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On L1 Attrition and Prosody in Pronominal Anaphora Resolution



ÉTUDES ROMANES DE LUND 110

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On L1 Attrition and Prosody in Pronominal Anaphora Resolution

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Abstract

This thesis is a collection of four studies on pronominal anaphora resolution with a focus on first language (L1) attrition and prosody. In Study I, we explored the temporariness of attrition effects on anaphora resolution in L1 Italian speakers who moved to Sweden after puberty (i.e., late bilinguals). An experimental group of 20 late Italian-Swedish bilinguals and a control group of 21 Italian monolinguals completed a self-paced interpretation task twice, and we measured response preferences and response times. In Study II, we investigated how L1 Italian and L1 Swedish speakers use pause features and prominence cues to resolve globally ambiguous anaphora sentences, and whether their patterns in the use of prosody mirror the divergent coreference patterns in the two languages. 28 L1 Italian speakers and 28 L1 Swedish speakers completed a speech production task, in which we analyzed the inter-clausal pause length and the pronoun's degree of prosodic prominence, and a control interpretation task, in which we considered response preferences. Study III represents a continuation of Study II, since we examined a group of 18 late Italian-Swedish bilinguals, who completed the same experimental tasks of Study II. Study IV is a theoretical investigation, in which we discussed previous inconsistent findings on anaphora resolution in light of the interplay between hierarchical structure and linear order of a sentence. The results of the four studies suggest, first, that anaphora resolution may also affect null pronouns, and that task-learning effects should be taken into account for further research on L1 re-immersion. Second, they suggest that inter-clausal pause and prosodic prominence of pronouns are likely to break the canonical coreference pattern, both in a null subject language and in a non-null subject language. Third, the findings also reveal that L1 attrition affects prominence patterns and pause features in pronoun resolution. In particular, the longer the residence in the foreign language (FL) environment, the higher the probability that late bilinguals adapt to the FL patterns when they use prosody to resolve anaphora sentences. Fourth, both monolinguals and bilinguals are sensitive to the interplay between hierarchical structure and linear order of anaphora. However, they employ different strategies to interpret an anaphora sentence, in which hierarchical structure and linear order favor different antecedents. The implications of the findings are discussed in light of the role of processing and cross-linguistic influence (CLI) in L1 attrition, as well as in light of the use of prosodic cues to resolve an anaphoric reference, both in relation to the *Null Subject Parameter* and in relation to L1 attrition.

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Content

List of Studies.....	5
Acknowledgements	7
Abbreviations	9
1. Introduction.....	11
2. Pronominal Anaphora Resolution.....	17
2.1 Anaphora: Definition and Classification.....	17
2.2 Italian Subject Pronouns.....	21
2.3 Swedish Subject Pronouns	27
3. On Null and Overt Pronouns	33
3.1 Pronoun Resolution in Discourse	33
3.1.1 The Topic Continuity Model.....	33
3.1.2 The Accessibility Theory	35
3.1.3 The Centering Theory	37
3.2 The Null Subject Parameter	41
3.3 Coreference in Italian	45
3.3.1 The Minimize Structure.....	45
3.3.2 Null Pronoun and Thema	48
3.3.3 The Aboutness-Shift Topic	50
3.3.4 The Position of Antecedent Strategy.....	51
3.4 Pronouns and Prosody in Empirical Investigations.....	53
4. Anaphora Resolution in L1 Attrition Research	59
4.1 Anaphora Resolution in Late Bilingualism	59
4.2 Recovery Effects on Anaphora Resolution	64
4.3 Attrition in the Phonetic and Phonological Domain	68
5. Overview of the Studies.....	73

5.1 Remarks on Terminology	73
5.2 Research Questions and Hypotheses	75
5.2.1 Study I	75
5.2.2 Study II	76
5.2.3 Study III	78
5.2.4 Study IV	81
5.3 Method	83
5.3.1 Participants	84
5.3.2 Material and Procedures	86
5.3.3 Measurements	89
5.4 Summary of the Main Findings	93
5.5 Discussion of the Main Findings	98
6. Conclusion	106
6.1 Original Contribution	106
6.2 Limitations and future research	113
References	116

List of Studies

- Study I: Gargiulo, C., & van de Weijer, J. (2020). Anaphora resolution in L1 Italian in a Swedish-speaking environment before and after L1 re-immersion: A study on attrition. *Lingua*, 233, 1–13. <https://doi.org/10.1016/j.lingua.2019.102746>¹
- Study II: Gargiulo, C., Tronnier, M., & Bernardini, P. (2019). The role of prosody in overt pronoun resolution in a null subject language and in a non-null subject language: A production study. *Glossa: A Journal of General Linguistics*, 4(1): 135. 1–21. <https://doi.org/10.5334/gjgl.973>²
- Study III: Gargiulo, C., & Tronnier, M. (accepted/in press). First language attrition on prosody in a foreign language environment: A speech production study on anaphora resolution. *Journal of Monolingual and Bilingual Speech*.³
- Study IV: Gargiulo, C. (manuscript). Anaphora resolution in null subject languages: Which factors explain conflicting findings?⁴

The Contribution of the Studies:

In Study I, I conceived the main idea, developed the theory, designed and carried out the experiment, and wrote the manuscript. Co-author Joost van de Weijer performed the statistical analysis and wrote the Results section. Both authors discussed theory, method and results, and contributed to the final manuscript.

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As for Study II, I conceived the main idea, developed the theory, designed and carried out the experiment, analyzed the data in Praat, performed the statistical analysis, and wrote the manuscript. Co-author Mechtild Tronnier suggested how to measure the prosodic variables. Co-author Petra Bernardini translated the sentences from Italian to Swedish, and actively participated in the data collection for the Swedish speakers, performing the role of the “listener” (see Section 5.3.2). All authors discussed theory, method and results, and contributed to the final manuscript.

Concerning Study III, I conceived the main idea, developed the theory, designed and carried out the experiment, analyzed the data in Praat, performed the statistical analysis, and wrote the manuscript. Co-author Mechtild Tronnier discussed the results and contributed to the final manuscript.

Finally, I am the sole author of Study IV.

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Abbreviations

1	First person
2	Second person
3	Third person
ACC	Accusative
AoA	Age of arrival
Cb	Backward-looking center
C-command	Constituent command
CL	Clitic
CLI	Cross-linguistic influence
COM	Common
Cp	Preferred center
DAT	Dative
DEM	Demonstrative
DP	Determiner phrase
F	Feminine
F0	Fundamental frequency
FL	Foreign language
FUT	Future
IMPF	Imperfect
H	High tone
L	Low tone
L1	First language
L2	Second language
LoR	Length of residence
M	Masculine
N	Neuter
NLP	Natural language processing
NNSL	Non-null subject language
NP	Noun phrase
NSL	Null subject language
OBJ	Object
PAS	Position of Antecedent Strategy
PL	Plural
PRS	Present
SBJ	Subject
SBJV	Subjunctive
SG	Singular

ST	Strong
StemV	Stem vowel
U	Utterance
VOT	Voice onset time
W	Weak

1. Introduction

[..] I was a Flower of the mountain yes when I put the rose in my hair like the Andalusian girls used or shall I wear a red yes and how **he** kissed me under the Moorish Wall and I thought well as well **him** as another and then I asked **him** with my eyes to ask again yes and then **he** asked me would I yes to say yes my mountain flower and first I put my arms around **him** yes and drew **him** down to me so **he** could feel my breasts all perfume yes and **his** heart was going like mad and yes I said yes I will Yes.

(James Joyce, *Ulysses*)

In her stream of consciousness, Molly Bloom is likely to play, cynically, with the ambiguity of the third-person singular masculine pronoun to refer, alternatively, to a lover who kissed her under a Moorish wall and to her husband. This ambiguity in the interpretation of pronouns leads the reader to a deeper understanding of Molly's feelings. Pronoun resolution or anaphora resolution represents, in fact, a powerful tool for discourse cohesion.

Anaphora resolution can be defined as the process of identifying the antecedent of an anaphoric item. The term 'anaphora' consists of the Greek words *ana-* 'backwards' and *-phorein* 'the act of carrying'. It designates the act of referring to a linguistic entity already mentioned in the discourse, namely the antecedent.

(1) **Mary_i** was reading a book when **she_i** heard a noise.

In example (1), *she* represents the anaphoric item, and *Mary* corresponds to the antecedent. Antecedent and anaphora are *coreferential*, since they relate to the same entity in the real world – the *referent*, a person named *Mary* in (1). Anaphora resolution allows speakers to correctly interpret a sentence by

associating the pronoun with the corresponding antecedent. When a sentence has more than one available referent, as in (2), the problem of identifying the correct antecedent of a pronoun arises.

- (2) Mary_i greeted Alice_j when she_{i/j} entered the store.

In (2), both *Mary* and *Alice* represent potential antecedents of the third-person pronoun *she*. This also occurs in Swedish, as shown in (3).

- (3) Mary_i hälsade på Alice_j när hon_{i/j} gick in i butiken.

Mary greeted at Alice when she went in the store

‘Mary greeted Alice when she entered the store.’

Contrary to non-null subject languages (“NNSLs”), such as English and Swedish, in null subject languages (“NSLs”), such as Italian, speakers can use two alternatives for the same linguistic structure. In fact, Italian speakers can use either a null pronoun (“pro” in the glosses) or an overt pronoun, as shown in (4a-b).

- (4) a. **Maria**_i ha salutato Alice_j quando **pro**_i è entrata nel negozio.

Maria has greeted Alice when _ is entered in the store

‘Mary greeted Alice when (she) entered the store.’

- b. Maria_i ha salutato **Alice**_j quando **lei**_j è entrata nel negozio.

Maria has greeted Alice when she is entered in the store

‘Mary greeted Alice when she entered the store.’

The distribution of null and overt pronouns is determined by specific syntactic-pragmatic features in Italian. In the case of intra-sentential anaphora, where pronoun and antecedent belong to the same sentence, as in (4a-b), the null pronoun is usually associated with the subject antecedent, such as *Maria* in (4a). Moreover, the overt pronoun is usually associated with the object antecedent, such as *Alice* in (4b).⁵ The different coreference patterns exhibited by NNSLs and NSLs raise questions that are relevant for a better understanding of the mechanisms operating in anaphora resolution, under different perspectives. In the present dissertation, we aim to address how globally ambiguous anaphora sentences are resolved by first-language (L1) speakers of

⁵ Theories of reference explaining the division of labor between null and overt pronouns are illustrated in Section 3.

an NSL (Italian), by L1 speakers of an NNSL (Swedish), and by late bilinguals, who have an NSL as L1, and an NNSL as FL.⁶ We therefore conducted four studies.

In Study I, we investigated whether Italian native speakers, who had lived in Sweden for a longer period of time (late bilinguals), exhibit attrition and recovery effects after L1 re-immersion when they interpret anaphora sentences. First, research on bilingualism suggests that both late bilinguals in attrition and L2 speakers are likely to differ from monolinguals when they resolve anaphora sentences, in terms of response preferences, reaction times, and online processing (Bel & García-Alcaraz, 2015; Belletti, Bennati, & Sorace, 2007; Cardinaletti, 2005; Chamorro, Sorace, & Sturt, 2016; Genevska-Hanke, 2017; Goad, White, Brambatti Guzzo, Garcia, Mortazavinia, Smeets, & Su, 2018; Gürel, 2004; Jegerski, VanPatten, & Keating, 2011; Kaltsa Tsimpli, & Rothman, 2015; Keating, VanPatten, & Jegerski, 2011; Köpke & Genevska-Hanke, 2018; Sorace & Filiaci, 2006; Tsimpli, Sorace, Heycock, & Filiaci, 2004, among others). The reasons for this difference between bilinguals and monolinguals are still being discussed. Second, previous research on anaphora resolution has often focused on the role of L1 attrition, whereas only three studies have investigated recovery effects after re-immersion in the L1-speaking environment (Chamorro et al., 2016; Genevska-Hanke, 2017; Köpke & Genevska-Hanke, 2018). The investigation of L1 re-immersion effects is relevant for the question of whether attrition is a temporary phenomenon affecting processing or a permanent restructuring of L1 knowledge. However, Chamorro et al. (2016) examined the late bilinguals only after L1 re-immersion. In addition, in the studies by Genevska-Hanke (2017), and Köpke & Genevska-Hanke (2018), which included non-structured conversation tasks, the target sentences were not controlled. Hence, we modestly aim at filling this gap. Thus, in Study I, the late bilinguals were tested both before and after L1 re-immersion and the target sentences were the same in all testing sessions.

In Study II, we shifted the focus of the investigation towards the role of prosodic cues in anaphora resolution, comparing an NSL (Italian) and an NNSL (Swedish). In particular, we explored how L1 Italian and L1 Swedish speakers use inter-clausal pause (i.e., the pause between main and subordinate clause) and prosodic prominence on the pronoun (in terms of length, intensity, and average fundamental frequency –“F0”– range), when they resolve the anaphoric reference. As previously mentioned, Italian and Swedish exhibit

⁶ *Late bilinguals* are speakers who moved to a foreign language environment after puberty. Thus, their L1 is assumed to be fully acquired.

different syntactic-pragmatic constraints in regard to pronoun distribution. In the case of intra-sentential anaphora with two competing antecedents, Italian speakers can potentially use either a null pronoun or an overt pronoun in finite clauses. The selection of a specific pronoun is driven by syntactic-pragmatic features and allows resolving the ambiguous anaphora. For a similar ambiguous sentence with two competing antecedents, Swedish speakers can only select an overt pronoun, since the subject is phonetically realized in finite clauses in Swedish. However, prosodic prominence and inter-clausal pause may influence the selection of the antecedent. In fact, prosodic cues have been found to represent a relevant source of information for personal pronouns in different languages (De Hoop, 2004; Jasinskaja, Kölsch, & Mayer, 2005; Rello & Llisterri, 2012; McClay & Wagner, 2014; Goad et al., 2018, among others). To the best of our knowledge, previous research has not examined this phenomenon of the interplay between prosody and syntactic-pragmatic features with respect to cross-linguistic differences between an NSL and an NNSL.

In Study III, we examined whether late L1 Italian-FL Swedish bilinguals show attrition in the use of prosodic cues in anaphora resolution and whether this effect of attrition is influenced by length of residence in the FL environment. This investigation was conducted on a group of late L1 Italian-FL Swedish bilinguals, who performed the same tasks of Study II. Then, the patterns exhibited by the late bilinguals were compared with those shown by Italian and Swedish monolinguals in Study II. Study III was prompted by a lack of research examining L1 attrition of prosodic cues with respect to anaphora resolution. In fact, previous studies on anaphora resolution in bilingualism have generally investigated syntactic-pragmatic features (cf. Cardinaletti, 2005; Chamorro et al., 2016; Genevskaja-Hanke, 2017; Gürel, 2004; Jegerski et al., 2011; Kaltsa et al., 2015; Keating et al., 2011; Köpke & Genevskaja-Hanke, 2018; Tsimpli et al., 2004, among others). To the best of our knowledge, only one study has explored the impact of prosody on anaphora resolution in a situation of bilingualism – a speech perception study by Goad et al. (2018) that focused on L2 speakers – whereas we investigate late bilinguals under L1 attrition.

In Study IV, we discussed factors that are likely to explain previous inconsistent findings across studies on anaphora resolution. The bias strength between null pronouns and subject antecedents, and the bias strength between overt pronouns and object antecedents, vary across anaphoric constructions, and also across NSLs (see Bel & García-Alcaraz, 2015; Belletti et al., 2007; Chamorro et al., 2016; Jegerski et al., 2011; Kaltsa et al., 2015; Keating et al.,

2011; Kraš, 2008a; Sorace & Filiaci, 2006; Tsimplici et al., 2004, among others). Therefore, we considered variance in intra-sentential anaphora resolution in light of the interaction between the hierarchical structure and the linear order of the sentence. In fact, the hierarchical structure of a sentence has a primary role in anaphora resolution (see, e.g., Carminati 2002). However, linear distance is also likely to affect pronominal reference (see Ariel, 1988, 1990; Clark & Sengul, 1979; Ehrlich, 1983; Ehrlich & Rayner, 1983; Givón, 1983). Hence, the present thesis aims to address the following research questions (“RQs”):

- RQ1) Do late L1 Italian-FL Swedish bilinguals show attrition effects on anaphora resolution before L1 re-immersion, and recovery effects after L1 re-immersion (**Study I**)?
- RQ2) Do L1 Italian and L1 Swedish speakers use inter-clausal pauses and prosodic prominence on pronouns to resolve anaphora sentences, in a way that reflects the divergent coreference patterns in the two languages (**Study II**)?
- RQ3) Do late L1 Italian-FL Swedish bilinguals abstain from producing prominence patterns and pause features of Italian monolinguals, and approach those of Swedish monolinguals, when they resolve anaphora sentences in L1, thus suggesting attrition, and is this effect of attrition influenced by length of residence in the FL environment (**Study III**)?
- RQ4) Does the complex interaction between the hierarchical structure and linear order of sentences affect the behaviors of both monolinguals and bilinguals, thus explaining contrasting findings reported in previous research on anaphora resolution (**Study IV**)?

To address these RQs, we tested 115 speakers in Studies I-III, and conducted a theoretical investigation in Study IV. In Study I, we administered a self-paced interpretation task to 20 late L1 Italian-FL Swedish bilinguals and 21 Italian monolingual controls. This experiment was divided into two testing sessions: the late bilinguals were tested before and after a vacation in their home country, Italy, and the monolinguals were tested before and after a comparable time interval, in which they did not change language environment. We measured response preferences and response times. In Study II, 28 L1 Italian speakers and 28 L1 Swedish speakers completed a speech production task and an

interpretation task. For the speech production task, we measured inter-clausal pause duration and average F0 range, relative length, and relative intensity of the target pronoun. In Study III, we administered the same speech production task and interpretation task in Italian to 18 late Italian-Swedish bilinguals. The patterns reported by the late bilinguals in Study III were compared with those exhibited by the monolinguals tested in Study II. We thereby utilized a multifaceted approach to the exploration of pronominal anaphora resolution, using different methods and investigating the phenomenon from different angles.

Anaphora resolution is a relevant topic not only in bilingualism research, but also for studies in Natural Language Processing (NLP). The correct resolution of the anaphoric reference represents a crucial objective for this field, being a fundamental task in several NLP applications, such as machine translation or information extraction (Mitkov, 2004, p. 110). In anaphora resolution applications, linguistic information is used to automatically extract the most probable antecedent of a pronoun from among a certain number of available options. In order to perform this task, knowledge of how speakers resolve the anaphoric reference is needed, especially in a cross-linguistic perspective. Since research in NLP has mainly focused on English, more work on the linguistic features of anaphora resolution in languages other than English, but also among bilingual speakers, would be beneficial to this field. Therefore, we aim at contributing to a better understanding of anaphora resolution mechanisms with a focus on Italian, in both a monolingual and a bilingual perspective.

The present thesis is divided into two parts. In the first part, we provide an overview of the dissertation project as a whole, by describing the main research questions and the motivations for the project (Section 1), the literature background (Sections 2–4), the summary of the four studies (Section 5), and our conclusions (Section 6). The second part of the thesis contains the four studies, in the order they were conducted and written.

2. Pronominal Anaphora Resolution

In this section, we introduce the main ideas and concepts related to anaphoric reference and illustrate the Italian and the Swedish pronominal systems. In **Section 2.1**, we discuss factors that are relevant for the categorization of the anaphoric reference, considering the distinction between linguistic constraints and preferences-based patterns (Mitkov, 1997, 2004). In **Section 2.2**, we provide an overview of the Italian pronominal system, with a focus on the null pronoun and the subject pronouns *lui* ‘he’ and *lei* ‘she’. In **Section 2.3**, we describe the Swedish pronominal system, especially properties and distribution of subject pronouns *han* ‘he’ and *hon* ‘she’.

2.1 Anaphora: Definition and Classification

Cohesion [...] is simply the presupposition of something that has gone before, whether in the preceding sentence or not. This form of presupposition, pointing BACK to some previous item, is known as ANAPHORA. (Halliday & Hasan, 1976, p. 14)

Anaphoric relations allow retrieving the referential meaning of a linguistic item in the discourse, ensuring a specific category of cohesion, namely pronominal reference (Halliday & Hasan, 1976). Pronominal reference can be endophoric or exophoric. In the former case, the referent of the anaphoric form is retrieved inside the text. In the latter case, the referent is retrieved by means of the situational context (Halliday & Hasan, 1976). This difference between endophora and exophora is illustrated in (5) and (6), respectively.

- (5) **Gianni**_i è al bar. **Lui**_i beve vino mentre Piero_j mangia.

Gianni is at the bar he drinks wine while Piero eats

‘Gianni is at the bar. He is drinking wine while Piero is eating.’

- (6) Guarda! **Lui**_i beve vino mentre Piero_j mangia.

look he drinks wine while Piero eats

‘Look! He is drinking wine while Piero is eating.’

An endophoric reference connects two items inside the text, as in (5), whereas an exophoric reference connects them beyond the text, as in (6). As a result, speaker and hearer are expected to share extra-linguistic knowledge to correctly interpret the exophoric reference (McCarthy, 1991). An anaphoric item is not endophoric or exophoric per se, but is instead just “phoric”; this indicates that the corresponding referent can be retrieved somewhere else, either inside or outside the text (Halliday & Hasan, 1976). An endophoric reference, the focal point of the present thesis, can be manifested through forward anaphora and backward anaphora, depending on the position of the antecedent in relation to the position of the pronoun.⁷ In forward anaphora, the potential antecedent precedes the target pronoun in the text, as in (7a). In backward anaphora, the target pronoun precedes the potential antecedent in the text, as in (7b).

- (7) a. Gianni_i non ha ancora chiamato **Maria_j** ma lei_j già sa tutto.
 Gianni not has yet called Maria but she already knows everything
 ‘Gianni hasn’t called Maria yet but she already knows everything.’
 b. Gianni_i non l’_j ha ancora chiamata ma **Maria_j** già sa tutto.
 Gianni not her has yet called but Maria already knows everything
 ‘Gianni hasn’t called her yet but Maria already knows everything.’

Backward anaphora sentences are generally less frequent than forward anaphora sentences in discourse, since the identification of the antecedent is postponed, and this operation determines a temporary difficulty in discourse processing (Beaugrande & Dressler, 1981). In addition, anaphora can be intra-sentential or inter-sentential, depending on the positions of pronoun and antecedent at the sentence level. As previously mentioned, in the case of intra-sentential anaphora, pronoun and corresponding antecedent occur in the same sentence, as in (7a-b). By contrast, in the case of inter-sentential anaphora, pronoun and corresponding antecedent occur in different sentences, as in (5).

The process of identifying the antecedent of a pronoun involves multiple levels of linguistic analysis. Factors affecting the interpretation of a pronominal anaphora can be classified as “constraint-based” or “preferences-based” (Mitkov, 1997, 2004). This division between constraint-based and preferences-based factors was formulated for English, but it is also applicable

⁷ The term *forward anaphora* alternates with *anaphora*, or *anticipatory anaphora* (Huddleston & Pullum, 2002). The term *backward anaphora* is alternated with *cataphora*, or *retrospective anaphora* (Huddleston & Pullum, 2002). Finally, *postcedent* can be used to indicate the antecedent of backward anaphora, but it is rarely used in the literature.

to Italian. Therefore, we distinguish between factors that may cause grammatical violations in Italian, and factors that may result in outcomes that are pragmatically unexpected, but not ungrammatical. Consequently, we use the terms *unexpected* or *unpredictable* patterns to indicate that the assignment of a pronoun to a specific antecedent does not conform to the theory. For example, the selection of *loro* ‘they’ in (8) leads to an ungrammatical sentence because number agreement is a grammatical constraint in pronoun resolution. Contrastingly, the pronoun *lui* ‘he’ is pragmatically unexpected but grammatically correct.⁸

- (8) **Gianni**_i è in casa e **pro**_i / ? lui_i / * loro_i sta cucinando.

Gianni is in home and _ he they stays cooking

‘Gianni is at home and *pro*/?he/*they is cooking.’

As for linguistic constraints in Italian, pronoun and antecedent must agree in gender and number. Moreover, they must conform to semantic consistency requirements and constituent-command (“c-command”) relations (Mitkov, 1997, 2004).⁹ First, the agreement in gender and number between pronoun and antecedent represents a main constraining factor in anaphora resolution, as shown in (9) and (10), respectively.

- (9) **Maria**_i scrive lettere a **Sara**_j da quando * **lui**_j vive a Parigi.

Maria writes letters to Sara from when he lives in Paris

‘Maria has written letters to Sara since *he has lived in Paris.’

- (10) **Maria**_i scrive lettere a **Sara**_j da quando * **loro**_j vivono a Parigi.

Maria writes letters to Sara from when they live in Paris

‘Maria has written letters to Sara since *they have lived in Paris.’

In addition, a pronoun and its antecedent must conform in terms of semantic consistency, as shown in example (11).¹⁰

⁸ We assume that the context is unmarked in (8). Therefore, a null pronoun coindexed with *Gianni* is expected.

⁹ Some of the linguistic constraints illustrated in this section are not limited to the Italian language and have been claimed to be cross-linguistically valid. However, discussing the universal validity of these constraints remains beyond the scope of the present study. The aim of this section is to present linguistic constraints in anaphora resolution that are applicable to Italian.

¹⁰ With the term “semantic consistency”, Mitkov (1997) suggests that the semantic requirements of a verb constrain the selection of the antecedent.

(11) (Adapted from Mitkov, 1997)

Gianni_i ha rimosso il dischetto_j dal **computer**_k, poi *pro*_i **lo**_k ha
 Gianni has removed the diskette from the computer then _ it has
 disconnesso.

disconnected

‘Gianni removed the diskette from the computer, then (he) disconnected it.’

The notion of c-command refers to the syntactic operations underlying different nodes of a parse tree. It establishes a series of syntactic relations between a personal pronoun and its antecedent (Chomsky 1981). In his *Binding Theory*, Chomsky (1981) distinguishes between anaphor, pronouns and referential expression (or “R-expression”), which are defined by *Principles A*, *B* and *C*. Under this account, the term anaphor only indicates reflexive pronouns such as *si* ‘himself’, thus restricting the traditional meaning of anaphora (cf. Halliday & Hasan 1976).¹¹ An anaphor, corresponding to a reflexive pronoun, must be bound in its binding domain, in line with *Principle A*, as illustrated in (12a-b).

(12) a. Gianni_i pensa che **Maria**_j ami **se stessa**_j.

Gianni thinks that Maria loves herself

‘Gianni thinks that Maria loves herself.’

b. **Gianni**_i pensa che Maria_j ami *se stesso_i.

Gianni thinks that Maria loves himself

‘Gianni thinks that Maria loves *himself.’

Principle B states that a pronoun, such as *lui* ‘he’ or *lei* ‘she’, cannot be bound in its binding domain, as illustrated in (13a-b). The term pronoun excludes reflexive pronouns.

(13) a. **Gianni**_i ha chiesto a Maria_j di guardarlo_i negli occhi.

Gianni has asked at Maria of look-CL in the eyes

‘Gianni asked Maria to look him in the eyes.’

b. **Gianni**_i guarda *lui_i allo specchio.

Gianni looks him to the mirror

‘Gianni looks *him in the mirror.’

¹¹ In the present thesis, the term *anaphora* is used in the sense of Halliday and Hasan (1976) and the term *anaphor* is restricted to the *Binding Theory* (Chomsky, 1981 and related work).

An R-expression corresponds to a name or a determiner phrase (“DP”). *Principle C* states that an R-expression must be free: it can be neither co-indexed, nor bound, nor c-commanded by another item, such as in (14a-b).

- (14) a. Lui_i ha visto Gianni_j.
 he has seen Gianni
 ‘He has seen Gianni.’
 b. * Lui_i ha visto Gianni_i.
 he has seen Gianni
 ‘*He has seen Gianni.’

To summarize, pronominal anaphora resolution is a multilayered phenomenon whose categorization depends on whether reference is intra-textual or extra-textual (endophora or exophora), whether a pronoun is placed before or after its antecedent in the text (backward anaphora or forward anaphora), and whether pronoun and antecedent belong to the same sentence or not (intra-sentential anaphora or inter-sentential anaphora). Multiple factors, which can be divided between linguistic constraints and preferences-based patterns, affect anaphora resolution. Gender agreement, number agreement, semantic consistency and c-command relations represent linguistic constraints, whereas preferences-based patterns are discussed in Section 3.

