A Different Type of RC Attachment Resolution: Comparing Bilingual and Trilingual Processing

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Abstract: This study explores attachment resolution of ambiguous relative clauses (RC) by second (L2) and third (L3) language speakers of English and Russian. It uses a self-paced reading task to investigate whether the language of testing, social convention biases, or a linguistic effect of the matrix verb (perception, non-perception) influence sentence interpretation in non-native processing. Control groups of Russian and English monolinguals confirm the pattern of cross-linguistic variation in RC resolution: high attachment in Russian and low attachment in English. Both L2 and L3 speakers demonstrate a tendency to show target-language-like preferences in their non-native languages. A perception matrix verb facilitates high attachment in all L2 and L3 groups, just as in monolingual controls. Neither monolinguals nor L2 or L3 learners rely on social conventions to interpret ambiguous RCs. Non-native sentence comprehension appears to be sensitive to syntactic cues prompted by a perception verb and both L2 and L3 speakers adjust their sentence processing accordingly.

Key words: non-native processing, bilingual, trilingual parsing, structural, top-down, projection, bottom-up.

1. Introduction

The study reported in this chapter approaches non-native processing at very early stages of language acquisition in adulthood. It focuses on how second language (L2) and third language (L3) learners of intermediate proficiency process ambiguous relative clauses (RC). It also aims to describe the specific characteristics of their language processing. The study examines the issue of whether non-native languages, be they L2, L3 or L*n*, use similar strategies in RC resolution. If this assumption holds true, the known facts about L2 processing could be generalized to the entire field of non-native processing.

We are interested in investigating intermediate speakers because of the research need to capture the earliest stage of non-native processing where its incipient differences from L1 processing can be observed. When developing a new L*n* linguistic system, a learner develops a set of certain processing strategies that ensure successful comprehension of the new language. Even though recent research investigating differences between native and non-native processing has offered different explanations (Dussias, 2003; Dussias & Sagarra, 2007; Hahne & Frederici, 2001; Hopp 2014a, 2014b), two approaches have put forward proposals about exactly how full comprehension in non-native languages is achieved: Full Transfer / Full Access / Full Parse (Dekydtspotter, Schwartz, & Sprouse, 2006) and the Shallow Structure Hypothesis (Clahsen & Felser, 2018).

According to the first approach, Full Transfer / Full Access / Full Parse (FT/FA/FP) (Dekydtspotter, Schwartz, & Sprouse, 2006), non-native speakers use structure-based parsing in their newly acquired languages. This proposal ties sentence processing to L2 acquisition. To acquire a new language, the parser performs input analysis and accumulates linguistic information, which can be added to the existing interlanguage grammar (Dekydtspotter, Schwartz, & Sprouse, 2006; Schwartz & Sprouse, 1996). In other words, the parser spots new linguistic features in the L2, which is impossible without a full structural analysis of the incoming linguistic information.

According to the second approach, the Shallow Structure Hypothesis (SSH), non-native processing is indeed *shallow*, i.e. non-native speakers rely on extra-syntactic information to interpret sentences in their L2 (Clahsen & Felser, 2018). Under this approach, a learner might disregard syntactic cues in L2 processing and use other sources of linguistic information to comprehend a sentence, for example contextual and lexical information.

The experiment described in this chapter addresses the predictions from both approaches. To test whether the parser is sensitive to the selectional properties of the matrix predicate and is capable of parsing a sentence accordingly, our stimuli include perception verbs in matrix clauses, which is a linguistic cue favoring high attachment of the RC (full analysis is provided in the next section). To test whether non-native processing is governed by non-structural information, we include social biases as a factor, since they prompt a certain type of RC resolution. Specifically, social biases in this study represent social conventions accepted in society; that is, an established tendency to assign certain activities as typically performed by certain social groups, for example, by men, women, children, adults, the elderly (a detailed description is provided in the next section).

The study is interested in capturing the moment of sentence processing when parsing decisions are made. Therefore, we use a self-paced reading technique, where the participants cannot go back and reread the sentences.[1] The interpretation decisions on RC attachment made by native and non-native speakers result from certain processing strategies implemented by the participants. The study focuses on the analysis of these strategies. It also broadens the scope of investigation of non-native processing mechanisms through comparisons between processing in L2 and L3.

2. Theoretical Motivation

The study investigates attachment resolution of ambiguous RCs in English and Russian and uses cross-linguistic variation to check whether non-native speakers of these languages process the RC as in their native language[2] or as in the target language. The study also investigates whether L2 and L3 speakers are sensitive to a perception verb in the main clause and use it as a linguistic prompt when parsing the rest of the sentence. Such a finding would be considered evidence for structural processing in non-native languages (Dekydtspotter et al., 2006). An alternative result is that participants use, instead, social conventions as the main cue for sentence processing in non-native languages. The latter result would be in line with the assumptions of the SSH (Clahsen & Felser, 2018).

To begin with, let us examine the structural ambiguity of the RC in (1), where both answers to the comprehension question are grammatical. In linguistic terms, option (a) is the result of high attachment (HA) of the RC, a strategy that is generally preferred in Russian (Sekerina, 2002). Option (b) results from attaching the RC to a lower noun (LA) which is mostly preferred in English (see Fodor, 2002 for a summary).[3]

(1) Bill saw the mother of the boy [$_{RC}$ that was talking about cosmetics in the yard].

Who was talking about cosmetics?

a. the mother b. the boy

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[1] In this chapter, we only report the data of the participants' comprehension answer choice, which is representative of the processing mechanisms used by the participants in sentence comprehension. An additional analysis of the reading times, which is not included in this chapter, did not add any statistically significant factors that influence sentence processing.

[2] For L3 speakers of English, the L1 effect in RC resolution is non-distinguishable from the effect of the L2. The choice of languages is deliberate and is explained in the section Participants.

[3] Cross linguistic variation in RC resolution was widely studied in monolingual populations. It was established that native speakers (NS) of Russian, French, Dutch, German, Greek, Spanish and Italian prefer HA, answer (a) in (2) (Cuetos & Mitchell, 1988; Hemforth et al., 1998; Zagar et al., 1997), whereas, NSs of English, Norwegian, Romanian, and Swedish prefer LA, answer (b) in (2) (Fernandez, 1999; Fodor, 2002).

Thus, in target sentence (1), RC resolution can have two answers, but only one is typically preferred in each language. Among other reasons, variation in RC attachment has been explained by the internal prosody of each language (Fodor, 2002). The Implicit Prosody Hypothesis (IPH, Fodor, 2002) claims that languages that have a prosodic break before the RC prefer HA. In our experimental setting, an example of such a language is Russian. On the other hand, languages that have a prosodic break before the prepositional phrase (‘*of the boy'* in (1), prefer LA. In our study, this type of language is represented by English.

Ambiguous RCs have been extensively studied in monolingual populations. However, they are also a convenient linguistic construction for the study of processing behavior in L2. In fact, we argue that RC resolution can be understood as a proxy for L2 acquisition, if we assume that default prosodic organization of a language is acquired together with the acquisition of the L2/L3: RC attachment pattern will become target-language-like (TL-like) when L2 speakers acquire the default prosodic organization of the target language. Therefore, the RC-resolution choices, as those presented in (1), can shed light on whether RCs are processed in a native-like fashion or not. Furthermore, our experimental design allows us to draw conclusions about the processing strategies that non-native speakers use to comprehend ambiguous RCs.

The two approaches to non-native processing mentioned above disagree about the role that syntactic information plays when L2 speakers process their L2. The first approach advocates for a full structural parse in the L2 (Dekydtspotter et al., 2006, see also Sprouse, 2011). The second approach claims that learners possess reduced capabilities for structure building in real time, suggesting instead that L2 processing is governed by non-structural information (Clahsen & Felser, 2006, 2018).

The account offered by Dekydtspotter and colleagues (Dekydtpostter et al., 2006, see also Sprouse, 2011) provides a detailed analysis of the role of processing in L2 acquisition. The authors claim that when processing new linguistic input, the parser manages to establish even minimal differences between L1 and L2. Afterwards, meaning is assigned to the newly spotted features and they can be successfully acquired in the L2 (Lardiere, 2009; Slabakova & Montrul, 2008, among many others, see Jiang, 2004 for a counterargument). Under this approach, parsing in L2 can only be performed in a TL-like manner. Otherwise, no noticing of new features or features that work differently in the L1 and L2 would be possible. In other words, any alternative processing mechanisms would make recognition of new linguistic properties, essential for L2 acquisition, impossible.

