easier to understand as a result of cross-linguistic transfer. Second, the comprehension of oblique RCs by Italian learners of English is hypothesized to be influenced by the semantic content of the prepositions used in the oblique RCs, namely locative or non-locative, and oblique RCs containing non-locative prepositions are expected to be easier to understand than those featuring locative prepositions because spatial prepositions have been shown to carry a heavier cognitive load (Noordzij et al., 2008).

The motivation for the first hypothesis stems from previous research. In the L2 literature, several studies have probed the acquisition of oblique RCs and have demonstrated that L2 learners are sensitive to the placement of the preposition when they have to produce or judge the grammaticality of oblique RCs (Bardovi-

Harlig, 1987; Marzurkewich, 1984; Ohba, 2003; White, 1987), and the experiment with French learners of English (see Chapter 3) has evidenced that this also applies to the L2 comprehension of oblique RCs. In addition, the assumption that oblique RCs with pied-piped prepositions have a comprehension advantage over the preposition-stranded ones arises from the literature on cross-linguistic transfer. Since L2 learners are hypothesized to resort to their native language at some point or other during the acquisition of the L2 (see Chapter 2.2.), the Italian learners of English tested in the present experiment are expected to understand oblique RCs featuring pied-piped prepositions better than the preposition-stranded ones because only pied-piping is allowed in their L1, Italian.

As far as the second hypothesis is concerned, its rationale has been described in this introduction and can be summarized thus: Since the difference in oblique RC comprehension results between the experiments with French and with Italian learners of English may have been caused by a semantic change in test design and since several researchers have demonstrated that a semantic variable, in particular the animacy of referents, affects the processing, comprehension, and acceptance of object RCs, it is hypothesized that another semantic variable, namely the locative or non-locative nature of the oblique RC prepositions, influences the RC comprehension. Moreover, oblique RCs containing non-locative prepositions are assumed to be easier to understand because the research on spatial sentences has indicated that spatial referencing is a cognitively demanding task (Levinson et al., 2002; Noordzij et al., 2008).

5.2. Method

5.2.1. Participants

The participants to the third experiment were 59 native speakers of Italian who were studying engineering at an Italian university. Participants volunteered to take the comprehension test and signed an informed consent form. The mean age was 23.49 years (*SD* = 1.21). On average participants had studied English for a period of 8.85 years (*SD* = 2.30). At the end of the test, participants filled out a background questionnaire, inside which they assessed their English proficiency

level and selected one of four categories: beginner, lower-intermediate, higher-intermediate, or advanced. The resulting distribution of self-reported proficiency levels was as follows: 17 lower intermediate, 36 higher intermediate, and 6 advanced participants.

5.2.2. Materials

In order to test the influence of syntax and of semantics on the comprehension of oblique RCs by Italian learners of English, two tests were created: a picture selection test and an elicited imitation one. The elicited imitation test was added to the present experiment in order to have a second measure of RC comprehension and to exclude possible ceiling effects in case the scores from the picture selection test were high (see the discussion of ceiling effects in Chapter 3.4.1.).

Description of the Picture selection Test

The design of the picture selection test was identical to the ones described in Chapter 3 and 4. Concretely, it consisted in listening to pre-recorded stimuli and to circle, inside a paper booklet, the character that had been described. All the vignettes contained animate characters, either animal or human, and full noun phrases. Intervals of five seconds separated the listening of each stimulus. Before starting the test, a context was provided, and three warm-up items were included. The test totaled 64 sentences, 32 of which were fillers. The fillers contained ten subject RCs featuring a human referent, 14 subject RCs with an animal referent, and eight adverbial RCs introduced with *where*. On the other hand, the 32 test sentences always referred to animals. They were built along a 2 X 2 design: Eight doublets of oblique RCs were constructed with either a locative or a non-locative preposition, which was placed either in pied-piped or in stranded position. Examples of doublets are given in (57) and (58).

(57) a. Circle the dog that the cat is standing over.

b. Circle the dog over which the cat is standing.

(58) a. Circle the parrot that the cat is looking at.

b. Circle the parrot at which the cat is looking.

In (56a), the oblique RC features a locative preposition (*over*) in stranded position, whereas in (56b) b, the preposition is pied-piped. Conversely, in (57a), the oblique RC preposition is non-locative (*at*) and placed in stranded position, while it is pied-piped in (57b). The combinations of verbs and locative prepositions were the following: *stand/fly over, sit/hang under, run/walk/sit/sleep behind*. The non-locative equivalents were: *look/laugh at, listen/talk to, think/ask/dream/talk about*.

In the vignettes, participants had the possibility to circle the right character, or to make a role reversal error, or to misunderstand the RC type. For example, after listening to (56a), whose vignette is illustrated in Figure (7), the participants could select the right dog, which is the correct answer, or they could circle the cat, in which case it is a role reversal error because the agent and patient of the test sentence have been inverted, or they could select the wrong dog, in which case they have made an RC type error because they have interpreted the oblique RC as a subject RC.

As already mentioned, the vignettes always contained three characters. However, a fourth character was introduced in some vignettes in order to depict a plausible reality. It was done for the test items containing the following verb-preposition sequences: *talk about, listen to, dream about, talk to, ask about, think about*. The vignettes corresponding to these test items depicted four animals interacting with each other inside two separate scenes (see Figure (4) in Chapter 4.2.2. for an illustration of such a vignette). Participants could select any of the four characters, but the possible interpretations of the test sentences remained constant: test takers could circle the right character, or make a role reversal error, or misinterpret the RC type. A list of all test sentences can be found in Appendix (C).

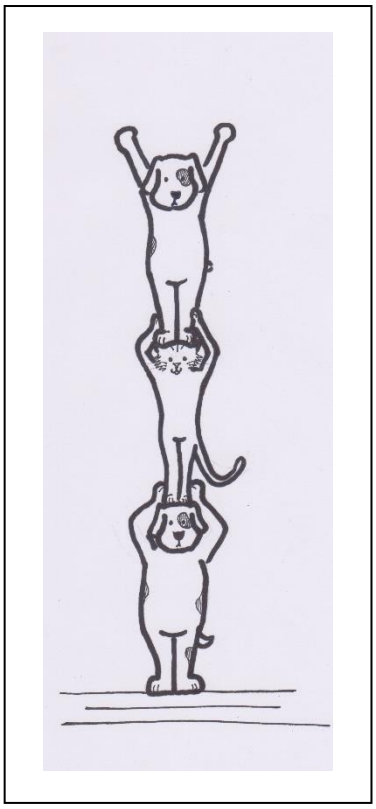


Figure 7. Test item: Example of vignette used in the picture selection test. The corresponding stimulus is *Circle the dog that the cat is standing over.*

Description of the Elicited Imitation Test

The second comprehension test was a written elicited imitation test, whose design was identical to the one described in Chapter 4.2.2. As a reminder, the elicited imitation technique can be used to measure language comprehension although it is also an indicator of language production ability. In the research concerning the comprehension of RCs, it has been used successfully by several authors (Diessel and Tomasello, 2005; Kidd, Brandt, Lieven, and Tomasello, 2007; Kang, 2015), and in the present experiment, it is meant to complement a first measure of RC comprehension collected with a picture selection test.

The test sentences used in the elicited imitation test totaled 32, of which 16 were fillers. These comprised six subject RCs featuring transitive verbs, four subject RCs with intransitive verbs, and six object RCs. The referents were animate, either human or animal. On the other hand, the target sentences were constructed along the 2 X 2 scheme of the picture selection test: four doublets of oblique RCs were created and they featured either a locative or a non-locative preposition placed in pied-piped or in stranded position. Sentences always started with *look at*, *this is*, or *is this*. Examples of doublets with locative prepositions are given in (59) and with non-locative prepositions in (60).

(59) a. Look at the sheep that the horse is jumping over.

b. Look at the dog over which the cat is stepping.

(60) a. This is the monkey that the mouse is looking at.

b. This is the sheep at which the monkey is laughing.

The prepositions inserted inside the target sentences were identical to the ones used in the picture selection task, and the sequences of verbs and locative prepositions were the following: *jump/step over*, *sit/hide under*, *run/walk/jump/hide behind*, while the non-locative equivalents were: *look/laugh at*, *listen/speak to*, *talk/dream/ask/think about*.

Finally, it should be noted that all the target sentences had the same length (12 syllables) and number of words (10), and that test sentences were presented in random order. The vocabulary of the whole test was controlled, so that all the verbs and animal names were not rated higher than a B1 level according to the Cambridge Essential English Dictionary (online version). A complete list of test sentences can be found in Appendix (C).

