
The subject realization in L2 Spanish by German L1 speakers: A corpus study

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Abstract

This article deals with the realization of referential subjects in the L2 Spanish of German (adult) native speakers. The acquisition of a null subject grammar by speakers of a non-null subject language has drawn considerable attention in generative approaches to L2 acquisition. This article revisits the issue and compares the predictions made by the Interface Hypothesis (Sorace 2005, 2011, Sorace and Filiaci 2006, Tsimpli and Sorace 2006) to an alternative, the Feature Reassembly Hypothesis (Lardiere 2008, Slabakova 2013 Cho and Slabakova 2014). Relying on corpus data, the study presents a novel empirical approach and applies an innovative statistical analysis procedure from learner corpus research. The results of the study corroborate previous empirical findings, namely that pronouns, yet not null subjects, are problematic, but also brings in new insights, in particular that issues with pronouns are consistent and go beyond the contexts predicted by the Interface Hypothesis. The contrasts between L1 and L2 subject realization found in the data therefore can only in part be explained to result from interface issues. The Feature Reassembly Hypothesis offers a suitable additional explanation relating the issues to the properties of the L1 and L2 learnability.

Keywords: null subjects, pronouns, L2 acquisition, interface, Spanish.

1. Introduction

The acquisition of a null-subject L2¹ by speakers of a non-null-subject L1 has been central in the development of the Interface Hypothesis. The hypothesis states that the external, syntax-pragmatics interface is vulnerable in L2 acquisition, suggesting that high complexity at the interface proves hard for L2 learners. Studies show that null subjects do not cause too many issues in L2 acquisition but overt subjects do (for instance Sorace and Filiaci 2006, Rothman and Iverson 2007, Rothman 2008, Serratrice 2008). A common explanation is that overt subjects are more complex from an interface perspective, they carry interface features which null subjects lack. Null subjects are therefore less complex and are predicted to be less problematic in acquisition (Tsimplici et al. 2004, Sorace and Filiaci 2006, Serratrice 2007, Sorace and Serratrice 2009).

This article takes a fresh look at this issue by comparing data from L1 Spanish to L2 Spanish from German natives from the CEDEL2 corpus.² The statistical analysis follows the MUPDARF procedure developed for learner corpus research (Gries and Deshors 2020, Gries 2022). The results confirm that L2 speakers have little trouble acquiring a target-like use of null subjects and they also use DPs competently, however, they show non-target-like use of pronouns. As predicted by previous research, they show difficulties in the crucial interface contexts, however, there are also differences in L1 and L2 subject realization that go beyond what is predicted by the Interface Hypothesis. While the Interface Hypothesis can explain part of the learning difficulties found in my data, it cannot account for the whole picture. I will rely on the Feature Reassembly Hypothesis and argue that some issues result from properties of the L1 grammar. German L1 speakers find a close functional match for Spanish null subjects in the contexts where pronouns are used in German, and thus acquire null subjects easily. The task that causes problems is to acquire a new functional meaning for Spanish pronouns, which only formally but not functionally match the German equivalents and thus requires feature reassembly. The article brings new insights into what, apart from complexity at the interface, can cause difficulty for L2 learners. Put simply, learning a new form for a familiar functional meaning is not difficult, but learning a new functional meaning for a familiar form is.

The article is structured as follows: Section 2. presents the types of referential subjects availability in Spanish and German and characterizes the pragmatic factors that condition the use of the different types. Section 3. summarizes the theoretical background and the previous research and identifies the gap the present investigation aims to fill. Section 4. presents the methodology. Section 4.1. illustrates the data basis, section 4.2. contains the variables that entered into the statistical analysis and section 4.3 describes the statistical methods. Section 5. summarizes the results and discusses them. In section 6. I interpret the results in the light of the theoretical hypotheses. Finally, section 7. concludes the article.

¹ I use the term L2 as a cover term to refer to all non-L1 languages.

² *Corpus Escrito del Español como L2* (Lozano 2022), see section 4.1. for a description of the corpus.

2. Referential Subjects in Spanish and German

Spanish has three main options to express referential subjects: DPs like *la mujer* in (1a), pronouns like *ella* in (1b) and null subjects as in (1c). In all three sentences the subject refers to the same individual.

(1) Spanish

- a. La mujer anda por la calle.
the woman walks on the street
'The woman is walking down the street.'
- b. Ella anda por la calle.
she walks on the street
'She is walking down the street.'
- c. Ø Anda por la calle.
walks on the street
'She is walking down the street.'

(2) German

- a. Die Frau geht die Straße entlang.
the woman walks the street down
'The woman is walking down the street.'
- b. Sie geht die Straße entlang.
she walks the street down
'She is walking down the street.'
- c. ?Ø Geht die Straße entlang.
walks the street down
intended: 'She is walking down the street.'

German, in principle, only has two options: DPs like *die Frau* in (2a) and pronouns like *sie* in (2b). In restricted contexts, German also allows null subjects like (2c). Schmitz et al. (2012), for instance, found 4% of subject omission in their German dataset of adult child-directed speech. Notably, this is a very small number compared to what is found in Spanish. Etxebarria Zuluaga (2022) reports omission rates between 54% and 80% depending on the variety of Spanish.

German subject omission is furthermore restricted to spoken and dialectal German. The literature distinguishes between two types: topic drop and out-of-the-blue drop. Cases of topic-drop null subjects are illustrated in (3) and (4). They mostly appear with third person subjects and only in cases where the referent of the subject is salient as in (3).

(3) German, Trutkowski (2010: 206, ex 1a)

- Kennst du den Hans?
know you the Hans
Na klar Ø is' mein Nachbar.
of course is my neighbor
'Do you know Hans? Of course, he's my neighbor.'

Topic drop is restricted to main clause declaratives, hence the contrast between (4a) and (4b). Topic-drop null subjects are furthermore ungrammatical when co-occurring with foci (4c) or *wh*-expressions (4d) (see Schmitz et al. 2012).

- (4) German, Schmitz et al. (2012: 212, exx 4-7)
- a. (Er) sollte das lesen.
 he should it read
 ‘He should read it.’
- b. Ich denke dass *(er) das lesen sollte.
 I think that he it read should
 ‘I believe that he should read it.’
- c. DAS sollte *(er) unbedingt lesen.
 this should he absolutely read
 ‘He should absolutely read THIS.’
- d. Was sollte *(er) unbedingt lesen?
 what should he absolutely read
 ‘What should he absolutely read?’

Out-of-the-blue-drop of subjects is a very different phenomenon from topic drop. Out-of-the-blue drop mostly affects first or second person referents without a salient antecedent (Trutkowski 2010, 2016). It is attested in many German dialects (see 5a-c) most broadly with second person subjects. Contrary to topic-drop, it is not restricted to main clauses (5a). Some authors have related the phenomenon to morphological syncretism (6a,b vs 6c), complementizer agreement (5a) and double agreement (see Trutkowski 2010 and Weiß and Volodina 2018).

- (5) a. Bavarian, Weiß and Volodina (2018: 275, ex 22a)
 wennsd Ø mogst
 if.2SG want.2SG
 ‘If you want.’
- b. Thuringian, Weiß and Volodina (2018: 275, ex 22b)
 kriegst Ø auch einen Groschen
 get.2SG too a penny
 ‘You’ll even get a penny.’
- c. Low German, Weiß and Volodina (2018: 275, ex 22c)
 Dat maakst Ø recht
 that make.2SG right
 ‘You are doing it right.’

According to Trutkowski 2010, out-of-the-blue drop of subjects is licensed by inflection and is not possible with morphologically syncretic forms. This is the reason why (6b) is ungrammatical in Swabian, in contrast to (6a) because plural verbs are syncretic in this dialect. In turn, both singular and plural first person subjects can be dropped in standard German as illustrated in (6c), because in this variety plural form are not syncretic.

- (6) a. Swabian, Trutkowski (2010: 213, ex 26a)
 Passet uff, Ø komm glei nüba.
 take care come.1SG soon over
 ‘Careful, or (I) will come over.’
- b. Swabian, Trutkowski (2010: 213, ex 26d)
 *Ø Gebet nix.
 give.1PL nothing
 ‘We give nothing.’
- c. Standard German, Trutkowski (2010: 207, ex 3a,b)
 Ø Komme / Ø Kommen nachher vorbei.
 come.1SG come.1PL later over
 ‘I/We’ll come over later.’

In sum, while there appear to be null subjects in spoken German, their number is very low. The literature furthermore reports dialectal variation. For the present investigation, it was not possible to include the variety of German as a potential factor. It is also doubtful that the availability of null subjects in the dialectal variety spoken by the participants would have a strong impact on the data: null subjects are restricted to spoken German and the investigation at hand is based on written data. For a study focusing on oral data, however, it could be worthwhile to include the availability of German null subjects as a factor.