To support the notion that learners can fully parse the L2, Dekydtspotter et al. (2008) tested second-year learners of French at an American University to investigate whether learners could develop sensitivity to L2-specific properties from relatively early stages of L2 acquisition. Dekydtspotter et al. (2008) tested L2 speakers' knowledge of the default prosodic differences between their L2 (French) and their L1 (English). Thus, the study tested the predictions of the IPH (Fodor, 2002) and claimed that different placement of prosodic breaks in French and English entailed different structural parses of the ambiguous RC, HA was preferred in French and LA in English. Results showed that learners demonstrated preference for HA in their L2-French, while also preferring LA in their native language, English. The authors concluded that the default prosodic organization of the new language was successfully acquired and that L2 speakers preferred HA in French because they were sensitive to its prosodic structure as early as in the second year of learning. Therefore, the authors argued that structure building guided processing both in the L1 and the L2.

The findings by Dekydtspotter et al. (2008) were supported by Witzel, Witzel and Nicol (2012) and by Hopp (2014b). Witzel et al. (2012) tested L1 speakers of Chinese who were highly proficient in their L2 English. The participants read part-way ambiguous RCs, which were disambiguated towards either HA or LA at the end of the sentence. The study measured the participants' reading time and established that disambiguation towards LA was more difficult for L2 speakers of English. The authors concluded that the participants demonstrated a clear preference for a certain type of RC attachment (HA), therefore, they performed structure-based parsing in their L2, even though they did not demonstrate the LA preference normally attested for English.

Hopp (2014b, see also Hopp, 2014a) investigated the role of individual differences on non-native processing. The study matched native and non-native speakers by working memory capacity. The participants were asked to read ambiguous RCs while their eye-movements were monitored. The results showed that native and non-native speakers of English demonstrated similar processing behavior when their working memory capacity matched.

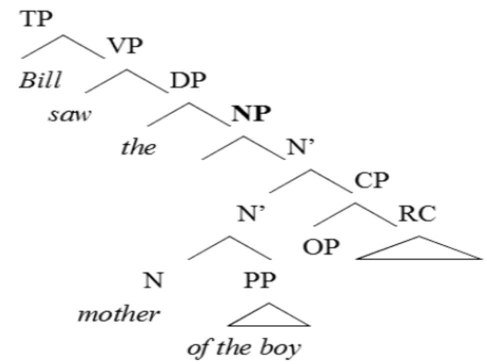
The second account we discussed above proposes that sentence processing is governed by non-structural information (Clahsen & Felser, 2018) and sentence parsing is performed in a "bottom-up manner" (Felser, 2018, personal communication). As articulated in the SSH (Clahsen & Felser, 2018), non-native speakers have trouble building mental structures in online processing. Therefore, non-native processing is primarily governed by non-structural information (lexical, pragmatic, etc.) that allows the comprehender to interpret a sentence. After the sentence is comprehended, a structural model of it is built. In this approach, mental structure building ensures a grammatical fit for the incoming string of words in accordance with the formed interpretation.

The SSH has received experimental support in studies by Felser, Roberts, Gross and Marinis (2003), Papadopoulou and Clahsen (2003), Felser, and Cunnings (2012), among others. These studies compared native and non-native processing and attested several behavioral differences. For example, advanced non-native speakers in Papadopoulou and Clahsen (2003) did not show a clear preference in RC resolution and performed at chance, whereas native speakers manifested their respective language-specific patterns of RC resolution.

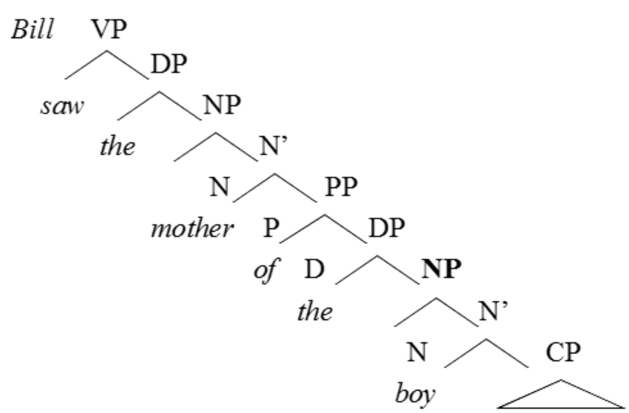
In an eye-tracking study by Felser and Cunnings (2012), non-native speakers read complex sentences with reflexives. In processing, the informants consulted the ungrammatical antecedents which matched the reflexives in gender. The eye movements of native speakers stayed within the grammatical options. The authors concluded that nonnative speakers relied on lexical semantic information, whereas, native speakers demonstrated a structure-based parse (see also Jiang, 2004 for another argument for the SSH).

Following the predictions of the SSH, non-native processing may rely on various non-structural cues, including social conventions, to interpret sentences such as those in (1). Social conventions are biases established in society that perceive certain activities to be typically masculine or typically feminine, etc. For example, the action of *talking about cosmetics* in (1) is most likely to be performed by a woman rather than a boy. Such a social bias would prompt HA of the RC in (1), as the agent of *talking about cosmetics* is a woman, *the mother*. Therefore, social convention information can shape the sentence interpretation either towards HA in (2) or towards LA in (3).

(2) Bill saw **the mother** of the boy that was talking about **cosmetics**.



(3) Bill saw the mother of **the boy** that was talking about **cartoons**.



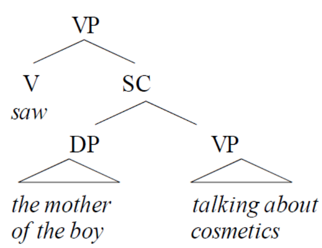
In order to test the assumptions of the SSH for non-native processing, the experiment we report in this chapter includes social conventions as a variable. This is because the SSH predicts that social conventions govern both L2 and L3 sentence processing. Therefore, participants tested in their non-native languages will be sensitive to non-syntactic information and prefer HA in sentences such as (2) and LA in sentences such as (3). Because the SSH claims that native language processing is structural, we would expect monolingual English speakers to show LA in English while monolingual Russian speakers should show HA in Russian.

To test the predictions for structural processing in non-native languages, as proposed by Dekydtspotter et al. (2006), our study includes a perception verb in the matrix clause. This verb type is expected to favor HA even in a LA language such as English (Grillo et al., 2015). The verbtype effect will be a processing cue signaling adjustment of mental structure in building the HA. Following Dekydtspotter et al. (2008), our study investigates whether L2 and L3 learners of English and Russian at early stages of non-native language proficiency show sensitivity to linguistic cues in L2/L3 processing.

What is the prediction of structural processing based on? The processing effects of a perception verb were studied by Grillo and Costa (2014), who argue that when a perception verb is placed in the matrix clause of a sentence with an ambiguous RC, it triggers a structural anticipation for an eventive complement, like *Bill saw (what event?)*. The eventive complement in (4) is structurally different from the RC in (5).

(4) Bill saw [$_{SC}$ the mother of the boy talking about cosmetics in the yard].

[$_{S}$ NP$_{Bill}$ [VP$_{saw}$ [SC]]]



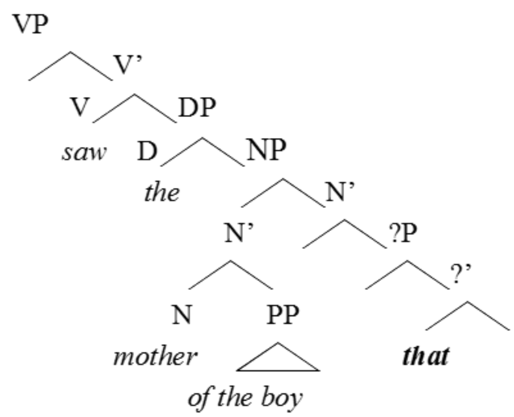
The subordinate clause in (4) is a Small Clause (SC); it provides an event-oriented interpretation of the sentence *Bill saw (what event?)* – the event of "talking about cosmetics performed by the mother of the boy." The eventive complement, the SC, modifies the matrix predicate. It makes the NP '*the mother'* the only grammatically licensed doer of the action of *talking*.