5.2.3. Procedure

Testing Procedure

Both tests, the picture selection test and the elicited imitation one, were administered in a single session. The procedure for the picture selection test was identical to the one described in Chapters 3.2.3. and 4.2.3. Concretely, participants received a paper booklet inside which they had to circle the character described in the test stimuli, which were pre-recorded and read only once at normal conversational speed. Participants received oral and written instructions, practiced on three warm-up items before starting the test, and were given a short context: they were told that animals in Fantasy Land were interacting with each other in order to prepare for the Fantasy Land Games. Intervals of five seconds separated the listening of each stimulus.

In the elicited imitation test, which followed the picture selection one, participants received oral and written instructions: they were asked to listen to the pre-recorded test sentences, to wait for the end of each one, and then to write them down. They were encouraged to focus on the meaning of the sentences and to write down whichever part of the sentence they had understood. They were given intervals of 40 seconds to transcribe the stimuli.

Scoring

The scoring of the picture selection and of the written elicited imitation tests was identical to the one detailed in Chapter 4.2.3. As a reminder, the scoring of the picture selection test followed a binary scale, correct or incorrect, and scores of one or zero were attributed accordingly. Then correctness scores were calculated for each of the four oblique RC variations: oblique RCs containing locative prepositions in pied-piped and in stranded position, and oblique RCs containing non-locative prepositions in pied-piped and in stranded position.

The scoring of the written elicited imitation test followed the one described in Chapter 4.2.3. and was based on Grant, Valian, and Karmiloff-Smith (2002). It

consisted in assigning a score of 1 to acceptable imitations and of 0 to erroneous or incomplete responses. The scoring was performed by two raters (inter-rater reliability $\kappa = 0.81$), who judged whether the imitated sentences were true imitations of the original stimuli. Imitated answers were considered correct if they conserved the syntax and the meaning of the original stimuli, and they were further classified into one of four categories: verbatim imitations of the original, imitations with a minor syntactic change, imitations with a minor morphological change, or imitations with a minor lexical change. (See Chapter 4.2.3. for a detailed description of accepted modifications.) During the scoring of the imitated responses, spelling was disregarded. Then, correctness scores were calculated for each oblique RC configuration, namely oblique RCs containing locative prepositions in pied-piped and in stranded position, and oblique RCs featuring non-locative prepositions in pied-piped and in stranded position.

As a reminder, an overview of the scoring procedures for the picture selection and for the elicited imitation test can be found in Chapter 4.2.3., Table (7).

5.3. Results

In order to see whether the comprehension of oblique RCs by Italian learners of English is influenced by the syntactic placement of the prepositions and by their semantic content, the comprehension scores from the picture selection and from the elicited imitation tests are presented in Figures (8) and (9). Scores are expressed in percentage.

In the picture selection test, the mean comprehension scores on oblique RCs are as follows: 94.28% (*SD* = 9.08) for RCs containing a locative preposition in stranded position, 86.23% (*SD* = 17.93) for RCs containing a locative preposition in pied-piped position, 97.67% (*SD* = 5.43) for RCs with a non-locative preposition in stranded position, and 92.16% (*SD* = 9.54) for RCs with non-locative preposition in pied-piped position.

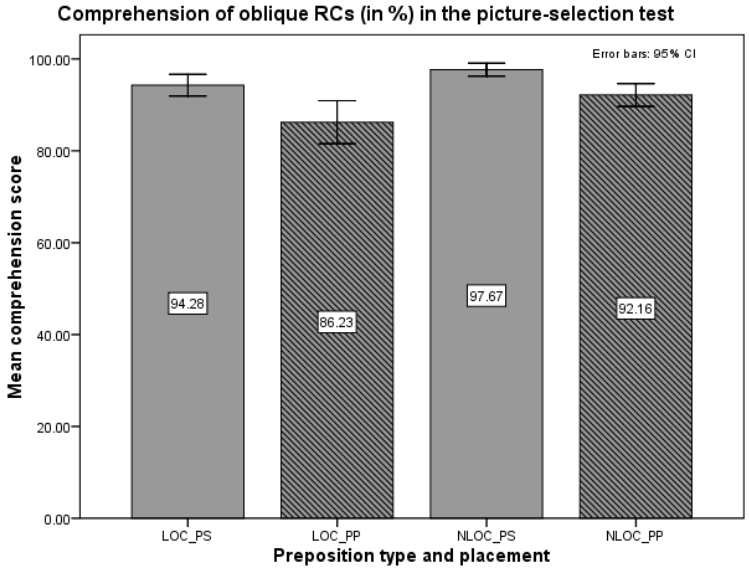


Figure 8. Comprehension of syntactically and semantically varied oblique RCs in the picture selection test. Bars indicate mean comprehension scores (in %) on oblique RCs containing locative (LOC) or non-locative (NLOC) prepositions in stranded (PS) or pied-piped (PP) position.

Since the data is not distributed normally, $D(59) = 0.397$, $p < .001$ for stranded, locative prepositions, $D(59) = 0.253$, $p < .001$ for pied-piped, locative prepositions, $D(59) = 0.497$, $p < .001$ for stranded, non-locative prepositions, $D(59) = 0.320$, $p < .001$ for pied-piped, non-locative prepositions, it is further analyzed with non-parametric tests. First, a comparison of the group means with Friedman's ANOVA reveals that these are significantly different, $\chi^2(3) = 31.04$, $p < .001$. This finding is followed up with pairwise comparisons. The first question to answer is whether the syntactic placement of the preposition influences the comprehension of oblique RCs whose prepositions feature a certain semantic content (locative or non-locative). The second question to address is whether the semantic content of the preposition affects the comprehension of oblique RCs whose prepositions are placed in various positions (in pied-piped or stranded position). Thus four

comparisons are run with the non-parametric Wilcoxon signed rank test, and a Bonferroni correction is applied, so that significance level reaches 0.0125. The results indicate that all comparisons are significant. First, preposition stranding is understood better than preposition pied-piping in oblique RCs containing locative prepositions, z = -3.177, p = .001, r = -.29, and in RCs featuring non-locative prepositions, z = -3.978, p < .001, r = -.37. Second, non-locative prepositions are comprehended more easily than locative ones in oblique RCs with stranded prepositions, z = -2.541, p = .011, r = -.23, and in those having pied-piped prepositions, z = -2.532, p = .011, r = -.23.

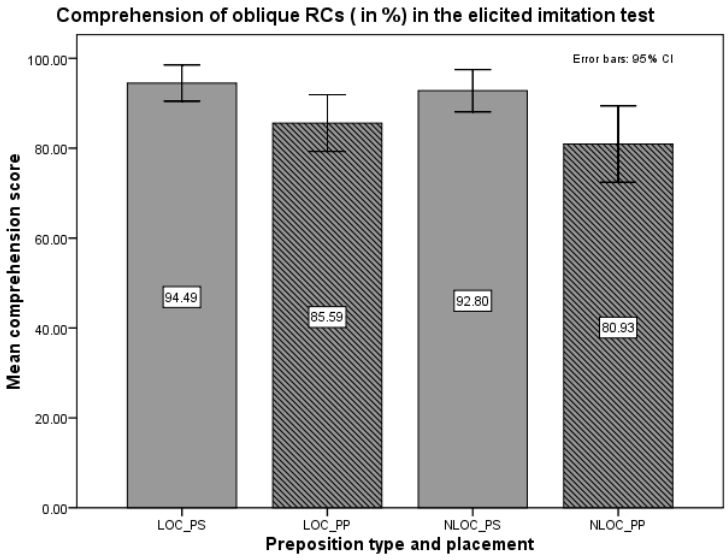


Figure 9. Comprehension of syntactically and semantically varied oblique RCs in the elicited imitation test. Bars indicate mean comprehension scores (in %) on oblique RCs containing locative (LOC) or non-locative (NLOC) prepositions in stranded (PS) or pied-piped (PP) position.

A similar analysis can now be performed with the scores coming from the written elicited imitation test. As illustrated in Figure (9), the mean comprehension scores

are the following: 94.49% (*SD* = 15.44) for RCs featuring a locative preposition in stranded position, 85.59% (*SD* = 24.21)) for RCs with a locative preposition in pied-piping position, 92.80% (*SD* = 18.01) for RCs having a non-locative preposition in stranded position, and 80.93% (*SD* = 32.61) for RCs with a non-locative preposition in pied-piped position.

A visual inspection of the data as well as normality tests reveal that the data is non-normally distributed, $D(59) = 0.504$, $p < .001$ for stranded, locative prepositions, $D(59) = 0.368$, $p < .001$ for pied-piped, locative prepositions, $D(59) = 0.452$, $p < .001$ for stranded, non-locative prepositions, and $D(59) = 0.382$, $p < .001$ for pied-piped, non-locative prepositions. The non-parametric Friedman's ANOVA indicates that the variation between groups is significant, $\chi^2 (3) = 24.792$, $p < .001$, and Wilcoxon's signed-rank tests are used to compare group means pairwise. Since the same pairs need to be compared as in the picture selection test, a similar Bonferroni correction is applied, with significance at $p = .0125$. The results of the pairwise comparisons reveal that preposition stranding is understood better than preposition pied-piping in oblique RCs containing a locative preposition, $z = -3.50$, $p < .001$, $r = -.32$, and in those having a non-locative preposition, $z = -3.291$, $p = .001$, $r = -.30$. On the other hand, the semantic content of the prepositions does not seem to affect the comprehension of oblique RCs with preposition stranding, $z = -0.943$, $p = .35$, $r = -.09$, nor of those having pied-piped prepositions, $z = -1.270$, $p = .20$, $r = -.12$.