The different subject types do not vary freely in neither of the two languages but are impacted by discourse pragmatic factors. Table 1. summarizes the most dominant factors and the tendencies of subject choices reported in the literature.

Table 1. Conditions of use of the different subject types in Spanish and German.

Information Structure	New	Given
Spanish	DP (pronoun)	null subject
German	DP	pronoun
Referential (Dis)continuity	Discontinuous	Continuous
Spanish	DP, pronoun	null subject
German	DP, demonstratives	pronouns
Contrast	Contrasted	Not Contrasted
Spanish	DP, pronoun	null subject
German	DP (pronoun)	pronoun

One factor that impacts the choice of the subject type, is whether the subject refers to newly introduced referents or to referents that are already given in the context. Spanish discourse new subjects tend to be realized overtly as DPs.

(7) Spanish, CEDEL2, L1 speaker

- a. Un hombre, interpretado por Charles Chaplin, va caminando
 a man interpreted by Charles Chaplin goes strolling
 tranquilamente por la calle.
 leisurely down the street
 ‘A man, interpreted by Charles Chaplin, leisurely strolls down the streets.’
- b. Ø Se enciende un cigarillo.
 3REFL= lights a cigarette
 ‘He lights a cigarette (for himself).’

Example (7a) is the first sentence of one of the texts written by a native speaker taken from my data set. The subject is newly introduced and consequently expressed by the DP *un hombre*. (7b) is the third sentence of the same text. The null subject is given and co-referent with the subject of the first sentence.

Brucart’s (1987: 219) *Principio de lexicalización de los pronominales* states that pronouns that attribute new information to the discourse are required to be realized phonetically in Spanish (see Vallduví 1992 for a similar idea). Given referent, in turn, tend to be realized as null subjects. German discourse new subjects are also realized as DPs and given subjects as pronouns.

The second factor has to do with whether the subjects in subsequent sentences refer to the same referent or whether there is a switch in the reference. Continuous and switch reference contexts have been studied extensively in the literature under different labels like *topic shift* (for instance, Carminati 2002, Tsimpli et al. 2004, Rothman 2008, Rothman and Iverson 2007, Quesada 2015,) or *subject (dis)continuity* (for instance, Mayol 2010, Vande and Ortiz 2022). On the present article, I use the more precise term *referential continuity* for clarity. The alternative term *subject continuity* might be misunderstood, because the continuity or discontinuity concerns the reference an expression denotes and not the expression or subject (type) itself. The term *topic shift* is too restrictive, because while subjects are often the topics of sentences, this is not necessarily the case.

Referential continuity is central in determining the use of null and overt subjects in null subject languages. Grimshaw and Samek-Lodovici (1998) first captured the contrast in terms of topichood, stating that null subjects are optimal with a co-referent topic antecedent. Just as in other Romance null subject languages, continuous referents tend to be null in Spanish while discontinuous ones tend to be overtly realized. (8) is a segment of four sentences from a text by an L1 speaker from my dataset. The subjects in (8a) (8c) and (8d) have the same referent and this referent is given. The contrast between (8c) with an overtly realized pronoun and (8d) with a null subject result from the fact that the reference is discontinuous in (8c) and continuous in (8d). Discontinuous references are characteristic for the topic shift contexts that are central in the theoretical discussion on the Interface Hypothesis (see section 3.1.).

(8) Spanish, CEDEL2, L1 speaker

- a. La mujer descubre de nuevo al bebé en el carro
 the woman discovers again DOM-the baby in the stroller
 ‘The woman discovers the baby again in the stroller.’

- b. y en ese momento pasa Charlie.
and in this moment passes Charlie
'and in this moment Charlie passes by.'
- c. Ella piensa que [...]
she thinks that
'She thinks that [...]'
- d. Ø Le grita.
him screams
'She screams at him.'

German discontinuous referents are realized as DPs or demonstratives, and continuous ones tend to be realized as pronouns (Bosch et al. 2003, Wilson 2009).³

A third factor that impacts the choice of subject type is contrast: In Spanish, when a (given) subject is not contrasted it is realized as a null subject, in turn, if a subject is contrasted to the subject of another sentence, it is realized overtly (see Mayol 2010). This is exemplified in (9). In German, contrasted subjects are realized as DPs or pronouns, and non-contrasted ones as pronouns.

- (9) Spanish, Mayol (2010: 8, ex 8)
Ellos fueron pero yo no fui.
they went but I not went
'They went but I didn't.'

In addition to these pragmatic factors, different authors found that grammatical person also impacts the choice of subject type in Spanish (Mayol 2010, Torres and Travis 2011, 2012, Schmitz, et al. 2012, Schmitz et al. 2016, Bessett 2018, Herbeck 2022).⁴ Subjects referring to speech participants, and in particular first person subjects, are realized overtly more frequently than third person subjects. For the empirical investigation reported in section 4. and 5., grammatical person is a negligible factor because the data stem from narrative texts with almost exclusive third person subjects. Information structure and referential continuity are included as factors in the empirical study. Contrast, unfortunately, could not be taken into consideration because contrastiveness was harder to operationalize systematically and too many cases were deemed ambiguous.

To sum up, the picture that emerges for Spanish is that generally null subjects are preferred if the referent can be clearly identified, whereas pronouns and DPs are used to signal change of reference, newness and contrast. It has to be emphasized, however, that these are merely tendencies and all of the mentioned factors interact heavily. One aspect I would like to point out, even if we are strictly dealing with tendencies, is that there is an interesting overlap found in table 1: in the contexts where

³ Demonstratives in German (and cross-linguistically) share properties with pronouns but are not necessarily always in complementary distribution (see Höhn 2015: 85-88). In the empirical study, still, to reduce the complexity, the choice was made to annotate instances of demonstratives as pronouns (see section 4.2. and 6.)

⁴ Some authors furthermore found that verb class can impact the choice of subject type in Spanish (Torres and Travis 2019, Orozco and Hurtado 2021).

Spanish uses a null subject, German uses a pronoun. I will return to this observation in section 6.

3. Previous Research

There is a large amount of research dedicated to the L2 acquisition of null subject languages. There is also research into this topic in heritage language acquisition and L1 acquisition. This section briefly summarizes the theoretical background and gives an overview of previous studies.

3.1. Interface Hypothesis

A fundamental theoretical concept that is essential for the topic of the present article is the Interface Hypothesis. The earlier version of the hypothesis stated that the interface between syntax and other domains of grammar is particularly difficult to acquire and can lead to persistent problems in L2 acquisition even in advanced speakers (Sorace 2005, 2011, Sorace and Filiaci 2006, Tsimpli and Sorace 2006).

In more recent versions of the hypothesis a distinction is made between internal and external interfaces (cf. Sorace and Serratrice 2009). Internal interfaces concern the interaction in the core grammar, typically understood as the areas of grammar in which syntax is impacted by semantics. External interfaces, in turn, correspond to the interaction of syntax and pragmatics. While internal interfaces can be acquired by L2 speakers to the level of target-like proficiency, according to the authors, external interfaces are harder to acquire and problematic even in advanced speakers. Among the reasons why external interfaces are more difficult, Sorace and Serratrice (2009) mention the underspecification of features at the external interface giving rise to ambiguity and optionality that is typical of pragmatics, the high cognitive load of the parallel processing of syntactic and discourse information, and input factors, i.e. the assumed lack of exposure to and use of structures targeting external interfaces.

The acquisition of null subject languages has been investigated by prominent proponents of the hypothesis (Tsimpli et al. 2004, Sorace and Filiaci 2006, Serratrice 2007, Sorace and Serratrice 2009). They found that L2 learners show little difficulty in acquiring null subjects, but have consistent difficulties with overt subjects. The authors propose that pronouns and DPs are more complex than null subjects from an interface perspective. They model complexity through the presence of concrete interface features, namely [+ Topic Shift] and [+ Focus] that overt subjects are endowed with. Null subjects, in turn, lack these specific interface features. Overt subjects thus have a more elaborate feature specification, rendering them more complex than null subjects and harder to acquire. The core contexts that motivate this feature specification are given in (10).

(10) a. Italian, Serratrice (2008: 182, ex 3a)

Marta_i scriveva frequentemente a Piera quando *pro*_i era negli Stati Uniti.

Marta wrote frequently to Piera when *pro* was in the US

‘Marta wrote frequently to Piera when (she) was in the United States.’

b. Italian, Serratrice (2008: 183, ex 3b)

Marta_i scriveva frequentemente a Piera_j quando lei_j era negli Stati Uniti.

Marta wrote frequently to Piera when she was in the US

‘Marta wrote frequently to Piera when she was in the United States.’