Grillo and Costa (2014) proposed that a perception verb such as *see* in the matrix clause in (1) had a cross-linguistic effect to favor HA. This prediction received experimental evidence from Grillo et al. (2015) and from Sokolova and Slabakova (2019). Grillo et al. (2015) tested monolingual speakers of English. Their participants changed their English-like preference for LA to HA when the sentences had a perception verb in the matrix clause. Sokolova and Slabakova (2019) checked the effect of a perception verb with native and non-native speakers of English and Russian. A perception verb prompted a change to HA in English and maintained HA in Russian.

Non-native speakers followed the structural prompt of a perception verb in the same way as monolinguals.

The effect found in Grillo et al. (2015) can be explained through the following order of structural operations. The parser generates a structural anticipation for an eventive complement in (4), which is supported by the incoming string of words until the complementizer _that_ is processed. When the parser encounters *that*, it 'realizes' that the structure generated for the SC (4) is impossible and performs a minimal adjustment of the structure, as shown in (5).

(5) Bill [$_{VP}$ saw [$_{DP}$ the mother of the boy [$_{?P}$ that…]]]



After the head NP is processed, the parser anticipates that the SC analysis will continue and generates a phrase for the upcoming verbal element, (?P) in (5). On processing *that*, the parser dismisses the originally anticipated projection for the VP in the SC in (4) and adjusts the parsing to accommodate the incoming RC. The RC is attached to the already generated head NP and modifies its head. Consequently, HA of the RC is preferred.

Thus, our research continues the line of investigation started by Grillo et al. (2015) and by Sokolova and Slabakova (2019). We extend the scope of our research to non-native processing that includes L2 and L3. If all the target groups are sensitive to the effect of a perception verb, the assumptions by Dekydtspotter et al. (2006, 2008) – that sentence processing is structural – would be supported and could be extended to a broader field of processing in L1, L2, L3 or L*n*.

In summary, our study investigates whether non-native speakers at the intermediate (B1)[4] level of proficiency are sensitive to the attachment preference of the TL and, thus, whether they prefer HA in Russian and LA in English. The study also examines whether native and non-native speakers use different processing strategies. Under the SSH, non-native speakers are expected to rely on social conventions in RC resolution, whereas monolinguals show language specific RC resolution (Clahsen & Felser, 2018). If both native and non-native processing use structural parse, then sensitivity to the effect of a perception verb can be expected in both groups of speakers (according to FT/FA/FP, Dekydtspotter et al., 2006).

The study addressed the following Research Questions (RQ).

RQ1: Do non-native speakers of English and Russian show L1-like patterns of RC resolution in their respective L2s or L3s?

RQ2: Is sentence processing structural in both native language and non-native languages?

RQ3: Is non-native processing governed by social biases?

3. Method

The RQs motivated the choice of the target groups of participants and informed the experimental method and its design. Before conducting the experiment, an IRB approval, protocol # 1602915700, was obtained. Participants were provided with all the necessary information related to their role in the experiment. Participation in the study was voluntary and the participants could quit the experiment at any moment without any consequences.

Our experiment focuses on eliciting the preferred patterns of RC resolution in native and non-native languages. It investigates a possible switch of attachment preference between high and low attachment languages, i.e. between Russian, be it L1 or L2 of the participants, and English, either L2 or L3 of the participants. In other words, the study aims to determine whether learners can show a switch in RC resolution preferences to conform to the target language preferences.

The aim of the study with the bilingual groups is straight-forward – to determine whether L2 speakers can switch to the TL-like pattern of RC resolution in their L2 as early as the intermediate level of proficiency.[5] This question is addressed through comparisons of the

[4] B1 is the 3rd level of proficiency in the Common European Framework of Reference for Languages, which covers the range of 6 levels, from *beginner* to *proficient user*: A1-A2-**B1**-B2-C1-C2.

[5] The level of participants' proficiency in their respective L2s or L3s is called 'intermediate' to provide correlations with the Common European Framework of Reference for Languages, where it would be labelled as B1. For the study,

participants performance in Russian and English, as L2s for Russian–English and English–Russian bilinguals and L1s for English and Russian monolinguals. The trilingual groups are L3 speakers of English. They also demonstrated an intermediate level of proficiency in English. By comparing the trilingual groups to L2 speakers, the study can determine whether a TL-like preference for LA in English can be acquired when more than one language in the participants' background is a HA-language.

For the trilingual groups (RFE and RGE), both L2s, French and German, belong to the HA group for RC resolution (see Fodor, 2002 for summary). Their native language – Russian – is also a HA language. If we establish a possible preference for HA in L3 English, influence from either the L1 or the L2 cannot be distinguished. This choice of experimental groups is deliberate because the study does not investigate how previously learnt languages influence L3 acquisition (see Rothman, 2010 and Slabakova, 2017 for relevant discussion). Rather, our experiment compares processing in L2 and L3 to establish whether non-native processing is governed by similar mechanisms.

Participants

The participants of the current study were adult speakers of English and Russian. The study included 10 monolingual speakers of English, 9 monolingual speakers of Russian, 14 native speakers of Russian with English as their L2 (Russian–English), and 14 native speakers of English with Russian as their L2 (English–Russian). We also included two groups of L3 speakers of English with the following linguistic backgrounds. Both L3 groups were native speakers of Russian. However, the participants' L2s were different. Fifteen people in the Russian–French–English group spoke French as their L2. Eleven participants in the Russian–German–English group spoke German as their L2 and English was the participants' L3.

The level of proficiency was measured in the target languages of the study; the L2 for the English–Russian group and the Russian–English bilingual group, and the L3 for the Russian–French–English group and the Russian–German–English groups. A C-test asked participants to fill in 60 gaps across 3 independent texts (20 gaps per text). The texts were balanced for number of sentences and sentence length. Those participants who completed 30% to 60% of the C-test

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the level of the English language classes the participants were taking and the results of a C-test were taken into account for the acceptance criteria.

correctly were classified as intermediate level speakers of English or Russian and were invited to participate in the experiment. The low cut-off of 30% was selected as the earliest possible level of L2 proficiency at which the participants processing behavior could be studied. Furthermore, the cut-off point of 30% was calculated as the lowest possible score which could not be obtained through incidental guessing of a preposition or a repeated word. All participants were recruited from college-level classes of English or Russian. The classification of the participants as intermediate matched the level of the English or Russian language course they were currently taking. For the learners of English, their courses were using textbooks pertaining to the B1 level of the Common European Framework of Reference for Languages.

For L3 speakers of English, proficiency in their respective L2s was assessed independently. They took language proficiency exams in their respective L2s at their Universities in Russia twice a year. The exams contained reading, writing, speaking, and listening parts. By the time of participation in the experiment, their most recent University exams in either L2-German or L2-French corresponded to the advanced (C1) level of proficiency in the Common European Framework of Language Proficiency Assessment. Besides, most participants had visited the countries of their respective L2s several times for both work and study. All the trilingual participants were taking at least one of their University courses in their L2 at the time of the experiment. The background information of the participants, including their level of proficiency in the target language is given in Table 1.

Table 1. Participant background information

Group	**E (NSs of English)**	**R (NSs of Russian)**	**ER (L1-English, L2-Russian)**	**RE (L1-Russian, L2-English)**	**RFE (L1 Russian, L2 French, L3 English)**	**RGE (L1 Russian, L2 German, L3 English)**
N participants	10	9	14	14	15	11
C-test % correct	–	–	37% range 30–60	45% range 30–60	54% range 30–60	56% range 40–57
Length of exposure to the target language	–	–	2 years: 4 hrs/week	4 years: 2 hrs/week	6.7 years (4 hrs/week)	5.4 years (4 hrs/week)
Mean age	40	29	21	30	24	25

In summary, all non-native participants demonstrated an intermediate level of proficiency in the target languages of the experiment (English and Russian), according to the C-test (threshold 30–60 % accuracy). This means that they were not beginners anymore, but not too advanced in their respective L2 or L3 yet. The L3 groups were very proficient in their L2s, which was confirmed by their general academic record and their results in standardized proficiency tests at their home Universities. In total, the study tested 2 monolinguals groups of English and Russian speakers, two intermediate groups of L2 speakers – one group of L2-English and a group of L2-Russian participants, as well as two groups of intermediate speakers of English as the L3. All the participants were adults, either college students or professionals with degrees not lower than BA.