In sum, it has been observed, first, that the syntactic placement of the preposition affects the comprehension of oblique RCs by Romance learners of English, and that oblique RCs featuring stranded prepositions have a comprehension advantage. Second, the semantic content of the preposition also influences the comprehension of oblique RCs, and oblique RCs featuring non-locative prepositions are understood better than those containing locative prepositions. The first observation is supported by the scores from both comprehension measures, while the second observation derives from the results of the picture selection test only.

5.4. Discussion

The first hypothesis formulated at the start of this chapter holds that the syntactic placement of the preposition inside oblique RCs affects the comprehension of those RCs by Italian learners of English, and that oblique RCs featuring pied-piped prepositions are understood better. The results of the present experiment clearly indicate that syntax does influence the L2 comprehension of oblique RCs, but that oblique RCs featuring pied-piped prepositions are not easier to comprehend. These results confirm the effect of the syntactic placement of prepositions inside oblique RCs evidenced in French learners of English (see Chapter 3.3.) and in other studies investigating oblique RCs (Bardovi-Harlig, 1987; Mazurkewich, 1984; Ohba, 2003). In addition, it should be noted that this trend was apparent in the comprehension scores of the Italian learners of English tested in Chapter 4, but that it was not significant because of a confounding factor in the design of the test, namely the insertion of semantically varied prepositions (locative and non-locative) in the tested oblique RCs.

On the other hand, the absence of comprehension advantage displayed by oblique RCs with pied-piped prepositions contradicts the second part of the first hypothesis, but it confirms the results of the experiments carried out with French (Chapter 3.3) and Italian (Chapter 4.3.) learners of English, as well as most of the research dedicated to oblique RCs in the L2, although it has not focused on comprehension. In particular, Bardovi-Harlig (1987) has shown that adult learners of English of various L1s tested with a sentence combination task produce more oblique RCs with stranded prepositions than with pied-piped ones, and Ohba (2003) has reported a greater use of preposition stranding in the production of oblique RCs by Japanese learners of English. The only divergent study is the one by Mazurkewich (1984), who has found that French learners of English resort more to pied-piping than to preposition stranding. However, since the focus of her investigation is not oblique RCs, but the production of *wh*-questions, it is doubtful whether her conclusions can be extended to the comprehension of oblique RCs.

In the first hypothesis, the motivation for expecting oblique RCs with pied-piped prepositions to be understood better derives from the assumption that cross-linguistic transfer is operating. In particular, since the Italian language sanctions only one syntactic placement for the oblique RC preposition, namely pied-piped, it is inferred that Italian learners of English would understand oblique RCs with pied-piped prepositions better than the preposition stranded ones. However, since the present experiment has demonstrated not only an absence of comprehension preference for pied-piped oblique RCs, but a comprehension advantage for oblique RCs containing stranded prepositions, it follows that Italian learners of English are not subject to cross-linguistic transfer, at least once they have reached an intermediate level of proficiency in the L2. As a result, if L2 learners of English are not influenced by their L1 when they process and understand oblique RCs in the L2, they are likely using L2 parsing strategies. Discovering which parsing strategies are used when processing the L2 is a much debated issue in the psycholinguistic literature, and it is beyond the scope of this thesis. However, it is a fact that the results of the present experiment point at an absence of facilitation effect due to L1 transfer, at least at the intermediate level of L2 proficiency, and thus gives support to the claim that L2 parsing strategies are accessible to L2 learners (Nitschke, Kidd, and Serratrice, 2010).

From a theoretical point of view, the comprehension scores of this experiment with Italian learners of English are easily accommodated by the Minimalist framework adopted by McDaniel et al. (1998). In particular, it claims that pied-piping the preposition in oblique RCs is a computationally costly operation and, thus, it should create greater comprehension difficulty than stranding the preposition (see Chapter 2.4.3. for a more detailed account). This is indeed what has been observed. On the other hand, the frequency of occurrence theory, which predicts a comprehension advantage for oblique RCs with pied-piped prepositions because these are more frequent in natural discourse (see frequency counts in Chapter 2.4.4.2.), is contradicted by the findings of the present experiment: Actually, oblique RCs with pied-piped prepositions are the less well understood construction by Italian learners of English.

In sum, it has been observed that the syntactic placement of the prepositions, and thus more generally syntax, affects the comprehension of oblique RCs by L2 learners: when the word order of English oblique RCs is manipulated, it leads to differential comprehension scores by Italian learners of English. Moreover, the comprehension advantage that Italian learners of English display for oblique RCs with stranded prepositions suggests that no cross-linguistic transfer is at play.

The second hypothesis tested in this chapter relates to the semantic content of the prepositions used inside the oblique RCs. It is predicted, on the one hand, that the comprehension of oblique RCs by Italian learners of English is affected by the semantic content of the prepositions used, namely locative or non-locative, and on the other hand, that oblique RCs containing non-locative prepositions are easier to understand as a result of the cognitive difficulty linked to spatial prepositions. The results of the present experiment validate this second hypothesis on both counts: The L2 comprehension of oblique RCs is clearly influenced by the semantic content of the prepositions found in the RCs, and Italian learners of English score better on oblique RCs featuring non-locative prepositions than on those containing locative ones.

The influence of semantics on the comprehension of oblique RCs reported in the present experiment with Italian learners of English is in line with the results of several studies investigating RC complexity and linking it to non-syntactic variables. Indeed, in L1 processing research, Mak et al. (2002, 2006) and Traxler et al. (2002) have evidenced that a semantic variable, such as the animacy of the relativized head noun, affects the reading of the RC, while Johnson et al. (2011) have shown that the frequency of the head and of the embedded noun in natural discourse (low or high frequency) is another influencing factor. Moreover, Reali and Christiansen (2007) and Heider et al. (2014) have demonstrated that RC complexity depends also on pragmatic considerations since the selection of a pronoun instead of a full noun inside the RCs alters their processing. These findings have been repeated in L1 experiments carried out with head-final languages (Hsiao & MacDonald, 2013; Wu et al., 2011) and with native children (Brandt et al., 2009; Kidd et al., 2007). In second language acquisition, the influence of noun animacy and category (noun phrase or pronoun) has been confirmed by Hu and Liu (2007), Ozeki and Shirai (2007), and Lee (2014). The

results of the present experiment constitute additional evidence that RC comprehension depends on non-syntactic factors and establish, for the first time, that the semantic content of oblique RC prepositions affects the RC comprehension by L2 learners.

The present evidence of semantic influence on the comprehension of oblique RCs in the L2 is interesting because it represents a break from the past. Indeed, the early research about RCs was carried out mostly within theories of syntax. For example, the RC complexity was explained in the L1 with accounts such as the Dependency Locality Theory, the Active Filler Strategy, the Structural Distance Hypothesis, or the Minimal Chain Principle, and in the L2, with the theories of Markedness, Implication Generalization, or Minimalism. It is undeniable that evidence of non-syntactic influence on the processing, comprehension, and production of RCs has now accumulated, and that it makes it necessary to widen the debate concerning RC complexity. In the case of the present experiment, it is clear that, while the comprehension of oblique RCs by Italian learners of English is affected by syntax, it cannot be accounted for only by variations in word order. Therefore, as argued by Diessel and Tomasello (2005), future models aiming to explain RC complexity will need to be multi-factorial, and in particular, they will need to include syntactic and semantic variables.