In (10a) the most natural interpretation of the null subject is that it is co-referent with the subject of the main clause *Marta*, constituting a case of topic continuity and thus not requiring a [+ Topic Shift] nor [+ Focus] feature. In turn, (10b) constitutes a case of topic shift with a discontinuous reference because the pronoun *lei* is not interpreted as referring to the matrix subject *Marta*, but to the indirect object *Piera*. Therefore the pronoun carries a [+ Topic Shift] feature. The [+ Focus] feature is motivated because of the contrastive interpretation that can be achieved through the presence of overt subjects.

3.2. Learnability and Feature Reassembly

Acquiring a part of the L2 grammar or lexicon can lead to problems because it is difficult from an L2 learnability perspective. Laufer and Eliasson (1993) and Schepens, Slik, and Van Hout et al. (2016) identify the following factors that can potentially provoke L2 learnability issues:

1. inherent complexity of the item of construction
2. difference between L1 and L2
3. identity between L1 and L2

The first factor is chiefly the scope of the Interface Hypothesis, as issues in the acquisition are explained as a result from the complexity of the L2. The second two factors target similarity and difference to the L1 as potential hindering factors in the acquisition of the L2. When learning the Spanish subject expressions, German L1 speakers are confronted with the task to associate a new form-meaning pair (see also Domínguez and Arche 2022 on English L1 speakers). To account for these issues in L2 acquisition, Lardiere (2008) formulates the Feature Reassembly Hypothesis. In this view, L2 acquisition involves the transfer and subsequent reassembly of features from L1 to L2 expressions. Mappings of form to meaning in L2 acquisition constituted cases of feature reassembly. Lardiere assumes that speakers will first transfer their L1 features to L2 expressions and then reassemble these features to the target mapping as their proficiency progresses. This is exemplified in figure 1.

Assume the L1 contains an expression α and the learner has reasons to consider α a possible functional match to the L2 expression β . As a first step the learner will transfer the features F_i, F_j, F_k from their native expression α onto β . This represents the initial learner hypothesis that α and β have a complete functional overlap. When progressing in the L2, the learner will revise this initial hypothesis and reassemble the features (removing F_j and F_k , adding F_m) to match the target expression more closely.

Figure 1. feature transfer and feature reassembly

	L1		L2		
form	α		β		β
function	$F_i F_j F_k$	\rightarrow	$F_i F_j F_k$	\Leftrightarrow	$F_i F_j F_k F_m$
		<i>feature transfer</i>		<i>feature reassembly</i>	

Slabakova (2013) and Cho and Slabakova (2014) add a further aspect to the Feature Reassembly Hypothesis. They propose that not all form-meaning mappings are equal, but there is a cline in difficulty. This cline depends on whether the features need to be reassembled or not, what Lardiere (2008) proposed in her hypothesis, and additionally on whether meanings are encoded directly or not, i.e. whether there is a one-to-one match between a particular form and a particular meaning. This predicts that meanings that are directly and overtly encoded are easier to acquire and also that L2 form-meaning pairs that match form-meaning pairs in the L1 are easier to acquire.

The cline from covert to overt is illustrated in the scale in figure 2. Note that the authors are well aware that the scale represents an idealized scenario and is restricted to only two of the many possible factors that enter in the complex task of language acquisition (cf. Cho and Slabakova 2014: 166). In their model, features that are directly encoded through morphological means in the L1 and L2 grammar are easier to acquire, and therefore located at the left edge of the scale. In turn, features that are contextually contributed and are not morphologically expressed are more difficult to acquire and located at the right edge of the scale in figure 2. This means that the difficulty in acquiring interface-features can be explained within this model based on the fact that, at least in the languages under investigation, these features are always contextually contributed and not directly encoded morphologically.

Feature reassembly is the other important factor contributing to the cline of difficulty in acquisition that is also integrated in the illustration in figure 2. When reassembly needs to take place, it leads to more difficulty in the acquisition. This is so irrespective of whether the feature is expressed morphologically or contextually contributed. What this means is that, if the L1 expression carries the same feature as the L2 expression, the basic feature transfer that takes place as an initial step (see figure 1) is sufficient. If, however, there is no match between the L1 and L2 feature, reassembly is required, which renders the acquisition of these expressions more difficult.

Figure 2. Cline of difficulty of acquisition of features by Cho and Slabakova (2014) adapted from Slabakova (2009); F_m = morphologically visible feature, F_c = contextually contributed feature; \diamond = no feature reassembly, \blacksquare = feature reassembly (taken from Domínguez and Arche 2022: 201: figure 1).

Easier to acquire			Harder to acquire		
F_m to F_m	F_m to F_m	F_c to F_m	F_m to F_c	F_c to F_c	F_c to F_c
\diamond	\blacksquare			\diamond	\blacksquare

The relation between feature reassembly and directly and indirectly encoded features was informed by a case study by on L2 Russian (Cho and Slabakova 2014). In their study they compare the acquisition of definiteness in L2 Russian by L1 speakers of English and Korean. Russian lacks definite articles and uses indirect strategies to mark definiteness. English uses articles, i.e. direct morphological means, to mark the definite vs indefinite contrast. Korean, like Russian, has no direct encoding of definiteness. The authors consider two cases of definiteness marking in Russian, one with overt morphological marking and one that relies solely on context. While English does not use either of these strategies to express definiteness, Korean makes use of similar strategies, although with marked differences to Russian, in particular in case of the indirect, contextual strategy. The results confirm that the cline of difficulty predicted by the scale in figure 2 holds: English speakers showed more problems overall, showing that it is more difficult to acquire an indirectly encoded feature than a directly encoded one, especially if the L1 encodes the feature directly. The hardest task in their study was the acquisition of the second strategy by the Korean speakers, which involved indirectly encoded features that require reassembly. Again supporting the cline of difficulty illustrated in figure 2.

Domínguez and Arche (2022) apply the Feature Reassembly Hypothesis to explain the difficulty in acquiring Spanish null and overt subjects by L1 English speakers. English, just as German, does not have null subjects. Based on the ideas developed in Lardiere (2008), Slabakova (2009) and Cho and Slabakova (2014), Domínguez and Arche (2022) assume that both null and overt subjects should be difficult to some extent for English learners. Although it is not stated explicitly by Domínguez and Arche (2022) – they only mention the pragmatic complexity of both types (216) – I suspect that null and overt subjects are assumed to be difficult in general because the features that help distinguish between the different subject types are not encoded directly through morphology but are indirect and context-dependent. This is true for overt and null subjects alike, but with null subjects, given that they virtually lack any morphological form, even phi features are indirectly encoded and must be determined contextually through verb agreement. The authors quote input factors and the need for feature reassembly as main reasons for the difficulty. The results of their study support their prediction: the beginner and intermediate learners in their sample showed non-target like uses of null and overt subjects. Advanced speakers behaved like the native controls, suggesting that Spanish subjects can be mastered by L1 English speakers. A further prediction, that overt subjects should be more difficult because they require feature reassembly, is, however, not supported by their results.

3.3. Previous Studies

Previous studies on the L2 acquisition of Spanish subjects focused mostly on L1 English speakers acquiring Spanish (Liceras 1989, Phinney 1987, Pérez-Leroux and Glass 1999, Montrul and Louro 2006, Rothman and Iverson 2007, Rothman 2008, Ballester 2013, Clements and Domínguez 2017, Domínguez and Arche 2022). There are also a number of investigations on other L1s, for instance Bel and García-Alcaraz (2015) and García-Alcaraz and Bel (2019) on L1 Moroccan Arabic, and Vande and Ortiz (2022) on L1 French. up until now, the specific language pairing I investigate has not been studied systematically. There are a few studies focusing on the acquisition of German and a Romance null subject language in a heritage context (see Schmitz et al.

2012, Schmitz et al. 2016). But to the best of my knowledge, the acquisition of Spanish subjects by German L1 speakers has only been addressed in a short section in Licerias and Díaz 1999), reporting data from three advanced speakers. They analyze spontaneous production data. Learners were asked to summarize the plot of their favorite movie. The goal was to investigate whether German L1 speaker would transfer their native topic-drop parameter to their L2 grammar, which would lead to the expectation of null subjects being more frequent in matrix than in subordinate clauses (see the discussion around example 4 in section 2.). This prediction is not borne out by the data as the three speakers actually produce null subjects to a higher degree in subordinate clauses than in matrix clauses.

Most previous studies on L2 Spanish employed experimental methods relying on comprehension and judgment tasks (for instance Rothman and Iverson 2007, Rothman 2008, Clements and Domínguez 2017). Some exceptions are Montrul and Louro (2006) and Domínguez and Arche (2022) using oral production data. Both use picture-story retelling to elicit data of L1 English speakers. In Domínguez and Arche (2022) the data are complemented by a paired-discussion task. Domínguez (2013: 131-155) relies on oral data of English L1 speakers from the corpus SPLLOC.⁵ The data were collected through a picture description task and an interview.