Materials

The study used a two-by-two design in both languages, English and Russian. The first condition employed a perception vs. a non-perception matrix verb. Recall that a perception verb is expected to favor HA across all languages and in all experimental groups. A non-perception verb would, in turn, favor a language-specific pattern of RC resolution.

The second condition manipulated social biases that would prompt a certain type of RC resolution. The social conventions used in the experiment were selected based on a survey taken by 20-25 adult native speakers in each country, the U.S. and Russia. The survey included a list of activities like *talking about cosmetics*, *buying flowers*, *playing in the yard* and a list of possible doers, like *a man*, *a woman*, *a child*, etc. There were 20 activities in the full list. Participants were asked to match an activity with the most likely doer of this activity. The participants' choices at 85% or higher were selected to design the experimental stimuli for social bias. A sample set of experimental sentences for English is given in Table 2.

Table 2. Sample stimuli quadruple in English

perception / HA bias	Bill *saw* **the mother** of the man that was talking about **cosmetics**.
non-perception / HA bias	Bill <u>arrested</u> **the mother** of the man that was talking about **cosmetics**.
perception / LA bias	Bill *saw* the son of **the woman** that was talking about **cosmetics**.
non-perception / LA bias	Bill <u>arrested</u> the son of **the woman** that was talking about **cosmetics**.

The English stimuli included NP object head nouns of two different genders and used social gender biases to assign certain activities to be performed by either men or women. This approach could not be used in Russian because grammatical gender is overtly marked and head nouns of different genders would entail gender marking on the complementizer, which would disambiguate the target sentence. Therefore, Russian stimuli used a different convention, splitting head nouns between different social groups by age. Table 3 shows a sample set of target sentences for Russian.

Table 3. Sample stimuli quadruple in Russian (English equivalents are shown)

perception / HA bias	Bill *saw* **the son** of the man that was **playing** in the yard.
non-perception / HA bias	Bill <u>arrested</u> **the son** of the man that was **playing** in the yard.
perception / LA bias	Bill *saw* the father of **the boy** that was **playing** in the yard.
non-perception / LA bias	Bill <u>arrested</u> the father of **the boy** that was **playing** in the yard.

The experiment contained 40 target sentences and 40 distractors. The distractors were complex sentences that did not contain ambiguous RCs. They were also followed by a comprehension question, like in (6):

(6) My friend likes the coffee that I brought her from Brazil last year.

Who likes the coffee?

a. my friend b. me

The order of the sentences was randomized by the program Linger so that each participant saw a unique sequence of experimental items.

Procedure

The experiment included three stages: a pre-experimental part, the experiment, and a wrap-up phase. During the pre-experimental part, participants completed the linguistic background questionnaire and completed the proficiency measure in the non-native languages in which they were tested. Monolingual speakers of English and Russian were exempt from the language proficiency test; they only completed the linguistic background form. The pre-testing part took the monolinguals 5–7 minutes and the non-native speakers 20–25 minutes to complete.

The main experiment started with a trial session where participants were introduced to the format of the experiment (a self-paced reading task). Each self-paced sentence was followed by a comprehension question. The comprehension questions had two answer choices which could be selected by pressing either the key F or the key J. To move forward, the participants had to press the SPACE bar. The main experiment took the participants 30–40 minutes to complete. Upon completion of the experiment, the participants had an opportunity to ask questions about the study and their results.

The results of the experiment were stored on a password-protected computer. We did not collect real names, as all the participants were registered under codes. For example, RE-1 meant a native speaker of Russian, L2 speaker of English, who was the first participant to be tested in the group.

Data Analysis

Data was analyzed in R using a mixed linear model, software package lmer4 (Bates, Mächler, Bolker & Walker, 2015). The dependent variable was Noun Choice, standing for the answer choice in the comprehension question that showed high- or low-attachment preferences in RC resolution.

The independent variables were the Verb Type (perception vs. non-perception), Social Biases (favoring HA vs. LA), and Group (ER, RFE, RGE, ER in analysis 1, and E, R, ER, RFE, RGE, ER in analysis 2). Verb Type, or the type of the matrix predicate, tested whether a perception verb favored HA of the RC across the two languages of the experiment. Social Bias measured whether the answer to a comprehension question depended on the activity expressed by the embedded verb and a social bias to assign this activity to a certain head noun. The third factor was Group, which allowed for comparisons between native and non-native speakers as well as for comparisons between the groups of L2 speakers vs. the groups of L3 speakers. The dependent variable, Noun Choice, was the data calculated as percentile preference for a certain type of RC resolution, HA or LA. The results are presented with HA as a reference category.

The statistical analysis used a mixed linear effect model to measure the effect of three factors: Group, Verb Type, and Social Bias on the answer choice (Nchoice) in a comprehension question: model.english = lmer(PctNoun1 ~ VerbType_factor*SocialBias_factor*Group_factor + (1 | Participant) + (1 | Item), data = full_data_set, REML = FALSE). The model had Participant and Item as random effects. The Results section below reports the significance or non-significance of the main factors, supported by the lsmean data. Two separate analyses were carried out: once with the non-native speaker groups only, and then with all the participant groups. Therefore, in the first analysis the Group factor had 4 levels, while in the second analysis it had 6 levels.

Results

Results are presented in two stages. In the first stage, non-native speakers were compared to each other. In the second stage, the two monolingual control groups were added to the analysis. The need for a two-stage data presentation was motivated by the complexity of the factor Group, since the study included 6 participant groups in total.

L2 and L3 speakers. The results of all non-native speakers analyzed together are presented in Table A in the Appendix. The analysis yielded only one significant main effect: Verb Type, or the type of matrix verb (*Estimate* = 0.07, *SE* = 0.02, *df* = 162, $t = 3.50$, $p < .001$). This means that a perception verb type favored overall preference for HA in the four experimental groups. Please notice that the target languages include a LA-language English, alongside a HA-language Russian.

Table 4 demonstrates how verb type (perception verb vs. non-perception verb) affected participants' behavior. The Perception condition returned 58% preference for HA vs. the Non-Perception condition with the 51% for HA.

Table 4. Verb type effect on high attachment preference

	After a perception verb			**After a non-perception verb**	
Preference for high attachment	**58%**			**51%**	
VerbType_factor	lsmean	SE	df	lower.CL	upper.CL
NonPerception	0.511	0.0249	83.5	0.462	0.561
Perception	0.579	0.0249	83.5	0.529	0.628

There was no effect of social bias on RC attachment resolution in either the L2 or L3. As demonstrated by Table 5, social bias favoring HA represented 55% of all HA choices, whereas the bias towards LA reduced this score by 1% only, $p < .8$ (see Appendix A for full statistical analysis).

Table 5. Effect of social bias on high attachment preference

	Favoring HA			**Favoring LA**	
Preference for high attachment	**55%**			**54%**	
Social_factor	lsmean	SE	df	lower.CL	upper.CL
forHA	0.547	0.0249	83.5	0.498	0.597
forLA	0.543	0.0249	83.5	0.493	0.592

There was no significant difference between the L2ers and L3ers. The group effect *p*-value for the populations tested in their non-native languages was $p < .3$ (see Appendix A for full analysis). Table 6 demonstrates the preferred percentile score for HA in each group of non-native speakers.

Table 6. Group effect on high attachment preference

	ER	RFE	RGR	RE	
Preference for high attachment	**51%**	**60%**	**51%**	**57%**	
Group_factor	lsmean	SE	df	lower.CL	upper.CL
ER	0.505	0.0442	58.3	0.417	0.594
RFE	0.597	0.0427	58.3	0.511	0.682
RGE	0.507	0.0498	58.3	0.407	0.607
RE	0.571	0.0442	58.3	0.483	0.660

Non-native speakers and monolinguals. The results of all the experimental groups together allow for a comparison between monolingual processing and processing in non-native languages (Appendix, Table B). When the data of native and non-native speakers were analyzed in one pool, the analysis unveiled two significant main effects: Group (*Estimate* = 0.06, *St. Error* = 0.02, $df = 73$, $t = 4.12$, $p < .001$) and Verb Type (*Estimate* = 0.27, *St. Error* = 0.06, $df = 219$, $t = 3.81$, $p < .001$). Therefore, a perception verb had a homogenous effect on the entire population of the participants (VerbType effect, $p < .001$). At the same time, the preference for RC resolution differed by Group (Group effect, $p < .001$). These seemingly contradicting results are explained below.

