Bridging the Gap between L2 Acquisition and Processing

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Implications for Teaching

Edited by

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TABLE OF CONTENTS

PREFACE

This book, 'Bridging the Gap between L2 Acquisition and Processing: Implications for Teaching' presents a collection of research in psycholinguistics, second language acquisition (SLA), and second language teaching aiming to advance understanding of whether differences between first language (L1) and second language (L2) processing arise from deficits in grammatical representations or from processing constraints due to limited cognitive capacity. With this objective, the book comprises six chapters, each focusing on a different aspect of L2 acquisition. The first four chapters explore L2 speakers' sensitivity to syntactic, semantic, and discourse information during online sentence processing and word processing, along with L2 acquisition of functional morphology. The final two chapters offer fresh insights and practical implications for enhancing L2 speaking skills. They achieve this through a comprehensive review of L2 research, encompassing cognitive, psychological, socioeconomic factors, and pragmatic considerations derived from speech act and politeness theories in L2 teaching.

The first chapter reviews current L2 studies to examine whether L2 speakers can use verb information to generate expectations and establish discourse coherence relations during both online and offline sentence processing. The chapter revolves around L2 speakers' sensitivity to implicit causality (IC) information of verbs in resolving referential ambiguity and relative clause attachment ambiguity. The author compares findings from L1 and L2 research concerning current theories of L2 processing and suggests that L1 speakers can establish discourse coherence relations using IC information early on, both in online and offline resolution of referential ambiguity and RC attachment ambiguity. L2 speakers resemble L1 speakers in their use of IC information from verbs in pronoun resolution. However, they differ from L1 speakers in terms of the timing and magnitude of the IC effect, which may be attributed to either the reduced ability of L2 speakers to utilize IC information, as posited by the Reduced Ability to Generate Expectations (RAGE) hypothesis, or to a diminished capacity to generate expectations due to the characteristics of L2 knowledge.

The second chapter explores whether L1 and L2 relative clause attachment preferences are similar; using a comprehensive review of L1 and L2 studies on the processing of relative clause attachment (RC) ambiguity.

It discusses the findings of current L2 studies on L2 processing of RC attachment ambiguity in light of current theories of sentence processing, including the Principle-Based Processing Hypothesis and Constraint-Based Processing in L1 and the Shallow Structure Hypothesis in L2. The author argues, based on these findings, that L1 speakers employ both syntactic and other informational sources, such as semantic, pragmatic, and discourse cues, during online and offline processing of RC attachment ambiguity. In contrast, L2 speakers are unable to employ syntactic information to the same extent as L1 speakers, a difference attributed to several factors.

Chapter 3 examines whether L1 and L2 word-processing mechanisms are similar, providing a comprehensive review of current L1 and L2 research. Specifically, the chapter focuses on the online processing of inflected and derived words to determine whether there is a consensus among L2 research regarding the processing strategies used by L1 and L2 speakers in online word processing. The author argues that L1 studies consistently demonstrate that L1 speakers employ the decomposition route in processing inflected words and the full-listing route in processing derived words. However, L2 studies have yet to yield consistent results. Primarily, the results suggest that L2 speakers lack access to inflectional morphology, possibly due to deficits in its representation or processing issues stemming from limited cognitive capacity. Nonetheless, achieving consistent results necessitates further research. The chapter calls for further research on L2 speakers' word-processing mechanisms to deepen our understanding of L2 processing inflectional and derivational morphology.

The fourth chapter provides an overview of current L2 theories on the acquisition of functional and inflectional morphology within the framework of generative grammar, aiming better to understand L1 and L2 acquisition of functional morphology. The chapter provides a brief description of L2 theories, including the Full Transfer/Full Access Hypothesis (Schwartz & Sprouse, 1996), the Missing Surface Hypothesis, the Prosodic Transfer Hypothesis (Goad & White, 2000), the Representational Deficit Hypothesis (Hawkins & Chan, 1997), the Interface Hypothesis (Sorace & Filiaci, 2006), the Bottleneck Hypothesis (Slabakova, 2008), and the Shallow Structure Hypothesis (Clahsen & Felser, 2006). It then explores the claims and predictions of these theories through the acquisition of adjectival morphology, particularly gender, number, and case features in the operation of NP-splitting d-linked questions in L2 Russian. The author concludes that most of the reviewed theories assume differences between L1 and L2 acquisition of functional morphology, which may account for the incomplete attainment of certain target categories in a second language or other factors.