2.2 Italian Subject Pronouns¹²

Italian personal pronouns are generally divided into two categories: free pronouns (“*pronomi liberi*” in Salvi & Vanelli, 2004) and clitics.¹³ These two pronominal categories differ in terms of their syntactic distribution and their semantic-pragmatic interpretation. A free pronoun can occur in the syntactic position of an NP (noun phrase), as illustrated by *lei* ‘she’ in (15). By contrast,

¹² The present description of the Italian pronominal system is based on Salvi and Vanelli (2004).

¹³ In Italian, the following reflexive pronouns are clitics: *mi* ‘myself’, *ti* ‘yourself’, *si* ‘himself’ or ‘herself’, *ci* ‘ourselves’, *vi* ‘yourselves’, *si* ‘themselves’. By contrast, the following reflexive forms correspond to free pronouns: *me (stesso)* ‘myself’, *te (stesso)* ‘yourself’, *sé (stesso/a)* ‘himself/herself’, *noi (stessi)* ‘ourselves’, *voi (stessi)* ‘yourselves’, *sé (stessi)* ‘themselves’).

a clitic pronoun (“CL” in the glosses), cannot occur in NP positions, as shown by *la* ‘her’ in (15).¹⁴

- (15) Al parco, *pro* ho incontrato Maria / **lei** / **la*.
at the park _ have-1SG met Maria her her[CL]
‘At the park, I met Maria/her/*her.’

In addition, clitics are always adjacent to the verb, as illustrated in (16a). A clitic pronoun and a verb can only be separated by another clitic, as shown in (16b). Contrary to free pronouns, clitics are always unstressed.

- (16) a. Noi **lo** **vediamo** spesso al bar.
 we him[CL] see-1PL often at the bar
 ‘We often see him at the bar.’
 b. **Lo** **si** **vede** spesso al bar.
 him[CL] one[CL] see-3SG often at the bar
 ‘You often see him at the bar.’

In Italian, free pronouns in the nominative case are used to express the subject of a sentence, whereas those in the oblique case are used for the other grammatical functions. Table 1 shows free pronouns in Italian.

Table 1. Free pronouns in Italian.

	SINGULAR		PLURAL	
	Nominative	Oblique	Nominative	Oblique
1 st	io	me	noi	noi
2 nd	tu	te	voi	voi
3 rd	lui (m.) / lei (f.)	lui (m.) / lei (f.)	loro	loro
	esso (m.) / essa (f.)	esso (m.) / essa (f.)	essi (m.) / esse (f.)	essi (m.) / esse (f.)
	egli (m.) / ella (f.)			

¹⁴ Clitics in Italian can be in **1) accusative case**: *mi* (1st sg.), *ti* (2nd sg.), *lo* (3rd m. sg.), *la* (3rd f. sg.), *ci* (1st pl.), *vi* (2nd pl.), *li* (3rd m. pl.), *le* (3rd f. pl.), **2) dative case**: *mi* (1st sg.), *ti* (2nd sg.), *gli* (3rd m. sg.), *le* (3rd f. sg.), *ci* (1st pl.), *vi* (2nd pl.), *gli/loro* (3rd pl.), **3) locative case**: *ci*, and **4) partitive genitive case**: *ne*.

Lui (m.sg.), *lei* (f.sg.) and *loro* (pl.) are the most frequent forms of the third-person pronoun, and usually indicate human referents.¹⁵ For those pronouns, the case distinction is not specified morphologically, as shown in (17) and (18):

- (17) **Lui** vive a Roma.

he-SBJ lives in Rome

‘He lives in Rome.’

- (18) Maria ha amato solo **lui**.

Maria has loved only he-OBJ

‘Maria has only loved him.’

Egli (m.sg.), *ella* (f.sg.), *esso* (m.sg.), *essa* (f.sg.), *essi* (m.pl.) and *esse* (f.pl.) are rare in modern Italian, and are generally limited to formal styles in written language. Those pronouns have a different distribution from that of *lui/lei* (see the discussion about weak/strong pronouns below). First, *egli/ella* indicate human referents and are only used in the nominative case. Second, *essa/essi/esse* usually indicate inanimate referents, especially abstract objects, but they can also refer to human referents in written language.¹⁶ Conversely, *esso* only identifies inanimate referents. Moreover, *esso/essa/essi/esse* can be used either in the nominative or in the oblique case, but they cannot be used as direct object, as illustrated in (19):

- (19) Maria ha visto * *esso* / * *essa* / * *essi* / * *esse*.

Maria has seen it-M it-F them-M them-F

First and second-person pronouns are morphologically specified for case, as shown in (20), while they are not specified for gender, as shown in (21).

- (20) Gianni ha chiamato **me** / * *io*.

Gianni has called me I

‘Gianni called me/*I.’

- (21) **Tu** lavor-i troppo e sei sempre stanc-**o** / stanc-**a**.

you work-2SG too much and be-2SG always tired-M.SG tired-F.SG

‘You work too much and are always tired.’

¹⁵ *Lui/lei/loro* can also indicate animate non-human referents (animals). In addition, Berruto (1987) suggests that *lui/lei* referring to inanimate referents represents a substandard feature of spoken Italian. For example, in the sentence “questo è un grosso problema anche lui” (Berruto, 1987, p. 74), the pronoun *lui* ‘he’ refers to the noun *problema* ‘problem’.

¹⁶ For concrete objects and for animate non-human referents (animals), a demonstrative pronoun is usually preferred.

The third-person plural *loro* is not morphologically specified either for case or for gender. The third-person singular pronoun distinguishes between a masculine form, such as *lui* ‘he’ in (22), and a feminine form, such as *lei* ‘she’ in (23).

- (22) **Lui** lavor-a troppo ed è sempre stanc-o.
 he work-3SG too much and be-3SG always tired-M.SG
 ‘He works too much and is always tired.’
- (23) **Lei** lavor-a troppo ed è sempre stanc-a.
 she work-3SG too much and be-3SG always tired-F.SG
 ‘She works too much and is always tired.’

As shown in (20)–(23), verbs agree with subjects in person and number in Italian. An exception is represented by the subjunctive.¹⁷ Thus, Italian speakers rely on the morphological form of a verb to identify the subject of a sentence.

The overt pronoun provides, morphologically, semantic information about the subject of a sentence, such as the gender distinction, as shown in (24). In contrast, the null pronoun does not generally provide semantic information, as illustrated in (25).¹⁸ However, subject number and person are recoverable from verbal inflection in a sentence containing a null subject, such as that in (25), with the exception of some forms of the subjunctive (see footnote 17).

- (24) **Lei** lavor-a troppo.
 she work-3SG too much
 ‘She works too much.’
- (25) **pro** lavor-a troppo.
 _ work-3SG too much
 ‘(He/she) works too much.’

¹⁷ First, second, and third-person singular pronouns have the same verbal inflection for present subjunctive (e.g., *che io/tu/lei/lui lavori*) and past subjunctive (e.g., *che io/tu/lei/lui abbia lavorato*). In addition, first and second-person singular pronouns present the same verbal inflection for imperfect subjunctive (e.g., *che io/tu lavorassi*) and pluperfect subjunctive (e.g., *che io/tu avessi lavorato*).

¹⁸ However, in copular sentences, the adjective must agree in gender with the antecedent. In this case, the gender distinction is clear for null pronouns as well, as shown in (i):

- (i) **pro** è diventata famosa.
 is become-PRT.F.SG famous-F.SG
 ‘(She) has become famous.’

Pronouns are traditionally classified according to a set of morphological, semantic, syntactic and phonetic properties. Kayne (1975) suggests a series of criteria to establish cliticness, and Holmberg (1986, 1991) proposes a tripartite classification of weak pronouns, based on different linguistic features. The present section discusses the well-known typological classification of pronouns developed by Cardinaletti and Starke (1999), which distinguishes between deficient forms (weak pronouns and clitics) and strong forms. This classification is illustrated in Figure 1.

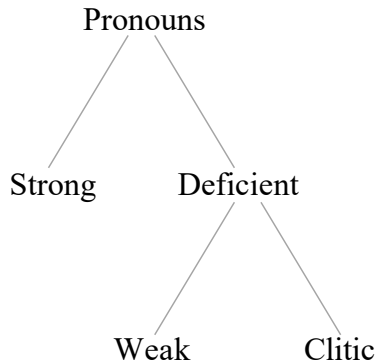


Figure 1. Classification of pronouns, based on Cardinaletti and Starke (1999).

In Italian, the pronouns *lui/lei* are traditionally considered strong forms, whereas *egli/ella*, as well as *esso/essa/essi/esse* and the null pronoun, are weak forms (Cardinaletti & Starke, 1999).¹⁹ The present discussion, restricted to pronouns that can refer to human referents, is based on the parameters proposed by Cardinaletti and Starke (1999) to identify whether a pronoun is weak (“W” in the glosses) or strong (“ST” in the glosses). *Lui/lei* are considered strong pronouns for several reasons.

First, they can occur in base position, as illustrated in (26), in peripheral positions, as in the cleft in (27), and in isolation, as in (28a-b). On the other hand, the null pronoun and *egli/ella* are not allowed in those positions, as shown in (26)-(28a-b).

¹⁹ Camacho (2013) questions the weak status of null pronouns by examining languages other than Italian, such as Irish. However, discussing the cross-linguistic validity of Cardinaletti and Starke (1999) remains beyond the scope of the present work.

(26) Arriva * *pro* / * *ella* / **lei**.
 arrives _ she[W] she[ST]
 ‘She arrives.’

(27) È * *pro* / * *egli* / **lui** che lavora in banca.
 is _ he[W] he[ST] which works in bank
 ‘It’s he who works in a bank.’

(28) a. Chi viene? b. * *pro* / * *Ella* / **Lei**.
 who comes _ she[W] she[ST]
 ‘Who is coming?’ ‘She (is).’

Second, *lui/lei* can be coordinated and modified, as shown in (29) and (30), respectively, whereas the null pronoun and *egli/ella* cannot.

(29) * *pro* / * *ella* / **Lei** e io lavoriamo in banca.
 _ she[W] she[ST] and I work in bank
 ‘She and I work in a bank.’

(30) Anche * *pro* / * *ella* / **lei**.
 too _ she[W] she[ST]
 ‘She too.’

Third, *lui/lei* and *egli/ella* are tonic. However, only *lui/lei* can be focalized to express a contrast, as shown in (31):

(31) * EGLI / **LUI** parla francese, non Gianni.
 HE[W] HE[ST] speaks French not Gianni
 ‘He speaks French, not Gianni.’

Fourth, *lui/lei* can be associated with non-prominent antecedents, whereas the null pronoun and *egli/ella* can only be assigned to antecedents that are prominent in the discourse. In more recent studies, it has been suggested that a new weak use of the overt pronouns *lui/lei* is emerging. Those pronouns are therefore replacing the infrequent weak pronouns *egli/ella*, without violating grammatical constraints (Cardinaletti, 2004; Frascarelli, 2007).

Next, *lui/lei* and *egli/ella* only refer to animate referents, usually human individuals, whereas the null pronoun can indicate both animate and inanimate referents.

Last, *lui/lei* and *egli/ella* cannot occur in non-referential positions, whereas the null pronoun is mandatory in expletive constructions, as illustrated in (32) and (33).

(32) *pro* nevica.

— snows
'(It) snows.'

(33) *pro* è giusto che Maria paghi.

— is right that Maria pays
'(It) is right that Maria pays.'

To sum up, the null pronoun and *egli/ella* can be classified as weak forms in Italian (Cardinaletti & Starke 1999). However, *egli/ella* are uncommon in modern Italian and only pertain to a formal register in written language. Conversely, *lui/lei* are traditionally considered strong forms (Cardinaletti & Starke, 1999) because they exhibit the following properties:

- they can occur in base position, in peripheral positions, and in isolation;
- they can be coordinated and modified;
- they can be focalized;
- they can refer to non-prominent antecedents;
- they refer only to animate referents, usually human referents;
- they are uninterpretable in non-referential positions (such as in expletive and impersonal constructions).

2.3 Swedish Subject Pronouns²⁰

Swedish personal pronouns can be classified as subject pronouns (nominative case) and oblique pronouns.²¹ They are illustrated in Table 2. Similar to other Germanic languages, clitic pronouns are not present in Swedish.²²

²⁰ The present description of the Swedish pronominal system is based on Teleman, Holm, Andersson, and Hellberg (1999).

²¹ In Swedish, reflexive pronouns are as follows: *mig* 'myself', *dig* 'yourself', *sig (sej)* 'himself' or 'herself', *oss* 'ourselves', *er* 'yourselves', *sig (sej)* 'themselves'.

²² However, some clitic forms are present for object pronouns in some Swedish dialects (Engdahl & Lindhal, 2014, p. 20).

Table 2. Pronouns in Swedish.

	SINGULAR		PLURAL	
	Nominative	Oblique	Nominative	Oblique
1 st	jag	mig	vi	oss
2 nd	du	dig	ni	er
3 rd	han (m.) / hon (f.) den (com.) / det (n.)	honom (m.) / henne (f.) den (com.) / det (n.)	de	dem

Note: *Mig* and *dig* are pronounced as *mej* ['mej] and *dej* ['dej]. The forms *mej* and *dej* can be used in informal styles of written language. The pronouns *de* and *dem* are usually pronounced as *dom* ['dɔm:]. *Dom* is also used in informal registers of written language to indicate both *de* 'they' and *dem* 'them'.

The Swedish personal pronouns illustrated in Table 2 are morphologically specified for case, except for *den* (common) and *det* (neuter).²³ First, second, and third-person plural pronouns are not morphologically specified for gender. Third-person singular pronouns, on the other hand, distinguish between a masculine form *han/honom* 'he/him', a feminine form *hon/henne* 'she/her', a common form *den* 'it' ('com' in the glosses), and a neuter form *det* 'it' ('N' in the glosses), as illustrated in (34)–(38).²⁴ The forms *den/det* indicate non-human referents and can be also used as demonstratives, as shown in (38).

- (34) Jag_i har **en** **bror_j**. **Han_j** bor i Lund.
 I have a brother he lives in Lund
 'I have a brother. He lives in Lund.'
- (35) Jag_i har **en** **syster_j**. **Hon_j** bor i Lund.
 I have a sister she lives in Lund
 'I have a sister. She lives in Lund.'
- (36) Jag_i har köpt **ett** **bälte_j**. **Det_j** var dyrt.
 I have bought a[N] belt it[N] was expensive[N]
 'I bought a belt. It was expensive.'

²³ Third-person pronouns also have a genitive case: *hans* (3rd m.sg.), *hennes* (3rd f.sg.), *dess/dens* (3rd com.sg.), *dess* (3rd n.sg.), *deras* (3rd pl.).

²⁴ Josefsson (2010) argues that the opposition common-neuter in Swedish (e.g., *en bil* 'a car' vs. *ett hus* 'a house') pertains to formal gender, while the opposition masculine-feminine pertains to semantic gender and applies only to pronominal forms. In fact, *han/hon* 'he/she' are marked for masculine and feminine but not for common and neuter (Josefsson, 2010, p. 2101). Consequently, those pronouns may refer to antecedents in common forms or in neuter forms.

- (37) Jag_i har köpt en **jacka_j** Den_j var dyr.
 I have bought a[COM] jacket it[COM] was expensive[COM]
 'I bought a jacket. It was expensive.'
- (38) Jag gillar **bälten**. Jag har köpt **det** där till höger.
 I like belts[N] I have bought that[N] one on right
 'I like belts. I bought that one on the right.'

Han/hon 'he/she' generally refer to human individuals, but they can also be used to indicate some categories of animals, the so-called "higher animals", corresponding to vertebrates other than fish (Holmes & Hinchliffe, 2008). Moreover, *hon* can be used to indicate time, and to refer to the term *människa* 'human being' (Holmes & Hinchliffe, 2008). This is illustrated in (39) and (40), respectively.

- (39) **Hon** är tre.
 she is three
 'It's three o'clock.'
- (40) (Adapted from Holmes & Hinchliffe, 2008, p. 79)
 En **människa_i** måste bestämma sig för hur **hon_i** vill leva.
 a human being must decide herself for how she want live
 'A person has to decide how she wants to live.'

In the case of intra-sentential anaphora sentences, the demonstrative pronouns *denne* (m.sg.) and *denna* (f.sg.) can be used to refer only to an object antecedent, as in (41). However, *denne/denna* are limited to written language (Delsing, 1993, p. 137).

- (41) Maria_i hälsade på **Johan_j** när **denne_j** gick in i butiken.
 Maria greeted at Johan when this-M went in the store
 'Maria greeted Johan when he entered the store.'

As previously mentioned, Italian speakers rely on the inflectional form of a verb to identify the subject of a sentence, whereas Swedish speakers cannot. Thus, pronouns in finite clauses are phonetically realized in Swedish (Holmberg, 1986; Platzack, 1986), as shown in (42) and (43).

- (42) **Jag** bor i Lund och min man bor i Malmö.
 I live in Lund and my husband lives in Malmö
 'I live in Lund and my husband lives in Malmö.'

- (43) * *pro* Bor i Lund och min man bor i Malmö.
 _ live in Lund and my husband lives in Malmö
 ‘(I) live in Lund and my husband lives in Malmö.’

The difference between weak and strong forms is realized morphologically in Italian. Contrastingly, the distinction weak/strong is not morphological in Swedish, but is related to the presence of stress (Hellan & Platzack, 1999). In written Swedish, the subject pronouns *han/hon* have the same distribution as the subject pronouns *lui/lei*. First, *han/hon* can occur in base position, as in (44), in peripheral positions, such as the cleft in (45), and in isolation, as shown in (46). In spoken Swedish, the pronouns *han/hon* are stressed in those contexts.

- (44) Imorgon ringer inte **HON**.
 tomorrow call not SHE[ST]
 ‘Tomorrow she will not call.’
- (45) Det är **HON** som pratar svenska.
 it is SHE[ST] that speaks Swedish
 ‘It’s she who speaks Swedish.’
- (46) a. Vem är svensk? b. **HAN**.
 who is Swedish HE[ST]
 ‘Who is Swedish?’ ‘He (is).’

Second, they can be coordinated and modified, as illustrated in (47) and (48) respectively.

- (47) **HON** och JAG pratar svenska.
 SHE[ST] and I[ST] speak Swedish
 ‘She and I speak Swedish.’
- (48) **HAN** också.
 HE[ST] too
 ‘He too.’

Third, *han/hon* do not occur in non-referential positions, such as in expletive and impersonal constructions, as shown in (49) and (50), respectively. Furthermore, while these pronouns usually refer to human referents, they can also refer to specific categories of animate non-human referents.

(49) * hon / **det** snöar.

she it snows

‘*She/it snows.’

(50) * hon / **det** levererades i tid.

she it has been delivered in time

‘*She/it has been delivered on time.’

Subject pronouns are always strong in Swedish when they occur after a negation, such as *inte* ‘not’ in (51a), or after an adverbial, such as *emellertid* ‘however’ in (51c-d) (Hellan & Platzack, 1999). This means that, in Swedish, weak subject pronouns can never occur after a negation or after an adverbial, as shown in (51b) and (51d). In fact, all subject pronouns that do not bear stress (e.g., *man* ‘one’, *det* ‘it’, among others) cannot occur after a negation or an adverbial.

(51) (Adapted from Hellan & Platzack, 1999, p. 125)

a. Igår tog **inte** **HAN** med sig sina pengar.

yesterday took not HE[ST] with himself his money

‘Yesterday he did not bring his money.’

b. Igår tog **inte** * **han** med sig sina pengar.

yesterday took not he[W] with himself his money

‘Yesterday he did not bring his money.’

c. Om detta händer så måste **emellertid** **HAN** ingripa.

if this happens so must however HE[ST] intervene

‘If this happens, he must intervene, however.’

d. Om detta händer så måste **emellertid** * **han** ingripa.

if this happens so must however he[W] intervene

‘If this happens, he must intervene, however.’

In summary, the distribution of the subject pronouns *han/hon* in written Swedish corresponds to that of the subject pronouns *lui/lei* in written Italian. In this case, *han/hon* and *lui/lei* are distributed in accordance with the parameters proposed by Cardinaletti and Starke (1999) for strong pronouns. Similar to *lui/lei*, *han/hon* present the following features:

- they occur in base position, in peripheral positions, and in isolation;
- they can be coordinated and modified;
- they can bear stress;

- they are uninterpretable in non-referential position (such as in expletive and impersonal constructions);
- they generally refer to human referents.

The difference in the distribution of *lui/lei*, on the one hand, and *han/hon*, on the other hand, pertains to spoken language. In spoken Swedish, subject pronouns *han/hon* function as strong pronouns when they are stressed.

3. On Null and Overt Pronouns

Pronoun resolution has been examined using different theoretical approaches that share the idea that a referential item has an intrinsically complex relation with its antecedent. This relation is likely to be affected by the notion of salience, which is operationalized in different ways. Concepts such as prominence, accessibility, recency, topicality, distance, competition, centering, and givenness have been examined to account for the distribution of referential items across languages.

In **Section 3.1**, we discuss theories of reference in discourse such as the *Topic Continuity Model* (Givón, 1983, 1985, 1990), the *Accessibility Theory*, (Ariel, 1988, 1990, 2001), and the *Centering Theory* (Grosz, Joshi, & Weinstein, 1995; Walker, Joshi, & Prince, 1998). These theories have contributed to a better understanding of the factors affecting the informational status of a referent in cognitive terms. However, their predictive power in Italian presents some limitations. In **Section 3.2**, we present an overview of relevant issues on null-subjecthood and pronominal reference. In **Section 3.3**, we discuss four theoretical frameworks on coreference in Italian: the *Minimize Structure* (Cardinaletti & Starke, 1999), the Thema position (Calabrese, 1986a), the Aboutness-Shift Topic (Frascarelli, 2007) and the *Position of Antecedent Strategy* (Carminati, 2002). In **Section 3.4**, we discuss empirical studies that examine the interaction between prosody and pronoun resolution.

3.1 Pronoun Resolution in Discourse

3.1.1 The Topic Continuity Model

Under the *Topic Continuity Model*, the selection of certain referring expressions is related to the way in which the referent is maintained in memory (Givón, 1983, 1985, 1990). This theory suggests that topic availability affects the distribution of referential markers in discourse. The main assumption is

that the more continuous the topic in the discourse, the higher the probability that it is realized as a reduced anaphoric form. The degree of continuity of the topic in discourse is mainly determined by three criteria: “referential distance (*look-back*)”, “topic persistence (*decay*)”, and “potential interference (*ambiguity*)” (Givón, 1983, pp. 13–15).

First, the referential distance criterion states that the number of clauses between two mentions of a referent affects the selection of referential markers. Specifically, a shorter referential distance would predict a more continuous topic than a longer referential distance. A more continuous topic is expected to be realized as a reduced anaphoric form. Second, the topic persistence criterion focuses on the clauses that are subsequent to a “relevant measuring point” (Givón, 1983, p. 15). A topic is more continuous in the discourse when it is mentioned in many subsequent clauses, without any interruption (i.e., every clause contains a reference to that topic). A high degree of topic continuity is expected when the topic persists longer in the discourse. Therefore, a more continuous topic is usually realized as a reduced anaphoric form. The referential distance criterion and the topic persistence criterion do not account for anaphoric chains realized with null pronouns in Italian, as that shown in (52).²⁵

- (52) Ricordi **l'avvocato Bianchi**? Ieri *pro_i* ha vinto il premio “Avvocato dell’anno”. Sei mesi fa *pro_j* lo_i contattai, *pro_j* lo_i misi al corrente della mia situazione e **lui_i**, **accettò di aiutarmi**. **pro_j**, **Mi sentii subito sollevato**. *pro_i* È un gran lavoratore e *pro_i* sembra molto preparato. *pro_i* Non ha mai perso una causa e *pro_j* spero lui_i vinca anche la mia.

‘Do you remember Mr. Bianchi, the lawyer? Yesterday (he) won the “Lawyer of the Year” award. Six months ago, (I) contacted him, (I) informed him about my situation and he agreed to help me. (I) immediately felt relieved. (He) is a hard worker and looks very prepared. (He) has never lost a case and (I) hope he wins mine too.’

The referential distance criterion does not hold in (52). In fact, the overt pronoun *lui* ‘he’, included in the clause *lui accettò di aiutarmi* ‘he agreed to help me’, is closer to the antecedent *l’avvocato Bianchi* ‘the lawyer Bianchi’ than the null pronoun used in subsequent clauses. In the same way, the topic persistence criterion does not hold in (52). In fact, the topic is not mentioned in the sentence *pro mi sentii subito sollevato* ‘(I) immediately felt relieved’; however, the null pronoun is used in subsequent mentions of the topic.

²⁵ Example (52) has been created by us.

Third, the potential interference criterion indicates that the number of potential antecedents affects the selection of the anaphoric form. The lower the number of potential competitors, the higher the probability that the topic is continuous. Under the potential interference criterion, the null pronoun would be expected in sentences with less competitors than in sentences with more competitors. However, a null pronoun is expected in both example (53a), in which the antecedent *Maria* has no competitors, and in example (53b), in which the antecedent *Maria* has one competitor, the complement *Alice*.

- (53) a. **Maria_i** è entrata nel negozio e **pro_i** ha salutato tutti.
 Maria is entered in the store and _ has greeted everybody
 ‘Maria entered the store and greeted everybody.’
 b. **Maria_i** ha salutato Alice_j ed **pro_i** è entrata nel negozio.
 Maria has greeted Alice and _ is entered in the store
 ‘Maria greeted Alice and entered the store.’

The *Topic Continuity Model* (Givón, 1983, 1985, 1990) has a limited predictive power in Italian since it does not properly account for the (almost) complementary distribution of null and overt pronouns, which is affected by specific syntactic-pragmatic features, as discussed in Section 3.3 below. However, we are not suggesting that the factors considered by Givón (1983, 1985, 1990) do not affect pronoun resolution. Linear distance between pronoun and antecedent may, in fact, play a role in anaphora resolution (see Ariel, 1988, 1990; Clark & Sengul, 1979; Ehrlich, 1983; Ehrlich & Rayner, 1983). For example, in two eye-tracking experiments, both Ehrlich (1983) and Ehrlich and Rayner (1983) manipulated the linear distance between a pronoun and the corresponding antecedent. The results of those two studies suggested that “pronoun assignment occurred later as the distance between antecedent and pronoun increased” (Ehrlich & Rayner, 1983). In Study IV, we suggest that the interplay between linear order of the constituents and hierarchical structure of a sentence may affect pronoun resolution, thus leading to conflicting results across anaphoric constructions. However, we also suggest that the linear order of a sentence alone cannot fully account for pronoun distribution in an NSL, such as Italian.

3.1.2 The Accessibility Theory

Under the *Accessibility Theory*, based on introspection and corpus analysis, it is argued that a speaker’s use of referential markers, such as pronouns,

depends on the degree of accessibility of the corresponding antecedents in the speaker’s and hearer’s minds (Ariel, 1988, 1990, 2001). Speakers more easily retrieve items that are more accessible in discourse. Thus, subsequent mentions of those items require referential expressions that are less “full”. Referential expressions are more or less full according to their degree of *informativity* (i.e., the proportion of lexical content), their *rigidity* (i.e., the capacity of selecting only one referent), and their *attenuation* (i.e., the phonological extent) (Ariel, 2001, p. 32). This means that the higher the degree of accessibility of an antecedent, the less informative, less rigid, and more attenuated the corresponding referential expression is. For example, a full name, such as *the teacher*, implies that the referent has a low degree of accessibility because *the teacher* is a “definite description”, highly informative, highly rigid, and unattenuated (see Ariel, 2001, p. 29). In contrast, the occurrence of the null pronoun implies that the corresponding referent is highly accessible. Ariel (1990, p. 73) proposes the *Accessibility Marking Scale*, illustrated in Table 3.

Table 3. Accessibility Marking Scale (adapted from Ariel, 1990).

Antecedent’s degree of accessibility	Referential markers
Lower	Full name + modifier > Full (“namy”) name > Long definite description > Short definite description > Last name > First name > Distal demonstrative + modifier > Proximal demonstrative + modifier > Distal demonstrative (+ NP) > Proximate demonstrative (+ NP) > Distal demonstrative>Proximate demonstrative > Stressed pronoun + gesture > Stressed pronoun > Unstressed pronoun > Cliticized pronoun > Extremely High Accessibility Markers (gaps, including pro, PRO and <i>wh</i> traces, reflexives, and Agreement).
Higher	



The first “step” of this scale shows a full referential expression (e.g., a full name with a modifier), which refers to an antecedent with a low degree of accessibility. The last “step” of this scale includes “reduced” referential markers (agreement), which correspond to antecedents with a high degree of accessibility. Ariel (1990) argues that, in languages licensing null pronouns, overt pronouns are “lower Accessibility Markers” (Ariel, 1990, p. 50). This would suggest that, in an NSL such as Italian, speakers are expected to use a null pronoun when the antecedent is more accessible, and an overt pronoun when the antecedent is less accessible. The accessibility status of the

antecedent is determined by at least four factors: distance, competition, saliency, and unity (Ariel, 1990, pp. 28–29).²⁶ An antecedent is more accessible in the discourse when distance and competition factors are low, and saliency and unity factors are high. For example, as compared to the overt pronoun *lui* ‘he’, *pro* would select an antecedent that 1) is closer in the text, 2) has fewer competitors, 3) occurs in the same paragraph in which the pronoun is located, and 4) is more salient. Similar to the *Topic Continuity Model*, the *Accessibility Theory* would not allow reliable predictions in Italian. Under the *Accessibility Theory*, linear distance and unity factors would not account for anaphoric chains with null pronouns in Italian, as previously illustrated (see (52)). In addition, the competition factor would not make good predictions in intra-sentential anaphora with two competitors, as previously shown in (53). In conclusion, the predictive power of the *Accessibility Theory* in Italian exhibits limitations that are similar to those of the *Topic Continuity Model*.