To begin with, a perception verb in the matrix clause favored HA in the entire data pool. Table 7 provides data for RC resolution after a perception matrix verb and after a non-perception one in the entire population of the participants.

Table 7. Verb type effect on high attachment preference in all groups

	After a perception verb		After a non-perception verb		
Preference for high attachment	**56%**		**50%**		
VerbType_factor	lsmean	SE	df	lower.CL	upper.CL
NonPerception	0.496	0.0226	96.78	0.451	0.541
Perception	0.555	0.0226	96.78	0.510	0.60

As becomes evident from Table 7, the participants preferred HA after a perception verb 6% more often than after a non-perception one. The homogenous effect of the matrix verb was supported by the lack of a significant interaction VerbType*Group. However, the group data on the effect of the matrix predicate in Figure 1 present insightful information. These data are used for illustrative purposes.

Figure 1. Noun choice by verb type in each group: Descriptive statistics

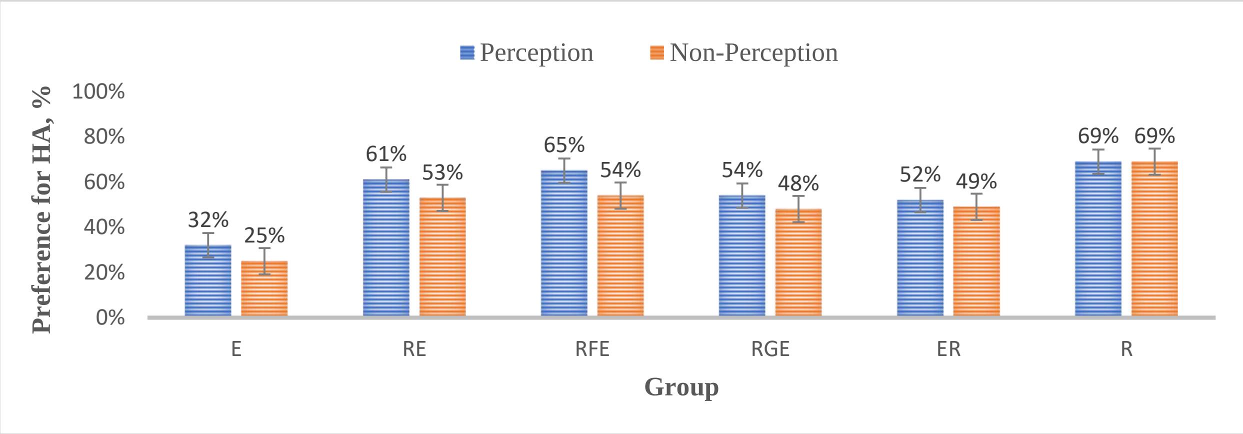

Figure 1 demonstrates a noticeable difference between the effect of a perception verb in Russian and English. A perception verb did not override the default preference for LA in English (E). Moreover, it had no effect on HA in Russian monolinguals (R). It is also noticeable that a perception verb tended to influence RC resolution in English more than in Russian, be it in native or non-native processing. The between-group difference in the participants' sensitivity to the effect of a perception verb becomes clearer in the analysis of the Group factor.

The statistical significance of the Group factor means that RC resolution varied depending on whether the participants were monolingual (Russian / English), or whether they were L2 learners of either English or Russian, or L3 learner of English. The Group factor included 6 experimental groups, which were compared to each other. Table 8 demonstrates how the contrasts within the Group factor were set in R.

***Table 8. Levels of Group factor in R*.**

contrasts(full_data_set$Group_factor)					
	[1]	[2]	[3]	[4]	[5]
E	-0.8630137	-0.239726	-0.130137	-0.08219178	-0.03424658
ER	0.1369863	-0.739726	-0.130137	-0.08219178	-0.03424658
RFE	0.1369863	0.260274	-0.630137	-0.08219178	-0.03424658
RGE	0.1369863	0.260274	0.369863	-0.58219178	-0.03424658
RE	0.1369863	0.260274	0.369863	0.41780822	-0.46575342

R	0.1369863	0.260274	0.369863	0.41780822	0.53424658

As can be gathered from Table 8, there were 5 levels of comparison within the Group factor. They are in columns and marked as [1], [2], [3], [4] and [5] in the table. The order of comparisons can be tracked by the changing balance between the negative and the positive decimals. In R, the decimals demonstrate how the variables are distributed around zero on the X axis. For example, in column [1] group E is placed to the left of zero (negative), and groups ER, RFE, RGE, RE and R to the right of zero (positive). This demonstrates that the comparison occurs between groups E and ER. In column [2], there are two groups whose data are distributed to the left of zero (negative) – E and ER. The data of the other four groups are distributed to the right of zero (positive). Thus, the second level of comparison (column [2]) places the main contrast between groups ER and RFE. The other three columns follow the same pattern of distribution.

The model returned only one statistically significant contrast within the Group factor. It was the first level of analysis reflected in column [1], (see Table B in the Appendix). In particular, English monolinguals were significantly different from the Anglophone learners of Russian (ER). This difference can be observed in the individual data on RC resolution provided in Figure A in the Appendix.

The lack of a significant difference at the other levels of comparison means that L2 learners of Russian were not significantly different from L2/L3 learners of English (column [2]). There was no significant difference that would separate the two trilingual groups (column [3]). A better visual representation of the RC resolution in groups RFE and RGE can be obtained from Figure C in the Appendix.

L3 speakers of English (RFE and RGE) were not different from L2 speakers of English (RE) (column [4]). It is important to notice that Russian monolinguals (R) were not statistically different from Russian learners of English (column [5]). Please, consult the individual data for groups R and RE in Figure B in the Appendix.

The percentile score of HA preferences and R statistics for the comparisons within the Group factor are provided in Table 9 below.

Table 9. Group effect on high attachment preference

	E	**ER**	**RFE**	**RGE**	**RE**	**R**
Preference for high attachment	**29%**	**51%**	**60%**	**51%**	**57%**	**69%**

Group_factor	lsmean	SE	df	lower.CL	upper.CL
E	0.2875000	0.05589181	73	0.1761078	0.3988922
ER	0.5053571	0.04723720	73	0.4112135	0.5995008
RFE	0.5966667	0.04563547	73	0.5057153	0.6876180
RGE	0.5068182	0.05329075	73	0.4006099	0.6130265
RE	0.5714286	0.04723720	73	0.4772850	0.6655722
R	0.6888889	0.05891514	73	0.5714712	0.8063066

Monolingual speakers of English showed a preference for LA, which was as expected. Monolingual speakers of Russian, on the other hand, showed a preference for HA, which patterned with the RC resolution most often preferred in Russian. L2 and L3 speakers tested in English still displayed a general preference for HA, i.e., the preference was above 50%. However, the rate of their HA choices was lower than in the monolingual Russian group (see data in Figures B and C in the Appendix).

Group RGE, non-native speakers of English, demonstrated the same preference for HA (51%) as the ER group, non-native speakers of Russian. We take this as additional evidence for a developing capability to parse non-native sentences in a target-like manner. Non-native speakers demonstrated a potential to change to the Russian-like HA in their non-native Russian and to the English-like LA in their non-native English

The results in Table 9 demonstrate that English monolinguals stayed within the preference for LA in their native language (see Figure 1 for the effect of a perception verb). The data in Figure 1 and Table 9 clearly illustrate that a perception verb did not override the default preference for LA in RC resolution in English. It had almost no effect in Russian (R and ER), where HA is generally preferred. All groups tested in English, be it their native or non-native language, showed a greater effect of a perception verb on RC resolution than those tested in Russian. Therefore, the effect of the verb type was mediated by the language in which participants were tested and not by the native language of the participants.

The statistical analysis did not return any significant effect of Social Bias on RC resolution; that is, the entire population of the participants did not rely on this type of non-structural information in RC resolution. Besides, a possible distinction between native and non-native speakers must be revealed through a significant interaction of the factors Group and Social Bias, which was not the case in our study (see Appendix for detail). Table 10 provides the relevant data.