As far as the comprehension asymmetry between semantically varied oblique RCs is concerned, the second hypothesis has been confirmed: Italian learners of English understand oblique RCs featuring non-locative prepositions better than those containing locative prepositions. This prediction is motivated by the results of research on spatial referencing (see section 5.1.) that report that processing spatial sentences is cognitively more taxing than processing non-spatial ones (Noordzij, Neggers, Ramsey, and Postma, 2008). It seems, therefore, that the conclusions of studies dedicated to spatial processing in the L1 can be extended to second language acquisition, in particular to the comprehension of oblique RCs. However, one remark is in order: the difference in comprehension scores between oblique RCs featuring locative and non-locative prepositions in the experiment with Italian learners of English reaches significance only in the picture selection test, not in the elicited imitation one. The explanation for this

discrepancy probably lies in the nature of the testing methods. As mentioned earlier in this chapter, comprehension is the capacity that humans have to extract intended meaning from language. This comprehension can be measured differently. In the picture elicitation test, participants are required to listen to the stimulus, process and understand it, and then select the intended character on a visual support (the vignette depicting three characters). In the written elicited imitation test, participants need to listen to the stimulus, process and understand it, and then write it down on a blank sheet of paper. If the productive nature of the elicited imitation test is disregarded and if only the capacity to measure comprehension of the two tests is compared, it emerges that the picture selection test is more demanding in that it requires that participants interpret the visual support (the vignette) and adopt the correct, intrinsic perspective to process the spatial oblique RCs. The frame of reference in the present experiment is intrinsic (see Levinson, Kita, Haun, and Rasch, 2002) because the locative prepositions used in the test sentences are centered on the object of reference, in particular one animal inside the vignettes. On the other hand, the written elicited imitation test does not make it necessary for participants to interpret any visual support and to change perspective. Therefore, it could be that the difficulty that Italian learners of English display when having to understand oblique RCs containing spatial prepositions originates from this difference in test designs. In conclusion, while both methods, picture selection and elicited imitation, measure language comprehension, they do so from different angles, and generally speaking, the best way to avoid biased conclusions is probably to confront the results from several data elicitation techniques.

From a theoretical viewpoint, the influence of semantics on the comprehension of oblique RCs by learners of English receives no explanation from the Minimalist theory as interpreted by McDaniel et al. (1998) or from the frequency-based account. Indeed, in the Minimalist framework, only the syntactic placement of the preposition bears on the comprehension of the oblique RC. While it predicts correctly that oblique RCs with pied-piped prepositions are more difficult to understand by Italian learners of English, it fails to explain why RCs containing non-locative prepositions have a comprehension advantage. In fact, computational complexity is not hypothesized to vary with the type of preposition used in the oblique RC. Therefore, it has to be concluded that the

Minimalist theory can account only partially for the oblique RC comprehension difficulty experienced by Italian learners of English. While the syntax of the oblique RC affects the RC comprehension by L2 learners, it is clear that it is not the only variable to exert influence. Nothing at this point indicates which of the two variables, the syntactic or the semantic one, has a major influence, but future models aiming to account for the comprehension of oblique RCs will need to be multi-factorial and include syntactic as well as non-syntactic factors.

As far as the frequency of occurrence framework is concerned, it predicts that oblique RCs featuring pied-piped prepositions are easier to understand due to their higher frequency in natural discourse. Since the results of the present experiment demonstrate the opposite, that is oblique RCs containing stranded prepositions are better understood by Italian learners of English, it should be concluded that the frequency account is not a good predictor of oblique RC comprehension. It should be noted, however, that an important element of the frequency-based theory is the grain of the analysis (Mitchell et al., 1995). In a fine-grained frequency analysis, the recurrence of lexical items is examined. In a broad-grained analysis, the frequency of broader patterns is looked for, such as the recurrence of syntactic categories in a certain sequence. In this thesis, a mixed-grain approach has been adopted, since sequences of lexical items and of formal categories have been combined to define RCs. It is therefore not impossible that the grain of the present analysis be inadequate. In other words, it might be that learners are sensitive not just to the syntactic pattern, but to the sequence of certain lexical items inside specific positions. For example, the syntax query used to identify pied-piped oblique RCs in the British and American corpus of English language (see Chapter 2.4.4.2.) is reported in (61):

(61) the [nn*] [i*] which|whom the [nn*] [v*]

The pattern looked for is the article "the" followed by any noun (nn*), any preposition (i*), then either of the relative pronouns "which" or "whom", followed by "the", any noun (nn*), and any verb (v*). As a result, this analysis does not discriminate between the types of nouns found before the preposition (for example, animate or inanimate), nor does it precise which kind of preposition precedes the relative pronoun (for example, locative or non-locative). Yet, the choice of pied-piping or stranding the preposition when people produce oblique

RCs naturally, and therefore their recurrence in corpus, is not random. As a matter of fact, a study by Hoffman (2005) reports that "the syntactic function of the PP, the level of formality, the type of phrase in which the PP is contained, and the restrictiveness of the entire RC have significant effects on the placement of the preposition" (p. 257). On the basis of Hoffman's results and of the demonstrated influence of the semantic content of prepositions on the RC comprehension in the present experiment, the conclusion that has to be drawn is that any analysis of frequency that aims to measure RC comprehension complexity needs to have a finer grain of analysis. In other words, an analysis based on the recurrence of syntactic categories only cannot explain the difficulty linked to some RC constructions.

Finally, according to MacWhinney's (1977) PH, the comprehension of oblique RCs by L2 learners is not expected to be affected by the syntactic placement of the prepositions inside the RCs, but it ought to vary with the semantic nature of the prepositions. In particular, oblique RCs with non-locative prepositions should be easier to understand than RCs featuring locative prepositions because the former involve less perspective shifting (see Chapter 2.4.4.3.). This prediction is borne out by the comprehension results of Italian learners of English, which therefore lend support to the PH. On the other hand, the lower comprehension scores linked to the placement of the oblique RC prepositions in pied-piped position receive no explanation from MacWhinney's (1977) Hypothesis. Consequently, the PH offers only a partial account of RC complexity: While it captures the difficulty to understand oblique RCs featuring semantically complex prepositions, it fails to account for the influence of syntax on oblique RC comprehension. Therefore, as argued before, an account based only on syntax or semantics can only be a partial model of RC complexity, and future models of RC comprehension will need to integrate the influences of both factors.

5.5. Conclusions

In this chapter two hypotheses have been tested. The first one predicts that the comprehension of oblique RCs by Italian learners of English is affected by the placement of the preposition inside the RC and that oblique RCs featuring pied-

piped prepositions are better understood than the preposition-stranded ones as a result of cross-linguistic transfer. The second one assumes that the semantic nature of the preposition used in the oblique RCs influences the RC comprehension by Italian learners of English and that oblique RCs containing non-locative prepositions are easier to understand than those featuring locative ones because they do not involve any kind of cognitively taxing spatial referencing.

The results of Italian learners of English on two measures of oblique RC comprehension indicate, first, that the comprehension of oblique RCs by L2 learners is indeed affected by a combination of syntactic (preposition placement) and semantic (preposition content) factors; second, that oblique RCs with pied-piped prepositions are not easier to understand than preposition-stranded ones, thereby suggesting that L2 learners are not influenced by their L1, at least at the intermediate level of L2 proficiency; and finally, that oblique RCs containing non-locative prepositions display a comprehension advantage probably due to the absence of spatial referencing.

From a theoretical viewpoint, the accounts of Minimalism as interpreted by McDaniel et al. (1998), frequency of occurrence, and Perspective Hypothesis (MacWhinney, 1977) are unable to explain all the variation found in the comprehension of oblique RCs by Italian learners of English. Indeed, Minimalism can account for the syntactic influence of preposition placement, but it fails to explain the role played by the semantic content of the prepositions used in the oblique RCs. The frequency account also predicts the influence of syntax, but it makes predictions that run contrary to the results since it foresees a comprehension advantage for pied-piped oblique RCs. Therefore, unless the grain of the frequency analysis is revised to include the recurrence of elements at a level lower than that of syntactic categories, the frequency account is an unlikely model of oblique RC comprehension. On the other hand, the PH can account for the influence of semantics on the oblique RC comprehension, but it fails to explain why oblique RCs with pied-piped prepositions are harder to understand.

In conclusion, the empirical results evidencing the influence of syntactic and non-syntactic factors on the L2 comprehension of oblique RCs and the partial inadequacy of theories based only on syntax or semantics to explain these results make it necessary for future models of RC comprehension to be multi-factorial and to include syntactic as well as semantic variables.

CHAPTER 6: GENERAL DISCUSSION AND CONCLUSIONS

The present thesis has investigated the comprehension of relative clauses (RC) by Romance learners of English and has tested the following three hypotheses in experiments involving native French and Italian learners of English. First, the comprehension of subject, object, and oblique RCs by Romance L2 learners is hypothesized to be influenced by the syntactic function of the relativized head noun, and to follow a gradient of difficulty corresponding to the Noun Phrase Accessibility Hierarchy (NPAH) formulated by Keenan and Comrie (1977). Concretely subject RCs are predicted to be easier to understand than object RC, which in turn are expected to be simpler than oblique ones. Second, the comprehension of oblique RCs by Romance learners of English is hypothesized to be affected by the syntactic position of the preposition inside the RC. In other words, the placement of the oblique RC preposition in stranded position (for example, *the dog that the cat is jumping over*) or in pied-piped position (for example, *the dog over which the cat is jumping*) determines how well the oblique RC is understood. Furthermore, the second hypothesis asserts that Romance learners of English understand oblique RCs featuring pied-piped prepositions better than their preposition-stranded counterparts because these L2 learners are influenced by their L1s, in which pied-piping is the only felicitous constructions. Finally, the comprehension of oblique RCs by Romance learners of English is hypothesized to be influenced by the semantic content of the preposition used inside the oblique RC, and oblique RCs containing non-locative prepositions are expected to be understood better than oblique RCs featuring locative prepositions because the former prepositions do not require spatial referencing, a complex mental operation.