3.1.3 The Centering Theory

To discuss the distribution of null and overt pronouns in Italian, Di Eugenio, (1990, 1996) considers the *Centering Theory* (Grosz et al., 1995; Walker et al., 1998). Under the *Centering Theory*, factors affecting local coherence and salience in discourse are investigated (Grosz et al., 1995; Walker et al., 1998). A discourse consists of a succession of discourse segments, which can be defined as portions of texts containing utterances. Every utterance evokes one or more discourse entities, named forward-looking centers. Forward-looking centers represent the potential antecedents of successive referential items, such as pronouns. In (54a-c) and (55a-c), *Gianni* and *the city library* are the forward-looking centers and also the potential antecedents of subsequent pronouns.

- (54) (Adapted from Hudson-D’Zmura, 1988)
- a. Gianni went to the city library.
 - b. **He** has frequented **it** since 1994.
 - c. **He** was disappointed because **it** was closed.
- (55) (Adapted from Hudson-D’Zmura, 1988)
- a. Gianni went to the city library.
 - b. **It** is the library **he** has frequented since 1994.
 - c. **It** was closed so **he** was disappointed.

²⁶ A unity of the discourse context can correspond to the discourse world, frame or viewpoint or to a portion of the text (e.g., a paragraph).

Example (54a-c) is perceived as more coherent than example (55a-c). This different degree of coherence is due to the fact that, in (54a-c), the discourse is centered on *Gianni*, whereas in (55a-c), the discourse is alternatively centered on *Gianni* and *the city library* (see Miltsakaki & Kukich, 2000). Forward-looking centers are ranked according to saliency; in every utterance, some discourse entities are more salient than others. The degree of saliency of an entity is determined by its grammatical function (Brennan, Friedman, & Pollard, 1987), or its syntactic positions (Walker et al., 1998). Different rankings have been proposed to account for the degree of saliency of an entity, but these are not examined here. There are two different forward-looking centers that determine the degree of coherence of adjacent utterances: backward-looking centers and preferred centers.

First, the backward-looking center corresponds to the highest-ranked member among the forward-looking centers of an utterance (“U”), realized in that utterance (U_i), that has a unique link with the previous utterance (U_{i-1}). It represents the entity that the utterance is about. No utterance has more than one backward-looking center but an utterance need not necessarily have any. For example, an utterance at the beginning of a discourse has no backward-looking center, such as in (54a). *Gianni* is the backward-looking center of (54b) and (54c), whereas *the city library* corresponds to the backward-looking center of (55b) and (55c). Second, every utterance may have a preferred center. The preferred center corresponds to the highest-ranked member among the forward-looking centers of an utterance (U_i) that has a potential link to the subsequent utterances. *Gianni* is the preferred center in (54a) and (55a).

Backward-looking center and preferred center may or may not coincide. *Gianni* is the backward-looking center in (54b) and (54c) and also the preferred center in (54a). On the other hand, *the city library* is the backward-looking center in (55b) and (55c), whereas *Gianni* is the preferred center in (55a). It is this difference between backward-looking center and preferred center that affects the degree of coherence in discourse, with (54a-c) being perceived as more coherent than (55a-c). Furthermore, the degree of coherence is affected by four transition rules, exemplified in Table 4.

Table 4. Transition rules (Walker & Prince, 1996, p. 296).

Transitions	$Cb(U_i) = Cb(U_{i-1})$	$Cb(U_i) \neq Cb(U_{i-1})$
$Cb(U_i) = Cp(U_i)$:	Continue	Smooth-Shift
$Cb(U_i) \neq Cp(U_i)$:	Retain	Rough-Shift

Note: “Cb” stands for backward-looking center, “Cp” for preferred center, and “U” for utterance.

The order of the transitions is as follows: continue > retain > smooth-shift > rough-shift. Those four transitions have a different processing load. For example, a continue transition requires a lower processing load than a retain transition. For example, the transition from (54a) to (54b) is easier to process than the transition from (55a) to (55b).

As for Italian, the main claim of Di Eugenio (1990) is that null pronouns are generally used in continue transitions, in which the corresponding antecedent of the previous utterance is the most salient candidate of the set of forward-looking centers, as shown in (56b) and (56c'). By contrast, overt pronouns are generally preferred in retain and shifting transitions, such as that in (56c'') and (56c'''), respectively. In those transitions, the pronoun's antecedent in the previous utterance is not the most salient candidate of the set of forward-looking centers.²⁷

- (56) (Adapted from Di Eugenio 1990)
- a. Gianni voleva andare all' Opera la settimana scorsa.
Gianni wanted go to the Opera the week last
'Gianni wanted to go to the Opera last week.'
 - b. *pro* chiamò Mario.
— called Mario
'(He) called Mario.'
 - c'. *pro* gli propose di vedere la Turandot.
— him suggested of see the Turandot
'(He) suggested watching the Turandot.'
 - c''. Lui fu felice della telefonata.
he was happy of the phone call
'He was happy (to receive) the phone call.'

²⁷ However, Di Eugenio (1990) suggests that a null subject can also be used in a retain or a shifting transition, if grammatical constraints force the interpretation towards a specific antecedent, as shown in (iia-c):

- (ii) a. Gianni voleva andare all' Opera.
Gianni wanted go to the Opera
'Gianni wanted to go to the Opera.'
- b. *pro* chiamò Maria.
— called Maria
'(He) called Maria.'
- c. *pro* era nervos-a.
— was nervous-F
'(She) was nervous.'

c'''. Lui riattaccò improvvisamente il telefono.
 he hung up suddenly the phone
 ‘He suddenly hung up the phone.’

The *Centering Theory* focuses on inter-sentential anaphora resolution (i.e., antecedent and pronoun belong to different sentences). Di Eugenio (1990) also applies the *Centering Theory* to intra-sentential anaphora in Italian. She reports similar outcomes in the distribution of null and overt pronouns in inter-sentential and intra-sentential anaphora. However, Carminati (2002) suggests that the *Centering Theory* does not make reliable predictions in intra-sentential anaphora containing post-verbal subjects in Italian: “in intra-sentential coreference a post-verbal subject in Italian cannot be a candidate for the top ranked member of the set of forward looking centers and therefore cannot subsequently be easily referred to anaphorically by a null pronoun” (Carminati, 2002, p. 25). The results of the experiments conducted by Carminati (2002) on intra-sentential anaphora containing post-verbal subjects do not conform to the predictions of the *Centering Theory*. In fact, Italian speakers judge a sentence such as that in (57a), where the null pronoun refers to the antecedent in the highest syntactic position, to be more natural than a sentence such as that in (57b).

(57) (Adapted from Carminati, 2002, p. 104)

- a. Siccome a **Maria**_i non piace Alice_j, **pro**_i la critica spesso.
 since to Maria not likes Alice — her criticizes often
 ‘As Maria doesn’t like Alice, (she) often criticizes her.’
- b. Siccome a **Maria**_i non piace Alice_j, ? **lei**_i la critica spesso.
 since to Maria not likes Alice she her criticizes often
 ‘As Maria doesn’t like Alice, she often criticizes her.’

Similarly, under Calabrese (1986a), *pro* generally picks an antecedent in the preceding clause that corresponds to the “subject of primary predication” (Calabrese, 1986a; for details, see Section 3.3.2). In example (57a-b), *Maria* corresponds to the subject of the primary predication, and not to the subject of the sentence. Thus, both under Carminati (2002) and Calabrese (1986a), *Maria* is the antecedent of the null pronoun, in a sentence such as that in (57a).

To conclude, the *Centering Theory* does not allow reliable predictions concerning the division of labor between null and overt pronouns in Italian, at least for anaphora sentences with postverbal subjects, such as those in (57a-b).

3.2 The Null Subject Parameter

The *Null Subject Parameter* has been developed under the *Generative Framework* and includes a set of properties that co-occur in languages that license null pronouns (Chomsky, 1981, 1982; Huang, 1984; Jaeggli & Safir, 1989; Rizzi, 1982, 1986; Roberts & Holmberg, 2010, among others). Some languages exhibit a positive setting [+null subject pro] of the parameter, whereas other languages display a negative setting [–null subject pro]. However, investigating the null subject status of a language is not as straightforward of a process as it may appear (Shlonsky, 1987; see D’Alessandro, 2015 for an overview). The properties occurring in NSLs consist of 1) free inversion of subject and verb in declarative sentences, 2) *wh*-movement of the subject across the complementizer *that*, 3) rich verb-subject agreement marking, 4) licensing of null referential subjects, and 5) licensing of null expletive subjects. Italian is traditionally considered a canonical NSL because it exhibits a positive setting of the parameter. Therefore, subjects can be phonetically unrealized in finite clauses. Conversely, Swedish is a full NNSL because it displays a negative setting of the parameter; as a consequence, subjects are phonetically realized in finite clauses.

Null subject licensing determines, first, free subject inversion and *wh*-movement of the subject across the complementizer *che* ‘that’ (Rizzi, 1982).²⁸ In Italian, the subject of a sentence can be inverted in declarative sentences, as shown in (58a). However, Antinucci and Cinque (1977) notice that postverbal subjects are focalized, thus carrying new information, such as *Maria* or *lei* ‘she’ in (58a). Moreover, Belletti (2001) suggests that subject inversion in declarative sentences in Italian depends on specific discourse-related contexts. In other words, subject inversion in Italian is not completely “free”, but is instead connected to properties of the discourse. By contrast, subject inversion is not allowed in Swedish, as shown in (58b) (Platzack, 1987).

- (58) a. È tornata **Maria** / **lei**.
 Is back Maria she
 b. Är tillbaka * **Maria** / * **hon**.
 is back Maria she

²⁸ As suggested by D’Alessandro (2015), Rizzi (1982) was the first scholar to associate subject inversion and subject extraction after ‘that’ with just one factor (null subjecthood), but other scholars had previously noticed the existence of these two phenomena in NSLs (Kayne, 1980; Perlmutter, 1971, among others).

Moreover, the subject can be extracted from an embedded clause in Italian when it follows the complementizer *che* ‘that’, as illustrated in (59). This property is known as *absence of that-trace effect*.

- (59) Chi pensi **che** abbia salutato Gianni?
 who think that has greeted Gianni
 ‘Who do you think greeted Gianni?’

In Swedish, a subject cannot be extracted when it follows the complementizer *att* ‘that’, as shown in (60a) (Holmberg, 1986; Platzack, 1986). Such extraction is allowed when the complementizer is deleted, as shown in (60b).²⁹

- (60) a. Vem tror du ***att** hälsade på Jonas?
 who think you that greeted at Jonas
 ‘Who do you think *that greeted Jonas?’
 b. Vem tror du hälsade på Jonas?
 who think you greeted at Jonas
 ‘Who do you think greeted Jonas?’

Second, the rich system of verb-subject agreement marking is associated with the availability of null subjects (Jaeggli & Safir, 1989; Rizzi, 1982; Taraldsen, 1978). For example, the paradigm of the present tense of the verb *vivere* ‘to live’ in Italian has six different inflectional endings, as illustrated in (61). Thus, *viviamo* ‘(we) live’ can only refer to the pronoun in first-person plural. By contrast, the paradigm of the present tense of the verb *bo* ‘to live’ in Swedish has only one inflectional ending, as shown in (62). In this case, an overt pronoun is necessary to identify which person the verb refers to (Platzack, 1987).

- | | | | | | |
|------|---------|--------------|------|---------|----------|
| (61) | io | viv-o | (62) | jag | bo-r |
| | I | live-PRS.1SG | | I | live-PRS |
| | tu | viv-i | | du | bo-r |
| | you | live-PRS.2SG | | you | live-PRS |
| | lui/lei | viv-e | | han/hon | bo-r |
| | he/she | live-PRS.3SG | | he/she | live-PRS |
| | noi | viv-iamo | | vi | bo-r |

²⁹ Variation has been reported with respect to the that-trace effect among Scandinavian languages (see Hellan & Christensen, 1986; Holmberg, 1986; Platzack, 1986).

we	live-PRS.1PL	we	live-PRS
voi	viv-ete	ni	bo-r
you	live-PRS.2PL	you	live-PRS
loro	viv-ono	de	bo-r
they	live-PRS.3PL	they	live-PRS

However, some languages lack verbal inflection but license null pronouns, such as Chinese. To explain this apparent incongruency, Huang (1989) proposes that only languages with a morphologically uniform verbal paradigm can license null pronouns. This “uniformity” can be manifested as a complete lack of verbal inflection or as rich verbal inflection. In Chinese, the verbal paradigm is uniform in the sense that it completely lacks verbal inflection, allowing only bare verb stem. Italian can be also considered a language with a morphologically uniform verbal paradigm, but in the opposite way. In fact, Italian only allows verbs containing stem and affix. Conversely, licensing is not allowed in those intermediate languages, such as English, that exhibit both bare and affixed forms. Since Italian and Chinese have a uniform verbal paradigm, they both license null pronouns. Swedish generally lacks subject-verb agreement, as do Danish and Norwegian. However, Swedish shows agreement between 1) predicative adjective and subject, 2) attributive adjective and head, and 3) determiner and head (Holmberg & Roberts, 2013, p. 122). For this reason, Swedish can be included in the category of languages with a non-morphologically uniform verb paradigm. Thus, Swedish does not license null subjects in finite clauses.

Third, Rizzi (1986) suggests that *pro* can function as argumental, quasi-argumental, and non-argumental (hence, expletive) subject. Argumental *pro* is identified by rich agreement as in (63):

- (63) *pro* è stanc-a.
 _ be-3SG tired-F.SG
 ‘(She) is tired.’

Following Chomsky (1981), Rizzi (1986) suggests that a *quasi-argument* is a specific category of argument that, for instance, occurs with weather verbs. *Quasi-arguments* bear atmospheric or temporal theta roles, as in (64).

- (64) *pro* nevicherà.
 _ snow-FUT.3SG
 ‘(It) will snow.’

A *non-argument* is an expletive linked to an “extraposed sentential complement” (Chomsky, 1981; Rizzi, 1986). *Non-argumental* null subjects, as in (65), therefore cannot bear theta roles.³⁰

- (65) *pro* è possibile che Maria torni presto.
 – is possible that Maria return-SBJV.PRS.SG soon
 ‘(It) is possible that Maria will come back soon.’

Contrary to Italian, Swedish licenses neither referential null subjects, as shown in (66a), nor *quasi-argumental* and *non-argumental* null subjects, as illustrated in (66b) and (66c), respectively.

- (66) a. **pro* älskar dig.
 – love-PRS you
 ‘(I) love you.’
 b. **pro* snö-a-r
 – snow-stemV-PRS
 ‘(It) snows.’
 c. **pro* är möjligt att Maria kommer tillbaka snart.
 – is possible that Maria come-PRS back soon
 ‘(It) is possible that Maria will come back soon.’

The cross-linguistic validity of the *Null Subject Parameter* has been challenged by Gilligan (1987), who examined whether the combination of four null subject-properties (i.e., referential null subjects, expletive null subjects, free subject inversion and absence of that-trace effect) is present in a sample of one hundred languages. He empirically proved that only some combinations of null subject-features hold in a relatively large number of languages. The occurrence of languages that seem to constitute exceptions to the *Null Subject*

³⁰ As suggested by Rizzi (1986), a null subject can be only *non-argumental* in small clauses, as shown in (iii). By contrast, it can be neither referential, nor *quasi-argumental*, as in (iv) and (v), respectively:

- (iii) Credo *pro* possibile che Maria sia colpevole.
 believe – possible that Maria is guilty
 (iv) *Reputo *pro* colpevole.
 consider – guilty
 (v) *Ritengo *pro* troppo presto per pranzare.
 believe – too early to eat lunch

Parameter questions the existence of the parameter itself (Newmeyer, 2004).³¹ However, Roberts and Holmberg (2005) consider the findings of Gilligan (1987) to be empirical proof in favor of the *Null Subject Parameter*:

When a very large number of genetically and typologically highly diverse languages were compared for the ‘same’ properties, with no control as to the other typological features of these languages, the original correlations were shown not to hold in their original form, although four implicational statements could still be gleaned and five unsuspected language types observed. To us, this does not seem like a bad or shocking result for parametric theory, but rather a fairly promising result from the admixture of a very large amount of essentially random data into an originally carefully controlled database. The fact that any coherent patterns survived is telling, and a sign that Rizzi’s observations were clearly on the right track. (Roberts & Holmberg, 2005, p. 544)

In summary, Italian is a canonical NSL, since the setting of the *Null Subject Parameter* is positive, whereas Swedish is a full NNSL, in which the setting of that parameter is negative. Italian exhibits (nearly) free subject inversion, *wh*-movement of the subject across the complementizer *that*, a rich system of verb-subject agreement marking, referential null subjects, and expletive null subjects. By contrast, Swedish lacks those features.

3.3 Coreference in Italian

3.3.1 The Minimize Structure

Following the work of Rizzi (1986, 1997), Cardinaletti and Starke (1999) propose a classification of pronominal forms based on the contraposition between strong and deficient pronouns (the latter are divided into weak pronouns and clitics). The opposition between weak and strong forms relies on a set of parameters outlined in Sections 2.2 and 2.3. As previously illustrated, strong pronouns 1) can occur in base position, in peripheral positions, and in isolation, 2) can be coordinated, and modified, 3) are uninterpretable in non-referential positions, 4) can refer to non-prominent antecedents, and 5) can bear contrastive stress.

³¹ See d’Alessandro (2015) for a detailed discussion about the universal validity of the *Null Subject Parameter*.

Cardinaletti and Starke (1999) suggest that “a *smaller structure* is obligatorily chosen, if possible [...] Only if the smaller structure is independently ruled out, is the bigger alternative possible” (Cardinaletti & Starke, 1999, p. 198). This principle, known as the *Minimize Structure* or *Economy of Representations*, stems from the assumptions of the *Avoid Pronoun Principle* (Chomsky 1981), but these two frameworks do not make the same predictions in Italian. The first prediction of the *Minimize Structure* is that null pronouns are generally preferred over strong pronouns in unmarked contexts, as shown in (67).³²

- (67) **Gianni_i** è stato arrestato perché ? lui_i / **pro_i** ha rubato un portafoglio.
 Gianni is been arrested because he[ST] _ has stolen a wallet
 ‘Gianni has been arrested because (he) stole a wallet.’

By contrast, marked contexts require a strong overt pronoun, as illustrated in (68).

- (68) **Gianni_i** è stato arrestato perché * *pro_i* / **lui_i**, non Piero_j, ha rubato un portafoglio.
 Gianni is been arrested because _ he[ST] not Piero has stolen a wallet
 ‘Gianni has been arrested because he stole a wallet, not Piero.’

The second prediction is that, in a language with two weak pronouns, one null and one overt (*egli/ella*), the selection is free in unmarked contexts, as in (69).

- (69) **Gianni_i** è stato arrestato perché **pro_i** / **egli_i** ha rubato un portafoglio.
 Gianni is been arrested because _ he[W] has stolen a wallet
 ‘Gianni has been arrested because (he) stole a wallet.’

The third prediction is that, in a language with two types of overt pronouns, one weak (*egli/ella*) and one strong (*lui/lei*), the weak form is preferred over the strong form in unmarked contexts, as shown in (70).³³

³² We are assuming that the context is unmarked in (67), (69), and (70).

³³ Contrary to the *Minimize Structure*, the *Avoid Pronoun Principle* would predict that, in a language with two overt forms for a subject pronoun, one weak (*egli/ella*) and one strong (*lui/lei*), a free choice is possible.

- (70) Gianni_i è stato arrestato perché ? lui_i / **egli_i** ha rubato un portafoglio.
 Gianni is been arrested because he[ST] he[W] has stolen a wallet
 ‘Gianni has been arrested because he stole a wallet.’

Hence, the *Minimize Structure* predicts that weak forms represent the default option and are generally preferred over less economical forms, “if possible”. Carminati (2002) suggests that the *Economy Hypothesis* (i.e., the *Minimize Structure*) would make predictions that contradict the *PAS*. In globally ambiguous sentences such as those in (71a-b), “the Economy Hypothesis predicts that subjects will choose Ø [pro] overwhelmingly as referring to both the subject and the object antecedent” (Carminati, 2002, p. 85), as illustrated in (71a). In opposition, the *PAS* predicts that Italian speakers overwhelmingly prefer a subject antecedent, as shown in (71b) (Carminati, 2002).

- (71) a. Piero_i ha salutato Gianni_j quando *pro_{ij}* ha aperto la porta.
 Piero has greeted Gianni when _ has opened the door
 ‘Piero greeted Gianni when (he) opened the door.’
 b. **Piero_i** ha salutato Gianni_j quando ***pro_i*** ha aperto la porta.
 Piero has greeted Gianni when _ has opened the door
 ‘Piero greeted Gianni when (he) opened the door.’

In contrast with Carminati (2002), we argue that the *PAS* and the *Minimize Structure* would make similar predictions in globally ambiguous intra-sentential anaphora sentences. Under the *Minimize Structure*, a null pronoun is preferred over an overt pronoun in an unmarked context, such as that in (72a), whereas an overt pronoun is preferred in a marked context, such as that in (72b).

- (72) a. **Piero_i** ha salutato Gianni_j quando ***pro_i*** ha aperto la porta.
 Piero has greeted Gianni when _ has opened the door
 ‘Piero greeted Gianni when (he) opened the door.’
 b. Piero_i ha salutato **Gianni_j** quando **lui_j** ha aperto la porta.
 Piero has greeted Gianni when he has opened the door
 ‘Piero greeted Gianni when he opened the door.’

The main difference between the two theories is that, contrary to the *Minimize Structure*, the *PAS* suggests the occurrence of a positional bias in which each pronoun picks an antecedent in a certain position: the SpecIP

position for the null pronoun, and a position different from that of the SpecIP for the overt pronoun.³⁴

3.3.2 Null Pronoun and Thema

In the theoretical framework proposed by Calabrese (1986a), unstressed pronouns would correspond to what Cardinaletti and Starke (1999) call weak pronouns, whereas stressed pronouns would correspond to strong pronouns. This association between strong/stressed pronouns and weak/unstressed pronouns is misleading in Italian (see Cardinaletti & Starke, 1999; Di Eugenio, 1990). In Italian, weak pronouns can also be stressed and strong pronouns can be unstressed (Cardinaletti & Starke, 1999). Thus, in the present thesis, we will not adopt the terms *unstressed/stressed* pronouns as used in Calabrese (1986a).

In certain structural contexts, such as intra-sentential anaphora, the null pronoun selects an “expected referent”, which occurs in the preceding clause. With the term “expected referent”, Calabrese (1986a) indicates the Thema, corresponding to “the subject of a primary predication”. The “expected referent” in (73), which is also called “aboutness subject” (Rizzi 2018), corresponds to *Maria*. Therefore, if *Maria* is the person who feels guilty, Italian speakers are expected to use a null pronoun in (73).

- (73) Quando **Maria_i** sgrida Gianna_j, **pro_i/?_j** si sente in colpa.
 when Maria scolds Gianna _ herself feels in guilt
 ‘When Maria scolds Gianna, (she) feels guilty.’

By contrast, overt strong pronouns, such as *lui/lei*, select a referent that is “not expected”, such as *Gianna* in (74). As a consequence, if *Gianna* is the person who feels guilty, speakers are expected to use an overt strong pronoun in (74).³⁵

³⁴ Another proposal on antecedent assignment patterns in Italian, the *Overt Pronoun Constraint* (Montalbetti, 1984), is worth mentioning here. Montalbetti (1984) suggests that, in an NSL like Italian, overt pronouns of embedded clauses cannot be bound by quantified antecedents (i.e., *nobody*) or *wh*-antecedents, in contrast with null pronouns. Since the present work does not include quantified antecedents or *wh*-antecedents, this theory remains beyond the scope of the present thesis.

³⁵ As observed by Rizzi (2018), the theoretical proposal by Calabrese (1986a) is strictly linked to the *Avoid Pronoun Principle* (Chomsky, 1981).

- (74) Quando Maria_i sgrida **Gianna_j**, lei_{2ij} si sente in colpa.
 when Maria scolds Gianna she herself feels in guilt
 ‘When Maria scolds Gianna, she feels guilty.’

Calabrese (1986a) argues this effect to be based on the interaction between two principles. Principle 1 states that a strong pronoun is used when the occurrence of its referent is unexpected. Principle 2 states that a subject pronoun picks another subject as its antecedent in the immediate context. However, the reliability of those principles seems to be restricted to certain sentence configurations. For example, the model of Calabrese (1986a) seems not to apply to anaphora sentences containing postverbal subjects, as illustrated in (75):

- (75) Quando ha parlato **Gianni_i**, **pro_i* ha alzato la voce.
 when has spoken Gianni _ has raised the voice
 ‘When Gianni spoke, (he) raised his voice.’

In (75), the subject of the predication, *Gianni_i*, is not in preverbal position (the position for Thema) and therefore cannot be referred to by a null pronoun. This may be due to the fact that the postverbal subject position is focalized in Italian (Antinucci & Cinque, 1977; Belletti, 2004). However, Calabrese (1986a) and subsequently Rizzi (2018) notice that an overt pronoun would also be unacceptable in that sentence, as shown in (76):

- (76) Quando ha parlato **Gianni_i**, **lui_i* ha alzato la voce.
 when has spoken Gianni he has raised the voice
 ‘When Gianni spoke, he raised his voice.’

Rizzi (2018) consequently claims that the unacceptability of (75) and (76) may depend on reasons that are not directly linked to the reliability of Principles 1 and 2 proposed by Calabrese (1986a). In any case, those observations raise relevant questions about the impact of focalization in antecedent assignment.

Under Calabrese (1986a), it is predicted that, when the antecedent corresponds to the “subject of a primary predication” in a preceding clause, an overt strong pronoun is preferred over the null pronoun only if the null pronoun is ruled out for independent reasons, such as when the subject pronoun is focalized. Consequently, in an intra-sentential anaphora sentence, such as that in (77), an overt strong pronoun can more plausibly be assigned to

Gianni if the pronoun is focalized, thus being associated with a higher level of prosodic prominence:

- (77) Gianni_i ha telefonato a Piero_j quando lui_j / LUI_{i/j} si è sposato.
 Gianni has phoned at Piero when he HE himself is married
 ‘Gianni called Piero when he got married.’

In addition, Calabrese (1986b) suggests that, in anaphora sentences with two competing antecedents, *pro* co-refers to a topical antecedent in Italian, as illustrated in (78):

- (78) **Gianni**_i ha telefonato a Piero_j quando **pro**_i si è sposato.
 Gianni has phoned at Piero when – himself is married
 ‘Gianni called Piero when (he) got married.’

To conclude, we argue that the terms unstressed (weak) pronoun and stressed (strong) pronoun, as used by Calabrese (1986a), may lead to conflicting predictions. In (77), the overt strong pronoun *lui* ‘he’ can be either unstressed or stressed. If unstressed, it generally refers back to an antecedent that is “not expected” (Calabrese, 1986a), corresponding to the complement *Piero* in (77). However, if that same pronoun is focalized, bearing contrastive stress, it may also refer back, to a certain extent, to the aboutness subject.

3.3.3 The Aboutness-Shift Topic

The impact of specific intonational properties on the distribution of overt pronouns is addressed by Frascarelli (2007). She suggests that strong pronouns are generally produced with a rising tone (“L*+H” in the glosses), whereas weak pronouns are generally produced with a low tone (“L*” in the glosses), and they are integrated, from a prosodic perspective, in the surrounding environment. Specific intonational properties of pronouns are associated with different types of topic (Frascarelli, 2007).³⁶ First, pronouns with a rising L*+H contour usually refer to aboutness-shift topics. The aboutness-shift topic has the role of reintroducing a topic in the discourse (Frascarelli, 2007; Frascarelli & Hinterhölzl, 2007). Second, pronouns produced with an L* tone usually refer to familiar topics. Third, pronouns with a high pitch (“H pitch”) usually refer to contrastive topics. Under this perspective, Frascarelli (2007)

³⁶ See Bocci (2013) for a cartographic approach to the syntax/prosody interface in Italian.

argues that the overt pronouns *lui/lei* ‘he/she’ can also be weak, as shown in (79). In this case, overt pronouns behave as *pro*, regardless of their syntactic function or their distance from the antecedent (Frascarelli, 2007, p. 713).