Many of the findings of the previous studies support the Interface Hypothesis. For instance, Rothman and Iverson (2007), Rothman (2008) find that pronouns are more complex than null subjects and harder to acquire, and thus can be cited in support of the Interface Hypothesis. Other authors, however, take a different stance. Montrul and Louro (2006), Clements and Domínguez (2017) and Domínguez and Arche (2022) argue that Spanish null subjects are equally restricted by pragmatic factors and therefore are also complex in their feature specification, casting doubt on the predictions of the Interface Hypothesis and the latter two instead argue in favor of the Feature Reassembly Hypothesis (see section 3.2). In terms of acquisitional development, many authors found a proficiency effect in that more advanced speakers perform more target-like (for instance Rothman and Iverson 2007, Rothman 2008, Montrul and Louro 2006, Domínguez and Arche 2022).

3.4. Theoretical Predictions and Methodological Innovations

The empirical study that will be outlined in section 4. and 5. is designed to evaluate the two hypotheses that were presented in 3.1. and 3.2. The Interface Hypothesis predicts issues in the contexts that involve external interfaces, namely the topic shift contexts and contexts involving contrast. It explains issues in acquisition that arise because of the complexity of the target grammar. Factors that go beyond these are not centrally addressed in the hypothesis.

The Feature Reassembly Hypothesis, in turn, takes L1 and L2 properties into account. It states that learnability issues arise in contexts where feature reassembly is required. The hypothesis predicts that aspects of the L2 grammar that formally match the L1 grammar but have different functional features are particularly difficult to acquire because learners have to unlearn the familiar features associated to a form and reconfigure new ones.

⁵ *Spanish Learner Language Oral Corpora* (Mitchell et al. 2008).

Both hypotheses predict that the L2 acquisition of Spanish overt subjects is more problematic than the acquisition of null subjects. In the Interface Hypothesis overt subjects are difficult because they carry a more complex feature specification than null subjects. In the Feature Reassembly Hypothesis overt subjects are more difficult because they require a more complex feature reassembly than null subjects. The hypotheses differ in their scope: while the Interface Hypothesis predicts difficulties in a restricted set of contexts (topic shift and contrast), the Feature Reassembly Hypothesis predicts difficulties that go beyond these contexts.

In terms of methodology and scope, there are a number of aspects that are novel about my investigation. First, as stated above, there are hardly any studies focusing on German L1 speakers. Although German certainly shares properties with English, the L1 that has been investigated extensively, this does not mean that it can be assumed that both groups of learners show the same behavior and difficulties in this acquisition task. Additionally, there are also differences with respect to the availability of topic-drop, that could lead to different paths in learning (see section 2.).

Secondly, most of the investigations only distinguished between overt and null subject but did not distinguish between DPs and pronouns as different types. As will be seen in section 5, the target-like behavior in the realization of the two types of overt subjects differs drastically in my dataset. Treating them as one category conceals these differences and can lead to wrong conclusions.

Thirdly, most previous studies on the L2 acquisition of Spanish subjects rely on experimentally elicited data or oral production data, while I use written corpus data. The only other study that relies on written production is by Vande and Ortiz (2022). Their study targets L1 French speakers and employs a controlled task designed to test the impact of referential continuity on the choice of subject type. Their databases is different from the one used in the present study which consists of a corpus of narrative texts that speakers were prompted to write freely without a specific theoretical hypothesis in mind. The production of written text, without a doubt, allows for a higher activation of linguistic and normative knowledge than spontaneous oral production. In particular, written productions involve more planning and allow for the possibility of auto-correction. All these facts might suggest that oral data are more suitable to investigate external interface issues, as Sorace (2011) would suggest. However, even oral production in the L2 can involve auto-correction and planning. Especially the story telling tasks, that many of the studies cited in section 3.3. rely on, are prone to involve a fair amount of planning. Furthermore, planning does not necessarily mean that the performance is more target-like. Studies comparing the oral and written production of L2 speakers (Granfeldt 2008, Kuiken et al. 2011) found that, contrary to one might expect based on the higher degree of planning, learners actually make more errors in written production than in oral production (Kuiken et al. 2011). This warrants my choice to rely on written corpus data as a means to enrich and complement the existing body of research.

Finally, relying on controlled tasks, many previous studies are targeted to investigate the contexts that are predicted to cause issues based on the Interface Hypothesis, namely topic shift contexts. Thus, the results confirm or disprove issues in these narrow contexts, however, what is going on more broadly remains largely understudied. Furthermore, this field of research currently lacks systematic studies of authentic data. This is what my study aims to contribute. It approaches the data in a

more exploratory way which permits deriving new hypotheses about areas that have so far been overlooked.

4. Methodology

This section lays out the methodology employed for the corpus study of the subject realization of German L2 speakers of Spanish.

4.1. Corpus

The data are taken from the *Corpus Escrito del Español como L2* (CEDEL2, Lozano 2022). It is a large open data collection comprising data from Spanish L2 speakers of different L1s as well as comparative data from L1 Spanish speakers of European and Latin American varieties. The corpus consists of mostly written (and some spoken) production data that is enriched with detailed demographic metadata on each speaker. The data were collected through dedicated online forms. In addition to the task prompting the production, participants also contributed information about their demographic and linguistic background and participated in a Spanish placement test (Lozano 2022). The production data used in the present study are narrative texts. In the corpus, different tasks were used to elicit the texts. The prompt for the data used in the present study was always the same, guaranteeing a large degree of compatibility, namely to watch and describe a short Charlie Chaplin video. Participants were allowed to watch the video more than one time (see <http://cedel2.learnercorpora.com/>). Furthermore, there appears to have been no time limit for completing the task (mean duration 60.4 min).

The L2 data basis is the whole sub corpus of German L1 speakers. These are 82 speakers, between 19 and 72 years of age (mean 25), with between 1 and 30 years of learning Spanish (mean 8). Speakers' proficiency spans from lower beginners to upper advanced, with a skew towards higher proficiency speakers (see section 4.2. for details). All of the speakers have knowledge in additional foreign languages, 18 of them have knowledge of an additional null subject language. The distribution of subject types does not differ significantly between the speakers who know an additional null subject language, and those who do not. There is no significant difference in the proportion of subject types depending on whether speakers have knowledge of an additional null subject language ($\chi^2=1.7$, $p>0.05$). The speaker with an additional null subject language realized 36% DPs, 49.9% null subjects and 13.8% pronouns. The others 37.3% DPs, 46.9% null subjects and 14.1% pronouns. The full L2 dataset consists 16,164 words, 2335 sentences.

The L1 data basis is a small subpart of the L1 comparison corpus of CEDEL2, consisting of 17 randomly sampled native speakers from different areas of Spain (4 from Madrid, 3 each from Barcelona, Bilbao and Granada, 2 from Valencia and 1 each from Almería and Cádiz), between 21 and 51 years of age (mean 34). The demographic data do not provide direct information about the variety of Spanish spoken by the L2 speakers. It is however plausible to assume a certain dominance of European Spanish, which motivates the choice of the L1 comparison group. 75% of the L2 speakers report having stayed abroad in a Spanish speaking country, 74% these stayed in Spain and an additional country, 56% stayed only in Spain. The full L1 dataset consists of 3,423

words, 522 sentences. Both datasets only include sentences with referential subjects, i.e. declarative and interrogative personal sentences. Imperatives and impersonal sentences were excluded.

In the process of settling on the final models, the impact of demographic (and other) factors were tested systematically. The models including these factors were not superior on goodness-of-fit measures nor in explanatory power, and therefore these factors are not included in the final models.

4.2. Variables and Descriptive Statistics

In this section I describe the variables and apply some descriptive statistics to get a first impression of their distribution. The raw data were annotated manually for a large number of different factors potentially impacting subject realization.⁶ Here I will only characterize the variables that entered into the model. They are summarized in table 2.

Table 2. Summary of the variables in the model.

Variables	Values
SUBJECTTYPE	nullsub(ject), dp, pron(oun)
INFORMATIONSTRUCTURE	ne(w), gi(ven)
REFERENTIALCONTINUITY	Y(es), N(o)
CLAUSETYPE	M(ain)C(lause), S(ubordinate)C(lause)
SUBJECTPOSITION	pre(verbal), post(verbal)
SCORE	0-100

The first variable encodes the type of subject, which is the response variable. The second two variables INFORMATIONSTRUCTURE and REFERENTIALCONTINUITY correspond to the central pragmatic factors determining subject type presented in section 2.2. They are expected to have a direct impact on the distribution of the types of subjects.