In order to test the above hypotheses, three experiments have been designed and conducted with Romance learners of English. The first and the second experiment were carried out with native French and Italian learners of English and aimed to examine the validity of the first two hypotheses. The third experiment was conducted with a group of native Italian learners of English and looked into the correctness of the third hypothesis. In this chapter, each hypothesis will be reviewed in light of the experimental results from this and from previous

research, then theoretical accounts of RC complexity and methodological issues will be examined, and finally, general conclusions will be drawn.

6.1. The Influence of Syntactic Function on RC Comprehension and the NPAH

In line with the prediction of the first hypothesis, this research has produced evidence that the comprehension of subject, object, and oblique RCs by Romance learners of English is affected by the function of the relativized head noun. In particular, the French and Italian learners of English tested in this research on their comprehension of RCs featuring animate referents and full noun phrases have been shown to understand subject RCs better than oblique ones.

This influence is not surprising if one considers the substantial body of literature that has documented it. Indeed, all the studies devoted to RCs across the fields of L1 and L2 acquisition have shown that some asymmetry or gradient of difficulty is present when speakers or learners have to interpret RCs having various RC functions. Specifically, in the second language acquisition field, oblique RCs have been reported to be more difficult to judge or produce than subject ones (Gass, 1979; Doughty, 1991; Ozeki and Shirai, 2007), and among the L2 studies that have restricted their field of investigation to subject and object RCs only, asymmetries have been reported in the production, processing, or acceptance of these RCs (Cook ,1975; Aydin, 2007; Havik et al., 2009; Izumi, 2003; Mitsugi et al., 2010; Xu, 2014). In L1 research, the subject-object RC asymmetry is also attested in a high number of publications, although these have focused mainly on the processing of RCs (Carreiras et al., 2010; Cook, 1973; Ford, 1983; Frauenfelder et al., 1980; Frazier, 1987; Gordon et al., 2004; Hakes et al., 1976; Hsiao and Gibbons, 2003; Hsiao and MacDonald, 2013; Ishizuka, 2005; Johnson et al., 2011; King and Just, 1991; King and Kutas, 1995; Kwon et al., 2010; Lin, 2006; Schelstraete and Degand, 1998; Traxler et al., 2002; Ueno and Garnsey, 2008; Vasishth et al., 2013). Finally, in L1 acquisition, several studies involving native children in various L1s have revealed a similar effect of RC function on the comprehension of subject and object RCs (Adani, 2011; Cook, 1975; Costa et al., 2011; Diessel and Tomasello, 2005; Volpato and Adani, 2009; Adani et al., 2010; Friedmann et al., 2009; Guasti et al., 2012).

On the other hand, the results of the present research indicate that the comprehension of RCs by Romance learners of English does not follow the gradient of difficulty described in Keenan and Comrie's (1977) NPAH. Indeed, no comprehension differences have been found between subject and object RCs by the French and Italian learners of English or between object and oblique RCs by the Italian participants. The absence of subject-object RC asymmetry in comprehension may seem to contrast with the large body of literature mentioned above, but this is only apparent. Indeed, closer scrutiny of RC research reveals that, as far as comprehension is concerned, no evidence of a significant difference between subject and object RCs has been produced (see Chapter 2.3.). In fact, numerous experiments in L1 which have measured comprehension accuracy with verification statements (Hsiao & Gibbons, 2003; Ishizuka, 2005; Lin, 2006; Ueno & Garnsey, 2008; Vasishth et al., 2013) have reported an equal comprehension of these two RCs, and studies in L2 acquisition (Izumi, 2003; Mitsugi et al., 2010) have supported this finding or have even reported an absence of comprehension difference between subject, object, and oblique RCs. Importantly, the studies that have revealed a subject-object RC asymmetry in adults are almost exclusively processing, acceptance, or production studies (Doughty, 1991; Eckman et al., 1988; Ford, 1983; Frauenfelder et al., 1980; Frazier, 1987; Gass, 1979; Hakes et al., 1976; Hamilton, 1994; King & Kutas, 1995; Kwon et al., 2010; Schelstraete & Degand, 1998). Therefore, it is clear that the difficulty linked to RCs cannot be dissociated from the skill that is under investigation. As far as comprehension is concerned, Romance learners of English understand subject and object RCs equally well, and the NPAH cannot be claimed to be a valid predictor of RC comprehension by L2 learners.

The equal comprehension of subject and object RCs by adult L2 learners, however, contrasts with the results of native children. Indeed, several experiments (Adani, 2011; Cook, 1975; Costa et al., 2011; Diessel and Tomasello, 2005; Volpato and Adani, 2009) have brought to light that children's comprehension of object RCs is significantly lower than that of subject RCs. Since the subject-object processing asymmetry evidenced in adults (L1 and L2) does not cause any comprehension breakdown, whereas native children typically fail to understand object RCs, it can be argued that there is a qualitative difference between the two populations. It may be that, because children's exposure to linguistic input is relatively short or

because their cognitive skills are developing, the processing of subject and object RCs by native children varies greatly and, as a result, major processing differences generate significant variation in comprehension. Unfortunately, to the author's best knowledge, no processing data is available concerning the processing of RCs by children, so that this explanation cannot be verified, but it would be an interesting topic for future research.

The divergent results that come from various strands of research on RCs carried out with diverse populations make it clear that the study of RCs is complex, and that no progress can be made unless it is well defined. In L1 research, such an evolution is perceptible. Indeed, the early claims that object RCs were more difficult than subject ones (Cook, 1973; Ford, 1983; Frauenfelder et al., 1980; Frazier, 1987; Hakes et al., 1976;) have been replaced with a more nuanced debate, where object RCs are said to be more difficult to process when they are in a certain configuration (Gordon et al., 2004; Johnson et al., 2011; Traxler et al., 2002; Mak et al., 2002, 2006), and there is consensus that the subject-object RC asymmetry depends on the language under study (head-initial or head-final). Unfortunately, the study of RCs in second language acquisition lacks this kind of refinement: it often limits itself to extending the general consensus about a subject-object RC asymmetry to the L2 population without specifying the skill under investigation or the RC configuration (Kang, 2015; Mitsugi et al., 2010; Xu, 2014). This research has shown how important it is to differentiate between processing, comprehension, and production, and it is hoped that future research on RCs in L2 acquisition will mirror the evolution of L1 research.

Finally, Izumi's (2003) call for a unified focus of research and multi-modal testing of RCs in L2 acquisition is still relevant. If the complexity of RC acquisition is to be elucidated in the L2, what is needed is more and more thorough research. Specifically, future L2 experiments about RCs will need first to broaden the skills tested so as to include comprehension and processing, second to control the factors that have been shown to influence RC processing and comprehension (such as head noun animacy and category), and third, to select the L1-L2 combinations carefully since the RC research in the L1 reaches conflicting conclusions depending on the language investigated.

6.2. The Influence of the Syntactic Placement of Prepositions on the Comprehension of Oblique RCs

As predicted by the second hypothesis, the comprehension of oblique RCs by Romance learners of English is affected by the syntactic placement of the prepositions inside the RCs. Concretely, placing the prepositions in pied-piped or in stranded position makes oblique RCs more or less comprehensible by L2 learners. On the other hand, the preferred placement of the oblique RC prepositions is not the pied-piped one, as had been expected as a result of cross-linguistic transfer (see Chapter 2.2.2.). In other words, although Romance learners of English have L1s that require that the oblique RC prepositions be pied-piped and that disallow the stranding of the prepositions, they understand oblique RCs with stranded prepositions better than the pied-piped counterparts.

The present evidence demonstrating the influence of preposition placement on the comprehension of oblique RCs is in line with the results of other L2 studies, although these have never tested comprehension. Bardovi-Harlig (1987), Mazurkewich (1984), and Ohba (2003) have all reported a preference for one syntactic placement over the other one in L2 production and acceptance, and most of them have indicated that oblique RCs containing stranded prepositions are produced more frequently than the pied-piped ones (Bardovi-Harlig, 1987; Ohba, 2003). Moreover, other L2 studies that have investigated the reversed language configuration, namely the acquisition of Romance languages by English learners, have shown that the target structure, pied-piping, is accepted and produced more often by L2 learners than the non-target one (White, 1987; Perpiñan, 2015). Consequently, the results of the present research and of previous experiments suggest that the behavior of L2 learners regarding their comprehension, production, or acceptance of oblique RCs is not influenced by their L1s.