(79) (Adapted from Frascarelli, 2007, p. 712)

domani devo andare con mio fratello_z e mia cognata_k a comprare le fedi [...] pro_{z+k} restano qui alla Garbatella per il momento – comunque lei_k (L+H) mi ha detto che appena pro_k può pro_k se ne va perché non per la zona credo perché è la casa dove lei_k [L*] è cresciuta per cui – bene o male la casa (L*+H) sì qualcosa l'hanno cambiata quando i genitori sono andati via però lei_k [L*+H] dice cioè mi muovo nella casa che per me è la casa dei miei genitori...*

‘tomorrow I must go with my brother_z and my sister-in-law_k to buy the wedding rings [...] they_{z+k} are staying here at the Garbatella [a neighborhood in Rome] for the moment – anyway she_k (L*+H) told me that as soon as pro_k can pro_k moves because, not for the zone, I think because this is the house where she_k [L*] grew up so that, yeah, more or less, something was changed in the house (L*+H) when her parents left however she_k [L*+H] says well I feel I’m moving in the house that was my parents’ house...’

In example (79), Frascarelli (2007) distinguishes between the weak pronoun *lei* ‘she’, produced with a low tone in the sentence *perché è la casa dove lei_k [L*] è cresciuta* ‘because this is the house where she grew up’, and the strong pronoun *lei*, produced with a rising tone in the sentence *però lei_k [L*+H] dice* ‘however she says’. In the latter case, the pronoun *lei* with a rising tone signals a shift from the hanging topic *la casa* ‘the house’ to the aboutness-shift topic *mia cognata* ‘my sister-in-law’. Therefore, the overt pronouns *lui/lei* with a low tone are likely to behave like weak pronouns, whereas they behave like strong pronouns when bearing a high pitch. The proposal by Frascarelli (2007) focuses on discourse chunks, and not on isolated sentences, such as those considered in the present work. That model is thus not applicable to intra-sentential anaphora sentences, but it does have a relevant theoretical impact on the role of intonational properties in pronoun distribution in Italian.

3.3.4 The Position of Antecedent Strategy

Carminati (2002) administered different experiments to L1 Italian speakers in order to test the hypothesis that overt and null pronouns present a positional bias. The focus of Carminati (2002) is the third-person singular pronoun, which can potentially refer to different available antecedents. As previously

mentioned, the findings of Carminati (2002) for intra-sentential anaphora suggest that the null pronoun in Italian is generally associated with the antecedent in the SpecIP position, usually corresponding to the subject antecedent. In addition, the overt pronoun is generally associated with an antecedent in a syntactic position lower than the SpecIP, usually corresponding to the object antecedent. This is shown in (4), here repeated as (80a-b). The opposite interpretive patterns for null and overt pronouns are not ungrammatical, but they would appear pragmatically unexpected to a native speaker of Italian, as shown in (81a-b).

- (80) a. **Gianni_i** frequenta Piero_j da quando *pro_i* ha divorziato.
 Gianni hangs out Piero from when _ has divorced
 ‘Gianni has been hanging out with Piero since (he) divorced.’
 b. **Gianni_i** frequenta **Piero_j** da quando **lui_j** ha divorziato.
 Gianni hangs out Piero from when he has divorced
 ‘Gianni has been hanging out with Piero since he divorced.’
- (81) a. **Gianni_i** frequenta **Piero_j** da quando *pro_j* ha divorziato.
 Gianni hangs out Piero from when _ has divorced
 ‘Gianni has been hanging out with Piero since (he) divorced.’
 b. **Gianni_i** frequenta Piero_j da quando **lui_i** ha divorziato.
 Gianni hangs out Piero from when he has divorced
 ‘Gianni has been hanging out with Piero since he divorced.’

The *PAS* was tested by measuring response preferences, acceptability judgments, and response times in a variety of intra-sentential contexts:³⁷

- different types of clauses (e.g., temporal clauses, if-clauses, complement clauses of report and belief verbs, existential *there*-sentences, among others);
- different types of subjects, such as canonical subjects and non-canonical subjects (e.g., expletive);
- anaphora sentences with different types of antecedents (e.g., one-antecedent sentences, two-antecedent sentences, quantified antecedents);
- different types of structures at the sentence level (e.g., subject-inverted structures);
- anaphora sentences with different degrees of ambiguity (e.g., globally ambiguous sentences and non-ambiguous sentences).

³⁷ Carminati (2002) assumes a difference in terms of sentence processing, between intra-sentential and inter-sentential anaphora.

Other possible theoretical frameworks are ruled out in each experiment by Carminati (2002). Contrary to previous theories, which supported an economy principle or an ambiguity-avoidance strategy, the *PAS* suggests a division of labor between null and overt pronouns, based on a configurational/positional bias (Carminati, 2002). While the *PAS* clearly holds for globally ambiguous sentences or for sentences with two competitors (such as the sentences used in the present study), it is also evident that the overt pronoun bias is less clear in non-ambiguous contexts with either one or two antecedents (Carminati, 2002, p. 303).³⁸ The expectations of the *PAS* have been tested on other NSLs, such as Spanish, Greek and Croatian, and on bilingual speakers (see Section 4 below). Finally, the *PAS* consider pronouns that do not bear contrastive stress (Carminati, 2002, p. 320). Stress has a relevant role in pronoun resolution but is not the only prosodic cue that may affect the anaphoric reference (see the next section for details).

3.4 Pronouns and Prosody in Empirical Investigations

As previously mentioned, the distinction between weak and strong pronouns in Swedish is directly associated with stress (Hellan & Platzack, 1999). The third-person singular pronouns *han* ‘he’ and *hon* ‘she’ are strong when they bear stress in spoken Swedish (Hellan & Platzack, 1999). In Italian, the opposition between weak and strong pronouns is morphological, since *lui* ‘he’ and *lei* ‘she’ are strong forms, whereas *egli* ‘he’ and *ella* ‘she’, as well as the null pronoun, are weak (Cardinaletti & Starke, 1999). However, contrastive stress also plays a relevant role in anaphora resolution in Italian. The occurrence of stress is not mandatory in Italian (cf. Calabrese, 1986a), but depends on pragmatic properties. In addition, Carminati (2002) suggests that the *PAS* is limited to unstressed pronouns, and Frascarelli (2007) claims that overt pronouns in Italian are weak when they are produced with a low tone, and strong when produced with a rising tone. Nevertheless, stress is not the only factor that influences pronominal reference. Speakers and listeners are sensitive to the functions of intonation (Arnold Kaiser, Kahn, & Kim, 2013). However, research is still needed to clarify “how speech reflects the linguistic

³⁸ Sorace and Filiaci (2006) suggest that syntactic-pragmatic features are likely to be more “relaxed” in non-ambiguous sentences because the risk of misunderstanding is lower in comparison with globally ambiguous sentences.

categories of information status” (Arnold et al., 2013). As for pronominal reference, previous research has investigated how pauses, nuclear accent placement, F0 movements, pitch reset, duration, amplitude, and other prosodic cues affect the interpretation of anaphora sentences (De Hoop, 2004; Goad et al., 2018; Jasinskaja et al., 2005, 2007; McClay & Wagner, 2014; Rello & Llisterri, 2012, among others). In those experimental investigations, the role of prosodic cues in pronoun resolution has been addressed in both perception and production studies.

Jasinskaja et al. (2005) conducted a perception study on the interpretation of ambiguous third-person pronouns in German, by manipulating the pitch range of the target sentences and the pause duration between sentences. Their main research question was whether prosodic cues, such as pause and pitch range, contribute to remove the structural ambiguity, at the perceptual level, of a discourse such as that in (82a-d).

(82) (Adapted from Jasinskaja et al., 2005)

- a. **Lena_i** war glücklich nach dem Tennisturnier.
 Lena was happy after the tennis tournament
 ‘Lena was happy after the tennis tournament.’
- b. **Die Silbermedaille** war ein großer Erfolg.
 the silver medal was a great achievement
 ‘The silver medal was a great achievement.’
- c. **Die Trainerin_j** gratulierte nach der Siegerehrung.
 the coach_F congratulated after the award ceremony
 ‘The coach congratulated [her] after the award ceremony.’
- d. Für das nächste Turnier wünscht **sie_{i/j}** sich allerdings
 for the next tournament wishes she herself however
 den ersten Platz.
 the first place
 ‘For the next tournament, however, she hopes for first place.’

Two interpretations of the discourse illustrated in (82a-d) are possible. On the one hand, sentence (82d) can be attached high in the tree and the ambiguous pronoun *sie* ‘she’ is therefore assigned to *Lena* in (82a). On the other hand, sentence (82d) can be attached low and, therefore, the pronoun refers to *die Trainerin* ‘the coach’ in (82c). These two interpretations are assumed to exhibit different prosodic realizations (Jasinskaja et al., 2005). In the high-attachment condition, a longer pause and a pitch reset³⁹ between (82c) and (82d) are

³⁹ This means that pitch range is compressed in one sentence, whereas it is expanded in the other sentence.

expected because the structural break between the sentence containing the ambiguous pronoun and the sentence containing the antecedent *Lena* is relatively large. In the low-attachment condition, a shorter pause and lack of pitch reset are expected because the ambiguous pronoun refers to the antecedent in the immediately preceding sentence, *die Trainerin* ‘the coach’. The question thus becomes whether this difference is used by hearers to disambiguate the discourse. A positive answer would suggest that “global prosodic features contribute to the interpretation of linguistic expressions by disambiguating structurally ambiguous discourses” (Jasinskaja et al., 2005, p. 5). The results of Jasinskaja et al. (2005) confirm their hypothesis that pitch range and pause – global prosodic features of the utterance – influence the resolution of ambiguous pronouns. Specifically, the participants preferred the second antecedent, *die Trainerin* ‘the coach’, when there was a short pause between sentences (82c) and (82d), and a decreasing pitch range over the entire sequence. By contrast, the participants preferred the first antecedent, *Lena*, when there was a long pause and a pitch reset between sentences (82c) and (82d).

Similar considerations about the relationship between pause and sentence attachment are provided by White et al. (2017), who examine whether L1 and L2 speakers of Italian are influenced by pause (and pronoun stress) when they resolve globally ambiguous anaphora sentences containing a main clause and a subordinate temporal clause introduced by *quando* ‘when’. The theoretical framework related to the distribution of null and overt pronouns in Italian, assumed in that study, is the *PAS*. White et al. (2017) hypothesize that inconsistent results reported in previous studies on anaphora resolution may be determined by the impact of prosody, which has not been explored by previous research. Following Fodor (2002), the authors assume that a silent prosodic contour, projected by speakers when they mentally read sentences, may explain previous contrasting results. In particular, they hypothesize that, in the case of intra-sentential anaphora, the presence of a pause between main and subordinate clause would have an impact on sentence attachment. They consider Frazier (1978), who claims that speakers and hearers tend to attach new items to the clause or phrase that is being processed (if grammatically acceptable).⁴⁰ The preference for low attachment is likely to be affected by the occurrence of a pause between main and subordinate clause, in the case of

⁴⁰ The universal validity of the *Late Closure Principle* (Frazier, 1978) has been challenged by studies focusing on languages other than English, such as Spanish (Cuetos & Mitchell, 1988). However, the *Late Closure Principle* is generally operative in Italian (De Vincenzi & Job, 1993).

intra-sentential anaphora in Italian (White et al., 2017). Specifically, the authors suggest that an intonational break would cause a re-analysis of the subordinate temporal clause containing null pronouns, which would be attached too high in the tree. This would therefore prevent the *PAS* from operating. This hypothesis was initially confirmed by White et al. (2017). However, in a subsequent study including more participants (Goad et al., 2018), the findings suggest, unexpectedly, a lack of the effect of pause on anaphora sentence interpretation.⁴¹

In a study focusing on speech production in L1 Spanish, Rello and Llisterri (2012) explore how speakers use several prosodic cues in discourse to resolve anaphora sentences containing ambiguous pronouns. The theoretical background of the study is the *Centering Theory* (Grosz et al., 1995; Walker et al., 1998), as well as the computational models developed by Mitkov (2002). Rello and Llisterri (2012) assume that, in the case of ambiguous pronouns, speakers rely on information provided by the discourse in order to resolve the ambiguity. Prosody represents one of the sources of information for monitoring reference in discourse. Therefore, speakers are likely to use prosodic cues to identify the correct antecedent of an ambiguous pronoun. In particular, Rello and Llisterri (2012) predict that, when different competing antecedents are available, the speakers would prefer the most salient or the most central one. When a linguistic item is prosodically prominent, it would be perceived as more salient. Therefore, duration, amplitude, and F0 range of the target pronoun were measured in two different experimental conditions (i.e., the “close antecedent” condition and the “further antecedent” condition). Moreover, the intonational break immediately preceding the ambiguous pronoun, such as the pause between *luego* ‘then’ and *ella* ‘she’ in (83a-b), was also measured. The method includes a short discourse (approximately six utterances, each utterance containing one or more clauses), as that in (83a-b):

(83) (Rello & Llisterri, 2012, pp. 200-201)

- a. Este domingo, Pilar ha decidido llevar por fin a su hija Ainara al parque de atracciones. [...] *Ainara* compraba una nube de azúcar mientras *Pilar* se comía un helado; luego, ella se subió a la noria. Era enternecedor ver cómo la niña saludaba a su madre desde las alturas, gritando de alegría.

This Sunday, Pilar has finally decided to take her daughter Ainara to the amusement park. [...] *Ainara* was buying a sugar cloud while *Pilar* was eating an ice cream; then, she got on to the Ferris wheel. It was touching to see how the girl was waving at her mother from the heights, shouting with joy.

⁴¹ The study by Goad et al. (2018) is illustrated in detail in Section 4.3 below.

- b. Este domingo, Pilar ha decidido llevar por fin a su hija Ainara al parque de atracciones. [...] *Pilar* compraba una nube de azúcar mientras *Ainara* se comía un helado; luego, ella se subió a la noria. Era enternecedor ver cómo la niña saludaba a su madre desde las alturas, gritando de alegría.

This Sunday, Pilar has finally decided to take her daughter Ainara to the amusement park. [...] *Pilar* was buying a sugar cloud while *Ainara* was eating an ice cream; then, she got on to the Ferris wheel. It was touching to see how the girl was waving at her mother from the heights, shouting with joy.

The discourse in (83a-b) was provided in two different versions. In one version, the further antecedent condition, the ambiguous pronoun was relatively far from the “correct” antecedent, *Ainara*, as shown in (83a). In the other version, the close antecedent condition, the pronoun was closer to the “correct” antecedent, *Ainara*. The participants first completed an interpretation task, in which they had to identify the “correct” antecedent (*Ainara*). They then read the story out loud. The results show first that the pause between *luego* ‘then’ and *ella* ‘she’ was longer in the further antecedent condition than in the closer antecedent condition. This finding mirrors the results reported by Jasinkaja et al. (2005) for the pause in German (see Rello & Llisterri, 2012). Second, the pronoun tended to be shorter in the further antecedent condition than in the closer antecedent condition. Third, trading relation between the pronoun’s duration and its F0 range and occurrence of pause were also reported. Finally, no significant effect was found for amplitude. Thus, the authors concluded that, despite inter-speaker variation, prosody may affect pronominal reference in Spanish.⁴² As underlined by Rello and Llisterri (2012), prosodic prominence has a relevant role in information structure. In particular, it was suggested that salient entities are expected to be realized as prosodically prominent items. In fact, prosodically prominent items are likely to “stand out” from the surrounding environment (Terken & Hermes, 2000, p. 89). Intensity, length, and F0 are considered primary predictors of prominence (Terken & Hermes, 2000). At the perceptual level, they correspond to loudness, duration, and pitch, respectively (Terken & Hermes, 2000).

However, the relationship between prosodic prominence and information status of an item is not limited to the notion of saliency in discourse. Wagner and Watson (2010) discuss earlier research in which prosodic prominence has been explored in relation to the notion of predictability. Specifically, it is suggested that prosodic prominence has an inverse relation with predictability

⁴² Spanish is an NSL. We therefore suggest that the alternation between overt and null pronouns should be considered in a discourse such as that in (83a-b).

(or frequency) of a linguistic item (see Alylett & Turk, 2004; Baumann & Roth, 2014; Bell, Brenier, Jurafsky, & Girand, 2002; Gahl & Garnsey, 2004, among others). For example, linguistic items that are unpredictable are more likely to lend acoustic measures of prominence than items that are more predictable (see Wagner & Watson, 2010 for an overview).

Baumann and Roth (2014) argue that there is an inverse relation between coreference and prominence in German. In German, new information is generally accompanied by a higher degree of prominence, realized by pitch accents. Contrastingly, coreferential anaphora, corresponding to given information, is usually deaccented. The authors hypothesize that German hearers avoid associating an anaphoric item, such as *deine Cousine* ‘your cousin’, with an available antecedent, such as *Tamara*, when such an antecedent is prosodically prominent. They also hypothesize that the three main predictors of prominence – F0 movement, duration, and intensity – have a different impact in speech perception. Specifically, F0 movement has the highest impact on the perception of non-coreference, followed by duration and, finally, intensity (Baumann & Roth, 2014). The method consists of a perception task in which German hearers judged the probability, on a gradient scale, that the target antecedent (e.g., *Tamara*) refers to a certain anaphoric item, such as *your cousin*. The authors manipulated the degree of prominence of the stressed syllable of the target item (e.g., *ta-MA-ra*), in terms of F0 movements (rise, fall or no tonal movement), duration (long or short), and intensity (loud or soft). The findings reveal that, when the target syllable was longer and had a rising contour, the target item was generally judged as non-coreferent with the anaphoric item, as predicted. Unexpectedly, intensity did not exhibit a significant effect on the perception of non-coreference. Tonal movement had the most relevant impact on the speaker’s perception of non-coreference, followed by duration (Baumann & Roth, 2014).

In summary, the role of intonation in pronominal reference is not limited to the occurrence of stress, both in speech production and perception. In discourse, global prosodic factors, such as pause and pitch reset, are likely to influence the selection of the antecedent because they are connected with the hierarchical structure of the sentences. As for intra-sentential anaphora, it has been suggested that the *PAS* does not take into account the potential effect of prosodic cues, and that prosody is likely to explain inconsistent results reported in previous research with respect to anaphora resolution.

4. Anaphora Resolution in L1 Attrition Research

When living in an FL environment for a longer period of time, late bilinguals are likely to show L1 attrition on anaphora sentences in terms of response preferences and response times (see Chamorro et al., 2016; Genevska-Hanke, 2017; Gürel, 2004; Kaltsa et al., 2015; Köpke & Genevska-Hanke, 2018; Tsimpli et al., 2004). In **Section 4.1**, we provide an overview of earlier research on attrition in anaphora resolution. The manifestations of attrition effects on anaphora resolution have been explained as difficulties at the processing level (Sorace 2011) or as the result of knowledge restructuring (Tsimpli et al., 2004). In this perspective, the temporary status of attrition represents a relevant topic of investigation. Consequently, in **Section 4.2**, previous research on the temporariness of attrition effects is discussed (Chamorro et al., 2016; Genevska-Hanke, 2017; Köpke & Genevska Hanke, 2018). **Section 4.3** contains a discussion of a crucial aspect, prosody, that has considered in previous research on L1 attrition, with a focus on speech production.

4.1 Anaphora Resolution in Late Bilingualism

Pronoun resolution represents a fertile topic of investigation for research in bilingualism because it has relevant theoretical implications connected with acquisition, maintenance and erosion of Universal Grammar (“UG”)-based properties (Gürel, 2019, p. 252). In the 1980s, the *Null Subject Parameter* was investigated in L2 acquisition research, which focused on several properties attributed to this parameter, such as licensing of null subjects, free subject inversion, and absence of that-trace effect (Emberson, 1986; Hilles, 1986; Liceras, 1988, 1989; Phinney, 1987; White, 1985, 1989). The principal topic of discussion concerned whether either [+null subject pro] or [–null subject pro] represent the unmarked/default setting and whether individuals who speak

an NSL (e.g., Spanish) and an NNSL (e.g., English) efficiently reset the parameter in L2 acquisition. Hyams (1983) suggested that [+null subject pro] represents the unmarked parameter and that L2 learners of an NNSL with an NSL as L1 need to switch the parameter setting from [+null subject pro] to [-null subject pro]. In contrast, White (1985) argued that [-null subject pro] represents the unmarked option and that parameter re-setting is not effective during the first stages of L2 acquisition, being a source of errors. Therefore, overt pronouns represent the default form and speakers who learn an NSL will acquire null pronouns at a later stage (White, 1989).

White (1985) examined subject omission, subject-verb inversion, and that-trace effect in an experimental group of L2 English speakers with L1 Spanish (an NSL) and a control group of L2 English speakers with L1 French (an NNSL). The participants judged the accuracy of sentences in L2 English in which 1) subject pronouns were omitted, 2) the subject was placed after the verb in declarative sentences, and 3) the subject was or wasn't extracted from an embedded clause after the complementizer *that*. The results revealed a significant difference in grammatical judgments between the two groups, with L1 Spanish speakers exhibiting a higher proportion of errors than L1 French speakers. The author concluded that L2 learners may have difficulties when changing an UG parameter, and this would cause interference errors, at least at initial stages of L2 acquisition (White, 1985, p. 22).

As highlighted by Gürel (2019, p. 252), subsequent research on L2 acquisition has explored pronoun distribution and syntactic-pragmatic features in bilingual adults and children (see Belletti et al., 2007; Cardinaletti, 2005; Gürel, 2006; Roberts, Gullberg, & Indefrey, 2008; Rothman & Iverson, 2007; Serratrice, 2007; Serratrice, 2013; Serratrice, Sorace, Filiaci, & Baldo, 2011; Sorace & Filiaci, 2006; Tsimpli & Sorace, 2006).

Previous theories on L2 acquisition in the pronominal domain have benefited from increased interest in L1 attrition, which consists of the erosion of an L1 as a consequence of reduced exposure to L1 input and regular use of an FL. In a narrow definition, L1 attrition refers to language changes affecting late bilinguals, speakers who moved to an FL environment after puberty, when the L1 had already been established. In the case of pre-puberty bilingualism, the L1 follows a developmental path that is qualitatively different from that of monolinguals due to the co-existence of two languages. Therefore, L1 attrition research has challenged the assumption that, once speakers reach maturity, their L1 remains stable over time (Schmid & de Leeuw, 2019). One linguistic domain that is highly vulnerable to L1 attrition is the lexicon, since late bilinguals generally exhibit difficulties in accessing lexical items in their L1

(Ammerlaan, 1996; Olshtain & Barzilay, 1991; Pavlenko, 2003, 2004). Another domain that has been extensively investigated in L1 attrition research is that of grammar. Crucially, grammatical attrition has been claimed to be selective, with some linguistic phenomena and domains being more vulnerable than others (Schmid & Köpke, 2017; Schmid & de Leeuw, 2019).

The selectivity of L1 attrition has been explained under the *Interface Hypothesis* (Sorace & Filiaci, 2006; Sorace & Serratrice, 2009; Tsimplici & Sorace, 2006, and related work). This theoretical account aims at providing a unified framework to explain non-native-like behaviors in L1 attrition, L2 acquisition and L1 acquisition in bilingualism. The main idea is that linguistic phenomena pertaining to different interfaces can be more or less acquirable or vulnerable. When an internal interface is involved, such as the interface between syntax and other modules of grammar (e.g., formal semantic features), linguistic phenomena are completely acquirable by L2 speakers and are resistant to L1 attrition (Sorace & Filiaci, 2006). Conversely, when an external interface is involved, such as the interface between syntax and pragmatics, linguistic phenomena are not completely acquirable and are vulnerable to L1 attrition (Sorace & Filiaci, 2006). Bilingual speakers are therefore expected to exhibit non-native-like behaviors in L2 acquisition and to exhibit L1 attrition with respect to pronoun resolution, since this phenomenon pertains to an external interface (i.e., the interface between syntax and pragmatics). In addition, Sorace and Filiaci (2006) suggest that bilinguals struggle to coordinate syntactic and pragmatic information. Therefore, deviations from the L1 target or the L2 target are mainly determined by inadequate processing strategies. In the first version of the *Interface Hypothesis*, changes at the representational level were not excluded, but were assumed to have a less relevant impact than processing-level difficulties (see Sorace & Filiaci, 2006; Sorace & Serratrice, 2009). In a second formulation of the *Interface Hypothesis*, the possibility that attrition affects L1 representations has been excluded (Sorace, 2011). This updated version of the *Interface Hypothesis* has been examined by Chamorro et al. (2016), who investigated the temporariness of attrition effects. If attrition affects representation, changes in the L1 should be permanent. Conversely, if attrition pertains to processing, changes in the L1 should be temporary. The findings of Chamorro et al. (2016) support the processing account (Sorace, 2011), since attrition effects are likely to decrease after re-immersion in the L1-speaking environment (for details, see Section 4.2 below).

Another theoretical proposal that accounts for the selectivity of L1 attrition effects is the *Representational/Underspecification Account* (see Belletti et al.,

2007; Tsimpli, 2007; Tsimpli et al., 2004). Tsimpli et al. (2004) discuss L1 attrition effects on anaphora resolution under the *Generative Framework*. They investigate pronoun resolution in late L1 Italian-L2 English bilinguals, late L1 Greek-L2 English bilinguals, and two control groups, L1 Italian and L1 Greek speakers. Here, I report only the results for pronoun interpretation in Italian, where target sentences consisted of globally ambiguous intra-sentential anaphora, including forward anaphora, as that in (84), and backward anaphora, as that in (85):

(84) *Forward anaphora* (Tsimpli et al., 2004, p. 270)

L' anziana signora_i saluta la ragazza_j quando *pro*_i / lei_{j/k} attraversa la strada.
 The old woman greets the girl when — she crosses the street
 'The old woman greets the girl when she is crossing the street.'

(85) *Backward anaphora* (Tsimpli et al., 2004, p. 270)

Quando *pro*_i / lei_{j/k} attraversa la strada, l' anziana signora_i
 when — she crosses the street the old woman
 saluta la ragazza_j.
 greets the girl
 'When she is crossing the street, the old woman greets the girl.'

In intra-sentential anaphora sentences, such as those in (84) and (85), the canonical pattern in L1 Italian would expect null pronouns to be associated with subject antecedents, and overt pronouns to be associated with a “new” element (the object or an extralinguistic referent). In a picture verification task, the participants selected one picture matching with the sentence of interest, such as those in (84) and (85). For each sentence, three pictures were presented. In one picture, the agent of the action described in the subordinate clause corresponded to the subject of the main clause; in another picture, it corresponded to the object of the main clause; and in the third, it corresponded to an external referent (i.e., someone not mentioned in the target sentence). The results revealed that late L1 Italian-L2 English bilinguals exhibit more unexpected responses than Italian monolinguals in the interpretation of anaphora sentences containing overt pronouns, thus suggesting a certain degree of ambiguity. Unlike the monolinguals, the bilinguals clearly interpret null pronouns as coreferential with the subject antecedent. Unexpectedly, the Italian monolinguals exhibit a measure of indeterminacy when they interpreted null pronouns in forward anaphora. Tsimpli et al. (2004) claim that L1 attrition is selective, since it impacts interpretable features in the representations (corresponding to pronoun distribution), but not uninterpretable features

(corresponding to the syntactic constraints that regulate the null pronoun licensing). Concerning interpretable features, CLI from English to Italian is likely to explain why late bilinguals do not conform to monolinguals. In fact, Italian and English differ with respect to pronoun distribution. In Italian, syntactic-pragmatic features in pronoun distribution are relatively strict, since null pronouns are generally realized in [–topic shift] contexts, whereas overt pronouns are generally realized in [+topic shift] contexts. Overt pronouns in English can instead be realized in both [–topic shift] and [+topic shift] contexts. The direction of CLI is always expected from the language with stricter coreference patterns (e.g., Italian) to the language with uncategorical coreference patterns (e.g., English). Therefore, the overt pronoun in Italian, which is associated with “new” information, exhibits emerging optionality when is in contact with the overt pronoun in English, which may be associated with either “old” or “new” information. Under this perspective, non-native-like behaviors are the consequence of CLI from the NNSL to the NSL.