Table 10. Effect of social bias on high attachment preference

	Favoring HA		Favoring LA	
Preference for high attachment	**53%**		**52%**	
Social_factor lsmean	SE	df	lower.CL	upper.CL
forHA 0.528	0.0226	96.78	0.483	0.573
forLA 0.523	0.0226	96.78	0.478	0.568

In summary, our results showed that verb type had a robust influence on RC attachment resolution across groups (monolinguals, L2 and L3 speakers). In the group analysis, only English monolinguals, who showed a strong preference for LA, were significantly different from the other experimental groups. Finally, social biases did not guide sentence processing in either native or non-native languages.

4. Discussion

Our study investigated processing of RC resolution at the intermediate level of L2 and L3 proficiency. It attempted to provide a description of how L*n* acquisition manifested itself in sentence processing. In addition, the study sought experimental evidence that non-native languages, L2 and L3, utilized the same mechanisms of sentence parsing.

Our first research question explored the influence of the native or previously learnt languages on RC resolution in English, L2 or L3 of the participants, and in Russian, L2. The results of the experiment suggested a negative answer for both, the influence from L1 English and from L1 Russian. First, there was no evidence of the L1-like English preferences (LA) in L2 Russian. We would also claim that there was no L1 Russian effect on L2/L3 processing in English. Even though the results in English as an L2/L3 were around 50% preference for HA or a bit higher, they were noticeably lower than in the participants' L1 Russian (69% HA), though the difference did not reach statistical significance. Bearing in mind that the participants were not highly proficient in the L2/L3, we interpreted these results as evidence of developing TL-like processing in non-native English. The tendency for processing non-native languages in a TL-like manner may be corroborated by future studies with more advanced non-native speakers of English and Russian.

There can be an alternative explanation of the results obtained. Preference for HA within the range of 51%–60% could be viewed as reflecting performance at chance, or as the absence of clear preferences in RC resolution in non-native languages (see Clahsen & Felser, 2006; Felser et al., 2003). We would like to offer an alternative explanation. We argue that the results of 51%–60% of HA in non-native English should be read as the participants' performance different from their HA-L1 Russian but not quite like their LA-L2/L3 English yet. As mentioned above, the results in RC resolution point to developmental changes in L2/L3 processing. However, there is another theoretically possible prediction for the participants' further Ln development.

Let us assume that the intermediate level of Ln proficiency provides the learner with enough linguistic information to realize that RC resolution can be high in Russian and low in English. In this case, the current state of the learners' mental grammar has been set to accommodate two grammatically possible options for RC parsing. If this assumption holds true, the preference for RC resolution around 50% is a result of the acquired flexibility in its attachment. Therefore, we cannot anticipate a full switch to the TL-like performance in RC resolution even from highly proficient L2/L3 speakers. Although this interpretation is unlikely, in our opinion, it cannot be refuted with our data or with the results of Sokolova and Slabakova (2019) and, thus, it must be resolved with further experiments.

Our second research question investigated whether the presence of a perception verb impacted RC resolution. It examined whether both native and non-native speakers could adjust their structural parse to favor HA when prompted by a perception verb. Our results pointed to an affirmative answer, although this statement requires further clarification.

First, there was a significant simple effect of a perception verb on RC resolution and no significant interaction Verb Type–Group. This effect suggests that a perception verb influenced RC resolution favoring HA, and it was homogenous for the entire population of participants. However, a closer look at the descriptive statistics in Figure 1 revealed a different amount of Verb Type effect in each experiment group. It varied from demonstrating no effect in NSs of Russian to the 7 % difference between HA and LA in NSs of English. Therefore, a LA-language English was sensitive to a parsing prompt of a perception verb; whereas, Russian remained a HA with or without a perception verb.

The amount of the effect of a perception verb demonstrated by non-native speakers definitely pointed to the TL-like sensitivity to this effect in non-native languages. The three groups tested in their non-native English demonstrated a high sensitivity to the effect of a perception verb and favored HA up to 11% more often after a perception verb. The group tested in their non-native Russian was less sensitive to the effect of a perception verb and preferred HA only 3% more often after it.

We view the effect produced by a perception verb as evidence for mental structure building in native and non-native languages. In doing so, we extend the theoretical analysis by Grillo and Costa (2014) to language processing. In our understanding, a perception verb triggers a projection for an eventive complement, a structure that leaves the higher noun *the mother* in (1) as the only possible doer of the action expressed by the embedded verb. When the complementizer *that* is encountered, the upcoming RC is added to the existing projection, and HA of the ambiguous RC ensues. The study provides experimental evidence for the effect of a main-clause perception verb and argues that non-native processing is based on mental structure building in the same way as native processing is.

Our results generally supported the assumptions by Grillo and Costa (2014), showing perception verbs affect RC resolution. However, our findings did not fully support the analysis of Grillo et al. (2015), who concluded that RC ambiguity resolution totally depended on the linguistic environment created by a perception verb. This is because our experimental results did not support the notion that the perception verb could override a LA preference in RC resolution. First, English monolinguals preserved their preference for LA and showed only a tendency towards HA in sentences with a perception verb. However, because our study included a small number of participants in the English monolingual group, the lack of an effect could be explained by insufficient power. Future experiments should address this question.

Second, the existing literature and our own results demonstrated that Russian is a HA language independently of whether there is a perception or a non-perception verb in the matrix clause (see Figure 1). Therefore, a perception verb may be an additional parsing cue supporting the original preference for HA in Russian, but it does not define RC attachment resolution in this language. Another study could measure the participants' processing time when they do a similar RC resolution task in English and Russian. This would be a good way to check whether a perception verb creates facilitative processing conditions in any of these languages.

With the current data, the effect of the matrix verb of RC resolution can be explained as the universal potential of a perception verb to select an eventive complement. Sensitivity to the selectional properties of the matrix verb explains a higher preference for HA in both native and non-native speakers in the sentences with a perception verb. Therefore, in agreement with Sokolova and Slabakova (2019), we conclude that both native and non-native speakers perform mental structure building in their sentence processing.

Our last research question investigated whether native and non-native speakers employed different processing strategies as predicted by the SSH, and suggested that non-native speakers relied on non-structural information in RC resolution. Evidence in support of shallow processing would entail a different pattern of RC processing between native and non-native speakers. In our experiment, social conventions established in society constituted non-structural information that could guide parsing. Thus, according to the SSH, sentence processing should be guided by such social biases. This was not the case in our experiment. Neither native nor non-native processing showed a significant effect of social conventions. Therefore, neither of these claims of *shallow* processing received experimental support. This conclusion should be corroborated in the future studies with higher number of participants and other language combinations.

In sum, our study supports the theoretical assumptions presented in Dekydtspotter et al. (2006) and argues that both native and non-native processing are fundamentally similar in that they both make use of structural (rather than shallow) parsing. Thus, we suggest that learners, when they acquire a new language, also acquire the processing strategies essential for the target language. The earliest evidence for the developing TL-like processing can be attested as early as at the intermediate level of L2/L3 proficiency. Thus, we conclude that the acquisition of parsing strategies is similar in L1, L2, L3 or L*n*.

5. Conclusions

This chapter reports on a study of non-native processing, where L2 and L3 speakers, as well as monolinguals, showed sensitivity to the effect of a perception verb in RC resolution. We take this result to constitute evidence of structural processing in native and non-native languages. Similarity of effects in L2 and L3 processing suggests that all non-native processing is fundamentally similar, and that most of the findings in the L2 research are generalizable to the entire field of non-native processing. Our findings also suggest that acquisition of processing strategies in the non-native language can develop with the growth of the speakers' proficiency in the L2/L3. In terms of RC resolution, L2 and L3 speakers show a tendency to parse the non-native sentences in a TL-like manner as early as the intermediate level of proficiency. Further studies with advanced speakers of L2 and L3, as well as studies with a higher number of participants, are needed to investigate whether there is a developmental trajectory from L1-like to TL-like processing in non-native languages.

References

Bates D, Mächler M, Bolker B, Walker S (2015). "Fitting Linear Mixed-Effects Models Using lme4." *Journal of Statistical Software*, **67**(1), 1–48. doi: 10.18637/jss.v067.i01.

Clahsen, H., & Felser, C. (2006). Continuity and shallow structures in language processing. *Applied Psycholinguistics, 27(2),* 107–126.

Clahsen, H., & Felser, C. (2018). Notes on the Shallow Structure Hypothesis. *Studies in Second Language Acquisition, 40(3)*, 693–706.