The absence of cross-linguistic transfer evidenced in Romance learners of English conflicts with the predictions of L2 acquisition theories (see Chapter 2.2.), according to which the L2 acquisition process is permeated by L1 transfer. However, this requires nuancing. First, cross-linguistic transfer is a broad concept, which has been hypothesized to affect differently various areas of

language, such as syntax, morphology, and lexicon (MacWhinney, 2005; White, 2003). The goal of the present research has been restricted to determine whether an instance of cross-linguistic transfer was present in the comprehension of oblique RCs by Romance learners. Second, it is generally accepted that cross-linguistic transfer evolves with time and that it is more significant at the beginning of the L2 acquisition and decreases as the learners become more proficient in the L2 (MacWhinney, 2005; Perpiñan, 2015). Finally, research has shown that the presence of cross-linguistic transfer does not impede the acquisition of native-like parsing strategies (Nitschke et al., 2010). Therefore, the reason why the Romance learners of English tested in the present research have failed to be influenced by their L1s is probably due to their relatively advanced proficiency level. As a matter of fact, the participants had at least an intermediate level of English and their comprehension scores were generally high. Consequently, it cannot be excluded that, at an earlier stage of L2 acquisition, Romance learners of English do transfer their L1 knowledge of oblique RCs to the L2, and this could be the topic of future research. On the other hand, the better understanding of oblique RCs with stranded prepositions by the French and Italian learners of English lends support to the claim that L2 learners can behave in a native-like fashion, as argued in two recent studies about RCs. The first one is by Nitschke, Kidd, and Serratrice (2010), who tested the comprehension of ambiguous RCs by English learners of Italian or German in a syntactic priming experiment, and reported that, although L1 transfer is evident in the comprehension data, it does not hinder the acquisition of L2 parsing strategies. The second one is by Perpiñan (2015), who observed that the processing of oblique RCs by L2 learners of Spanish was native-like: in other words, in a self-paced reading experiment, the reading times of oblique RCs containing pied-piped prepositions (the only felicitous construction in Spanish) were identical for the English and Arabic learners of Spanish and for the native speakers.

6.3. The Influence of the Semantic Content of Prepositions on the Comprehension of Oblique RCs

In line with the third hypothesis, the present research has revealed that the comprehension of oblique RCs by Romance learners of English is affected by the semantic content of the prepositions used inside the oblique RCs and that oblique RCs containing non-locative prepositions are better understood than those featuring locative prepositions.

Previous studies on RCs have already produced evidence that semantic factors interfere with the processing or comprehension of RCs. In particular, the processing of RCs by native adults varies when the animacy of the referents or the category of the embedded noun is manipulated (Gordon et al., 2004; Heider et al., 2014; Mak et al., 2002, 2006; Reali & Christiansen, 2007; Traxler et al., 2002), and, besides noun animacy and category (Brandt et al., 2009; Kidd et al., 2007), native children have been reported to be sensitive to indications of number and gender in their comprehension of RCs (Adani et al., 2010). In second language acquisition too, similar results have been obtained (Hu & Liu, 2007; Lee, 2014; Ozeki & Shirai, 2007). However, no other studies have investigated the semantic content of oblique RC prepositions, and this research is the first one to report its influence on the comprehension of RCs by L2 learners of English.

The better comprehension of oblique RCs featuring non-locative prepositions by Romance learners of English is interesting because it mirrors the findings of studies on spatial referencing carried out in the L1. Indeed, L1 research has revealed that sentences containing locative prepositions are harder to process than those without spatial referencing (Noordzij, Neggers, Ramsey, and Postma, 2008). Therefore, since both L1 and L2 populations are affected by the cognitive difficulty of processing locative prepositions, it can be concluded that their parsing of sentences cannot be completely divergent. This result, therefore, lends additional support to the claim formulated after examining the second hypothesis and the lack of cross-linguistic transfer that L2 learners must converge at some point with L1 speakers. However, it remains to be seen if the influence of semantics spans the whole L2 acquisition process and which skills are affected. In

other words, future research ought to determine whether L2 beginners behave in the same way as intermediate or advanced learners and whether the comprehension advantage of non-locative oblique RCs is evidenced also in L2 processing and production results.

A final remark is in order before moving on to theoretical and methodological considerations. The experimental manipulation of preposition semantics has been possible only because the design of the present research had included oblique RCs. Much research on RCs, in particular in L1, and more recently also in L2, has focused on the subject-object asymmetry. This narrow focus is generally understandable and often motivated by clear hypotheses. However, as is apparent from the present research, leaving several RC categories out of the research design severely reduces the possibility to test new variables and to confront results with theoretical accounts. Therefore, it would be desirable for future L2 research on RCs to broaden the range of RCs under investigation so as to include oblique and even genitive RCs.

6.4. Theoretical Accounts of RC Comprehension

In the present thesis, three theories have been presented in order to account for the comprehension behavior of Romance learners of English: the Structural Distance Hypothesis (O'Grady, 1997) / Minimalism (Chomsky, 1995) as interpreted by McDaniel et al. (1998), the frequency account, and the Perspective Hypothesis (MacWhinney, 1977). In what follows, the experimental findings will be discussed in light of each account.

The Structural Distance Hypothesis (SDH) and Minimalism as interpreted by McDaniel et al. (1998) are complementary generativist accounts, which link the difficulty of understanding certain RCs to the number of syntactic computations (see Chapter 2.4.2.). Specifically, the SDH predicts an increasing order of RC comprehension difficulty from subject to oblique RCs due to the greater number of nodes separating the RC gap and its antecedent, while McDaniel et al.'s (1998) interpretation of Minimalism states that oblique RCs with stranded prepositions

are easier to understand than the pied-piped counterparts because they require fewer derivations. These combined accounts receive only partial support from the results of the present comprehension experiments. Indeed, the influences of syntax and of preposition placement are correctly predicted: subject RCs are more difficult to understand than oblique ones, and oblique RCs containing stranded prepositions have a comprehension advantage over the pied-piped ones. On the other hand, these theories are unable to explain why no comprehension asymmetry is found between subject and object RCs or why the semantic content of the oblique RC prepositions affects the RC comprehension. Regarding the lack of subject-object RC comprehension asymmetry, it could be argued that it is linked to the testing modality, and that finer measures, such as processing ones, actually report differences between the two RC functions, therefore validating the generativist accounts. However, neither the SDH nor Minimalism according to McDaniel et al.'s (1998) are able to justify the influence of semantics on RC comprehension since both accounts are based on strict syntactic considerations. As a result, it has to be concluded that the SDH and McDaniel et al.'s (1998) interpretation of Minimalism are incomplete accounts that capture, to some extent, the influence of syntax but fail to describe the effect of semantic variations.

The frequency account, on the other hand, predicts the difficulty of RCs on the basis of their relative frequency in discourse: the more frequent a structure is, the more familiar it becomes to language users, and the easier it is to understand. As seen in Chapter 2.4.4.2., subject, object, and oblique RCs are expected to be understood in a decreasing order of ease which mirrors their decreasing occurrence in corpora of British and American English. Concerning oblique RCs, the RCs featuring pied-piped prepositions ought to be understood more easily than the preposition-stranded ones because they appear more frequently in natural discourse. As a reminder, an important concept in the frequency theory is the grain of the analysis (see Chapter 2.4.2.4.). Indeed, if frequency influences the retention and accessibility of certain structures, these structures have to be defined. In a fine-grained analysis, the recurrence of lexical items is counted, whereas in a coarse-grained analysis, the frequency of broad syntactic patterns is investigated. In the present research, a mixed-grained approach has been used: in other words, the patterns that have been counted in the linguistic corpora are a

combination of exact terms and formal syntactic categories organized along a certain sequence.

The comprehension results of Romance learners of English tested in the present research fail to support the frequency account. Indeed, while the theory correctly predicts the general influence of syntax, it fails to describe the exact effect of RC function, of preposition placement, and of preposition semantics on the comprehension of RCs. Specifically, the frequency account does not explain why no comprehension asymmetry is found between subject and object RCs, and it predicts wrongly that pied-piped oblique RCs have a comprehension advantage. Moreover, it offers no explanation concerning the influence of preposition semantics. As a result, it has to be concluded that the present frequency account is a poor predictor of RC comprehension by L2 learners. However, this assessment should not be definitive. Indeed, it should be remembered that, in this research, the frequency-based predictions regarding the difficulty of RCs are rooted in corpus searches that have looked for the recurrence of syntactic patterns, consisting of a sequence of formal syntactic categories and exact terms. This level of frequency analysis has produced erroneous predictions, but nothing excludes that an analysis at a lower level, in other words a finer-grained analysis, may account for the comprehension behavior of L2 learners. Considering the present evidence and that of Hoffman (2005), who has shown that the distribution of oblique RC prepositions in pied-piped or stranded position in natural discourse is not random but is affected by semantic-pragmatic considerations, it follows that any future account of RC comprehension based on the frequency of occurrence will need to define searches that combine syntactic patterns with semantic factors. For example, the frequency of oblique RC prepositions ought to be counted in relation with the syntactic placement of the preposition (pied-piped or stranded) and its semantic content (locative or non-locative).