However, bilinguals are also likely to differ from monolinguals in pronominal coreference when the languages under investigation are typologically related (e.g., two NSLs). In particular, L2 speakers of Italian with L1 Spanish (Bini, 1993) and L2 speakers of Spanish with L1 Greek (Lozano, 2006; Margaza & Bel, 2006) showed a non-native distribution of pronouns in the L2. This finding seems to suggest that CLI plays a minor role in anaphora resolution. However, previous research reports that the distribution of overt and null pronouns is not clear in Spanish. In particular, the overt pronoun is not consistently associated with [+topic shift] contexts in Spanish, in the case of intra-sentential anaphora (Jegerski, et al. 2011; Keating et al., 2011; Filiaci et al., 2013).⁴³ Non-native-like behaviors in online and offline resolution of pronominal coreference are also reported in two typologically related NNSLs, Dutch and German (Ellert, 2013), suggesting that “even when source and target language systems are typologically very close, learners rely on general L2 strategies which may be different from those of their source language system” (Ellert, 2013, p. 195). In addition, Roberts et al. (2008) unexpectedly found that both advanced L2 learners of Dutch with L1 German and advanced L2 learners of Dutch with L1 Turkish exhibit a processing disadvantage when interpreting anaphora sentences in Dutch in an online task. Personal pronouns show a consistent bias towards topical antecedents in both German and Dutch. As a consequence, L1 German-L2 Dutch bilinguals are expected to take advantage of this cross-linguistic similarity between the two languages.

⁴³ However, these results are inconsistent with those of Bel and García-Alcaraz (2015) and Chamorro (2018) for forward anaphora in L1 Spanish (see Study IV for details).

However, a lack of a processing advantage in L1 German-L2 Dutch bilinguals in the online task suggests that a general L2 processing effect influenced the learners' behaviors (cf. Sorace & Filiaci, 2006). An L1 effect was only reported in the offline task, in which the L1 German learners, but not the L1 Turkish learners, exhibited a native-like performance in L2 Dutch. On the other hand, Kraš (2008b) found that speakers of two NSLs with comparable coreference patterns (i.e., L1 Croatian-L2 Italian speakers) generally show native-like interpretation of null and overt pronouns.

In conclusion, the question of whether attrition affects either processing or L1 representations has a relevant theoretical impact in bilingualism research. In fact, one of the most debated theoretical issues is concerned with whether attrition should be defined only by structural changes in L1 representations (Gürel, 2017; Tsimpli, 2017), or whether attrition should also include temporary changes pertaining to processing (see Schmid & Köpke, 2017 for an overview). There is general consensus that restructuring of L1 representations is unlikely in late bilingualism. Non-native-like behaviors found in late bilinguals are principally attributed to temporary difficulties at the processing level. However, a lack of solid evidence that attrition affects representations may be due to methodological issues. In conclusion, the opposition between temporary difficulties pertaining to processing and permanent restructuring of L1 representations is a relevant issue in attrition research, because it is connected to broader aspects of cognition. The temporariness of attrition effects is discussed in the next section.

4.2 Recovery Effects on Anaphora Resolution

Speakers living in an FL environment are usually exposed to an input in their L1 that is different, in quantity and quality, from the input received in the L1-speaking environment. The impact of L1 use on the attrition rate is not straightforward. Schmid (2019a) found that a significant effect of L1 use was reported in only one-third of 46 selected studies on attrition (see Bergmann, Nota, Sprenger, & Schmid, 2016; de Bot, Gommans, & Rossing, 1991; Kasparian & Steinhauer, 2017; Schmid & Dusseldorp, 2010, among others). Schmid (2019a) suggests that the small average sample size of the population is likely to explain the lack of an effect of L1 use. In addition, another problematic element is concerned with the absence of detailed information

about the type of input (e.g., L1 input from other bilinguals vs. L1 input from monolinguals).

Paradis (2007) claims that disuse of a linguistic item is likely to be a “primary cause” of the attrition rate, followed by age, motivation, and similarities between the two languages, among other factors (Paradis, 2007, p. 130). Following this assumption, L1 disuse affects the L1 activation threshold, as suggested by the *Activation Threshold Hypothesis* (“ATH” – Paradis, 1993; 2007). In the case of reduced use of the L1 and regular use of an FL, the activation threshold of the L1 will be raised. Crucially, frequency and recency of use of linguistic items impact their activation threshold. The lower the frequency and recency of use, the higher the amount of neural impulses needed for activation. In addition, the presence of a similar item in the FL would further increase the probability of attrition. Thus, attrition is expected when an FL item that is used more often interferes with the corresponding L1 item that is used less often. The *ATH* is consistent with the findings of Gürel (2004), Chamorro et al. (2016), Genevskaja-Hanke (2017), and Köpke & Genevskaja-Hanke (2018) on anaphora resolution. Gürel (2004) found attrition effects in late L1 Turkish-L2 English bilinguals when they resolve pronominal anaphora sentences. Attrition affected the pronoun *o* ‘he/she’ in L1 Turkish, but not the pronoun *kendisi* ‘self’ or the null pronoun. Following the *ATH*, Gürel (2004) argues that attrition on the pronoun *o* is determined by disuse of this item in the L2-speaking environment, and also by interference of the corresponding item in L2 English (the pronouns *he* and *she*). On the other hand, *kendisi* and the null pronoun in Turkish do not correspond to any competing item in English. As a consequence, they were not affected by attrition. In a similar vein, under the *ATH*, re-immersion in the L1-speaking environment is expected to correlate with a decrease of attrition effects. This has been tested in recent studies on anaphora resolution by Chamorro et al. (2016), Genevskaja-Hanke (2017), and Köpke & Genevskaja-Hanke (2018). These studies examined whether attrition is a temporary phenomenon caused by difficulties affecting processing (Chamorro et al., 2016) and performance (Genevskaja-Hanke, 2017), or by a shift in language dominance (Köpke & Genevskaja-Hanke, 2018). This perspective excludes the possibility of permanent changes at the representation or competence level.⁴⁴

Chamorro et al. (2016) examine anaphora resolution in two groups of late L1 Spanish-L2 English bilinguals, and one group of Spanish monolinguals. One group of bilinguals, named “exposed”, had been briefly re-immersed in

⁴⁴ The effects of L1 re-immersion in late bilinguals have also been tested for other linguistic phenomena (Sancier & Fowler, 1997; Stolberg & Münch, 2010).

the L1-speaking environment, whereas the other bilingual group, named “attriters”, had not recently changed language environment. A control group of Spanish speakers, named “monolinguals”, who had arrived in the UK a few weeks before the testing session, was also examined. Data were elicited in two different tasks: an eye-tracking-while-reading task and an offline acceptability judgment task. In each trial, the speaker read sentences on a computer screen and then rated the naturalness of each sentence on a five-point scale. Their eye-movements were recorded during the trial. Reading times at or after the critical pronoun region and response preferences were measured. The testing material in Chamorro et al. (2016) consisted of forward anaphora sentences in Spanish, containing either the null or the overt pronoun, which were presented in two experimental conditions. In the match-condition, the pronoun agreed in number with the expected antecedent, as shown in (86a). The expected antecedent corresponded to the subject for null pronouns, and to the object for overt pronouns (see Carminati, 2002). In the mismatch-condition, the pronoun agreed in number with the unexpected antecedent, as illustrated in (86b).

(86) (Adapted from Chamorro et al., 2016, p. 525)

- a. **La madre_i** saludó a las chicas_j cuando **pro_i** cruzaba una
the mother-SG greeted to the girl-PL when – cross-IMPF.3SG a
calle con mucho tráfico.
street with much traffic
‘The mother greeted the girls when (she) crossed a street with a lot of traffic.’
- b. **La madre_i** saludó a las chicas_j cuando **ella_j** cruzaba una
the mother-SG greeted to the girl-PL when she cross-IMPF.3SG a
calle con mucho tráfico.
street with a lot traffic
‘The mother greeted the girls when she crossed a street with a lot of traffic.’

First, the results suggest that the monolinguals and the “exposed” bilinguals exhibited similar reading times for online pronoun matching, whereas the “attriters” significantly differed from the monolinguals for the same variable. Second, the results also suggest that the reading times of the “exposed” bilinguals did not significantly differ from those of the “attriters”. In addition, no difference between the three groups was found in the offline acceptability judgment task. The researchers conclude, first, that attrition effects decrease with L1 re-immersion and, second, that attrition pertains to the speaker’s capacity for processing interface structures, whereas representations are not affected (Chamorro et al., 2016, p. 531). However, Chamorro et al. (2016) unexpectedly found the null pronoun bias to be inconsistent in all three groups.

They provide two possible explanations for this unexpected result. First, they consider methodological differences between their study and previous research. Second, they argue that clause order is likely to affect the pronoun bias strength.

In another study on the effects of L1 re-immersion, Genevskaja-Hanke (2017) investigates anaphora resolution in non-structured conversations by a late L1 Bulgarian-L2 German speaker.⁴⁵ Genevskaja-Hanke (2017) examines null and overt pronoun realization in different contexts (e.g., topic shift, topic continuity, and focal contexts), comparing the late bilingual to 10 Bulgarian monolingual controls. The results reveal that the late L1 Bulgarian-L2 German speaker tended to produce overt pronouns in contexts where null pronouns are expected in L1 Bulgarian. However, this overproduction of overt pronouns was attested only when the speaker was in the FL environment (Germany), but not when she was in the L1-speaking environment (Bulgaria). Native-like performance was regained after two-weeks of re-immersion in the L1-speaking environment. The author argues that attrition is a temporary phenomenon affecting performance, but not competence.

In a longitudinal case study, Köpcke and Genevskaja-Hanke (2018) explore the effects of attrition in terms of shifts in language dominance. The same late bilingual examined by Genevskaja-Hanke (2017) was tested five years later in a non-structured conversation task. German was assessed as her dominant language. Köpcke and Genevskaja-Hanke (2018) predict attrition effects in the L2 environment (Germany), and recovery effects after re-immersion in the L1-speaking environment (Bulgaria). The late bilingual was expected to exhibit monolingual-like behaviors after L1 re-immersion, as a consequence of increased dominance or higher accessibility to L1 Bulgarian. The results suggest, unexpectedly, that the late bilingual did not display attrition in any of the testing sessions. Her production of overt pronouns was comparable to that of the monolingual controls, both before and after L1 re-immersion. This unexpected finding can be explained by a shift in language use at home. In fact, three years before the second investigation, the bilingual married a Bulgarian speaker. Thus, frequency of use of L1 Bulgarian at home had increased before the second investigation took place. The authors conclude that CLI in attrition is a temporary condition, and is sensitive to several factors,

⁴⁵ Bulgarian is a consistent NSL (Genevskaja-Hanke, 2019), whereas German is classified as an expletive NSL (for an overview see d'Alessandro, 2015). In German, the null pronoun is mandatory in non-argumental expletive constructions in non-clause initial positions (Roberts & Holmberg, 2010). Moreover, topic drop is allowed in spoken German (Hamann, 1996; Trutkowski, 2016). For a detailed discussion, see Genevskaja-Hanke (2019).

such as language exposure and use, and language status (which depends on age and order of acquisition).

To summarize, previous research on the role of short-term L1 re-immersion in late bilingualism suggests that attrition is a temporary phenomenon, at least for anaphora resolution. However, the temporariness of attrition effects on anaphora resolution is a topic that needs further investigation. In the study by Chamorro et al. (2016), speakers were not tested before L1 re-immersion. Therefore, it was not possible to clearly establish a correlation between L1 re-immersion and lower attrition rates exhibited by the “exposed” bilinguals. In the studies by Genevskaja-Hanke (2017), and Köpcke and Genevskaja-Hanke (2018), target sentences were not controlled in all testing sessions, since the task included semi-structured conversations. Finally, Köpcke and Genevskaja-Hanke (2018) did not find clear attrition effects on anaphora resolution in the first testing session (before L1 re-immersion).

4.3 Attrition in the Phonetic and Phonological Domain

In recent research, the effects of longer exposure to an FL environment have also been explored in the phonetic and phonological domains (de Leeuw, 2008; de Leeuw, 2017; de Leeuw, Mennen, & Scobbie, 2012; 2013; de Leeuw, Tusha, & Schmid, 2017; Hopp & Schmid, 2013; Mayr, Price, & Mennen, 2012; Mennen, 2004; Ulbrich & Ordin, 2014, among others).⁴⁶ Attrition of sounds in speech production and perception is a relevant topic to understand whether the L1 is subjected to “sustained plasticity” over a speaker’s lifespan (de Leeuw, 2019). In other words, L1 speech is likely to remain plastic after puberty, across a speaker’s adulthood. In addition, attrition of speech is likely to provide a significant contribution to the debate concerning attrition as knowledge restructuring or attrition as superficial change pertaining to processing. Phonetic attrition is likely to impact the L1 only superficially, whereas the occurrence of phonological attrition may suggest knowledge restructuring (Schmid & de Leeuw, 2019, p. 183). However, Schmid & de Leeuw (2019, p. 183) claim that drawing a clear-cut line between superficial and structural changes is problematic. To explain this viewpoint, they consider two studies in which darkening of the lateral approximant was found in two

⁴⁶ For an overview of phonetic and phonological attrition, see de Leeuw (2019).

groups of late bilinguals, L1 German-L2 Canadian English bilinguals (de Leeuw et al., 2013), and L1 Albanian-L2 Southern British English bilinguals living in London (de Leeuw et al., 2017). While darkening of the lateral phoneme /l/ in German is an example of “superficial” attrition, because it only affects pronunciation, the same phenomenon in Albanian may be interpreted as knowledge restructuring (Schmid & de Leeuw, 2019, p. 183). In particular, de Leeuw et al. (2017, pp. 11–12) found contrastive distribution in Albanian to be replaced by complementary distribution, which characterizes the speech of Southern British English spoken in London, causing the break of the phonemic contrast in Albanian among late bilinguals (e.g., the contrast between *mal* /mal/ ‘mountain’ vs. *mall* /maɫ/ ‘goods’).

In a unique study on phonetic L1 attrition, Mayr et al. (2012) compare voice onset time (VOT) and vowel production in two monozygotic twin sisters. The two sisters grew up in the same language environment, speaking Standard Dutch. They both started to learn L2 English in high school, when they were 13 years old, and subsequently spoke English in their working environment. When they were 32 years old, one sister moved to the United Kingdom (UK), whereas the other sister remained in the Netherlands. The testing took place when they were 62 years old, meaning that one sister, but not the other, had been immersed in an English-speaking environment for 30 years. The main hypothesis is that attrition would affect VOT and vowel production in the sister immersed in the English-speaking environment. Voiceless plosives, such as /p t k/, have longer VOT values in English than in Dutch. In addition, voiced plosives, such as /b d/, present pre-voicing in Dutch, but not in English. Both sisters completed two formal word elicitation tasks in L1 Dutch and in L2 English. In one task, VOT values in plosives were tested; in the other task, vowel production was examined. As for /p t k/, the results reveal that the migrant speaker produced longer VOT in L1 Dutch than her twin sister, hence suggesting attrition. Contrastingly, attrition was not reported for /b d/. The reasons for this asymmetry remain unclear and may be connected to differences in speech rate (Mayr et al., 2012, p. 693). In addition, inaccurate F1 frequency values were reported in the migrant sister when she produced most of the vowels in Dutch, except for /a/, which was accurately produced in the L1. Thus, phonetic L1 attrition is mainly manifested as assimilation and some aspects of pronunciation are more permeable to attrition than others (Mayr et al., 2012, p. 698). Investigations into attrition effects on speech have recently started focusing on suprasegmental phenomena as well. Previous studies have found that L1 attrition is likely to affect the way late bilinguals use prosodic cues in speech (de Leeuw et al., 2012; Mennen, 2004).

Mennen (2004) investigates whether experienced L2 speakers of Greek with L1 Dutch maintain cross-linguistic differences in prenuclear rise in declarative intonation in both L1 and L2. Dutch and Greek exhibit a sequence of LH* tones to express prenuclear rise but 1) the timing of the peak is earlier in Dutch than in Greek, and 2) the peak timing is affected by the phonological length of the vowel in Dutch, but not in Greek (Mennen, 2004, p. 546). In Dutch, the peak is aligned earlier in syllables with long vowels than in syllables with short vowels. Five experienced L2 learners of Greek with L1 Dutch, five Dutch monolinguals, and five Greek monolinguals completed a formal sentence elicitation task. The L2 speakers were tested in two sessions, one including only declarative sentences in Greek, and the other including only declarative sentences in Dutch. The results reveal that CLI in prenuclear rise in declarative intonation is bi-directional, since the L1 affected the L2 and the L2 affected the L1. In particular, four out of five bilinguals showed non-native-like behaviors in peak alignment in L2 Greek, and neutralized peak timing in L1 Dutch that differed from that of the varied timing exhibited by Dutch monolinguals (Mennen, 2004, p. 558).

In a study on prosodic L1 attrition, prenuclear tonal alignment was investigated in 10 German monolinguals, 10 Canadian English monolinguals, and 10 German native speakers who moved to English-speaking Canada in late adolescence to adulthood (de Leeuw et al., 2012). The alignment of the accentual rise is expected to be produced earlier in Canadian English than in Standard German. Hence, the main hypothesis was that the late L1 German-L2 Canadian English bilinguals would show an earlier prenuclear tonal alignment than the German monolinguals. Data were elicited through a formal sentence elicitation task, in which test words were designed to stimulate the production of prenuclear rising accents. The results confirm, first, that L1 Canadian English speakers exhibit an earlier prenuclear tonal alignment than L1 German speakers. Second, the findings suggest that attrition consistently affects the start but not the end of the prenuclear rise. Third, the bilinguals show inter-speaker variation since 1) clear attrition effects were reported at the start of the rise by two bilinguals and at the end of the rise by three bilinguals, 2) no attrition was reported at the start of the rise by three bilinguals and at the end of the rise by four bilinguals, and 3) two bilinguals surprisingly “overshot” the German monolinguals in the end of the prenuclear rise. Finally, de Leeuw et al. (2012, pp. 110–111) explain inter-speaker variation considering the effect of age of arrival: those bilinguals who moved to Canada in late adolescence were affected by attrition more than those bilinguals who moved to Canada in adulthood.

An investigation into phonetic and phonological attrition would contribute to an understanding of 1) whether it is possible to identify a clear-cut point where a processing change (phonetic) becomes representational (phonological), and 2) whether some linguistic domains, such as phonetics, are more permeable to attrition than others, such as morpho-syntax or phonology (Schmid & de Leeuw, 2019, p. 187). Notably, an investigation into the mechanisms underlying anaphora resolution can shed light on the second question, since syntactic, pragmatic, and prosodic information all contribute to identifying the most plausible antecedent of a pronoun. The same phenomenon, anaphoric reference, can therefore be analyzed in relation to different linguistic domains. Nevertheless, changes with respect to anaphora resolution in a situation of post-puberty bilingualism have been mainly considered at the syntactic-pragmatic level, thus excluding the investigation of the prosodic domain (see Cardinaletti, 2005; Chamorro et al., 2016; Genevskaja-Hanke, 2017; Gürel, 2004; Kaltsa et al., 2015; Köpke & Genevskaja-Hanke, 2018; Tsimpli et al., 2004). To the best of our knowledge, only one study has explored whether prosody impacts pronoun resolution in a situation of late bilingualism (Goad et al., 2018). Goad et al. (2018) hypothesize that pause and stress are likely to break the canonical pattern of pronominal coreference in L1 and L2 Italian. In order to test this hypothesis, a group of intermediate and advanced L2 speakers of Italian, with L1 English and L1 Dutch, and a group of L1 speakers of Italian completed a perception task in which they were asked to interpret globally ambiguous intra-sentential anaphora containing overt and null pronouns. It is predicted that speakers would interpret sentences with an inter-clausal pause or with a stressed pronoun differently from sentences without an inter-clausal pause or with an unstressed pronoun. In particular, the main theoretical assumption is that pause and contrastive stress would break the *PAS* in anaphora sentences such as that in (87).

(87) (Adapted from Goad et al., 2018)

Gianni ha chiamato Marco (#) quando *pro* / *lui* / *LUI* si è laureato.
 Gianni has chiamato Marco when _ he HE himself is graduated
 ‘Gianni called Marco when he graduated.’

Target sentences were auditorily presented to participants and inter-clausal pause and stress were manipulated, as in (86). The participants were asked to associate the pronoun (either null or overt) to one of the available antecedents. Three options were given: the pronoun in (86) would refer to the subject, to the the object, or to a third external referent. A previous sentence, containing

information about the context, was visually presented to introduce the third external referent. The results suggest that contrastive stress on overt pronouns affects the interpretation of sentences such as that in (86). In those contexts, the results show an increase of subject assignment for L1 speakers, and also an increase of external referent assignment for L2 speakers. Unexpectedly, the pause did not affect pronoun resolution.

In conclusion, it has been generally found that late bilinguals are likely to undergo attrition when they perceive or produce sounds in their L1. To date, attrition on anaphora resolution has not been explored with respect to the prosodic domain, despite the fact that prosody has a crucial impact on information structure and is likely to influence pronoun interpretation.

5. Overview of the Studies

This thesis contains four papers. Study I is an experimental work entitled “Anaphora Resolution in L1 Italian in a Swedish-Speaking Environment Before and After L1 Re-immersion: A Study on Attrition” and was published in *Lingua*, Vol. 233, 2020. This article is the result of my collaboration with Joost van de Weijer. Study II has the title “The Role of Prosody in Overt Pronoun Resolution in a Null Subject Language and in a Non-Null Subject Language: A Production Study” and was published in *Glossa: A Journal of General Linguistics*, Vol. 4, No. 1, Art. 135, 2019. This experimental work is the result of my collaboration with Mechtild Tronnier and Petra Bernardini. Study III is entitled “First Language Attrition on Prosody in a Foreign Language Environment: A Speech Production Study on Anaphora Resolution”. This experimental study is the result of my collaboration with Mechtild Tronnier and is accepted/in press in the *Journal of Monolingual and Bilingual Speech*. Study IV is a theoretical paper with the title “Anaphora Resolution in Null Subject Languages: Which Factors Explain Conflicting Findings?” and is an unsubmitted manuscript. I am the sole author of that paper.

5.1 Remarks on Terminology

In the present thesis, we use the terms *late bilingual* and *monolingual*.⁴⁷ In the literature on L1 attrition, the terms *late bilingual* (de Leeuw et al., 2017), *attriter* (Chamorro et al., 2016; Gürel, 2004; Kaltsa et al., 2015) and *near-native speaker* (Tsimpili et al., 2004) are used to refer to the same category of speakers. Those three terms all indicate speakers who learned a foreign language after puberty or who moved to an FL environment after puberty. We decided to use the word *late bilingual* instead of *attriter/near-native speaker*

⁴⁷ However, in Study II, we use the term *native speaker*, since bilinguals were not included in that cross-linguistic study.

for several different reasons. First, we excluded the term *attriter* because it describes the speakers' linguistic behavior aprioristically. For example, Chamorro et al. (2016) found L1 attrition in anaphora resolution in a group of bilinguals, but not in a second group of bilinguals re-immersed in the L1-speaking environment. This second group of bilinguals behaved, in fact, similarly to the control group of monolinguals. Despite these findings, the bilinguals belonging to the group in which attrition was not found were defined as *attriters* anyway (see Chamorro et al., 2016). Second, we excluded the expression *near-native speaker*, used by Tsimpli et al. (2004), because it shifts the focus to the speaker's L2, even if the language under investigation is the L1. We therefore prefer the term *late bilingual*, which describes the speakers circumstantially, without providing any information about their linguistic behaviors.

The term *monolingual* is generally used in the literature in opposition to *attriter/late bilingual* (Chamorro et al., 2016; Kaltsa et al., 2015, among others). The word *monolingual* is also used in the current work, despite its limitations. The monolinguals tested in the present work vary with respect to their knowledge of foreign languages. For example, some of the monolinguals have very limited knowledge of L2 English; others have a good knowledge of English but rarely use it; others are only passively exposed to it, and so on. This variation indicates that alternative descriptive labels are necessary.

In addition, we use the term *L1 re-immersion* to indicate the late bilinguals' action of going back to the L1-speaking environment for a limited period of time (summer vacation). In earlier studies, the term *re-exposure* (Chamorro et al., 2016; Köpke & Genevskaja-Hanke, 2018) or *exposure* (Genevskaja-Hanke, 2017) are used. The expressions *exposure* and *re-exposure* imply that speakers who live in an FL environment are no longer exposed to their L1. However, we presume that late bilinguals are exposed to their L1, even when they live in a foreign country (e.g., they can be in contact with their family of origin).⁴⁸ The main difference between late bilinguals and monolinguals is related to quantity and quality of L1 input. Finally, Schmid (2019b, p. 540) uses the term *re-immersion* when describing the studies by Chamorro et al. (2016) and Genevskaja-Hanke (2017). For all of these reasons, in the present thesis, we prefer the term *L1 re-immersion* to *re-exposure* or *exposure*.

⁴⁸ In the early research on L1 attrition, late bilinguals often had infrequent contacts with their family of origin (see, e.g., the studies by de Bot et al., 1991; Lambert & Freed, 1982; Seliger & Vago, 1991). However, in more recent years, the potential exposure to L1 input has increased thanks to social media, communication software, etc.

5.2 Research Questions and Hypotheses

5.2.1 Study I

In Study I, we investigated the temporariness of attrition effects on anaphora resolution by examining whether L1 attrition on pronominal anaphora diminishes after late bilinguals' re-immersion in the L1-speaking environment. This study was conducted with 20 native Italian speakers who had moved to Sweden after puberty (late bilinguals), and 21 Italian monolingual controls. Both groups completed a self-paced interpretation task twice, in which we measured response times and response preferences, and a background questionnaire. The late bilinguals completed the same task once before and once after their summer vacation in Italy. In order to ensure that this (potential) difference between the two sessions would be genuinely due to L1 re-immersion, the monolinguals completed the same self-paced interpretation task twice, once before and once after a comparable time span. We addressed the following research questions:

- RQ1 a) Do late bilinguals show a general effect of L1 attrition on response times, when they interpret both null and overt pronouns?
b) Does this attrition effect on response times diminish after a period in the L1-speaking environment?
- RQ2 a) Do late bilinguals exhibit L1 attrition on the interpretation of overt pronouns, in terms of response preferences?
b) Does this effect of attrition on overt pronouns diminish after a period in the L1-speaking environment?

These research questions were prompted by the limitations of previous studies. Chamorro et al. (2016), Genevska-Hanke (2017), and Köpke and Genevska-Hanke (2018) suggested that attrition in late bilinguals is a temporary condition, at least with respect to anaphora resolution. However, the late bilinguals of the study by Chamorro et al. (2016) were examined after L1 re-immersion, but not before it. In the studies by Genevska-Hanke (2017) and Köpke and Genevska-Hanke (2018), data were elicited through non-structured conversations and the target sentences were thus not the same in all experimental sessions. Thus, in Study I, we modestly aim at filling this gap.

We formulated six predictions. We first predicted that the late bilinguals would show a general effect of attrition on anaphora resolution in terms of response times in Session 1, i.e., before the re-immersion (PRED 1a), and a recovery effect in Session 2, i.e., after the re-immersion (PRED 1b). Second, we expected that, in terms of response preferences, attrition effects would be limited to the Italian overt pronoun (PRED 2a). This hypothesis was based on the assumption that the intrinsic ambiguity of the Swedish overt pronoun, which can be potentially associated with a subject or an object antecedent, would affect the interpretation of the Italian overt pronoun, which is usually associated with an object antecedent. On the other hand, we did not expect to find attrition effects in the interpretation of the null pronoun in Italian (PRED 2b) because a competing item does not exist in Swedish. This entire hypothesis, which includes PRED 2a and 2b, follows Gürel (2004), who explains her findings under the *ATH* (Paradis, 1993). As previously mentioned, the *ATH* states that the activation of a linguistic item is determined by how much neural stimulation the process entails. If a linguistic item is not often used, the neural stimulation needed to activate it will be high. In particular, recency and frequency of the input will affect the item's activation threshold. This means that a linguistic element that has been more often activated needs less neural stimulation than an element that has been activated less often. Gürel (2004) interprets the *ATH* as follows: the infrequently used L1 element (e.g., the overt pronoun of the NSL) would be affected by a competing element in the co-activated L2 (e.g., the overt pronoun of the NNSL), which is more often used by a speaker. This explanation of the *ATH* is also assumed in Study I of the present thesis. In addition, we expected that the late bilinguals would show recovery effects on the “attrited” pronoun after L1 re-immersion (PRED 3a), in terms of response preferences. In contrast, since we did not expect to find attrition effects on the null pronoun (see PRED 2b), we also expected that re-immersion would not affect the interpretation of that pronoun (PRED 3b).