The syntactic factors CLAUSETYPE and SUBJECTPOSITION are included because I expect that they have an indirect impact. For instance, there might be a difference in the preferred subject type of continuous and discontinuous references, depending on whether the subject appears in a main or a subordinate clause.

SUBJECTPOSITION could impact the choice between the overt alternatives DPs and pronouns. With most types of verbs, the preverbal position of the subject is information-structurally neutral. While the post verbal position is linked to the expression of focus. With unaccusative and presentative verbs, the pattern is reversed: the postverbal position is the information-structurally unmarked one (Dufter and Gabriel 2016: 228-230, Cruschina 2019: 122-124). Given its relation to information structure it could be that the syntactic position indirectly impacts the choice of the overt subjects.

SUBJECTTYPE is the form in which the subject is realized. It distinguishes three values: *null subject* for zero realizations, *pronoun* for personal pronouns, wh-

⁶ Data annotation was done by a trained student assistant and controlled individually by me.

interrogative, relative and demonstrative pronouns, *DP* for full noun phrases and proper names.

Table 3. Proportion and frequency of subject type in the L1 and L2 data.

	DP	Null Subject	Pronoun
L1	34.1% (178)	50% (261)	15.9% (83)
L2	37% (865)	47.5% (1110)	15.5% (360)

The proportion of the different types of subjects in the L1 and the L2 dataset is very similar (see table 3), L2 speakers do not show an over- or under-use of either of the types. A chi-square-test also reveals no significant difference ($\chi^2=1.617$, $p>0.05$).

INFORMATIONSTRUCTURE distinguishes between new and given referents. When a referent is introduced in the text for the first time, the referent was annotated with the value *new*, when it has been introduced before in the text, it was annotated as *given*. The distribution of the subject types by INFORMATIONSTRUCTURE are given in table 4.

Table 4. Proportion and frequency of new vs. given subjects by type in the L1 and L2 data.

	DP		Null Subject		Pronoun	
	Given	New	Given	New	Given	New
L1	59.5% (106)	40.5% (72)	96.1% (248)	3.9% (10)	84.1% (69)	15.9% (13)
L2	71.1% (615)	28.9% (250)	98.5% (1084)	1.5% (16)	89.4% (322)	10.6% (38)

Both groups use more given than new subjects across all types. New subjects are most often expressed as DPs. The difference between the types is higher in L2 speakers across all groups. The differences are statistically significant ($\chi^2=418.64$, $p<0.001$).

REFERENTIALCONTINUITY distinguishes between continuous and discontinuous referents. A referent is continuous if the subject of the preceding sentence referred to the same individual, and discontinuous otherwise.

Table 5. Proportion and frequency of continuous vs. discontinuous referents by type in the L1 and L2 data.

	DP		Null Subject		Pronoun	
	Continuous	Dis-continuous	Continuous	Dis-continuous	Continuous	Dis-continuous
L1	9% (16)	91% (162)	61.5% (158)	38.5% (99)	29% (24)	71% (59)
L2	10% (86)	90% (779)	76% (835)	24% (265)	32% (115)	68% (245)

The distribution of REFERENTIALCONTINUITY matches the expectations in both data sets (see table 5): null subjects are used more often with continuous referents and DPs and pronouns are used more often with discontinuous referents. The differences are, again, statistically significant ($\chi^2=1007.9$, $p<0.001$).

CLAUSETYPE distinguishes between main clauses and subordinate clauses. The value *main clause* is used for individual and conjoined main clauses. The value *subordinate clause* is used for all subordinate clauses.

Table 6. Proportion and frequency of main vs. subordinate clauses by subject type in the L1 and L2 data.

	DP		Null Subject		Pronoun	
	Main	Sub-ordinate	Main	Sub-ordinate	Main	Sub-ordinate
L1	75.8% (135)	24.2% (43)	72% (188)	28% (73)	26.5% (22)	73.5% (61)
L2	77% (666)	23% (199)	80% (888)	20% (222)	40.8% (147)	59.2% (213)

As can be seen in table 6, DPs and null subjects are more frequent in main clauses, pronouns are more frequent in subordinate clauses in both data sets. L2 speakers show larger contrasts in the frequency of main and subordinate clauses in DPs and null subjects but smaller contrasts in pronouns than L1 speakers. The differences are, again, statistically significant ($\chi^2=294$, $p<0.001$).

SUBJECTPOSITION encodes the position of the overtly realized subjects (pronouns and DPs), with respect to the finite verb. The values are *pre* if the subject precedes the verb and *post* if the subject follows the verb. The distribution of preverbal and postverbal DPs and pronouns is given in table 7.

Table 7. Proportion and frequency of pre- and postverbal subjects by subject type in the L1 and L2 data.

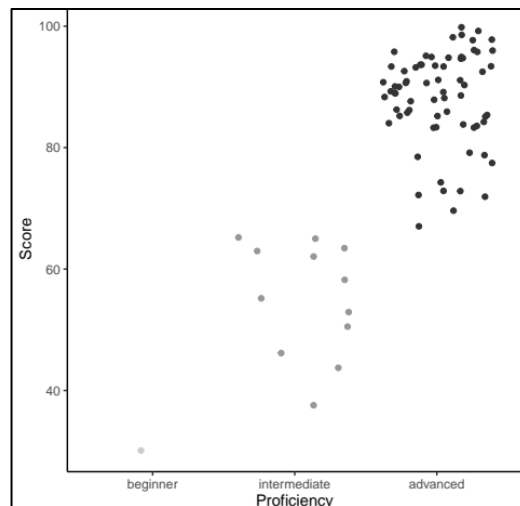
	DP		Pronoun	
	Preverbal	Postverbal	Preverbal	Postverbal
L1	77.5% (138)	22.5% (40)	95% (77)	5% (4)
L2	86% (737)	14% (119)	96.1% (346)	3.9% (14)

Preverbal subjects are strongly preferred with both types of subjects and across both groups of speakers. L2 speakers show an even stronger preference for preverbal placement than L1 speakers. While pronouns are almost exclusively realized preverbally, the proportion of postverbal DPs is larger. The differences are, again, statistically significant ($\chi^2=294$, $p<0.001$).

As stated above, the unmarked position with most verbs in Spanish is preverbal. The same is true for German. A preference for the preverbal position is therefore in line with a preference for the unmarked position in both languages. In

Spanish presentative constructions and with unaccusative verbs the reverse pattern holds: the postverbal position is unmarked and the preverbal one is marked. L1 and L2 speaker both appear to follow this principle of markedness, since the most frequent verbs that appear with postverbal subjects in both groups of speakers are in fact presentative *ser* and unaccusative verbs (*aparecer, venir, caer, pasar*).

Figure 3. Placement score of each speaker, light gray: beginners (<33), gray: intermediate (33>66), black: advanced (>66).



SCORE is the measure of language proficiency of the L2 speakers used in my model. It reports a value between 0 and 100 corresponding to the percentage of correct answers to a standardized proficiency test.

The graph in figure 3 shows that the language proficiency among the L2 speakers is skewed towards advanced speakers. Only one speaker has a score below 33. 11 speakers have score between 33 and 66, the rest has a score of 66 or higher.

4.3. Statistical Modeling

I use Multifactorial Prediction and Deviation Analysis Using Regression/Random Forests (hence MuPDARF, Gries and Deshors 2020, Gries 2022). This is a multi-step analysis procedure developed for learner corpus researcher and it is an extremely useful way to analyze and compare L1 and L2 data.

One common methodological approach in quantitative learner research is to fit two independent models for L1 and L2 speakers and compare these. Comparing independent models, however, can be inconclusive and, at worst, lead to wrong conclusions. The incomparability results from the fact that the models are built on different independent data sets, often with different factors and interactions at play. MuPDARF presents a solution to counteract the incomparability issue. Instead of creating two individual models for L1 and L2 speakers and comparing them, the procedure makes it possible to model the difference between L1 and L2 speakers in a single model. MuPDARF consists of four steps: The first step is to fit a predictive model of the L1 data. The second step applies this model to the L2 data. The third step compares the predictions made by the L1 model to the observations in the L2 data and

codifies whether L2 behavior matches L1 predictions or not. Through this step a new variable is created that encodes the target-likeness of the L2 speaker, i.e. how similar or dissimilar an L2 speaker behaves to an L1 speaker in a given context. In step four, this variable is modeled as the response variable in an exploratory model.