In sum, the present frequency account fails to explain the comprehension behavior of Romance learners of English and indicates that a frequency analysis carried out only at the syntactic level is a poor predictor of RC comprehension. On the other hand, it cannot be excluded that a frequency analysis that would

combine syntactic and semantic variables may be able to account for the L2 comprehension of RCs.

Finally, MacWhinney's (1977) Perspective Hypothesis (PH) links the complexity of understanding RCs to the number of perspectives the listener has to adopt (see Chapter 2.4.4.3.). Every time the perspective is shifted from one thematic role to another, the comprehension becomes more arduous. As a result, the PH predicts that subject RCs ought to be more difficult to understand than object and oblique ones, which are, on the other hand, equally difficult, whereas oblique RCs containing non-locative prepositions are hypothesized to have a comprehension advantage over those featuring locative prepositions. Locative prepositions are expected to be harder because they require intrinsic spatial referencing, which means that the listener has to adopt the perspective of the object of reference.

The comprehension results of the present research lend only partial support to MacWhinney's (1977) PH. Indeed, while this account predicts correctly the general influence of syntax and of semantics, it fails to capture the influence of RC function and of preposition placement. In other words, the cost of perspective shifting can explain that some RCs varying in syntactic function are easier than others and that oblique RCs with locative prepositions are harder to understand than those having non-locative prepositions, but it falls short of justifying the equal comprehension of subject and object RCs by Romance learners of English or the comprehension asymmetry observed between oblique RCs varying in preposition placement.

In conclusion, none of the three theories that have just been examined are fully capable of accounting for the comprehension of RCs by Romance learners of English. It is noteworthy that the two syntax-driven theories discussed in this chapter, O'Grady's (1997) SDH / Minimalism according to MacDaniel et al. (1998) and the frequency of occurrence, make accurate predictions concerning the general influence of syntax on RC comprehension, but they are unable to determine the exact influence of RC function and they ignore completely the effect

of preposition semantics on the comprehension of oblique RCs. Conversely, the pragmatically-driven PH (MacWhinney, 1977) captures the general effect of syntax and the influence of preposition semantics on RC comprehension, but it is unsuccessful in predicting the influence of RC function and of the placement of oblique RC prepositions. Consequently, since the empirical results of the present research converge to reveal the influence of syntactic as well as semantic variables, and since theories motivated only by syntactic or semantic-pragmatic considerations fall short of explaining all the variation observed in the comprehension of RCs by Romance learners of English, it is concluded that any future model of RC comprehension by L2 learners will need to be multi-factorial and include syntactic as well as semantic variables. At this point, it is too early to say how the variables examined in the present research will contribute to this future model, but it may be conjectured that the syntactic placement as well as the semantic content of oblique RC prepositions may carry more weight than the syntactic function of the RC since the former have generated comprehension differences whereas the latter has not.

6.5. Methodological Observations

Methodological precision is important in the study of RCs. Indeed, much research has been carried out on RC complexity in the fields of L1, L1 acquisition, and L2 acquisition, and their conclusions are often conflicting. However, the divergent results are due most of the time to variations in test design (see Chapter 2.3.). Therefore, in addition to the usual syntactic manipulations, it would be desirable for future research on RCs to include the following considerations in their experimental designs. First, the skill under investigation has to be well defined: processing, comprehension, and production are distinct skills, and the results coming from measuring one of them cannot be claimed to extend to the other competences. Second, the semantic and pragmatic factors that influence the processing, comprehension, and production of RCs have to be controlled. These include the animacy of the referents (animate or inanimate), the category of the embedded noun (noun or pronoun), the frequency of head and embedded nouns (low or high frequency), the number and gender of constituents, and the semantic content of oblique RC prepositions (locative or non-locative). Finally, in the research in L2 acquisition, the combination of L1-L2 has to be carefully chosen

because the research on RCs coming from typologically diverse languages can be conflicting.

In the present research, the comprehension of RCs by Romance learners of English has been measured with two methods: a picture selection task and an elicited imitation one. Both methods have been used in previous research to test RC comprehension, but the elicited imitation tests carried out by Romance learners of English differ from past studies in that they were done in writing. Concretely, participants were requested to listen to pre-recorded, oral stimuli containing various RCs and to write them down within a timed interval. Moreover, they were told that spelling was disregarded and that they needed to focus on the meaning of the sentences. Since it is the first time that the written variant of the elicited imitation method is used to measure RC comprehension, an assessment of the technique is in order. The advantages of performing the elicited imitation task in writing are threefold. First, it allows to test a large number of participants in a single session and makes it possible to have a repeated measures design. Indeed, in this research, the same subjects participated in the picture selection and elicited imitation experiment in a single testing session, so that the variation due to population and timing differences were kept to a minimum. Second, asking L2 learners to write the stimuli instead of repeating them orally has the advantage that the imitated responses are not ambiguous as a result of non-native pronunciation. In other words, the written variant prevents articulatory issues from influencing the rating of responses. Third, since the spelling of the English language is particularly unpredictable, it can be argued that rote imitation is hardly possible: participants have to understand the stimuli in order to be able to write them down. On the other hand, one of the difficulties arising from the written modality is that spelling mistakes can be ambiguous: they can be interpreted as erroneous orthography or as signs of miscomprehension, which causes raters to accept or to reject the responses respectively. Therefore, it is important that raters agree on a rating scale prior to judging answers, but this observation holds regardless of the elicited imitation variant chosen. Indeed, even if the responses are imitated orally, raters have to decide whether to accept them or not on the basis of clearly defined rubrics. In conclusion, the elicited imitation task is a good method to complement another measure of comprehension, and performing it in writing instead of orally has several advantages: it allows to test

the same participants in a short period of time, hence increasing the reliability of the statistical analysis; it prevents articulatory issues from influencing the rating of answers; and, as far as the English language is concerned, it discourages phonetic writing and hence imitation devoid of comprehension.

6.6. Conclusions

The evidence presented and discussed in this chapter leads to four general conclusions. First of all, as evidenced in the present research, it is clear that the comprehension of RCs by Romance learners of English is affected by both syntactic and semantic variables of the target language. The influence of syntax has been observed in two instances. First, it has been seen that the function of the relativized head noun determines how well the RC is understood by L2 learners. Concretely, subject RCs are understood better than oblique ones. Second, the placement of the preposition inside the oblique RC has been shown to affect the comprehension of the RC. In particular, oblique RCs containing stranded prepositions have a comprehension advantage over their pied-piped counterparts. Regarding the effect of semantics on RC comprehension, it has been manifest in the case of oblique RCs. In particular, the preposition employed inside the oblique RC can vary semantically and hence involve spatial referencing or not. In this research, it appears that oblique RCs containing non-locative prepositions, which are inherently devoid of spatial reference, are understood better than those featuring locative ones.

The results of this research can only add support to the already vast body of literature evidencing the combined effect of syntax and semantics on the processing and comprehension of RCs. The role of syntax, which has been the most researched topic, has been investigated in numerous experiments. Their results show that the function of the relativized head noun affects the comprehension of the RC. Concerning the semantic variable, it has been shown that manipulating the animacy of the relativized head noun leads to unequal RC comprehension. It should be added that some researchers have also brought to light the additional influence of pragmatics and morphology on RC comprehension. For example, selecting a known referent instead of a new one

inside the RC affects its comprehension, and morphological markers such as case endings can make RCs easier to understand. Therefore, the evidence set forth in the present research and in the literature leads to the natural conclusion that the comprehension of RCs is affected by a combination of linguistic variables, among which syntax, semantics, pragmatics, and morphology. As a result, any future model that aims to describe and predict RC comprehension will need to be multi-factorial.

Second, the theoretical implication deriving from this empirically-based conclusion is that any theory that wishes to explain the mechanisms underlying RC comprehension cannot be based on syntax or on semantics only. Therefore, by themselves, Minimalism (Chomsky, 1995) and the Structural Distance Hypothesis (O'Grady, 1997) cannot be considered valid frameworks to account for RC comprehension because they are part of theories that exclude variables other than syntactic ones. Similarly, the frequency of occurrence theory may be a valid theory only if it adopts a fine-grained analysis that looks for the recurrence of patterns others than strictly syntactic ones. By the same token, the Perspective Hypothesis (MacWhinney, 1977) offers an incomplete account of RC comprehension because it leaves out the influence of syntactic factors. In sum, future models of RC comprehension will need to be multi-factorial and the theory used to explain it will need to be broad and account for syntactic as well as semantic influences.