5.2.2 Study II

In Study II, we explored how native Italian and native Swedish speakers use prosodic cues when an overt pronoun is assigned to a subject or an object antecedent. This study was conducted with 28 native Italian speakers and 28 native Swedish speakers. Both groups completed a (speech) production task, a control interpretation task, and a background questionnaire. In the production task, the speakers read globally ambiguous anaphora in their L1 out loud. The goal of this task was to explore whether pronouns would be more prominent

and pauses would be longer in Italian when the antecedent corresponded to the subject of the main clause (the unexpected antecedent), and whether no difference in terms of prominence or pause duration would be found in Swedish speakers. In the control interpretation task, the participants were presented sentences similar to those of the production task. In this case, the participant's task was to assign the pronoun to one of two available antecedents. The goal of the control interpretation task was to assess whether the Italian speakers would conform to the *PAS* and whether the Swedish speakers would show no clear preference in pronoun interpretation (see Kaltsa et al., 2015). We therefore addressed the following research questions:

- RQ1 a) Do Italian speakers produce inter-clausal pauses with a longer duration and pronouns with a higher degree of prominence when the antecedent of an overt pronoun corresponds to the subject (the unpredictable antecedent) rather than the object (the predictable antecedent)?
- b) Do Swedish speakers produce inter-clausal pauses with a similar duration and pronouns with a similar degree of prominence in the two experimental conditions (subject and object antecedent)?
- RQ2 a) Do Italian speakers associate overt pronouns with object antecedents and associate null pronouns with subject antecedents, suggesting that they conform to the *PAS* (Carminati, 2002)?
- b) Do Swedish speakers assign overt pronouns to subject and object antecedents equally, thus reflecting the intrinsic ambiguity of pronoun resolution in this language?

These research questions were prompted by the absence of cross-linguistic research exploring the use of prosody in an NSL and an NNSL. We argue that, when speakers use prosody to solve pronominal coreference, they are influenced by language-specific patterns in antecedent assignment. In an NSL, such as Italian, two alternatives of the same linguistic structure are allowed (i.e., a finite clause containing either an overt or a null pronoun). This is not possible in an NNSL, such as Swedish, in which only one linguistic structure is allowed (i.e., a finite clause containing an overt pronoun). We therefore expected that this difference between the two languages would affect coreference patterns and, consequently, speakers' use of prosodic cues in a pronoun resolution task. Previous research has, in fact, demonstrated that prosody is likely to impact pronoun resolution (De Hoop, 2004; Jasinskaja et

al., 2005; Rello & Llisterri, 2012; McClay & Wagner, 2014; Goad et al., 2018, among others). For example, the results by Goad et al. (2018) suggest that the presence of contrastive stress on an overt pronoun in Italian changes speakers' interpretation of that pronoun.

We made four predictions for the speech production task (PREDS 1-4) and two predictions for the control interpretation task (PREDS 5-6). First of all, we predicted that the Italian speakers would produce a longer inter-clausal pause duration when the antecedent corresponds to the subject of the main clause (the unpredictable antecedent) instead of the object (the predictable antecedent) (PRED 1). We also expected that the Italian speakers would produce a pronoun with a higher degree of prosodic prominence when the antecedent corresponds to the subject of the main clause, instead of the object (PRED 2). We formulated PREDS 1-2 on the idea that pause and prominence would break the canonical coreference pattern in Italian, favoring the unpredictable antecedent, the subject (see Goad et al., 2018). As for Swedish, we predicted that we would find no difference in terms of pause duration (PRED 3) and prosodic prominence (PRED 4) between sentences with a subject antecedent and sentences with an object antecedent. PREDS 3-4 were developed under the assumption that Swedish speakers leave a measure of indeterminacy when it comes to assigning the overt pronoun to an available antecedent. In other words, the overt pronoun in Swedish can be associated with subject or object antecedents. This would determine no relevant difference in the use of prosodic cues in Swedish between the two conditions (subject and object antecedent). Second, we predicted that, in the control interpretation task, the Italian speakers would prefer an overt pronoun as coreferential with the object antecedent, and would also prefer a null pronoun as coreferential with the subject antecedent (PRED 5), thus suggesting conformation with the *PAS*. We also predicted that the Swedish speakers would not display any significant preference for either subjects or objects when assigning the overt pronoun to an available antecedent (PRED 6). This would confirm that the Swedish speakers leave a measure of ambiguity with respect to antecedent assignment.

5.2.3 Study III

In Study III, we investigated the effects of L1 attrition on the use of prosodic cues in anaphora resolution. To address this question, prominence patterns and pause features exhibited by late L1 Italian-FL Swedish bilinguals were analyzed in relation to those shown by Italian and Swedish monolinguals in Study II. In particular, 18 late bilinguals completed the same (speech)

production task and the same control interpretation task administered to the speakers of Study II, as well as a background questionnaire. The goal of the production task was to examine whether the late bilinguals abstain from the production of prominence patterns and pause features of the Italian monolinguals, and approach those of the Swedish monolinguals when they read globally ambiguous sentences containing an overt pronoun in L1 Italian. A positive answer would suggest that L1 attrition is likely to affect late bilinguals' use of prosody when they resolve the anaphoric reference. We also explored whether attrition rate on prosody is influenced by length of residence in the FL environment (Sweden). The goal of the control interpretation task was to examine whether the late bilinguals conform to the *PAS*, as the Italian monolinguals did in Study II. In other words, this task was developed to investigate whether the late bilinguals replicate the coreference pattern of the Italian monolinguals when sentences are mentally but not orally produced. Therefore, we addressed the following research questions:

- RQ 1) Do late bilinguals abstain from the production of prominence patterns and pause features exhibited by the Italian monolinguals and approach those shown by the Swedish monolinguals when they resolve anaphoric reference in their L1, and is this effect influenced by length of residence in Sweden?
- RQ 2) When anaphora sentences are mentally but not orally produced, do late bilinguals conform to the *PAS*?

Those research questions were first prompted by lack of research on L1 attrition on the use of prosodic cues in pronoun resolution. Prosodic cues are relevant sources of information for anaphora resolution, as suggested by previous research (see De Hoop, 2004; Goad et al., 2018; Jasinskaja et al., 2005; Rello & Llisterri, 2012; McClay & Wagner, 2014). Nevertheless, the exploration of a non-native-like use of prosody when solving an anaphora sentence has not been examined by previous studies, which focused on the syntactic-pragmatic level (see Cardinaletti, 2005; Chamorro et al., 2016; Genevska-Hanke, 2017; Gürel, 2004; Kaltsa et al., 2015; Köpke & Genevska-Hanke, 2018; Tsimpli et al., 2004). To date, only Goad et al. (2018) examined the effects of prosody in anaphora resolution in a situation of language contact. In that study, the focus was on bilinguals' L2, whereas we focused on bilinguals' L1.

Second, L1 attrition has been previously found for different prosodic cues with respect to speech production (see de Leeuw et al., 2012; Mennen, 2004, among others). While late bilinguals generally display modest effects of attrition (Schmid & Köpke, 2017), they show clear effects of attrition when the phonetic domain is considered, despite inter-speaker variation (de Leeuw, 2019). Consequently, Schmid and de Leeuw (2019) suggest that future research should focus on which linguistic domains are more sensitive to L1 attrition than others. In light of those observations, we argue that, since anaphora resolution involves the integration of information belonging to different linguistic domains (syntax, pragmatics and prosody), it represents a fertile ground of research for attrition studies.

In Study II, we suggested that prosodic prominence on the pronoun and inter-clausal pause are likely to break the canonical pattern of coreference, thus allowing the overt pronoun to also be coindexed to a subject antecedent, which corresponds, in our target sentences, to the antecedent in SpecIP position (Carminati, 2002) or to the “subject of a primary predication” (Calabrese, 1986a). Speakers in attrition with Swedish might be less sensitive to those prosodic cues, as a consequence of a more lenient approach to the L1-coreference patterns. Thus, they might allow an overt pronoun to be assigned, to a certain extent, to a subject antecedent, even when that pronoun is not focalized or when there is no inter-clausal pause to break the canonical coreference pattern.

Third, other than investigating attrition effects on prosody, we also examined whether length of residence impacts the degree of prosodic attrition. Previous studies found contradictory results on the impact of length of residence on attrition (Schmid, 2019a). In some studies, it was found that a longer length of residence was correlated with a higher attrition rate (see Bergmann et al., 2016; de Bot et al., 1991; Kasparian & Steinhauer, 2017; Schmid & Dusseldorp, 2010). In other studies, it was suggested that length of residence does not affect attrition (de Leeuw, Schmid, & Mennen, 2010; Kasparian, Vespignani, & Steinhauer, 2017; Schmid, & Beers Fägersten, 2010; Schmid & Jarvis, 2014; Varga, 2012, among others). Moreover, de Leeuw (2008) found that the longer the residence in the FL environment, the lower the attrition rate. Schmid (2019a) notices that a positive correlation between length of residence and attrition was found in those studies in which the minimum number of years in the FL environment was lower than 10 (Schmid, 2019a: 295). However, no correlation between length of residence and attrition was found for bilinguals who had been living in the FL environment for 10 years or more (Schmid, 2019a, p. 295).

We made three hypotheses in Study III. For the production task, we expected that the late L1 Italian-FL Swedish bilinguals would not replicate prominence patterns and pause features of the Italian monolinguals and would instead approach those of the Swedish monolinguals when they use prosodic cues in L1-pronoun resolution (H1). Second, we expected the rate of L1 attrition to be influenced by length of residence in Sweden (H2). Third, as for the interpretation task, we hypothesized that the late bilinguals would replicate the coreference pattern of the Italian monolinguals when anaphora sentences are not vocalized (H3). Specifically, the late bilinguals were expected to conform to the *PAS*.

5.2.4 Study IV

In Study IV, we examined whether the interplay between hierarchical structure and linear order of the sentence is likely to explain previous contrasting results in anaphora resolution, reported for both monolinguals and bilinguals. Moreover, we discussed its potential impact on theories about the non-native-like distribution of pronominal forms in bilingualism research, such as the *Representational/Underspecification Account* (Tsimpili et al., 2004), and the *Processing Account* (Sorace & Filiaci, 2006; Sorace, 2011).

As previously mentioned, null pronouns are generally biased towards an antecedent in SpecIP position, usually corresponding to the subject, and overt pronouns are generally biased towards an antecedent in a position lower than the SpecIP, usually corresponding to the object (see Carminati, 2002). This pattern has been found in different NSLs, such as Italian, Croatian and Greek. By contrast, the distribution of null and overt pronouns leaves a measure of ambiguity in Spanish. In fact, overt pronouns exhibit an unclear bias in Spanish (see Filiaci et al., 2013; Jegerski et al., 2011; Keating et al., 2011; but cf. Bel & García-Alcaraz, 2015; Chamorro, 2018; Chamorro et al., 2016). Hence, microvariation in subject realization can explain some previous inconsistencies.

However, conflicting findings have also been reported across anaphoric constructions. For example, monolinguals of different NSLs have been found to overwhelmingly assign null pronouns to subject antecedents in backward anaphora with subordinate-main clause order (e.g., *Quando pro dipinge, Alice guarda Maria* ‘when [she] paints, Alice looks at Maria’). Contrastingly, inconsistencies have been reported in the resolution of null pronouns in forward anaphora with main-subordinate clause order (e.g., *Alice guarda Maria quando pro dipinge* ‘Alice looks at Maria when [she] paints’). As for

the latter construction, null pronouns have been interpreted as coreferential with subject antecedents in some studies (for L1 Italian, see Carminati, 2002; Fedele & Kaiser, 2014; for L1 Spanish, see Jegerski et al., 2011; Keating et al., 2011; for L1 Croatian, see Kraš, 2008a; for L1 Greek, see Papadopoulou et al., 2015), whereas no clear pattern has been found in other studies (for L1 Italian, see Belletti et al., 2007; Serratrice, 2007; Sorace & Filiaci, 2006; Tsimpli et al., 2004; for L1 Spanish, see Bel & García-Alcaraz, 2015; Chamorro et al., 2016; Chamorro, 2018; for L1 Greek, see Kaltsa et al., 2015). The high proportion of divergent findings suggests that this bias may be unstable. Crucially, the subject represents the antecedent that is closest to the null pronoun in backward anaphora with subordinate-main clause order, whereas it corresponds to the farthest antecedent in forward anaphora with main-subordinate clause order, as illustrated by comparing (88) with (89).

(88) *Backward anaphora with subordinate-main clause order*

Quando **pro_i** dipinge, **Alice_i** guarda Maria_j.
 when — paints Alice looks at Maria
 ‘When (she) paints, Alice looks at Maria.’

(89) *Forward anaphora with main-subordinate clause order*

Alice_i guarda Maria_j quando **pro_i** dipinge.
 Alice looks at Maria when — paints
 ‘Alice looks at Maria when (she) paints.’

We therefore discussed whether differences in linear distance between pronoun and felicitous antecedent, such as those shown in (88) vs. (89), are likely to explain previous conflicting findings exhibited by monolinguals, considering that speakers may be sensitive to the linear order of the text (see Ariel, 1988; 1990; Clark & Sengul, 1979; Ehrlich, 1983; Ehrlich & Rainer, 1983; Givón, 1983; but cf. Clifton and Ferreira, 1987). In addition, we discuss whether bilinguals exhibit a similar sensitivity to the linear order of the sentence. Finally, we discuss which strategies are employed by both monolinguals and bilinguals when the expectations provided by the *PAS* are in conflict with the predictions given by the linear order of the sentence, as in (89).

In summary, we discussed whether pronoun resolution is inherently more demanding in certain anaphoric constructions, by examining the interplay between hierarchical structure and linear order of the sentence. We also considered whether the non-native-like behaviors found in bilinguals can be

explained in light of this variance across anaphoric constructions. Thus, we addressed the following research questions:

- RQ 1) Are certain anaphoric constructions inherently more difficult to process than others because the constraints of the *PAS* collide with the expectations given by the linear order of the sentence?
- RQ 2) Are both monolinguals and bilinguals sensitive to the interaction between hierarchical structure and linear order of a sentence? If so, in which ways do they differ?
- RQ 3) Can the variance in bias strength across anaphoric construction explain the inconsistencies reported in previous research?

To address these research questions, we discussed previous research on anaphora resolution with a focus on studies in which intra-sentential anaphora containing two competing antecedents have been investigated in post-puberty bilinguals.

5.3 Method

In this section, we provide an overview of participants, material, procedures and measurements of the three empirical investigations conducted in this thesis (Studies I, II and III).

In Study I, anaphora resolution in Italian was investigated in a group of late L1 Italian-FL Swedish bilinguals and a group of Italian monolingual controls. The former group was tested in Sweden (Stockholm, Göteborg, Malmö, Lund, and Kristianstad), and the latter group was tested in Italy (Rome metropolitan area). Both groups completed the same experimental task twice. Specifically, the late bilinguals were examined before and after their summer vacation in Italy, and the monolinguals were examined before and after a comparable time span.

Study II was a cross-linguistic investigation in which the patterns related to L1-anaphora resolution exhibited by native Italian speakers were compared to the patterns shown by native Swedish speakers. The former group was tested in Italy (Rome metropolitan area), and the latter group was tested in Sweden (Lund). Both groups completed two different tasks during the same

experimental session in their L1, one to investigate prosodic cues and one to investigate syntactic-pragmatic features.

In Study III, anaphora resolution in Italian was explored in a group of late L1 Italian-FL Swedish bilinguals, tested in Sweden (Stockholm, Malmö, Lund, Helsingborg and Norrköping). The same experimental tasks of Study II were administered to the participants of Study III. The patterns shown by the late bilinguals were then compared to those shown by Italian and Swedish monolinguals in Study II. An overview of the experimental design in Studies I, II, and III is illustrated in Table 5.

Table 5. Overview of methods in Studies I, II and III.

	Target language	Speakers	Testing sessions (N)	Testing country	Experimental tasks (N)	Level of analysis
Study I	L1 ITA	Late bilinguals	2	Sweden	1	Syntactic/pragmatic
		Monolinguals	2	Italy	1	Syntactic/pragmatic
Study II	L1 ITA	Monolinguals	1	Italy	2	Prosodic + Syntactic/pragmatic
		Monolinguals	1	Sweden	2	Prosodic + Syntactic/pragmatic
Study III	L1 ITA	Late bilinguals	1	Sweden	2	Prosodic + Syntactic/pragmatic

5.3.1 Participants

A total of 115 speakers, divided into five groups, participated to the three empirical studies of the present thesis. First, two groups of late bilinguals were investigated, one in Study I and another one in Study III, for a total of 38 speakers. Their parents were all native speakers of Italian, except for one case (see Study I). The late bilinguals had grown up in Italy and had moved to Sweden after puberty, except for one case (see Study I). All the late bilinguals had a university-level degree, except for two cases (see Studies I and III). Details related to the late bilinguals' profile are illustrated in Table 6.

Table 6. General information about the late bilinguals in Studies I and III.

	N			Age			LoR in Sweden (in years)			AoA in Sweden		
	Tot.	Males	Females	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.
Study I	20	7	13	42.96	34	77	11.83	7	52	29.1	15	42
Study III	18	6	12	47.39	30	59	17.17	8	29	29	19	40

Note: “LoR” stands for *length of residence* and “AoA” for *age of arrival*.

In the background questionnaire, the late bilinguals gave information about how often they use Italian, Swedish, and other FLs (if any) during their everyday life in Sweden, by answering to the following question: “How often do you speak Italian/Swedish/another language?”. They answered using a five-point scale, designed as follows: 1= never, 2= rarely, 3= every month, 4= every week, and 5= every day. They also self-rated their proficiency in Swedish on a five-point ordinal scale, where 1= very low, 2= low, 3= sufficient, 4= good, and 5= very good. Moreover, in Study I, the late bilinguals also provided information about their linguistic habits during their vacation in Italy (L1 re-immersion). In this case, the scale was designed as follows: 1= never, 2= rarely, 3= sometimes, 4= often, and 5= every day. Main language-related information is reported in Table 7.

Table 7. Language-related information about the late bilinguals in Studies I and III.

	Proficiency (mean)	Frequency of use (mean)					
		Everyday life in Sweden			Vacation in Italy		
		L1 Italian	FL Swedish	Another FL	L1 Italian	FL Swedish	Another FL
Study I	4.75	3.28	4.43	2.7	4.62	1.85	1.68
Study III	4.89	3.59	4.33	2.76	-	-	-

In addition, three groups of monolinguals were investigated for a total of 77 speakers: two groups of L1 Italians speakers (see Studies I and II), and one group of L1 Swedish speakers (see Study II). All of them had been raised monolingually from birth. As for the Italian monolinguals, their parents were all native speakers of Italian, except for one case (see Study II). They had spent most of their life in Italy, and none of them spoke Swedish at the time of the

testing. Approximately 75% of the Italian monolinguals had a university-level degree. All the Swedish monolinguals had L1 Swedish-speaking parents, and spent most of their life in Sweden. Approximately 40% of them had a university-level degree, whereas the others were all enrolled in an academic program at the time of the testing. Details about the monolingual speakers are provided in Table 8.

Table 8. General information about the monolinguals in Studies I and II.

	Italian natives						Swedish natives					
	N			Age			N			Age		
	Tot.	Males	Females	Mean	Min.	Max.	Tot.	Males	Females	Mean	Min.	Max.
Study I	21	8	13	51.08	38	65	-	-	-	-	-	-
Study II	28	17	11	32.75	20	62	28	6	22	31.29	19	54

Similar to the late bilinguals, the monolinguals rated their frequency of use of their L1 and any FL during their everyday life, on the five-point scale. In most cases, English was their L2. Details about language frequency of use are illustrated in Table 9.

Table 9. Language frequency of use related to the monolinguals in Studies I and II.

	Italian natives		Swedish natives	
	Italian (mean)	FL (mean)	Swedish (mean)	FL (mean)
Study I	4.98	2.16	-	-
Study II	5.00	1.95	4.94	3.15

5.3.2 Material and Procedures

In the experimental studies, the participants completed an informed consent and a background questionnaire, and received instructions in their L1.⁴⁹ In Study I, the focus was on syntactic-pragmatic features related to the division of labor between null and overt pronouns. The participants completed a self-paced interpretation task in which they interpreted sentences on a computer screen, presented using PsychoPy software (Peirce, 2007). They had to respond intuitively and quickly to a *who*-question. In Studies II and III, we

⁴⁹ The background questionnaires developed for the late bilinguals were modeled on Keijzer (2007).

examined prosodic cues in anaphora resolution. The speakers completed a speech production task in which they were recorded while reading sentences on a computer screen out loud, presented using PsychoPy software (Peirce, 2007). In addition, they completed a control interpretation task on paper. In Studies II and III, the speakers had no time limit, and were not asked to complete the tasks as fast as possible.

In all three studies, the stimuli consisted of target sentences and fillers. Target sentences always included globally ambiguous intra-sentential bi-clausal forward anaphora in which grammatical and pragmatic cues did not force the interpretation towards any specific antecedent, as shown in (90) and (91).

(90) *Italian*

Riccardo ha conosciuto Diego quando lui lavorava in una clinica privata.
 Riccardo has known Diego when he worked in a clinic private
 ‘Riccardo got to know Diego when he worked in a private clinic.’

(91) *Swedish*

Per lärde känna Martin när han arbetade på en privatklinik.
 Per learned know Martin when he worked for a private clinic
 ‘Per got to know Martin when he worked in a private clinic.’

We included anaphoric reference but not cataphoric reference in our empirical studies. This is due to the fact that forward anaphora is more “neutral” than backward anaphora. A sentence in which the pronoun precedes the antecedent, as in the case of backward anaphora, is highly marked, especially when that sentence is poorly contextualized because it is not part of a discourse. Table 10 summarizes the experimental design for the three studies.

Table 10. Overview of the experimental design for Studies I, II, and III.

Language		Stimuli (N)			Data elicitation	Tools for data collection
		Tot.	Target	Fillers		
Study I	ITA	90	20	70	Self-paced interpretation task	<i>PsychoPy</i> software
Study II	ITA	40	20	20	Speech production task	<i>PsychoPy</i> software + recorder/microphone
		40	20	20	Control interpretation task	Paper & pencil
		40	20	20	Speech production task	<i>PsychoPy</i> software + recorder/microphone
	SWE	40	20	20	Control interpretation task	Paper & pencil
		40	20	20	Speech production task	<i>PsychoPy</i> software + recorder/microphone
Study III	ITA	40	20	20	Speech production task	<i>PsychoPy</i> software + recorder/microphone
		40	20	20	Control interpretation task	Paper & pencil

In Study I, the proportion of target sentences and fillers is approximately 1/3, whereas it corresponds to 1/2 in Studies II and III. This choice is due to the fact that, in Study I, it was important to lower the participant's awareness about our object of interest (globally ambiguous intra-sentential anaphora), since inefficient processing has been claimed to be a major factor in L1 attrition on anaphora resolution (see Sorace & Filiaci, 2006; Sorace, 2011, and related work). In Studies II and III, the speech production task itself stimulated the speaker's meta-linguistic abilities. We therefore assumed the role of distractors to be less relevant in those two studies and consequently lowered the proportion of fillers to make the experiment shorter. In addition, the 40 sentences included in Studies II and III were presented twice over the course of the experiment. In Study I, fillers included syntactically ambiguous sentences, non-ambiguous sentences, and target-like sentences with two different grammatical genders. In Studies II and III, fillers included ambiguous relative clauses and target-like sentences containing antecedents with two different grammatical genders.

Heuristic procedures in Study I were different from those included in Studies II and III. In Study I, the procedure followed by the speakers consisted of 1) reading the sentence of interest, such as that in (90), 2) reading the *who*-question, and 3) selecting one response among two given options (e.g., either *Riccardo* or *Diego*). In the speech production task of Studies II and III, the procedure consisted of 1) reading a context sentence, which provided information about the situational context (e.g., *Riccardo lavorava in una clinica privata* 'Riccardo was working in a private clinic'), 2) reading the sentence of interest out loud, such as that in (90), and 3) making it very clear to a listener who the actor in the discourse was (e.g., either *Riccardo* or *Diego*). Hence, in Study I, the speakers had to imagine a situational context in order to interpret the sentences, whereas in Studies II and III, the description of the situational context was already provided by the context sentence, which preceded the globally ambiguous anaphora sentence.

In the speech production task, we included a listener, who was one of the researchers (see Figure 2). The L1 of the listener always matched the L1 of the participant. The listener was also the person who provided the instructions. The participants were informed that the listener was unaware of the correct response and that she would try to understand who the actor of the discourse was and write her responses in a notebook. The listener did not give any feedback to the participants. We included a listener in the experimental procedure to solicit the participant's involvement in the task.



Figure 2. Experimental procedure for the speech production task (Studies II and III).

5.3.3 Measurements

Table 11 illustrates how we measured the speaker's outcomes for each task in each experimental study.

Table 11. Overview of data analysis for Studies I, II, and III.

	Task	Measurements	Statistical analysis	Tools for data analysis
Study I	Self-paced interpretation task	1. Response preferences 2. Response times (ms)	1. Logistic regression 2. Linear mixed-effects regression	<i>R</i> software
Studies II & III	Speech production task	1. Inter-clausal pause duration (ms) 2. Degree of prominence on pronouns: relative length (%), average F0 range (st), relative intensity (dB)	Linear mixed-effects regression	<i>Praat</i> software + <i>R</i> software
	Control interpretation task	Response preferences	Logistic regression	<i>R</i> software

In Study I, we analyzed response preferences and response times in two different testing sessions. Response preferences were measured to establish whether the participants conformed to the *PAS*. Response times refer to the time interval needed to give the response. Faster response times are generally associated with a certain ease in providing the response to a linguistic stimulus. For this reason, we used this measure as a way to examine whether late bilinguals were affected by attrition.

In the speech production task of Studies II and III, we considered 1) the length of the pause between the two clauses (i.e., inter-clausal pause), and 2) the degree of (prosodic) prominence on the target pronoun, using Praat software (Boersma & Weenink, 2018). Previous studies have focused on pause and prosodic prominence to examine the role of prosody in pronoun resolution (Goad et al., 2018; Jasinskaja et al., 2005; Rello & Llisterri, 2012, among others). As in Goad et al. (2018), we considered the pause between main clause and subordinate clause (i.e., inter-clausal pause). In particular, we measured the absolute length of the inter-clausal pause (ms). As for prosodic prominence, we focused on three acoustic measures that are primary predictors of prominence. These measures are length, F0 and intensity (Terken & Hermes, 2000). Specifically, we measured 1) the pronoun's relative length (%), 2) the pronoun's average F0 range in semitones (st), and 3) the pronoun's relative intensity (dB).

We normalized the pronoun's length and the pronoun's intensity by taking into account length and intensity of the subordinate conjunction *when*. This means that the subordinate conjunction was used as baseline to establish the degree of prominence of the pronoun, in terms of length and intensity. Reading speed and speech loudness can, in fact, vary across the sentences for reasons that are not necessarily related to information structure. The action of increasing or decreasing speech tempo can be related to several factors, such as the speaker's age, emotional state, etc. (Fletcher, 2010). Moreover, in Studies II and III, data were elicited through repeated sentence reading and task-learning effects may have influenced the participants' outcomes. For example, some speakers may have decreased their reading times over the trial, as a consequence of experimental practice. In this case, the absolute length of the pronouns could have been longer in the sentences presented at the beginning of the experiment than in those sentences presented at the end of the experiment.⁵⁰ At the same time, intensity is likely to vary in relation to external

⁵⁰ We did not analyze whether reading speed decreased over the course of the experiment, but we had considered this issue *a-priori*, by identifying some potential confounds and measuring the acoustic variables adequately.

factors, such as background noise and distance from the listener, among other things (Remacle, Finck, Roche, & Morsomme, 2012). The rooms in which the experiment took place were generally silent, but temporary background noise may have influenced the degree of speech loudness during the trial.