Cuetos, F., & Mitchell, D. (1988). Cross-linguistic differences in parsing: Restrictions on the use of the Late Closure strategy in Spanish. *Cognition, 30*, 73–105.

Dekydspotter, L., Schwartz, B. D., & Sprouse R. A. (2006). The comparative fallacy in L2 processing research. In M. Grantham O'Brien, C. Shea, and J. Archibald (Eds.) *Proceedings of the 8th Generative Approaches to Second Language Acquisition Conference (GASLA 2006)* (pp. 33–40). Somerville, MA: Cascadilla Proceedings Project.

Dekydspotter, L., Donaldson, B., Edmonds, A.C., Fultz, A.L. & Petrush, R.A. (2008). Syntactic and prosodic computation in the resolution of relative clause attachment ambiguity by English-French learners. *Studies in Second Language Acquisition*, *30*, 453–480.

Dussias, P.E. (2003). Syntactic ambiguity resolution in L2 learners. *Studies in Second Language Acquisition*, *25(04),* 529–557.

Dussias, P.E., & Sagarra, N. (2007). The effect of exposure on syntactic parsing in Spanish-English bilinguals. *Bilingualism: Language and Cognition*, *10(01),* 101–116.

Felser, C., Roberts, L., Gross, R., & Marinis, T. (2003). The Processing of Ambiguous Sentences by First and Second Language Learners of English. *Applied Psycholinguistics, 24,* 453–489.

Felser, C., & Cunnings, I. (2012). Processing reflexives in English as a second language: The role of structural and discourse-level constraints. *Applied Psycholinguistics*, *33,* 571–603.

Fernandez, E. (1999). Processing strategies in second language acquisition: Some preliminary results. In E. Klein & G. Martohardjono (Eds.), *The development of second language grammars: A generative approach* (pp. 217–239). Amsterdam: Benjamins.

Fodor, J. (2002). Psycholinguistics cannot escape prosody. *Speech Prosody 2002, ISCA Archive https://www.isca-speech.org/archive/sp2002/sp02_083.html*.

Grillo, N., & Costa, J. (2014). A novel argument for the universality of parsing principles. *Cognition, 133(1)*, 156–187.

Grillo, N., Costa, J., Fernandes, B., & Santi, A. (2015). Highs and Lows in English attachment. *Cognition*, *144*, 116–122.

Lardiere, D. (2009). Some thoughts on the contrastive analyses of features in second language acquisition. *Second Language Research*, *25(2)*, 173–227.

Hemforth, B., Konieczny, L., Scheepers, C., & Strube, G. (1998). Syntactic ambiguity resolution in German. *Syntax and Semantics, 31,* 293–309.

Hopp, H. (2014a). Individual differences in the L2 processing of object-subject ambiguities. *Applied Psycholinguistics, 36(2)*, 129–173.

Hopp, H. (2014b). Working memory effects on the L2 processing of ambiguous relative clauses. *Language Acquisition, 21*(3), 250–278.

Papadopoulou, D., & Clahsen, H (2003). Parsing strategies in L1 and L2 sentence processing: A study of relative clause attachment in Greek. *Studies in Second Language Acquisition*, *25*, 501–528.

Schwartz, B., & Sprouse, R. (1996). L2 cognitive states and Full Transfer / Full Access Model. *Second Language Acquisition*, *12(1),* pp. 40–72.

Sekerina, I (2002). The Late Closure Principle in processing of ambiguous Russian sentences. *Proceedings of the 2nd Conference on Formal Description of Slavic Languages,* pp. 1–17. https://www.academia.edu/2173650/_2002_The_Late_Closure_Principle_in_processing_of_ambiguous_Russian_sentences

Slabakova, R., & Montrul, S., A. (2008). Aspectual shifts: Grammatical and pragmatic knowledge in L2 acquisition. In J. M. Liceras, H. Zobl, and H. Goodluck (Eds). *The role of formal features in second language acquisition* (pp. 455–83). New York: Lawrence Erlbaum Associates.

Sokolova, M., Slabakova, R (2019). L3-sentence processing: Language-specific or phenomenon-sensitive. *Languages, 4(5),* 1–17.

Sprouse, R, A. (2011). The Interface Hypothesis and Full Transfer/Full Access/Full Parse: A brief comparison. *Linguistic Approaches to Bilingualism, 1,* 97–100.

Witzel, J., Witzel, N., & Nicol, J. (2012). Deeper than shallow: Evidence for structure-based parsing biases in second-language sentence processing. *Applied Psycholinguistics, 33*, 419–456.

Zagar, D., Pynte, J., & Rativeau, S. (1997). Evidence for early closure attachment on first-pass reading times in French. *Quarterly Journal of Experimental Psychology, 50A*, 421–438.

Appendix. Statistical analysis, full output

Table A. R statistics for the four groups of non-native speakers.

Fixed effects:	Estimate	Std. Error	df	t value	Pr(>|t|)
(Intercept)	0.548148	0.021646	53.999998	25.324	< 2e-16 ***
VerbType	0.068519	0.019595	162.000001	3.497	0.000608***
SocialBias	-0.003704	0.019595	162.000001	-0.189	0.850317
Group_factor1	0.062538	0.049856	53.999998	1.254	0.215106
Group_factor2	-0.057543	0.052092	53.999998	-1.105	0.274207
Group_factor3	0.064610	0.064088	53.999998	1.008	0.317878
VerbType:SocialBias	-0.062963	0.039189	162.000001	-1.607	0.110082
VerbType:Group_factor1	0.053820	0.045132	162.000001	1.193	0.234802
VerbType:Group_factor2	-0.041407	0.047156	162.000001	-0.878	0.381197
VerbType:Group_factor3	0.012338	0.058016	162.000001	0.213	0.831859
SocialBias:Group_factor1	-0.013896	0.045132	162.000001	-0.308	0.758553
SocialBias:Group_factor2	0.019351	0.047156	162.000001	0.410	0.682088
SocialBias:Group_factor3	0.044156	0.058016	162.000001	0.761	0.447702
VerbType:SocialBias:Group1	0.046104	0.090263	162.000001	0.511	0.610207
VerbType:SocialBias:Group2	-0.093506	0.094312	162.000001	-0.991	0.322939
VerbType:SocialBias Group3	0.158442	0.116031	162.000001	1.366	0.173986
Signif. codes: 0 '' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1***					

Table B. R statistics for all groups: native and non-native speakers.

Fixed effects:	Estimate	Std. Error	df	t value	Pr(>|t|)
(Intercept)	0.529795	0.020686	72.999995	25.611	< 2e-16 ***
VerbType	0.062329	0.016344	219.000002	3.814	0.000178 ***
SocialBias	-0.004795	0.016344	219.000002	-0.293	0.769526
Group_factor1	0.256467	0.062278	72.999995	4.118	9.95e-05 ***
Group_factor2	0.077220	0.054942	72.999995	1.405	0.164116
Group_factor3	-0.028178	0.056116	72.999995	-0.502	0.617077
Group_factor4	0.123341	0.065311	72.999995	1.889	0.062929.
Group_factor5	0.117460	0.075514	72.999995	1.555	0.124157
VerbType: SocialBias	-0.058904	0.032687	219.000002	-1.802	0.072912.
VerbType:Group_factor 1	-0.019717	0.049203	219.000002	-0.401	0.689016
VerbType:Group_factor 2	0.046281	0.043407	219.000002	1.066	0.287510
VerbType:Group_factor 3	-0.056486	0.044335	219.000002	-1.274	0.203984
VerbType:Group_factor 4	-0.017821	0.051599	219.000002	-0.345	0.730145
VerbType:Group_factor 5	-0.060317	0.059661	219.000002	-1.011	0.313127
SocialBias:Group_factor1	0.042367	0.049203	219.000002	0.861	0.390143
SocialBias:Group_factor2	-0.012408	0.043407	219.000002	-0.286	0.775263
SocialBias:Group_factor3	0.022327	0.044335	219.000002	0.504	0.615051
SocialBias:Group_factor4	0.050108	0.051599	219.000002	0.971	0.332570
SocialBias:Group_factor5	0.011905	0.059661	219.000002	0.200	0.842024
VerbType:SocialBias:Group1	-0.150023	0.098407	219.000002	-1.525	0.128821
VerbType:SocialBias:Group2	0.025667	0.086815	219.000002	0.296	0.767772
VerbType:SocialBias:Group3	-0.134380	0.088670	219.000002	-1.516	0.131086
VerbType:SocialBias:Group4	0.076696	0.103199	219.000002	0.743	0.458168
VerbType:SocialBias:Group5	-0.163492	0.119321	219.000002	-1.370	0.172032
Signif. codes: 0 '' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1***					