Third, beside the empirical results and their theoretical implications, this research has also illustrated the importance of methodological considerations on RC comprehension outcomes. Indeed, the research on RCs spans five decades, yet it has generated little consensus among linguists. The reasons for this are several. First, researchers have used all sorts of data elicitation techniques. This could be a positive element, but regrettably, the methods target different skills (processing, comprehension, acceptance, production), so that comparisons are rendered difficult, if not impossible. Second, linguists have researched concepts that have never been defined. Indeed, no unified framework has been created for RC comprehension. Therefore, it seems difficult to contribute to research on RC comprehension, and perhaps even on language comprehension more generally, in a constructive way unless common ground is agreed among psycholinguists.

This point is made forcefully by Jarvis (2000) concerning the concept of language transfer and by Rondal (2011) regarding the general terminology used in the psychology of language, which he regrets has been borrowed from linguistics. Finally, the research on RCs has suffered from a concentration of attention on the duality between subject and object RCs, thereby leaving aside the study of other RC functions, which, however, could have made it possible to test other theories than syntactic ones. Consequently, it is to be hoped that future research on RC comprehension will be based on comparable elicitation techniques and investigate the whole range of RCs inside a unified framework. It should be noted, however, that such an evolution is starting to be perceptible in the most recent studies.

Finally, this thesis has presented the contribution that the field of SLA can make to L1 research despite the difficulty of comparing studies in various areas of psycholinguistics. Indeed, the results of the present investigation of L2 learners have confirmed the influence of syntax and semantics on the comprehension of RCs, which have been reported by L1 researchers, and at the same time, they have cast doubts on syntax- or semantics-driven linguistic theories that have been formulated by L1 scholars. Therefore, it can be observed that research in L1, L1 acquisition, and L2 acquisition are complementary and can benefit from each other's advancement. For example, while L1 researchers have hypothesized that case marking affects RC comprehension (Carreiras et al., 2010), studies in L1 acquisition have demonstrated its influence (Guasti et al., 2012). Similarly, whereas processing studies with L1 adults and comprehension experiments with native children have proven the influence of animacy on RC complexity (Brandt et al., 2009; Kidd et al., 2007; Mak et al., 2002, 2006; Traxler et al., 2002), L2 scholars have confirmed it with experiments evidencing its role in acceptance and comprehension (Hu & Liu, 2007; Lee, 2014). So, the three sub-fields can be at the same time sources of inspiration and of empirical data for the design of future experiments and for the discussion of theoretical frameworks.

In conclusion, this thesis has presented evidence of the influence of syntactic and semantic variables on the comprehension of RCs by Romance learners of English, has argued in favor of a theory of RC comprehension that encompasses syntactic

and non-syntactic influences, has raised awareness about methodological issues concerning RC research, and has illustrated the beneficial effect of comparing research across the fields of L1, L1 acquisition, and L2 acquisition. Since the essence of research is concerned with asking the right questions and daring to challenge received theories, it is hoped that future L1 and L2 researchers will keep investigating RCs constructively and in a cross-disciplinary way.

Appendices

A. Test materials for the picture selection test with French learners of English

The picture selection test administered to the French learners of English contained the following test sentences: eight subject-object RC doublets and eight subject-oblique RC doublets, with the prepositions in stranded or in pied-piped position.

Show me	the mouse that is watching the elephant
	the mouse that the elephant is watching
	the dog that is biting the cat
	the dog that the cat is biting
	the lion that is following the rat
	the lion that the rat is following
	the pony that is hitting the cat
	the pony that the cat is hitting
	the dog that is pulling the cat
	the dog that the cat is pulling
	the tiger that is pushing the horse
	the tiger that the horse is pushing
	the monkey that is lifting the eagle
	the monkey that the eagle is lifting
	the monkey that is brushing the elephant
	the monkey that the elephant is brushing
Show me	the monkey that is looking at the mouse
	the monkey that the mouse is looking at
	the monkey at which the mouse is looking
	the dog that is stepping over the cat
	the dog that the cat is stepping over
	the dog over which the cat is stepping
	the lion that is jumping over the horse
	the lion that the horse is jumping over

the lion over which the horse is jumping
the horse that is looking at the lion
the horse that the lion is looking at
the horse at which the lion is looking
the dog that is running behind the cat
the dog that the cat is running behind
the dog behind which the cat is running
the cat that is running in front of the dog
the cat that the dog is running in front of
the cat in front of which the dog is running
the horse that is walking in front of the sheep
the horse that the sheep is walking in front of
the horse in front of which the sheep is walking
the sheep that is walking behind the lion
the sheep that the lion is walking behind
the sheep behind which the lion is walking

B. Test materials for the picture selection test and the elicited imitation test with Italian learners of English

The picture selection test administered to the Italian learners of English contained the following test sentences: eight subject-object RC doublets and eight oblique RC doublets, with the prepositions in stranded or in pied-piped position.

Show me the monkey that is brushing the elephant
the monkey that the elephant is brushing
the dog that is pulling the cat
the dog that the cat is pulling
the cat that is watching the elephant
the cat that the elephant is watching
the cat that is hitting the horse
the cat that the horse is hitting
the tiger that is pushing the horse
the tiger that the horse is pushing
the eagle that is lifting the monkey

the eagle that the monkey is lifting
the rat that is following the lion
the rat that the lion is following
the dog that is biting the cat
the dog that the cat is biting

Show me
the lion that the horse is jumping over
the lion over which the horse is jumping
the cat that the dog is listening to
the cat to which the dog is listening
the mouse that the lion is looking at
the mouse at which the lion is looking
the cat that the monkey is playing with
the cat with which the monkey is playing
the sheep that the bear is pointing at
the sheep at which the bear is pointing
the dog that the sheep is running behind
the dog behind which the sheep is running
the dog that the cat is smiling at
the dog at which the cat is smiling
the bird that the cat is waving at
the bird at which the cat is waving

The elicited imitation test administered to the Italian learners of English contained the following test sentences: four subject and four object RCs.

This is the dog that follows the cat everywhere.
This is the lion that hunts rabbits every day.
Look at the monkey that's biting the woman now.
Is this the horse that kicked the woman yesterday?

This is the cat that the dog hunted yesterday.
This is the lion that the boy saw at the zoo.

Look at the rabbit that the cat is following.
Is this the horse that the boys ride in the morning?

C. Test materials for the picture selection test and the elicited imitation test measuring the comprehension of syntactically and semantically varied oblique RCs

The picture selection test measuring the comprehension of syntactically and semantically varied oblique RCs by Italian learners of English contained the following test sentences: eight doublets of oblique RCs containing locative prepositions in stranded and in pied-piped position and eight doublets of oblique RCs containing non-locative prepositions in stranded and in pied-piped position.

Show me	the dog that the cat is standing over
	the dog over which the cat is standing
	the pelican that the parrot is flying over
	the pelican over which the parrot is flying
	the lion that the sheep is sitting under
	the lion under which the sheep is sitting
	the dog that the cat is hanging under
	the dog under which the cat is hanging
	the dog that the sheep is running behind
	the dog behind which the sheep is running
	the lion that the tiger is walking behind
	the lion behind which the tiger is walking
	the cat that the lion is sitting behind
	the cat behind which the lion is sitting
	the horse that the sheep is sleeping behind
	the horse behind which the sheep is sleeping

Show me	the parrot that the cat is looking at
	the parrot at which the cat is looking
	the dog that the monkey is laughing at
	the dog at which the monkey is laughing
	the cat that the dog is listening to

the cat to which the dog is listening
the dog that the sheep is talking to
the dog to which the sheep is talking
the sheep that the lion is thinking about
the sheep about which the lion is thinking
the cat that the dog is asking about
the cat about which the dog is asking
the tiger that the lion is dreaming about
the tiger about which the lion is dreaming
the mouse that the parrot is talking about
the mouse about which the parrot is talking

The elicited imitation test measuring the comprehension of syntactically and semantically varied oblique RCs by Italian learners of English contained the following test sentences: two sets of four oblique RCs containing locative prepositions, in stranded and in pied-piped position, and two sets of oblique RCs containing non-locative prepositions, in stranded and in pied-piped position.

Look at the sheep that the horse is jumping over.
This is the sheep that the cat is sitting under.
Is this the sheep that the dog is running behind?
This is the dog that the cat is jumping behind.

Look at the dog over which the cat is stepping.
This is the dog under which the mouse is hiding.
Is this the mouse behind which the cat is walking?
This is the horse behind which the cat is hiding.

This is the monkey that the mouse is looking at.
Look at the sheep that the cat is listening to.
Is this the horse that the dog is talking about?
This is the dog that the sheep is asking about.

This is the sheep at which the monkey is laughing.
Look at the lion to which the mouse is speaking.

Is this the cat about which the sheep is dreaming?
This is the cat about which the mouse is thinking.

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