As previously mentioned, we accounted for these potential effects by normalizing the values of length and intensity, using the subordinate conjunction *when* as baseline. We considered the subordinate conjunction to be a reliable baseline for several reasons. First, the subordinate conjunction is not likely to be prominent in the target sentences of Studies II and III.⁵¹ Second, the subordinate conjunction corresponded to the word immediately prior to the pronoun in all the target sentences (e.g., *quando lei* ‘when she’). Third, we did not consider other measures, such as total length of the target sentence or mean intensity of the whole sentence, to be reliable values to normalize the pronoun’s absolute length and absolute intensity, respectively. In a recent study, Stowe, Kaan, Sabourin, and Taylor (2018) discuss previous research demonstrating that reading times increase at the end of the clause or sentence (see Hill & Murray, 2000; Just, Carpenter, & Woolley, 1982; Rayner, Kambe, & Duffy, 2000). This means that the total length of a sentence is likely to vary according to variation in reading speed due to lengthening of portions of the sentence. Consequently, using the total length of the sentence to normalize the pronoun’s absolute length would have resulted in confounds, especially if we consider that the target sentences of Studies II and III vary slightly in regard to the total number of words or syllables. In Study II, it was not possible to control for number of words or syllables of the target sentences because two different languages were examined. The same issue is present in Study III. This variation in the total length of a sentence also explains our choice to exclude it from the normalization of the inter-clausal pause length. Furthermore, previous studies have suggested that a decrease in speech tempo is correlated to a higher number of pauses, but not necessarily to an increase in pause length (Butcher, 1981; Grosjean, 1980).⁵² Thus, we considered that measuring the absolute length of the inter-clausal pause was a more reliable methodological choice

⁵¹ The subordinate conjunctions *quando* ‘when’ is not expected to be (prosodically) prominent in the following sentence in Italian: *Emma ha scritto subito a Laura quando lei ha superato l'ultimo esame* ‘Emma immediately wrote to Laura when she passed the last exam’. Similarly, in the corresponding sentence in Swedish, *Emma skrev genast till Laura när hon klarat den sista tentan*, the subordinate conjunctions *när* ‘when’ is not expected to be prominent.

⁵² However, other studies have demonstrated that pause length is likely to be affected by variations in speech tempo (see Fletcher, 1987; Grosjean & Deschamps, 1975).

than measuring the length of the inter-clausal pause in relation to the total length of the sentence.

As for F0, we measured the pronoun's average F0 range in semitones (st), which corresponds to the tonal excursion of the pronoun or, in other words, to the excursion of the pitch in semitones. However, we did not examine timing and shape of the pitch accent for several reasons. First, temporal alignment of F0 has a relevant role for the specific types of lexical word accents in Swedish. In Swedish, stressed syllables present two possible pitch accents, accent 1 and accent 2. Each word has either accent 1 or accent 2, depending on phonological, morphological, and lexical factors (Myrberg & Riad, 2016). Previous evidence has suggested that these two accents have a different timing (Gårding, 1977; Bruce, 1983). The timing of accent 1 is, in fact, relatively earlier than that of accent 2 (Bruce, 1983). For this reason, we did not compare timing of pitch accent in Swedish with timing of pitch accent in Italian, which does not present this distinction. Second, variation in the contours of pitch accent is connected, in Swedish, with two different levels of prominence: focal accent and word accent (Myrberg & Riad, 2016). For example, in Stockholm Swedish, lexical accent 1 is realized with the HL* contour when it corresponds to a word accent, and is realized with the L*H contour when it corresponds to a focal accent (Myrberg & Riad, 2016). Thus, word accent shape is affected by focus. Again, this characteristic of Swedish pitch contours would have caused methodological issues when comparing the two languages. For this reason, the shape of pitch accent was not included in the analysis. On the other hand, tonal excursion did not present any relevant problem for the comparison between Italian and Swedish. Furthermore, tonal excursion (F0 range) has been clearly correlated with the perception of prominence (Baumann & Winter, 2018). As previously mentioned, we measured the pronoun's relative intensity and relative duration by taking into account mean intensity and total duration of the subordinate conjunction *when*. However, we did not measure the pronoun's average F0 range in relation to the average F0 range of another word of the target sentence. While factors such as task-learning effects and background noise are likely to influence the degree of intensity and reading speed, as explained above, we did not expect similar issues for average F0 range. Remacle et al. (2012) found that prolonged reading affects average F0 (and also other acoustic measures), but the participants of that study were tested for a long period of time (two hours). Finally, potential differences between genders in the realization of pitch were taken into account by using a scale in semitones (st) to measure the pronoun's average F0 range.

5.4 Summary of the Main Findings

In the present section, we summarize the main findings of the three empirical investigations (Studies I, II and III) and the observations brought to the fore in Study IV. In the empirical studies, statistical analyses were conducted using logistic and linear mixed-effects regression models in R (version 3.5.1, R core team, 2018). Study I was a between-group investigation, in which we analyzed response times (using linear mixed-effects regression), and response preferences (using logistic regression). In Studies II and III, we performed a within-group analysis and compared the patterns exhibited by the different groups. For statistical analysis of the speech production data, we used linear mixed-effects regression, considering the following acoustic variables: inter-clausal pause duration, pronoun's relative length, pronoun's average F0 range, and pronoun's relative intensity. For statistical analysis of the data for the control interpretation task, we considered response preferences using logistic regression models.

In Study I, we first examined whether late L1 Italian-FL Swedish bilinguals show attrition on response times in Session 1 (RQ1a) and recovery effects in Session 2, after L1 re-immersion (RQ1b). We expected the late bilinguals to exhibit slower response times than monolinguals (PRED1a). The results reveal the opposite pattern; the monolinguals were significantly slower than the bilinguals ($p = 0.023$). Moreover, we also predicted the late bilinguals to be faster in Session 2 than in Session 1, thus suggesting recovery effects (PRED1b). Both the late bilinguals and the monolinguals were faster in Session 2 than in Session 1, but the decrease in response times was even larger in the monolinguals than the bilinguals ($p = 0.009$). Second, we explored whether late bilinguals' response preferences show attrition effects in Session 1 (RQ2a) and recovery effects in Session 2 (RQ2b). We expected the late bilinguals to prefer overt pronouns as coreferential with object antecedents less often than the monolinguals in Session 1, thus suggesting attrition effects (PRED2a). In addition, we predicted that there would be no differences between the two groups in the interpretation of null pronouns in Session 1, thus suggesting lack of attrition (PRED2b). Moreover, the late bilinguals assigned an overt pronoun to the object antecedent on average 84% of the time in Session 1. For the same testing session, the monolinguals associated an overt pronoun with the object antecedent on average 91% of the time. However, this difference was not significant ($p = 0.124$). In addition, we found a significant interaction between pronoun and group ($p = 0.018$). To further explore that interaction, we calculated the proportions of expected responses for each

speaker. From those proportions, it appears that the difference between the monolinguals and the bilinguals is larger for the null pronoun condition than for the overt pronoun condition. The bilinguals thus exhibited attrition effects on null pronouns, since they associated null pronouns to object antecedents (the unexpected response) relatively often. In addition, we predicted the late bilinguals to show a recovery effect in Session 2 in terms of response preferences on the potentially “attrited” overt pronoun (PRED3a). Since we expected a lack of attrition on the null pronoun in Session 1, we consequently predicted a lack of recovery effects for that pronoun (PRED3b). However, the interaction between session and pronoun suggests that, in Session 2, both groups exhibited an improvement in response preferences for the null pronoun, as compared to the overt pronoun ($p = 0.037$).

In Study II, we explored how native Italian and native Swedish speakers use prominence patterns and pause features when they have to solve globally ambiguous anaphora containing two competing antecedents. We first examined whether Italian speakers exhibit longer inter-clausal pauses and give a higher degree of prosodic prominence to pronouns when the antecedent corresponds to the subject (the unpredictable antecedent) than the object (the predictable antecedent) (RQ1). The findings reveal that, when the pronoun corresponded to the subject antecedent, the Italian speakers produced a longer inter-clausal pause ($p = 0.000274$), and pronouns with a higher degree of prominence in terms of relative length ($p = 4.02e-09$), average F0 range ($p = 1.00e-06$), and relative intensity ($p = 1.07e-11$). Second, we investigated whether Swedish speakers produce inter-clausal pauses with a similar duration and pronouns with a similar degree of prominence in the two experimental conditions, subject and object antecedent (RQ1b). The results do not support our prediction; when the target pronoun was associated with the object antecedent, the Swedish speakers exhibited a longer inter-clausal pause ($p = 0.0197$), and a more prominent pronoun, with regard to relative length ($p < 2e-16$) and average F0 range ($p = 4.25e-16$), but not with regard to relative intensity ($p = 0.832$). Third, we explored whether the Italian speakers conform to the *PAS*, thus associating overt pronoun with object antecedents and associating null pronouns with subject antecedents (RQ2a). The results suggest that the Italian speakers assigned null pronouns to subjects (80% on average), and assigned overt pronouns to objects (69% on average). Antecedent assignment was therefore predicted by pronoun type ($p < 2e-16$). Fourth, we investigated whether Swedish speakers show intrinsic ambiguity when they assign the overt pronoun to either a subject or an object antecedent (RQ2b). Contrary to our prediction, the Swedish speakers generally assigned the overt

pronoun to subject antecedents (66% on average). Antecedent selection was significantly selected above chance, i.e., above 50% ($p = 0.000192$).

In Study III, we first explored whether the late L1 Italian-FL Swedish bilinguals would abstain from the production of prominence patterns and pause features of the Italian monolinguals and instead approach those of the Swedish monolinguals, as well as the effect of LoR (RQ1). The results of the production task suggest that the late bilinguals did not replicate the patterns of the Italian monolinguals for most prosodic cues (H1). Unlike the Italian monolinguals, the late bilinguals did not exhibit the effect of the factor *antecedent* for the inter-clausal pause duration ($p = 0.87240$), the pronoun's relative length ($p = 0.0553$), and the pronoun's relative intensity ($p = 0.4445$). However, they unexpectedly produced pronouns with a larger average F0 range for subject antecedents ($p = 0.013583$), thus replicating the pattern of the Italian monolinguals for that acoustic measure. In addition, the outcomes also reveal an extremely significant interaction between the factor *antecedent* and *LoR* (H2). In particular, the longer the late bilinguals had been living in Sweden, the shorter the pronoun's length ($p = 3.72e-05$) and the smaller its average F0 range ($p = 0.000267$), when the target pronoun was associated with the subject antecedent. In other words, the longer they had been living in Sweden, the more they tended to approach the prosodic pattern of Swedish for subject antecedents. Second, we also explored whether the late bilinguals conformed to the *PAS*, as the Italian monolinguals did (see Study II), when sentences are not vocalized (RQ2). In the control interpretation task, the late bilinguals preferred null pronouns as coreferential with the subject antecedent (78% on average) and preferred overt pronouns as coreferential with the object antecedent (74% on average). Therefore, the preference for either a subject or an object antecedent was predicted by pronoun type ($p < 2e-16$) (H3).

In Study IV, we first discussed whether certain anaphoric constructions are inherently more difficult to process than others because the constraints of the *PAS* and the information provided by the linear order of a sentence favor different antecedents (RQ1). Second, we investigated whether both monolinguals and bilinguals are sensitive to the interplay between hierarchical structure and linear order of the sentence and, if so, in which ways they differ (RQ2). Third, we considered whether that interplay is likely to explain inconsistent findings reported in previous research on anaphora resolution (RQ3). By discussing previous studies, we found, first, that while both monolinguals and bilinguals generally conformed to the *PAS* in four anaphoric constructions, they exhibited a measure of ambiguity regarding the constraints of the *PAS* in two anaphoric constructions. Specifically, when the linear order

of a sentence and the constraints of the *PAS* favor the same antecedent, as in (92) and (93), both monolinguals and bilinguals exhibit a clear coreference between null pronouns and subject antecedents (for adult Italian monolinguals, see Belletti et al., 2007; Fedele & Kaiser, 2014; Filiaci et al., 2013; Serratrice, 2007; Sorace & Filiaci, 2006; Tsimpli et al., 2004; for adult Croatian monolinguals, see Kraš, 2008a; for adult Spanish monolinguals, see Filiaci et al., 2013; Bel & García-Alcaraz, 2015; for Italian bilinguals under L1 attrition see Tsimpli et al., 2004; for highly proficient L2 Italian speakers, see Belletti et al., 2007; Sorace & Filiaci, 2006).⁵³

(92) *Backward anaphora with subordinate-main clause order*

Mentre **pro_i** cucina, **Gianni_i** parla con Marco_j.
 while _ cooks Gianni talks with Marco
 ‘While (he) is cooking, Gianni talks to Marco.’

(93) *Forward anaphora with subordinate-main clause order*

Mentre **Gianni_i** parla con Marco_j, **pro_i** cucina.
 while Gianni talks with Marco _ cooks
 ‘While Gianni is talking to Marco, (he) cooks.’

Similarly, in anaphoric constructions such as those in (94) and (95), both monolinguals and bilinguals preferred to interpret overt pronouns as coreferential with object antecedents (for adult Italian monolinguals, see Belletti et al., 2007; Fedele & Kaiser, 2014; Serratrice, 2007; Sorace & Filiaci, 2006; Tsimpli et al., 2004; for adult Croatian monolinguals, see Kraš, 2008a; for adult Greek monolinguals, see Kaltsa et al., 2015; Papadopoulou et al., 2015; for Italian bilinguals under L1 attrition, see Tsimpli et al., 2004; for highly proficient L2 Italian speakers, see Belletti et al., 2007; Sorace & Filiaci, 2006). Inconsistencies have been reported only for Spanish, an NSL in which the division of labor between null and overt pronouns is not straightforward (see Filiaci et al., 2013 for details).

(94) *Forward anaphora with subordinate-main clause order*

Mentre Gianni_i parla con **Marco_j**, **lui_j** cucina.
 while Gianni talks with Marco he cooks
 ‘While Gianni is talking to Marco, he cooks.’

⁵³ In forward anaphora with subordinate-main clause order, such as that in (93), a linear order in which a subordinate clause precedes a main clause favors the least-demanding interpretation of a null pronoun, as suggested by Bel and Garcia-Alcaraz (2015) (see Study IV for details).

(95) *Forward anaphora with main-subordinate clause order*

Gianni_i parla con **Marco_j** mentre **lui_j** cucina.
Gianni talks with Marco while he cooks
'Gianni talks to Marco while he is cooking.'

In contrast, when the linear order of sentences and the *PAS* favor different antecedents, both monolinguals and bilinguals might exhibit an absence of a strong and consistent coreference between null pronouns and subject antecedents, as in (96), and between overt pronouns and object antecedents, as in (97). In fact, previous research has reported a high proportion of inconsistent results for these two constructions, for both monolingual and bilinguals.

(96) *Forward anaphora with main-subordinate clause order*

Gianni_i parla con Marco_j mentre **pro_i** cucina.
Gianni talks with Marco while — cooks
'Gianni talks to Marco while (he) is cooking.'

(97) *Backward anaphora with subordinate-main clause order*

Mentre **lui_{j/k}** cucina, Gianni_i parla con Marco_j.
while he cooks Gianni talks with Marco
'While he is cooking, Gianni talks to Marco.'

In particular, in (96), monolinguals preferred to interpret a null pronoun as coreferring with a subject antecedent in around half of the studies (for adult Italian monolinguals, see Fedele & Kaiser, 2014; for adult Spanish monolinguals, see Jegerski et al., 2011; Keating et al., 2011; for adult Croatian monolinguals, see Kraš, 2008a; for adult Greek monolinguals, see Papadopoulou et al., 2015), whereas no clear preference has been reported in the other half (for adult Italian monolinguals, see Belletti et al., 2007; Serratrice, 2007; Sorace & Filiaci, 2006; Tsimpli et al., 2004; for adult Spanish monolinguals, see Bel & García-Alcaraz, 2015; Chamorro, 2018; for adult Greek monolinguals, see Kaltsa et al., 2015). This suggests that the *PAS* may be unstable for that construction. Finally, monolinguals and bilinguals have been found to choose different strategies to resolve the anaphoric reference in more demanding constructions. In (97), monolinguals preferred to interpret the overt pronoun as coreferential with an extralinguistic referent (i.e., a person different from *Gianni* and *Marco*, not mentioned in the text), even if it represents the most pragmatically marked candidate (for adult Italian monolinguals, see Belletti et al., 2007; Serratrice, 2007; Sorace and Filiaci 2006; Tsimpli et al., 2004). By contrast, bilinguals mostly selected a subject antecedent (for highly proficient L2 Italian speakers, see Sorace and Filiaci,

2006; Belletti et al., 2007) or exhibited a lack of clear preference for any antecedent (for Italian bilinguals under L1 attrition, see Tsimpli et al., 2004). Hence, in a sentence such as that in (97), monolinguals give priority to the *PAS*, whereas bilinguals violate it.

5.5 Discussion of the Main Findings

In Study I, we explored whether attrition effects on anaphora resolution are temporary, thus decreasing after L1 re-immersion. Study II then investigated cross-linguistic differences between Italian and Swedish in a speaker's use of prosodic cues to resolve anaphora sentences. The potential effects of L1 attrition on the use of prosodic cues in anaphora resolution were examined in Study III. Finally, in Study IV, we discuss whether the interaction between the hierarchical structure and the linear order of sentences is likely to explain previous inconsistent findings on anaphora resolution in both monolinguals and post-puberty bilinguals.

The results reported in Study I question previous assumptions on the ways L1 attrition impacts anaphora resolution. First, the late bilinguals were not generally slower than the monolinguals in terms of response times (see Kaltsa et al., 2015). As a matter of fact, the late bilinguals were even faster than the monolinguals, but their responses were less “accurate”. A lack of attrition in terms of response times may be explained either by a positive bilingualism effect on cognitive control (Bialystok et al., 2004; Costa, Hernández, Costa-Faidella, & Sebastián-Gallés, 2009), or by factors beyond our control (e.g., stress). A positive effect of bilingualism is unlikely to explain our results concerning response times because it is in contrast with the findings related to response preferences, in which attrition effects were found. Therefore, we argue that factors beyond our control may have affected the data, such as working memory capacity, attentional control, and executive processing (Harley, 2014, pp. 386-387), or coincidental factors such as stress (Castiello, 1995, pp. 11-14). Second, the late bilinguals exhibited faster response times after L1 re-immersion, as we expected. In fact, they provided faster response times in Session 2 (after their vacation in Italy) than in Session 1. However, the monolinguals, who were tested twice as well (before and after a comparable time span, in which their language environment did not change), showed a similar improvement in response times. Therefore, the findings for response times cannot fully support our hypothesis that L1 re-immersion

decreases attrition effects, because a task-learning effect influenced the monolinguals' responses.

As for response preferences, we found L1 attrition in Session 1, since the late L1 Italian-FL Swedish bilinguals generally exhibited more unexpected responses than the Italian monolinguals. However, we found attrition in the interpretation of null pronouns, and a lack of attrition in the interpretation of overt pronouns (see Study I). This finding is in contrast with our initial hypothesis that attrition would be limited to overt pronouns. We hypothesized that the syntactic-pragmatic constraints of the overt pronoun in Italian would be affected by the syntactic-pragmatic constraints of the competing overt pronoun in Swedish, and thus be activated more frequently and more recently (see the *ATH* – Paradis, 1993). The overt pronoun in Swedish can, in fact, be coindexed with either subject or object antecedents. We also hypothesized a lack of attrition on the null pronoun because there is no competing item in Swedish. This hypothesis was based on previous research, in which it was suggested that the null pronoun is generally not vulnerable in a situation of late bilingualism, whereas the overt pronoun exhibits non-native-like interpretation in both L1 attrition and near-native L2 acquisition (Belletti et al., 2007; Kaltsa et al., 2015; Sorace & Filiaci, 2006; Tsimpli et al., 2004). However, our results in Study I, showing the null pronoun to be vulnerable in late bilingualism, challenge that assumption. In addition, in our theoretical paper (Study IV), we observed that, in many previous studies, adult monolinguals unexpectedly exhibited an ambiguous coreference for the null pronoun in the case of forward anaphora in Italian (Belletti et al., 2007; Serratrice, 2007; Sorace & Filiaci, 2006; Tsimpli et al., 2004), Spanish (Bel and García-Alcaraz, 2015; Chamorro, 2018; Chamorro et al., 2016), and Greek (Kaltsa et al., 2015). Contrastingly, in Study I of the present thesis, the Italian monolinguals exhibited a consistent bias for the null pronoun, which generally preferred a subject antecedent, thus conforming to the *PAS*.⁵⁴

A compelling question is why many previous studies unexpectedly showed a negligible bias in favor of subject antecedents in forward anaphora sentences containing null pronouns by adult monolinguals (for Italian, see Belletti et al., 2007; Serratrice, 2007; Sorace & Filiaci, 2006; Tsimpli et al., 2004; for Spanish, see Bel and García-Alcaraz, 2015; Chamorro, 2018; Chamorro et al., 2016; for Greek, see Kaltsa et al., 2015), whereas other studies revealed a significant preference for subject antecedents for the same construction (for Italian, see Fedele & Kaiser, 2014; for Spanish, see Jegerski et al., 2011;

⁵⁴ However, the null pronoun bias was slightly weaker than the overt pronoun bias in Italian monolingual controls (see Study I).

Keating et al., 2011; for Greek, see Papadopoulou et al., 2015; for Croatian, see Kraš, 2008a).

Divergent results are likely to be partially explained by microvariation in pronoun distribution across different NSLs (see Study IV). In particular, the division of labor between null and overt pronoun is less straightforward in Spanish than in other NSLs, such as Italian, Greek and Croatian. In fact, the subject pronouns *èl/ella* ‘he/she’ in Spanish are assigned to either subject or object antecedents (see Filiaci et al., 2013). However, inconsistencies have also been reported across studies testing the same NSL, such as Italian.

Hence, in Study IV, we suggested that some anaphoric constructions are inherently more unstable than others. This instability is likely to be explained by the complex interaction between the hierarchical structure and the linear order of a sentence. Specifically, in two anaphoric constructions, the constraints of the *PAS* are in contrast with the expectations given by the linear order of the sentence: backward anaphora with subordinate-main clause order containing an overt pronoun and forward anaphora with main-subordinate clause order containing a null pronoun.

First, in backward anaphora with subordinate-main clause order containing an overt pronoun, the linear order of the sentence favors the subject antecedent, since the object is too far from the target pronoun, as illustrated in (98). However, the *PAS* predicts that an overt pronoun cannot be associated with a subject antecedent.

- (98) Quando **lui**_{i/k} viveva a Roma, Riccardo_i faceva spesso visita a **Diego**_j.
when he lived in Rome Riccardo made often visit to Diego
‘When he lived in Rome, Riccardo often visited Diego.’

In (98), the processor encounters the infelicitous antecedent, the subject *Riccardo*, before coming across the felicitous antecedent, the object *Diego*. This may prevent speakers from selecting the object as coindexed with the overt pronoun. Crucially, adult monolinguals, but not bilinguals, prefer to pick another available antecedent, the extralinguistic referent, i.e., someone else, not mentioned in the sentence (Belletti et al., 2007; Serratrice, 2007; Sorace & Filiaci, 2006; Tsimpli et al., 2004). Presumably, bilinguals cannot access the extralinguistic referent as a consequence of sub-optimal processing resources (see Sorace & Filiaci, 2006).

Second, forward anaphora with main-subordinate clause order, like those examined in Study I, are likely to present a similar issue for null pronouns. The *PAS* predicts that a null pronoun will be interpreted as coreferential with a

subject antecedent. However, the subject antecedent is also the farthest candidate from the null pronoun in an anaphoric construction such as that in (99):

(99) **Riccardo**_i faceva spesso visita a Diego_j quando *pro*_i viveva a Roma.

Riccardo made often visit to Diego when _ lived in Rome

‘Riccardo often visited Diego when (he) lived in Rome.’

As shown in (99), the least plausible antecedent for the *PAS*, *Diego*, is also the candidate closest to *pro* in the sentence. Hence, the hierarchical structure and the linear order of a sentence favor different antecedents: the subject and the object, respectively. We therefore suggested that this contrast may cause instability in antecedent assignment. This can likely explain why previous research has reported contrasting results for anaphoric constructions similar to that illustrated in (99).

Nevertheless, the results of Study I revealed the null pronoun to be straightforwardly assigned to a subject antecedent by Italian monolinguals. We have thus not detected an intrinsic instability in the construction in (99), which is in line with the results reported by some previous studies (for adult Italian monolinguals, see Fedele & Kaiser, 2014; for adult Spanish monolinguals, see Jegerski et al., 2011; Keating et al., 2011; for adult Croatian monolinguals, see Kraš, 2008a; for adult Greek monolinguals, see Papadopoulou et al., 2015). Our findings are, however, in contrast with other previous studies, in which an absence of a clear bias between null pronouns and subject antecedents has been reported for the anaphoric construction illustrated in (99) (for adult Italian monolinguals, see Belletti et al., 2007; Serratrice, 2007; Sorace & Filiaci, 2006; Tsimpli et al., 2004; for adult Spanish monolinguals, see Bel & García-Alcaraz, 2015; Chamorro, 2018; for adult Greek monolinguals, see Kaltsa et al., 2015). This high number of inconsistent findings, reported across previous research, is an indication that the construction in (99) can be unstable.

Notably, in Study I, the late L1 Italian-FL Swedish bilinguals exhibited a measure of ambiguity when interpreting null pronouns in a construction such as that in (99) which was not exhibited to the same extent by the Italian monolinguals. This represents an unexpected finding, since previous research has reported non-native-like behaviors mostly in the interpretation of overt pronouns (Belletti et al., 2007; Serratrice, 2007; Sorace & Filiaci, 2006; Tsimpli et al., 2004; but cf. Bel & García-Alcaraz, 2015). We therefore suggested that the linear order of the sentence may have affected the late bilinguals’ responses. The object is, in fact, the candidate closest to the target

pronoun in the text. It is possible that late bilinguals are more sensitive than monolinguals to the information provided by the linear order of the sentence. This is likely to explain both the occurrence of attrition effects on the null pronoun and a lack of attrition effects on the overt pronoun. The absence of attrition on the overt pronoun is particularly relevant for the present discussion because it reveals that CLI did not impact pronoun interpretation. In fact, the syntactic-pragmatic features of the overt pronoun in Swedish did not affect the interpretation of overt pronouns in Italian. This suggests that non-native-like behaviors in late bilingualism may be caused by processing difficulties (Sorace & Filiaci, 2006; Sorace, 2011) rather than by CLI from the NNSL to the NSL (Tsimpli et al., 2004).

In Studies II and III, we shifted the focus to the role of prosodic cues in anaphora resolution, in a cross-linguistic perspective and in late bilingualism, respectively. The results of Study II largely support our hypothesis that, since overt pronouns in Italian and overt pronouns in Swedish present different coreference patterns, native speakers of these two languages use prosodic cues to indicate different antecedents. However, we found some unexpected results for the Swedish speakers, which we discuss below.

First, the Italian speakers produced longer pauses and pronouns with a higher degree of prominence when the antecedent of the overt pronoun referred to the subject (the unpredictable antecedent) than the object (the predictable antecedent). The higher degree of prosodic prominence was reported for all of the three acoustic measures: the pronoun's relative length, the pronoun's average F0 range, and the pronoun's relative intensity. Thus, the pronoun was longer (relative length), louder (relative intensity), and exhibited a wider tonal excursion (average F0 range) when it referred to the unpredictable antecedent in Italian, the subject. The assumption that, in Italian, the subject represents the unpredictable antecedent of an overt pronoun, whereas the object represents the most predictable antecedent of an overt pronoun, was confirmed by the results of the control interpretation task. In fact, the Italian speakers significantly associated overt pronouns with object antecedents, and also significantly associated null pronouns with subject antecedents, conforming to the *PAS*.

Second, contrary to our predictions, the Swedish speakers showed no inherent ambiguity in pronoun resolution, neither in their use of prosodic cues (speech production task), nor in their interpretation of globally ambiguous anaphora sentences (control interpretation task). They generally produced longer pauses and pronouns with a higher degree of prominence when the antecedent referred to the object than to the subject of the main clause.

However, a higher degree of prominence was reported for the pronoun's relative length and for its average F0 range, whereas this was not found for the pronoun's relative intensity. Therefore, the Swedish speakers produced pronouns that were longer (relative length) and had a wider tonal excursion (average F0 range) when the antecedent referred to the object of the main clause. In addition, intensity was not used as a cue to modulate prosodic prominence on the pronoun. This non-relevant role of intensity was also reported in other studies on prosody and coreference (Rello & Llisterri, 2012; Baumann & Roth, 2014).⁵⁵ The use of prosody by the Swedish speakers reflects their responses in the control interpretation task. They generally associated overt pronouns with subject antecedents. We did not expect to find this coreference pattern, since we predicted that the Swedish speakers would exhibit inherent ambiguity in pronoun resolution, thus associating overt pronouns with the subject or the object antecedent equally. However, this preference for subject antecedents is not completely surprising. While Tsimpli et al. (2004) suggest that overt pronouns in English can be associated with either subject or object antecedents, Belletti et al. (2007) propose that, in intra-sentential anaphora such as those included in the current thesis, overt pronouns generally pick a subject antecedent in English (see Study IV). We argue that the status of the subject in our target sentences is likely to explain the preference of Swedish speakers for subject antecedents. In fact, in our target sentences, the subject occurs in first position, which is considered the most prominent position (Choi, 2001). In addition, the subject is generally more cognitively prominent than items with other grammatical functions (Keenan & Comrie, 1977).⁵⁶ Taken together, our results suggest that Italian and Swedish speakers use inter-clausal pause and prosodic prominence on pronouns to refer to different antecedents, thus reflecting opposite patterns in antecedent assignment in the two languages. Therefore, inter-clausal pause and prosodic prominence broke the canonical coreference patterns in both groups, favoring the most unpredictable antecedent: the subject in Italian and the object in Swedish.