Figure A. Percentage noun choice with HA as a reference category: English monolinguals and English-Russian L2ers

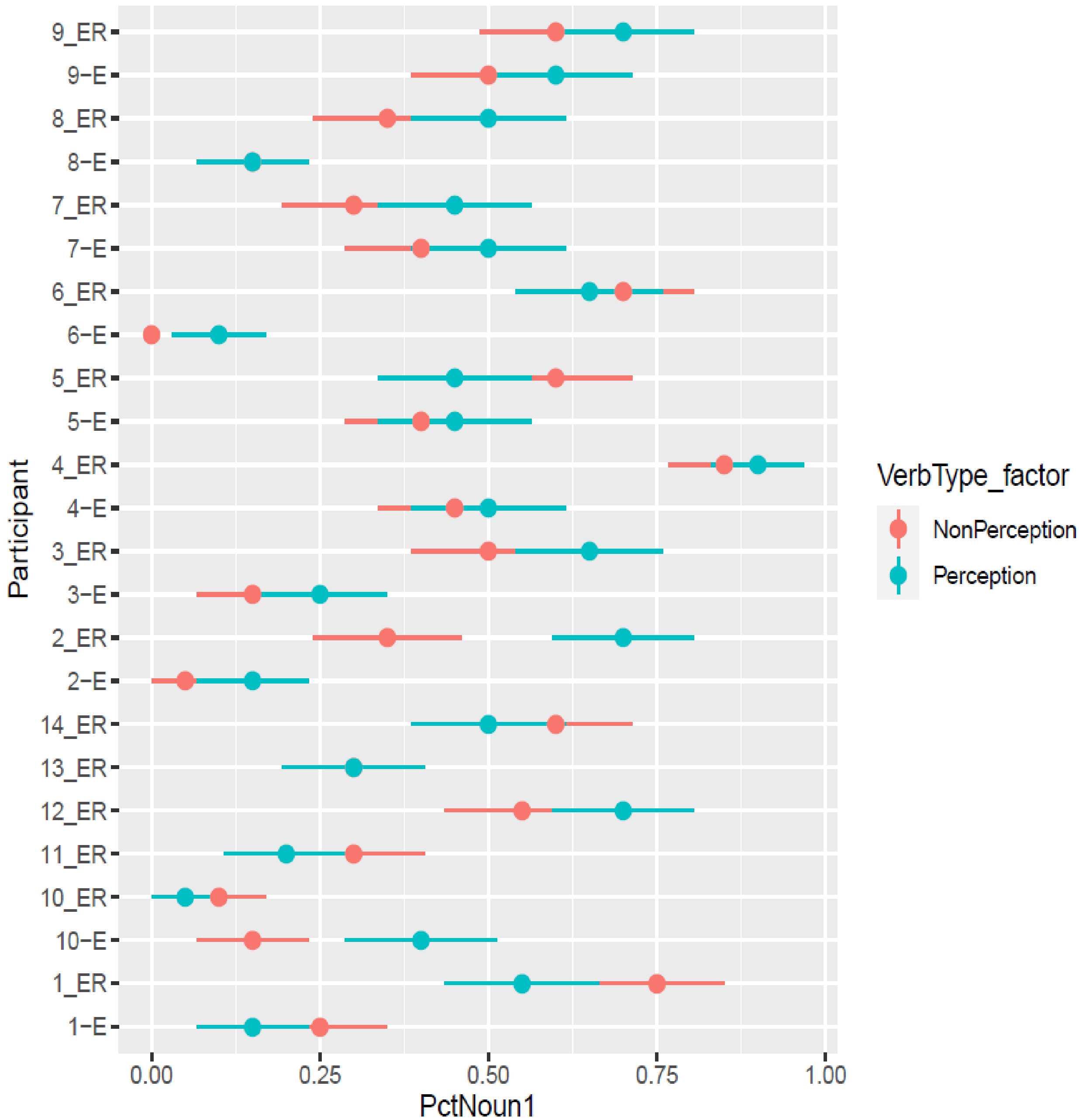

Figure B. Percentage noun choice with HA as a reference category: Russian monolinguals and Russian-English L2ers

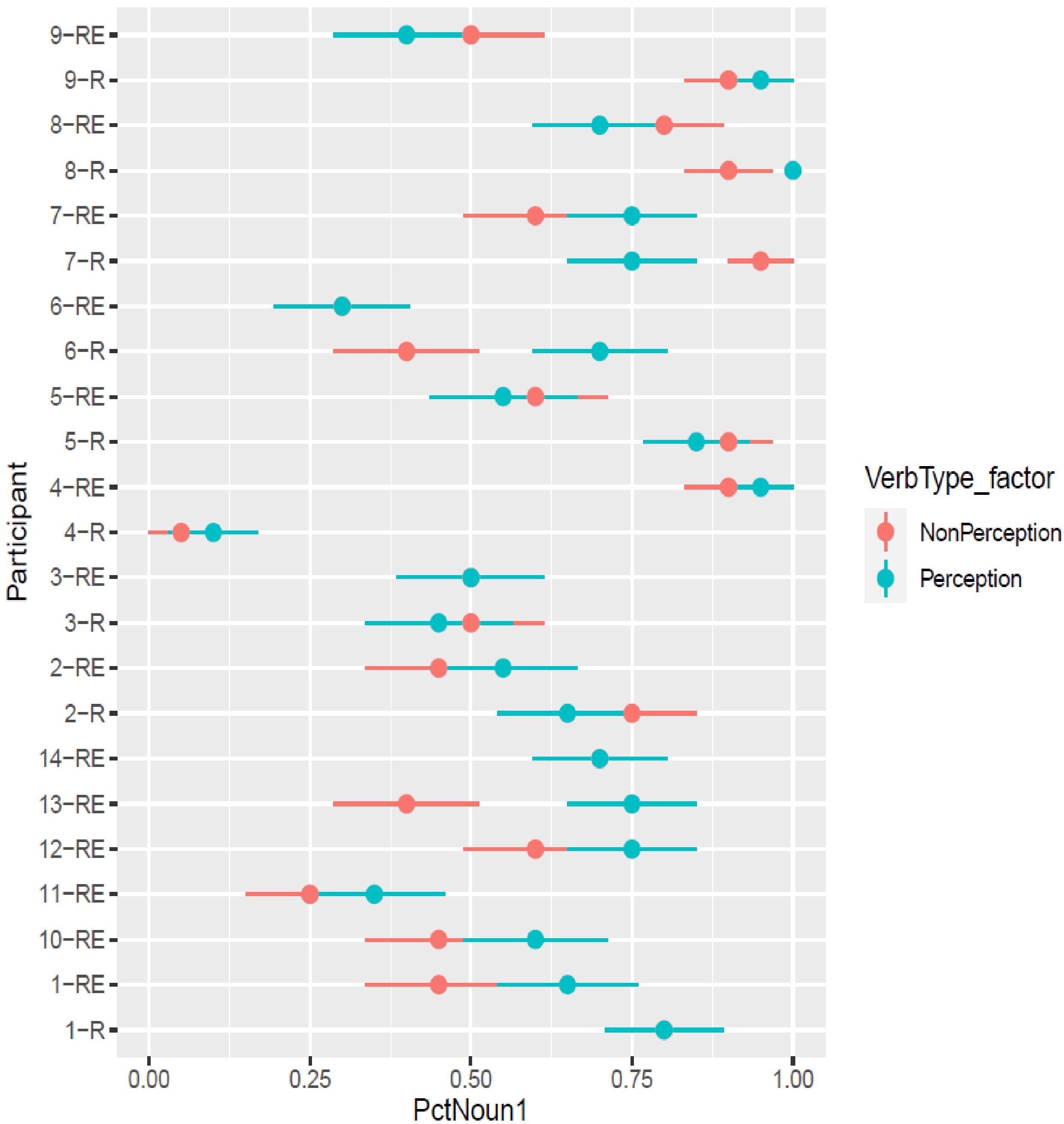

Figure C. Percentage noun choice with HA as a reference category: L3 speakers of English