Applied to the investigation at hand, in step 1 I trained a model that predicts the type of subject realized by L1 speakers based on the variables INFORMATIONSTRUCTURE, REFERENTIALCONTINUITY, SUBJECTPOSITION and CLAUSETYPE. This model can be viewed as an algorithm that mimics L1 grammar in subject realization. In step 2, the L1 model is applied to the L2 data. For each L2 data point, the model sees the values of the variables that entered into the calculation but it does not see the value of the response variable SUBJECTTYPE. For each data point the L1 model predicts a value for the subject type, and thereby informs us what type of subject an L1 speaker would have realized in the given context. The third step compares the observed values in the L2 data to the predicted values from the L1 model. A new variable is created that encodes target-likeness. The values are *correct*, if the observation matches the prediction, *predictdp*, *predictnullsub*, *predictpron*, if there is a mismatch and the L1 model would have predicted a DP, null subject or pronoun respectively. This variable encodes where L2 speakers behave target like and where they fail to do so.

In the final step I trained a model of the L2 data with the new variable TARGETLIKENESS as the response variable and (observed) SUBJECTTYPE, INFORMATIONSTRUCTURE, REFERENTIALCONTINUITY, SUBJECTPOSITION, CLAUSETYPE and proficiency SCORE as the predictors.

Different statistical models can be used for the L1 model in step one and the final model in step four. For this investigation I used random forest modeling. Random forests are used frequently in machine learning. They are based on decision tree models. These models perform recursive binary splits of the dataset based on the impact of the predictor variables on the response variable. They test if a predictor variable is associated with a response variable to the level of statistical significance, it chooses the predictor that has the strongest association with the response variable and splits the dataset in two subsets. These steps are repeated until there are no predictor variables that have a significant impact on the response variable. Random forests compute large numbers of decision trees based on randomly generated subsets of the data. (see Breiman 2001, Hothorn et al. 2006, Strobl et al. 2009, and see Tagliamonte and Baayen 2012 for, as far as I know, the first application of decision tree modeling for linguistics).

Random forests are non-parametric, i.e. do not make any distributional assumptions about the population that the sample was drawn from. They are relatively robust in cases of data scarcity, high variability of data and collinearity of variables. Finally, they are good tools to detect high-order interactions (although see Gries 2020 for a critical view on this assumption). All these properties make them a very adequate method for research on authentic corpus data.

Random forests have the drawback that they can be hard to interpret (see Gries 2020 for a discussion). They are sometimes called black box models (Molnar 2019) reflecting the fact that the complex internal mechanisms of the algorithm appear intransparent and are difficult to grasp and interpret. Being built on large numbers of decision trees, there is no way to visualize and inspect the entire random forest model. It is only possible to inspect the global effect of the variables within the model for

instance by determining the variable importance (see figure 4. and 5.). Some limited insights into the directions of effects and interactions can be gathered by investigating partial dependency scores of single or multiple variables. To get a greater understanding of the direction of the effects and the interactions of all variables in the model, other measures must be taken.

Here, I will adopt the method of surrogate modeling from machine learning to achieve higher interpretability. Surrogate models are simpler models that are trained to approximate an underlying black box model. Surrogate models are less complex and therefore can be inspected in their entirety. By interpreting the surrogate model, one can draw conclusions about the underlying model (see Molnar 2019). They are trained on the dataset and the predictions made by the underlying model. In the present study, I will use a decision tree model as the interpretable surrogate model. This means that instead of a complex forest of decision trees that are built on random subsets of my dataset, I will investigate a single surrogate decision tree model of the predictions the underlying random forest model made. This simpler model has the advantage that, contrary to the random forest model, it can be inspected visually and interpreted straightforwardly. Through this, the complex interactions and the directions of the effect of the variables can be made transparent.

5. Results

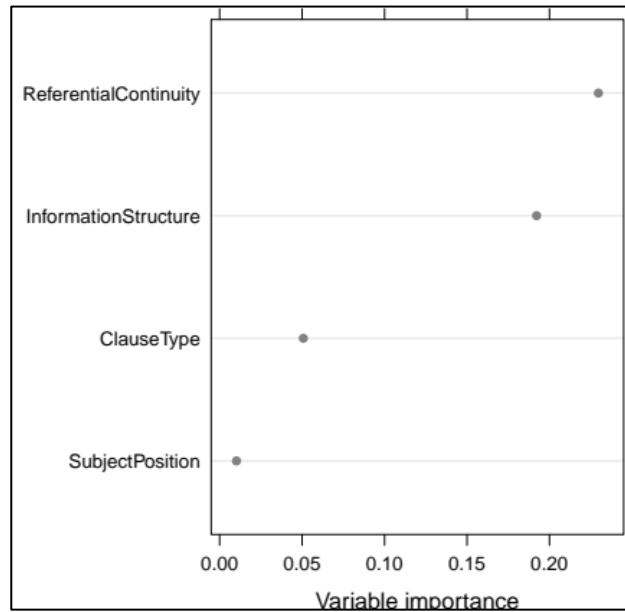
This section presents the results of the MuPDARF analysis of the L1 and L2 data. I will briefly summarize steps 1-3 and then focus mostly on the description of the results of the final step that consists of the exploratory modeling of the target-likeness of the subject realization of the L2 speakers.

5.1. Preparatory steps

The first step creates a model of the L1 speakers that functions as the reference model for the L2 speakers. I trained a random forest model⁷ of the L1 dataset that predicts the type of subject realized by the L1 speakers based on the factors INFORMATIONSTRUCTURE, REFERENTIALCONTINUITY, SUBJECTPOSITION and CLAUSETYPE. All variables impact the choice of subject type. REFERENTIALCONTINUITY and INFORMATIONSTRUCTURE are by far the strongest predictors for subject realization, see figure 4. The model has a moderate accuracy of 64%. The incorrect predictions concern in particular pronouns, of which roughly 40% are predicted correctly. In comparison, 80% of DPs and 60% of null subjects are predicted correctly by the model. An alternative model of the L1 data, containing more predictor variables targeting a large range of potential linguistic factors and also including demographic factors, only lead to an increase of accuracy of 1%. It is possible that additional linguistics factors are at play, or that a larger dataset could lead to a higher accuracy. However, I suspect that these incorrect predictions suggest that even in the L1 grammar there is substantial variation (or even uncertainty) with respect to the use of Spanish pronouns. I will return to this fact in section 6.

⁷ Using the cforest function of the partykit package in R.

Figure 4. Variable importance of the random forest model of the subject realization of the L1 speakers.



The L1 behavior found in my data is in line with the previous research. This suggests that even though the dataset is moderate - stemming from only 17 native speakers – it matches what is known from the literature about subject realization in Spanish and can thus be employed as an abstract model of Spanish grammar in this investigation.

The second step feeds the L2 data to the L1 model which predicts what type of subject the L1 speakers would have chosen in a given context. The third step evaluates whether the predicted values of the L1 model match the observed values of the L2 speakers. This results in the creation of a new variable encoding the target-likeness of the L2 speakers.

Table 8. The values observed in the L2 dataset and the values predicted by the L1 model. The correctly predicted values are highlighted in bold font.

	Observed		
Predicted	DP	Null Subject	Pronoun
DP	667 (77%)	191 (17%)	122 (34%)
null subject	86 (10%)	834 (75%)	115 (32%)
pronoun	112 (13%)	85 (8%)	123 (34%)

Table 8 shows the observed L2 values in the columns and the values predicted by the L1 model in the rows. Overall, in 69% of the cases the predictions match the observations. The remaining 21% are the contexts in which the L2 speakers realized a different type of subject than what the L1 speaker model predicts. The distribution of

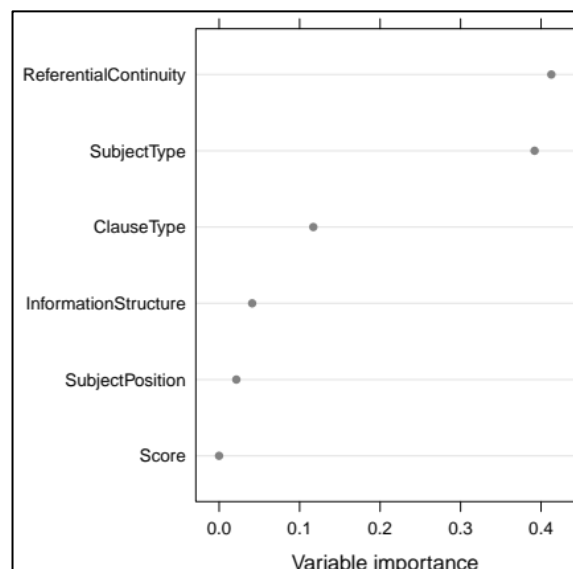
target-like subjects is not evenly distributed, while 77% of DPs and 75% of null subjects realized by the L2 speakers match what the L1 model would have predicted, with pronouns there is only a 34% match. In other words, in 66% of the cases where L2 speakers realized a pronoun, L1 speakers would have rather used DPs or a null subjects. This suggests that, while the L2 speakers in our dataset show a relatively competent use of DPs and null subjects, their use of pronouns is not target-like.