Crucially, the late L1 Italian-FL Swedish bilinguals tested in Study III exhibited attrition on the use of prosodic cues to solve globally ambiguous anaphora. In particular, they did not generally replicate prominence patterns and pause features of the Italian monolinguals. The rate of attrition depended on length of residence in the FL environment; the longer in Sweden, the higher

⁵⁵ However, Rello and Llisterri (2012) investigated L1 Spanish, and Baumann and Roth (2014) did not explore pronouns.

⁵⁶ This explanation is from Kawaguchi (2016).

the probability of adapting to the patterns of Swedish. In addition, the late bilinguals replicated the coreference patterns of the Italian monolinguals when sentences were not vocalized. As previously mentioned, we found that the Italian monolinguals produced longer inter-clausal pauses and more prominent pronouns (for length, intensity, and average F0 range) for subject rather than object antecedents (see Study II). Contrastingly, the late bilinguals of Study III did not conform to that tendency when they used prosodic cues in L1 anaphora resolution, except as regards average F0 range. Specifically, the results of the late bilinguals suggest that 1) antecedent assignment did not impact the inter-clausal pause length, the pronoun's relative length, and the pronoun's relative intensity, 2) the values for the pronoun's average F0 range were higher for subject antecedents, thus replicating the pattern of the Italian monolinguals, and 3) length of residence in Sweden affected the relative length and the average F0 range of the target pronouns. Specifically, the longer the residence in Sweden, the higher the probability that the late bilinguals shortened the target pronoun and increased its average F0 range when the antecedent corresponded to the subject. Hence, the longer the late bilinguals had been living in Sweden, the higher the probability that their use of prosodic cues diverged from the pattern of the Italian monolinguals and approached the pattern of the Swedish monolinguals, for most prosodic cues. The interaction between attrition rate and length of residence has been suggested by some previous studies (see Bergmann et al., 2016; de Bot et al., 1991; Kasparian & Steinhauer, 2017; Schmid & Dusseldorp, 2010).⁵⁷ Unexpectedly, the use of inter-clausal pauses by late bilinguals did not conform either to the tendency shown by the Italian monolinguals, or to the tendency exhibited by the Swedish monolinguals. Longer inter-clausal pauses were produced by the Italian monolinguals for subject antecedents, and by the Swedish monolinguals for object antecedents. By contrast, the late bilinguals did not use the inter-clausal pause to signal coreference to any specific antecedent. We therefore claim that inter-clausal pause is less relevant than prosodic prominence for antecedent assignment, in both Swedish and Italian. Moreover, when sentences were not vocalized (control interpretation task), the late bilinguals conformed to the *PAS*, since they assigned null pronouns to subject antecedents, and assigned overt pronouns to object antecedents, as the Italian monolinguals did in Study II. This suggests that prosody could be a compelling domain for attrition studies, and that it is especially relevant in anaphora resolution. From our

⁵⁷ However, a lack of correlation between attrition and length of residence has been reported in other studies (de Leeuw, Schmid, & Mennen, 2010; Kasparian et al., 2017; Schmid, & Beers Fägersten, 2010; Schmid & Jarvis, 2014; Varga, 2012).

findings for Study III, it appears that attrition in the use of prosodic cues did not affect sentence interpretation when sentences are mentally but not orally produced. However, Italian speakers in attrition with Swedish might be influenced, in speech, by the shift in prominence patterns that we have previously described. It might be possible that speakers in attrition would accept, to a certain extent, an overt strong pronoun associated with a subject antecedent, even if that pronoun is not focalized. If this is the case, a higher degree of prosodic prominence is no longer a condition to allow the coreference of an overt pronoun to the antecedent in SpecIP position (Carminati, 2002) or the aboutness subject (Calabrese, 1986a). Similar observations were brought to the fore by Sorace and Filiaci (2006), who suggested that contrastive stress on the overt strong pronoun is likely to allow more subject responses in Italian.

Interestingly, the findings of Study I suggest that CLI did not impact pronoun resolution, since the overt pronoun in Swedish, which allows either a subject or an object antecedent, did not affect the pragmatic constraints of the overt pronoun in Italian, which requires an object antecedent. However, in Study III, it was shown that CLI is likely to affect the use of prosodic cues in anaphora resolution, since those late bilinguals exhibiting a longer length of residence in Sweden approached the Swedish prosodic pattern. Therefore, it is likely that CLI has a different impact on different linguistic domains.

6. Conclusion

6.1 Original Contribution

The principal aim of this thesis was to explore how late bilinguals and monolinguals resolve the anaphoric reference when sentences are globally ambiguous. The focus was, first, on those individual changes in L1 pronominal distribution that are likely to occur in a situation of language contact and, second, on the impact of prosodic cues in both a cross-linguistic and a bilingual perspective. The main language under investigation was Italian, an NSL in which pronominal distribution is governed by specific syntactic-pragmatic constraints.

In Study I, we explored whether L1 attrition effects on anaphora resolution diminish after a brief re-immersion in the L1-speaking country. The 20 late L1 Italian-FL Swedish speakers and the 21 Italian monolingual controls completed a self-paced interpretation task intuitively and as fast as possible, for which we measured response preferences and response times. In Study II, we shifted the focus from L1 attrition to the impact of prosody in a cross-linguistic perspective. The main research question concerned whether the use of prosodic cues in anaphora resolution mirror the different coreference patterns in an NSL (Italian) and an NNSL (Swedish). To answer this question, 28 Italian speakers and 28 Swedish speakers completed two experimental tasks: a speech production task and a control interpretation task. The findings and observations from Studies I and II form the basis of Study III, in which we examined whether L1 attrition affects prosodic cues in anaphora resolution. In particular, we investigated whether late bilinguals abstain from producing the prominence patterns and pause features of Italian monolinguals and instead approach those of Swedish monolinguals, as well as to what extent length of residence has an impact on this effect. In addition, we also explored whether late bilinguals conform to the *PAS* when sentences are not vocalized. To this end, 18 late L1 Italian-FL Swedish bilinguals completed the same task of Study II, and their patterns were compared to those shown by Italian and Swedish monolinguals in that previous study. In Study IV, we examined which factors

are likely to explain previous inconsistent findings with respect to anaphora resolution. Specifically, we discussed whether the complex interaction between the hierarchical structure and the linear order of the sentence is likely to explain those conflicting results. Moreover, we considered which specific strategies are used by post-puberty bilinguals to deal with anaphoric constructions with different processing costs. Table 12 summarizes the answers to our main research questions.

Table 12. Summary of main RQs and answers.

RQs	Answers
1) Do late L1 Italian-FL Swedish bilinguals show attrition effects on anaphora resolution before L1 re-immersion, and recovery effects after L1 re-immersion (Study I)?	Yes, late bilinguals show attrition effects on response preferences, limited to the null pronoun. The recovery effect is likely to be determined by a task-learning effect because the control group improved as well.
2) Do L1 Italian and L1 Swedish speakers use inter-clausal pauses and prosodic prominence on pronouns to resolve anaphora sentences, in a way that reflects the divergent coreference patterns in the two languages (Study II)?	Yes, longer pauses and pronouns with a higher degree of prominence are produced for subject antecedents in Italian, and for object antecedents in Swedish. This reflects divergent coreference patterns in the two languages; overt pronouns generally select an object antecedent in Italian, whereas they generally select a subject antecedent in Swedish. Thus, pause and prosodic prominence break the canonical coreference pattern, favoring the unpredictable antecedent.
3) Do late L1 Italian-FL Swedish bilinguals abstain from producing prominence patterns and pause features of Italian monolinguals and approach those of Swedish monolinguals when they resolve anaphora sentences in L1, thus suggesting attrition, and is this effect of attrition influenced by length of residence in the FL environment (Study III)?	Yes, attrition generally affects prominence patterns and pause features in anaphora resolution. The rate of attrition on prosodic cues is influenced by length of residence in the FL environment (Sweden). By contrast, when sentences are not vocalized, late bilinguals replicate coreference patterns of the Italian monolinguals.
4) Does the complex interaction between the hierarchical structure and linear order of sentences affect the behaviors of both monolinguals and bilinguals, thus explaining contrasting findings reported in previous research on anaphora resolution (Study IV)?	Yes. When the constraints of the <i>PAS</i> and the expectations provided by the linear order of the sentence favor the same candidate, both monolinguals and bilinguals generally assign 1) null pronouns to subject antecedents, and 2) overt pronouns to object antecedents. Contrastingly, when the constraints of the <i>PAS</i> and the information provided by the linear order of a sentence do not favor the same antecedent, both monolinguals and bilinguals may exhibit an absence of a bias between 1) null pronouns and subject antecedents, and 2) overt pronouns and object antecedents. However, monolinguals and bilinguals employ different strategies to deal with more (cognitively) demanding constructions.

Our findings concerning late bilinguals contribute to the current debate on the nature of attrition, i.e. the erosion of a speaker's native language, after reduced exposure to the L1 and regular use of an FL (see Studies I, III and IV). A relevant question concerns the nature of attrition, and whether it only affects processing or whether L1 restructuring of representations can also be expected. Currently, two main accounts are likely to explain the findings exhibited by late bilinguals with respect to anaphora resolution: 1) attrition only affects processing, thus excluding changes in L1 representations (Sorace, 2011), and 2) attrition can also affect L1 representations (Tsimpli et al., 2004).⁵⁸ The impact of CLI has a different “weight” in those two accounts. Under the *Processing Account*, CLI does not have a primary role but it may enhance difficulties occurring at the processing level. Under the *Representational/Underspecification Account*, non-native-like behaviors in late bilingualism are determined by the transfer of syntactic-pragmatic features from one language to the other; specifically, from the NNSL to the NSL. As a consequence, under the *Processing Account*, non-native-like behaviors occur despite CLI.

Our results suggest that processing has a principal role in attrition on anaphora resolution. First, in Study I, L1 attrition was found for the null pronoun in Italian, which lacks a corresponding item in the FL (Swedish), suggesting that CLI did not play a relevant role. Second, previous research has reported that adult monolinguals are also likely to exhibit coreference patterns that contradict the theory (see the inconsistent bias for null pronouns in forward anaphora reported in Belletti et al., 2007; Serratrice, 2007; Sorace & Filiaci, 2006; Tsimpli et al., 2004, for L1 Italian; Bel and García-Alcaraz, 2015; Chamorro, 2018; Chamorro et al., 2016, for L1 Spanish; Kaltsa et al., 2015 for L1 Greek). We therefore argue that some anaphoric constructions inherently require a higher processing cost than others, and that this is likely to affect pronoun resolution in both late bilinguals and monolinguals (Study IV). Coreference is more straightforward for some anaphoric constructions than for others (e.g., the null pronoun is more clearly associated with the subject antecedent in the sentence *Quando pro ha vinto la lotteria, Maria ha chiamato Anna* ‘when [she] won the lottery, Maria called Anna’ than in the sentence *Maria ha chiamato Anna quando pro ha vinto la lotteria* ‘Maria called Anna, when [she] won the lottery’). We argue that anaphora resolution is more challenging for those constructions in which the predictions of the *PAS* and the information given by the linear order of a sentence favor different antecedents.

⁵⁸ We agree with Schmid and Köpke (2017), who suggest that attrition should include both temporary changes affecting processing and permanent changes in L1 representations.

In particular, difficulties may arise when the specific syntactic-pragmatic constraints of a language are in conflict with the expectations of the processor, sensitive to the linear order of anaphora sentences.

For example, in backward anaphora with subordinate-main clause order, the overt pronoun linearly precedes the two competing antecedents: the subject and the object (e.g., *Quando lei ha vinto la lotteria, Maria ha chiamato Anna* ‘when she won the lottery, Maria called Anna’). Therefore, the processor immediately looks for an available antecedent for the ambiguous pronoun (see Fedele & Kaiser, 2014; Sorace & Filiaci, 2006; Serratrice, 2007). The first antecedent encountered by the processor in the sentence is the subject. However, the subject is not a plausible antecedent for an overt pronoun for the *PAS*. Hence, this contraposition between the strategies of the processor and the constraints of the *PAS* is likely to prevent both monolinguals and bilinguals from selecting the object as coreferential with the overt pronoun. Notably, the two groups employ different strategies to solve this issue. Adult monolinguals prefer the overt pronoun as coreferential with an extralinguistic referent, hence they avoid to break the *PAS*. Contrastingly, adult bilinguals show either a lack of a significant preference for any candidate (for late bilinguals under L1 attrition, see Tsimpli et al., 2004) or a preference for the subject antecedent (for highly proficient L2ers, see Belletti et al., 2007; Sorace & Filiaci, 2006).

This is not the case for forward anaphora with main-subordinate clause order, in which the most plausible candidate for the *PAS*, the object, is also the antecedent closest to the overt pronoun in the text (e.g., *Maria ha chiamato Anna quando lei ha vinto la lotteria* ‘Maria called Anna, when she won the lottery’). In fact, both adult monolinguals and bilinguals conform to the *PAS* for that construction (see Study I, and also Belletti et al., 2007; Serratrice, 2007; Sorace & Filiaci, 2006; Tsimpli et al., 2004). Nevertheless, bilinguals may accept a coreference with an unexpected antecedent (the subject) more often than monolinguals (for late bilinguals under L1 attrition, see Tsimpli et al., 2004; but cf. Study I; for L2ers, see Belletti et al., 2007; Sorace & Filiaci, 2006). We thus suggested that some anaphoric constructions are more demanding than others, at the processing level, because the expectations provided by the hierarchical structure of the sentence are in contrast with those given by the linear order of the sentence. Hence, we argued that processing has a central role in anaphora resolution, not only for bilinguals, but also for monolinguals. In fact, a certain degree of indeterminacy is inherent to certain anaphoric constructions. Nevertheless, the co-existence of one or more languages in the same speaker enhances the intrinsic difficulty of processing

some anaphoric constructions. Therefore, sub-optimal processing resources are more likely to explain our findings for the late bilinguals.

Crucially, CLI has not been detected in the results of Study I, since the syntactic-pragmatic features of the overt pronoun in Italian were not influenced by those of Swedish, in which a coreference with the object antecedent is not expected. In addition, in Study III, our findings suggested a lack of an effect of attrition for the late bilinguals, since they generally conformed to the *PAS*. This may be explained by the nature of the task in Study III, in which heavy load on the processing was not expected, contrary to the task in Study I. In fact, in Study III, the speakers completed the control interpretation task without any time limitation, and were not required to answer as soon as possible, and they could therefore reflect on their responses and correct them. This further enhances the idea of a processing effect in anaphora resolution by late bilinguals. Nevertheless, we acknowledge that the statistical analyses performed in Studies I and III are not directly comparable. In the former study, we performed a between-group analysis, whereas in the latter study, we performed a within-group study, in which we examined whether speakers conformed to the *PAS* or not.

Turning now to prosody, our findings contribute to a better understanding of how prosodic cues modulate focusing properties in relation to the *Null Subject Parameter* (Study II). Italian is an NSL, where null pronouns are associated with subject antecedents, and overt pronouns are associated with object antecedents, at least in the case of intra-sentential anaphora (see the *PAS*). Contrastingly, Swedish is an NNSL, in which overt pronouns can be potentially associated with either subject or object antecedents in the case of intra-sentential anaphora. Nevertheless, we found the Swedish speakers to prefer subject over object antecedents. This may be explained by the special status of the subject in our target sentences, as it is in first position – the most prominent position (Choi, 2001). Concerning the speaker's use of prosody, both groups used inter-clausal pauses and prosodic prominence to break the canonical coreference pattern in the L1. This finding conforms to the perception study by Goad et al. (2018), in which it was found that Italian monolinguals tended to select more subject responses for the overt pronoun when that pronoun had contrastive stress. In addition, our results are in line with the idea that prosody is a key factor in pronoun resolution, since variation in the use of prosodic cues is likely to affect the information status of linguistic items (see De Hoop, 2004; Jasinskaja et al., 2005; 2007; Rello & Llisterri, 2012; McClay & Wagner, 2014). In particular, we suggest that Italian and Swedish are likely to exhibit different coreference patterns; one language

virtually presents three realizations of intra-sentential anaphora, whereas the other language presents two possible realizations, as shown in (100) and (101) respectively:

- (100) Alberto_i usciva sempre con Dario_j quando *pro_i/lui_j/ LUI_{i,j}* lavorava in un
 Alberto went out always with Dario when _ he HE worked in an
 ufficio in città.
 office in city

‘Alberto always went out with Dario when he worked in an office in the city.’

- (101) Albert_i gick alltid ut med Sven_j när *han_i/HAN_j* arbetade på ett
 Albert went always out with Sven when he HE worked in an
 kontor i stan.
 office in city

‘Albert always went out with Sven when he worked in an office in the city.’

As previously mentioned, while Cardinaletti and Starke (1999) argue that Italian strong overt pronouns *lui/lei* ‘he/she’ can bear contrastive stress, they need not necessarily bear it. When unstressed, those pronouns are generally associated with the antecedents in a position lower than the SpecIP of the phrase structure (Carminati, 2002). The occurrence of stress is likely to break their canonical coreference pattern, allowing coreference also with the unpredictable antecedent, the subject (see Goad et al., 2018; Sorace & Filiaci, 2006). If we interpret this finding under Calabrese (1986a), we might expect that, when the aboutness subject represents the subject of a subsequent clause, Italian speakers might accept, to some extent, its association with an overt strong pronoun if that pronoun is focalized. In fact, the null pronoun is independently ruled out because the subject of the subsequent clause is in focus. Focalization is linked to a higher degree of prosodic prominence. As a consequence, an overt strong pronoun, which has a higher degree of prosodic prominence, could also be assigned to a subject antecedent, as shown in (100). On the other hand, the Swedish pronouns *han/hon* ‘he/she’ are strong when they bear stress (Hellan & Platzack, 1999). In this case, they tend to be associated with a non-prominent antecedent, which corresponds to the object in the case of an intra-sentential anaphora sentence, such as that in (101). When unstressed, *han/hon* ‘he/she’ behave as weak pronouns, thus selecting a prominent antecedent, represented by the subject *Albert* in the sentence in (101).

Moreover, our investigation on prosody contributes by elucidating whether, and how, the use of L1 suprasegmental phenomena changes in a situation of

language contact. Our findings suggest that speakers who have been living abroad generally exhibit attrition in the use of prosodic cues when they resolve globally ambiguous anaphora sentences. In addition, the longer the residence in the FL environment, the higher the probability that late bilinguals will adapt to the FL prosodic patterns. The late L1 Italian-FL Swedish bilinguals did not generally replicate prominence patterns and pause features exhibited by the Italian monolinguals, except for average F0 range. In this case, both the Italian monolinguals and the late bilinguals exhibited a larger average F0 range for subject antecedents. This unexpected result might be due to the occurrence of melodic features for both focal accents and lexical word accents in Swedish. These tonal features in Swedish are difficult to acquire for L2 speakers but, once acquired, they might persevere. Thus, the late bilinguals who had been in Sweden for a longer period of time might have adapted to the prominence pattern of Swedish for average F0 range. In addition, the longer the late bilinguals had been living in Sweden, the higher the probability that they shortened the pronoun's length for subject antecedents. Therefore, the longer in Sweden, the more the late bilinguals adapted to the prominence pattern of Swedish. The Italian monolinguals used the pronoun's intensity as a cue to distinguish between subject and object antecedents (see Study II), whereas intensity was not relevant for the Swedish monolinguals. The late bilinguals approached the Swedish pattern with respect to pronoun intensity, showing no difference between subject and object antecedent. Taken together, all these findings support the idea that L1 attrition is likely to affect the use of suprasegmental cues (de Leeuw et al., 2012; Mennen, 2004). While the late bilinguals generally abstained from producing the L1 prosodic patterns, they did replicate the L1 coreference pattern in the interpretation task. In fact, they conformed to the *PAS*, as the Italian monolinguals did. Nevertheless, it is possible that, in contrast with Italian monolinguals, late bilinguals might accept, to a certain extent, the overt pronoun coindexed to the antecedent in SpecIP position (corresponding to the aboutness subject in our target sentences), even when the pronoun is not in focus. This suggests that a higher degree of prosodic prominence is no longer a condition to allow the association between an overt pronoun and the subject antecedent. These findings indicate that prosody represents a compelling domain for examining attrition effects in pronoun resolution and should be explored further.

6.2 Limitations and future research

In our studies, the monolinguals represent the baseline for exploring late bilinguals' behaviors. This methodological choice is based on previous research on anaphora resolution in bilingualism (Bel & García-Alcaraz, 2015; Belletti et al., 2007; Chamorro et al., 2016; Genevska-Hanke, 2017; Goad et al., 2018; Gürel, 2004; Kaltsa et al., 2015; Köpke & Genevska-Hanke, 2018; Sorace & Filiaci, 2006; Tsimpli et al., 2004, among others). However, we acknowledge potential limitations of this design.

First, as previously mentioned, our (predominantly) monolingual speakers may vary in terms of knowledge and exposure to FLs. While they mainly speak the L1 on a daily basis, some of them have very little knowledge of an FL, whereas others may speak an FL (usually English) to a limited extent. Contrary to monolinguals, however, late bilinguals constantly activate one language and inhibit (Green, 1986) or deactivate (Grosjean, 2013) the other language. Moreover, late bilinguals and monolinguals exhibit similar language development until puberty. Both groups grow up in a predominantly monolingual environment, and the language environment of one group changes only in adulthood.

Second, attrition is usually examined in relation to individual changes in the L1. However, languages also change over time. As for pronoun distribution in Italian, Cardinaletti (2004) and Frascarelli (2007) suggest that a weak use of the overt (strong) pronouns *lui/lei* is emerging. These are replacing the weak overt pronouns *egli/ella*, which are restricted to a formal register. As a consequence, *lui/lei* can alternate the distribution of strong and weak pronouns without violating grammar. This potential change in pronoun distribution in Italian may influence monolinguals' response preferences. It is possible that Italian monolinguals will become less categorical when they assign either null or overt pronouns to an available antecedent. Contrastingly, late bilinguals may not be affected by this change in Italian, because they live in a different country. Therefore, individual changes in the L1 (attrition) should also be considered in relation to language changes over time.

Third, as explained in the methodological section, in the experimental studies, we included forward anaphora sentences, but not backward anaphora sentences, which are marked and would require being embedded in a larger discourse. Thus, future research should also explore how syntactic-pragmatic factors interact with prosody in L1 and in attrition, and also how backward anaphora are affected by L1 re-immersion.

Concerning Study I, we unexpectedly found an improvement in terms of response preferences and response times in the control group, which we interpreted as a task-learning effect. Therefore, further research is needed to investigate whether attrition effects decrease with short-term re-immersion in the L1-speaking environment. To avoid task-learning effects in future research, we first recommend considering a longer time interval between the two experimental sessions, if possible. Second, a higher number of distractors could also help prevent participants from “remembering” the task. Another potential limitation of Study I is its lack of a second group of late bilinguals who were not re-immersed in the L1-speaking environment. Monolingual controls are necessary to establish whether late bilinguals deviate from the L1 coreference pattern. Nevertheless, a second group of late bilinguals, who did not experience any change in the L1 input, should be considered in order to improve the experimental design. In our case, this was not possible for practical constraints, since it was problematic to find bilinguals with specific characteristics. In addition, similar to other previous studies, Study I lacks a Latin-square design (see Bel & García-Alcaraz, 2015; Jegerski et al., 2011; Keating et al., 2011), but we controlled that the global meaning of the sentences was generally ambiguous.

A potential limitation of Studies II and III concerns F0, since we excluded from the analysis shape and timing of pitch accents on the pronoun, which are relevant for prosodic prominence. This choice is determined by cross-linguistic differences between Italian and Swedish. As mentioned in the methodological section, Swedish exhibits a distinction between accent 1 and accent 2, which present different timings (Bruce, 1983; Gårding, 1977, among others). Each word includes either accent 1 or 2, depending on phonological, morphological and lexical factors (Myrberg & Riad, 2016). Second, the shape of pitch accents is related, in Swedish, to the distinction between focal accent and word accent (Myrberg & Riad, 2016). Word accent shape is therefore affected by focus. Therefore, they may interfere with focal accents. For these reasons, shape and timing of pitch accents cannot easily be compared in Italian and Swedish. Second, Studies II and III might have been improved if other measurements for intensity had been used, such as root-mean-square (RMS) or spectral emphasis or balance. Other factors should be considered in future research, such as the impact of dynamic pitch properties, like pitch slope, as a cue to prominence (Baumann & Winter, 2018). Third, the participants who completed the task in Italian were exposed only to overt pronouns in the production task, yet were exposed to both overt and null pronouns in the control interpretation task. This methodological choice was determined by the

necessity of developing the same experimental design in Italian and Swedish for the production task, but we acknowledge that the Italian speakers could have been affected by this difference between the two tasks. Fourth, a speech perception study is needed to confirm the relevance of our findings for Studies II and III (cf. Goad et al., 2018). Study II would also benefit from the analysis of individual differences; therefore, a more fine-grained study should be considered for future research. In addition, in Study III, we did not explore the potential effect of input in L1 Italian, and input and proficiency in FL Swedish. As explained in the paper, we collected information concerning those factors to obtain a general profile of the participants, but they were not intended to be part of the analysis. Thus, future research should also consider whether and how those factors affect a speaker's use of prosodic cues.

As for Study IV, we focused on the interplay between hierarchical structure and linear order of the sentence, but we are aware that other factors should also be discussed with respect to their role in anaphora resolution. First, aging is likely to impact anaphora resolution (Kaltsa et al., 2015). Previous research has, in fact, suggested that elderly speakers show difficulties in tracking the referents in discourse (Hendriks, Koster, & Hoeks, 2014). Second, more attention should be given to those grammatical conditions that may facilitate or inhibit certain readings of anaphora, such as verb tense and aspect (see Rohde, Kehler, & Elman, 2006, for L1 English). Third, future research should also consider the potential impact of different methodologies. Processing load can vary across elicitation tasks, such as self-paced reading experiments, picture verification tasks or eye-tracking tasks. Finally, more fine-grained measurements are likely to uncover subtler differences in speakers' interpretations of pronominal coreference.

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This thesis is a collection of four studies on pronominal anaphora resolution with a focus on first language (L1) attrition and prosody. In Study I, we explored the temporariness of attrition effects on anaphora resolution in L1 Italian speakers who moved to Sweden after puberty (i.e., late bilinguals). An experimental group of 20 late Italian-Swedish bilinguals and a control group of 21 Italian monolinguals completed a self-paced interpretation task twice, and we measured response preferences and response times. In Study II, we investigated how L1 Italian and L1 Swedish speakers use pause features and prominence cues to resolve globally ambiguous anaphora sentences, and whether their patterns in the use of prosody mirror the divergent coreference patterns in the two languages. 28 L1 Italian speakers and 28 L1 Swedish speakers completed a speech production task, in which we analyzed the inter-clausal pause length and the pronoun's degree of prosodic prominence, and a control interpretation task, in which we considered response preferences. Study III represents a continuation of Study II, since we examined a group of 18 late Italian-Swedish bilinguals, who completed the same experimental tasks of Study II. Study IV is a theoretical investigation, in which we discussed previous inconsistent findings on anaphora resolution in light of the interplay between hierarchical structure and linear order of a sentence. The results of the four studies suggest, first, that anaphora resolution may also affect null pronouns, and that task-learning effects should be taken into account for further research on L1 re-immersion. Second, they suggest that inter-clausal pause and prosodic prominence of pronouns are likely to break the canonical coreference pattern, both in a null subject language and in a non-null subject language. Third, the findings also reveal that L1 attrition affects prominence patterns and pause features in pronoun resolution. In particular, the longer the residence in the foreign language (FL) environment, the higher the probability that late bilinguals adapt to the FL patterns when they use prosody to resolve anaphora sentences. Fourth, both monolinguals and bilinguals are sensitive to the interplay between hierarchical structure and linear order of anaphora. However, they employ different strategies to interpret an anaphora sentence, in which hierarchical structure and linear order favor different antecedents. The implications of the findings are discussed in light of the role of processing and cross-linguistic influence (CLI) in L1 attrition, as well as in light of the use of prosodic cues to resolve an anaphoric reference, both in relation to the *Null Subject Parameter* and in relation to L1 attrition.



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