5.2. Final Model

The final exploratory random forest model predicts the TARGETLIKENESS of the L2 speakers based on the observed SUBJECTTYPE, InformationStructure, REFERENTIALCONTINUITY, SUBJECTPOSITION, CLAUSETYPE and the proficiency SCORE.⁸ The model has an extremely high accuracy of prediction of 99%.

The effects of the predictors are summarized in figure 5. REFERENTIALCONTINUITY and the observed SUBJECTTYPE have the strongest impact on the TARGETLIKENESS in the model. CLAUSETYPE has a moderate effect. The effect of INFORMATIONSTRUCTURE and SUBJECTPOSITION are even smaller and the effect of the proficiency SCORE is almost zero.

Figure 5. Variable importance of the random forest model of the TARGETLIKENESS of the L2 speakers.



To investigate the direction of the effect and the interactions of the predictors, I trained a surrogate decision tree model.⁹ As stated above, surrogate models approximate underlying machine learning models and make them more interpretable. The surrogate model I chose is a decision tree model, that models the predictions of the random forest model based on same predictor variables that were used in the random forest model, that is REFERENTIALCONTINUITY, observed SUBJECTTYPE, INFORMATIONSTRUCTURE, CLAUSETYPE, SUBJECTPOSITION and the proficiency

⁸ Using again the cforest function from the partykit package in R.

⁹ Using the surro function of the moreparty package in R.

SCORE. The surrogate model has a high R^2 of 0.94, suggesting a good fit to the data. The surrogate model is visualized in figure 6.

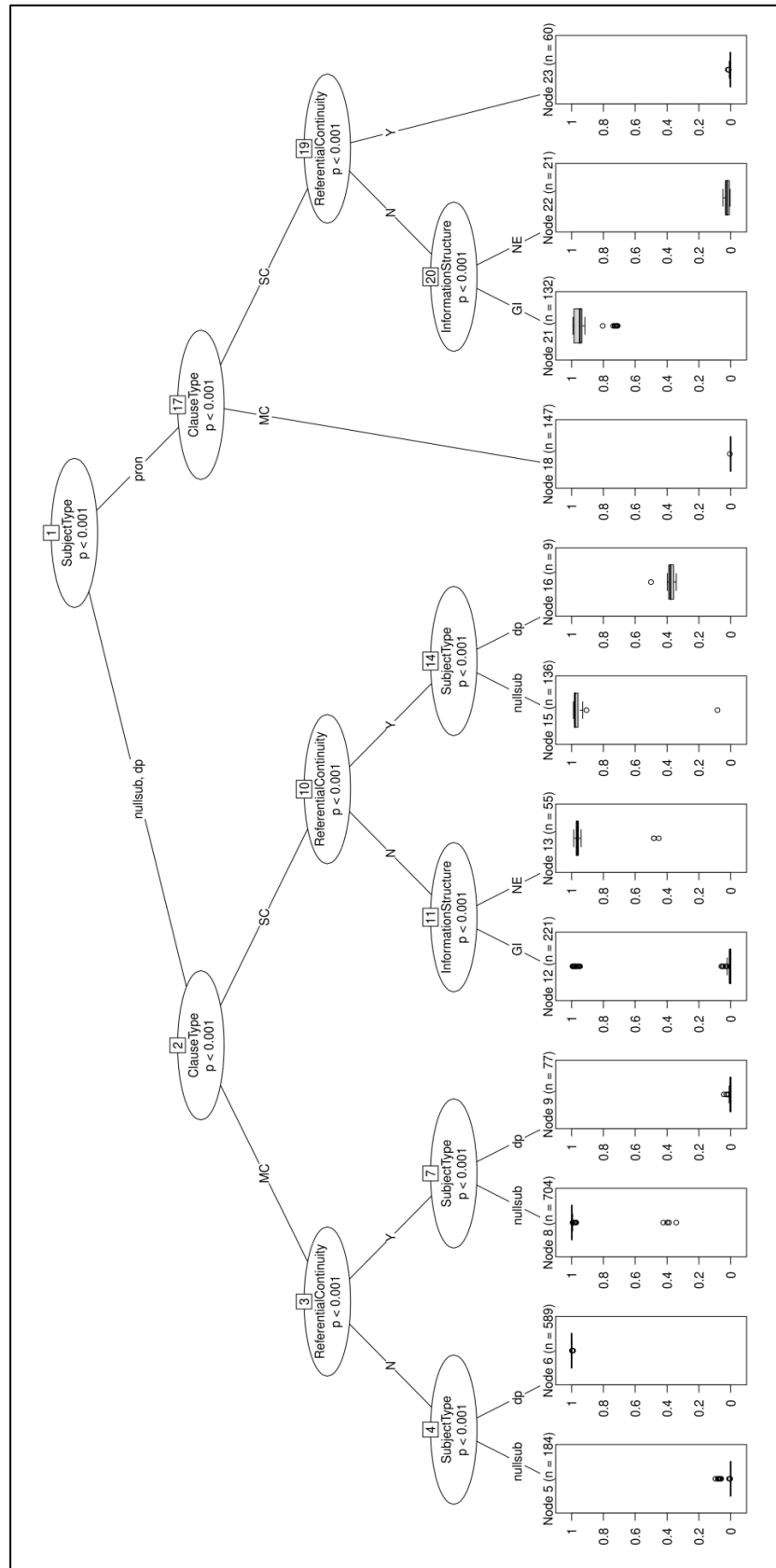
The plot has the structure of a binary branching tree. The nodes in the structure represent the significant recursive splits on the predictor variables. The box plots at the terminal nodes summarize the distribution of the response variable. The values between 0 and 1 correspond to the degree of target-likeness, where 1 corresponds to a match between the observed subject type in the L2 data and the predicted subject type by the L1 model and 0 corresponds to cases where the L1 model would have predicted a different type from observed type in the L2 data.

The first split in the model separates pronouns from DPs and null subjects. Within the subset containing the pronouns, there is a complex interaction between `CLAUSETYPE`, `REFERENTIALCONTINUITY`, `INFORMATIONSTRUCTURE` and `SCORE`. The boxplots show that in almost all cases (node 18, 22, 23) where the L2 speakers used pronouns, the L1 model would have predicted a different subject type, i.e. all values are close to 0. The only contexts where the L2 speakers behaved almost target-like in their pronoun use, are cases of given discontinuous subjects in subordinate clauses (node 21). This means that they correctly use pronouns in these topic shift contexts.

In the subset containing null subjects and DPs, there are again complex interactions between `CLAUSETYPE`, `REFERENTIALCONTINUITY`, `INFORMATIONSTRUCTURE` and `SUBJECTTYPE`. In almost all cases where the L2 speakers used null subjects, the L1 model also predicts predominantly null subjects, suggesting that L2 speakers show a target-like use of null subjects in most contexts (node 8, node 15). There is only one context where L2 speaker overused null subjects and the L1 model would have predicted a different type, namely discontinuous subjects in main clauses. This case of overgeneralization is interesting. Both in German and Spanish, the preferred subject type would be a pronoun, this means that the L2 speakers' use of null subjects constitutes an innovation. This fact will be returned to in section 5.

With DPs the `TARGETLIKENESS` is high in some contexts (node 6, 13), but there are also areas of discrepancies. There are main clause contexts with continuous subjects where L2 speakers chose DPs but L1 speakers would rather use a different subject type (node 9). In subordinate clauses, L2 speaker furthermore show an overuse of DPs with continuous subjects (node 16), and with given discontinuous subjects (node 12).

Figure 6. Surrogate tree of the random forest model of the TARGETLIKENESS of the L2 speakers



5.3. Discussion

All factors that contribute to the subject realization in L1 speakers also impact the target-likeness of L2 speakers both in a positive and negative direction. A sensibility to these factors is not unexpected because many of them also impact the subject realization in L1 German. The most dominant factor in the model is REFERENTIALCONTINUITY, which has been discussed broadly in the literature, followed by the observed SUBJECTTYPE. The other linguistic factors have more moderate effects. The impact of proficiency is negligible in my data, contrary to what other authors found (for instance Rothman and Iverson 2007, Rothman 2008, Montrul and Louro 2006, Domínguez and Arche 2022). The lack of proficiency effect is likely due to the fact that most speakers have a high proficiency and there are only few speakers with intermediate or beginner proficiencies (see figure 3). In order to study the effect of proficiency and investigate whether there is a development in the target-like use of subjects in L2 Spanish, a dataset with more balanced proficiencies would be required. Furthermore, an anonymous reviewer suggested that the fact that I use written rather than oral data could be an additional reason why there is no proficiency effect found. The reasoning behind this is that written productions are more planned, and permit revision and correction which could render them more target-like than oral productions. Although this explanation is certainly worth exploring, research comparing oral and written tasks in L2 acquisition (for instance Granfeldt 2008, Kuiken et al. 2011), actually points in the opposite direction (see section 3.4.).

The L2 speakers in my dataset do not exhibit a lot of difficulty with null subjects. These results confirm what has been observed in most previous studies. The use of DPs is, apart from some areas, relatively target-like. The biggest difficulty and the largest discrepancies are found in the use of pronouns, where only 34% of the cases match the L1 behavior.

6. Interpretation

This study was set out to evaluate the Interface Hypothesis and the Feature Reassembly Hypothesis laid out in sections 3.1. and 3.2. The results are only in part compatible with the Interface Hypothesis. The hypothesis predicts difficulties in the acquisition of all realized subjects. The clear difference between pronouns and DPs that I found in my data, is therefore not expected. The Interface Hypothesis also predicts that topic shift contexts should be particularly hard to acquire for L2 speakers, since high degree of interface complexity is expected to be more difficult in L2 acquisition. My results suggest that L2 speakers actually behave as L1 speakers in some of the topic shift contexts. As stated above, the only context where pronouns are used target-like is precisely a topic shift contexts (node 21). L2 speakers, however, do also show an overuse of null subjects in main clause topic shift contexts (node 5), and an overuse of DPs in subordinate clauses topic shift contexts (node 12). In both cases the L1 model would have predicted the use pronouns. What is important, however, is that the lack of target-likeness goes beyond the topic shift contexts. This is not expected if the reasons for the difficulties in the acquisition were merely due to interface complexity. What the results actually suggest is that L2 speaker show persistent issues with Spanish pronouns. For this, I would like to propose that, rather than just being due to the

interface complexity, these issues arise because the acquisition of pronouns is a difficult task from an L2 learnability perspective because it requires feature reassembly.

As discussed in section 3.2., Domínguez and Arche (2022) explain the difficulty for English L1 speakers to acquire target-like use of Spanish pronouns on the grounds that features need to be reassembled, which is complex (see Lardiere 2008, Slabakova 2013, Cho and Slabakova 2014). My results suggest that the same happens when German L1 speakers attempt to acquire the Spanish pronominal uses. The German L1 speakers find a form-meaning match between German pronouns and Spanish null subjects, that requires almost no feature reassembly. German L1 speakers are aware that there is a functional overlap and use Spanish null subjects where their native grammar would require pronouns. The context of overgeneralization of null subjects mentioned above, supports this hypothesis. In this context, the L2 speakers realize a type that is neither preferred in their L1 nor in the target grammar. The fact that it is a pronoun-context in German suggests that the German L2 speakers generalize the use of null subjects to German pronoun-contexts. Apart from this context, null subjects are realized very close to the target grammar. German L2 speakers, in turn, show persistent difficulties in pronoun use, an expression that has a close formal equivalent in their L1. But the functional meaning of pronouns in Spanish is different from that of pronouns in German and therefore requires feature reassembly. This means that German speakers have trouble acquiring Spanish pronouns because they are difficult from an L2 learnability perspective in line with the conception of Slabakova (2013) and Cho and Slabakova (2014).

Figure 7. feature transfer and feature reassembly

	German		Spanish		
form	pronoun		pronoun	pronoun	
function	$F_i F_j F_k$	→	$F_i F_j F_k$	⇔	$F_i \cancel{F_j} \cancel{F_k} F_m, F_l$
form	pronoun		null subject		null subject
function	$F_i F_j F_k$	→	$F_i F_j F_k$	⇔	$F_i \cancel{F_j} F_k$
		<i>feature transfer</i>		<i>feature reassembly</i>	

Figure 7. illustrates what is taking place. German learners' first hypothesis is that German and Spanish pronouns share the same functional features. The features of the German pronominal expressions are therefore simply transferred to the Spanish expressions. However, as they receive more Spanish input, they have to revise their hypothesis and reassemble the features. The results of my study suggest that this step is very complex as even advanced speakers do not achieve target-like use of pronouns in their L2 Spanish. Very probably this is because the relevant features are interface features that are encoded indirectly.

German speakers do not find a formal match for Spanish null subjects in their native grammar. I assume, however, that they identify German pronouns as a close functional match to Spanish null subjects early on in their acquisition. This is

supported by the fact that even the less advanced speakers in my data set show almost target like-use of null subjects. The transfer of the features of the German pronouns onto the null subjects proves to be a successful strategy and is further supported by the cases of overgeneralization of null subjects in (German) pronoun-contexts. Only little feature reassembly is required to acquire the functional features of Spanish null subjects based on German pronouns. This explains why null subjects are acquired fairly easily as opposed to pronouns.

Finally, DPs pose little problems for German learners, suggesting that German and Spanish DPs overlap in their functional features and that little to no feature reassembly is required to reach target-like proficiency.

On the whole, the results of the study are not intended to warrant a rejection of the Interface Hypothesis, as the complexity of the external interfaces do in fact contribute to the difficulty in the acquisition. My results, however, suggest that something more is going on, because the discrepancies in the subject realization of L2 speakers goes beyond the contexts that are predicted to be problematic by the Interface Hypothesis. I proposed that additionally L2 learnability factors are at play and that the Feature Reassembly Hypothesis offers an apt way to account for these. Furthermore, it appears that both hypotheses can be reconciled fairly straightforwardly. The features that are predicted to be hardest to acquire by the Feature Reassembly Hypothesis (see figure 2) are features that lack a formal expression and are contributed contextually, which are precisely the properties of external interface features.

Still, interface complexity and L2 learnability are very unlikely to be the only factors contributing to the difficulty in the acquisition of Spanish subject types. Another potential factor is the linguistic input a learner receives. While we cannot control all the input a learner is exposed to, we can draw conclusions from the variability in L1 Spanish. It is particularly revealing with respect to pronouns. Authors found that the degree of pronoun use varies significantly in L1 Spanish and that the acquisition can be difficult even for L1 speakers (for instance, Shin and Erker 2015, Orozco and Hurtado 2021). A large variation in pronoun use is also supported by the low prediction accuracy for pronouns in my L1 model (see section 5.1.). The variability in the use of pronouns still differs between L1 and L2 speakers. This can be seen clearly in the differences in the inaccurate predictions in my data. Even though both the L1 model and the final model show discrepancies in the pronoun use, the areas where the use is divergent, are not the same. The wrong predictions in the L1 model concern cases of relative pronouns in subject relatives for which the L1 model would have predominantly predicted null subjects, as well as cases of demonstrative pronouns for which the L1 model would have predicted the use of DPs.¹⁰ The values the L1 model predicted wrongly for the L2 data are predominately regular personal pronoun contexts. In sum, although this requires further systematic investigation, it is very possible that the lack of unambiguous input for pronouns by the L1 speakers is a further contributing factor that should be explored in future research.

¹⁰ These systematic errors in the predictions suggest that a model could become more accurate if the values were recoded (relative pronouns as null subjects and demonstratives pronouns as DP). However, an alternative model where the response variable was recoded in this way failed to predict pronouns at all due to their low number in the response variable. Therefore I chose to keep to the initial coding.

7. Conclusion

To conclude, this article provided novel insights into a well-studied topic of L2 research: the acquisition of subjects of a null subject L2 by speakers of a non-null subject L1. Relying on corpus data of L2 Spanish by L1 German speakers and a comparison corpus of L1 Spanish speakers, I investigated which factors impact the differences in use between L1 and L2 Spanish. The aim was to evaluate the predictions made by the Interface Hypothesis and the Feature Reassembly Hypothesis. The results show that L2 German speakers show consistent difficulty in the acquisition of pronouns but acquire DPs and null subjects fairly easily. This is predicted by both hypotheses. Furthermore, I found that the L2 speakers show difficulty in contexts involving external interfaces, but crucially, also beyond these. I interpreted this to show that inherent interface complexity is not the sole reason for the difficulty to acquire a target-like use of Spanish subjects, but L1 factors also play a role, which is captured by the Feature Reassembly Hypothesis.

My investigation offers methodological innovations. Previous research into this topic was mainly based on experimentally elicited data with a focus on contexts relevant for testing the Interface Hypothesis. Most of the studies furthermore distinguished exclusively between null and overt subjects, disregarding differences between DPs and pronouns. As a result, the interface contexts are very well understood, but more general properties and also the difference between DP and pronoun acquisition have been somewhat overlooked up until now. Finally, I applied a novel protocol in the statistical modeling from learner corpus research that proved adequate and insightful for the investigation at hand.

Within a well-studied field, my study therefore sheds light on previously unexplored areas and shows that it can be worthwhile to investigate different types of data with advanced statistical approaches to gain a fuller understanding of a phenomenon and find new directions for future research.

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