Chapter 5 explores the impact of cognitive, psychological, and socioeconomic factors on the development of L2 speakers' speaking ability, conducting a comprehensive review of current L2 research. It offers a comprehensive insight into the multifaceted influences on language learning and L2 communication. The chapter specifically investigates the influence of speaking anxiety, self-efficacy perceptions, and socioeconomic background on the development of L2 communication skills. By synthesizing findings from reviewed studies, the authors provide valuable insights and propose various implications for language classes and policymaking in second language education. These implications include strategies for reducing the negative impact of anxiety and enhancing the positive effect of self-efficacy on L2 speaking ability. Ultimately, the authors call for equal educational opportunities for language learners across public and private schools, irrespective of socioeconomic status. This stance underscores the need for a revision in education policies, teaching strategies, and learning environments, guided by administrators and educators alike.

The final chapter examines factors that affect the development of L2 speaking skills in second language classes through a review of studies on language functions. The chapter focuses on speech acts and politeness theory to provide a comprehensive understanding of politeness theory's general patterns and preferences in diverse social interactions, including both face-to-face and online interactions. The authors review the studies done on speech-act theory and politeness theory and provide a detailed examination of incorporating them into English as Foreign Language (EFL) classrooms, along with the advantages and drawbacks of implementing speech acts and politeness theory in ESL classrooms. They present practical suggestions for educators who seek to optimize language teaching in a variety of linguistic and cultural contexts and circumstances.

CHAPTER ONE

NON-GRAMMATICAL INFORMATION IN L2 PROCESSING: IMPLICIT CAUSALITY VERBS

FILIZ CELE

Abstract

This chapter examines the effect of implicit causality (IC) information provided by verbs in second language (L2) sentence processing. It does so through a critical review of current research on L2 pronoun resolution and relative clause attachment resolution. The aim is to understand better whether L2 speakers exhibit the same sensitivity to semantic information encoded in verbs as L1 speakers and whether they use it to anticipate a subsequent referent to be mentioned or a subsequent relative clause (RC) that will refer to a high attachment. Studies on L1 speakers, as reviewed below, demonstrate that they can establish discourse coherence relations using IC information early on, both in online and offline pronoun resolution. In other words, IC verbs are used to predict which reference will be re-mentioned during online and offline pronoun resolution. In the case of RC attachment resolution, IC information is favored to anticipate subsequent RCs referring to high noun phrases (NPs) and involving a causal explanation about the direct object (high NP), which influences the syntactic attachment decisions in their L1. Reviewing studies on L2 speakers revealed that L2 speakers resemble L1 speakers in their use of IC information achieved from verbs in pronoun resolution. However, they differ from L1 speakers in terms of the timing and magnitude of the IC effect. These disparities may stem either from the reduced ability of L2 speakers to use IC information, as posited by the Reduced Ability to Generate Expectations (RAGE) hypothesis or from a diminished capacity to generate expectations due to the characteristics of L2 knowledge. These factors warrant further

research to reach a conclusive understanding of L2 speakers' use of semantic information in verbs, particularly IC information.

1. Introduction

In the field of L2 research, various hypotheses have been put forward to explain disparities in sentence processing between L1 and L2 speakers. Some scholars account for these differences by the Shallow Structure Hypothesis (SSH) posited by Clahsen and Felser (2006; 2018), which suggests that differences in L1 and L2 processing may be due to potential deficits in the representation and/or processing of L2 grammatical knowledge. This may result in an overreliance on lexical, semantic, or other surface-level information during L2 sentence comprehension. Conversely, other studies propose that L2 speakers may exhibit a Reduced Ability to Generate Expectations (RAGE) (Grüter et al., 2017), or L2 speakers' difficulty in integrating various sources of information due to non-linguistic factors such as limited cognitive resources and/or working memory (e.g., 2011; Hopp, 2010; Roberts et al., 2008; Sorace & Filiaci, 2006).

In this paper, we investigate whether L2 speakers demonstrate a sensitivity comparable to L1 speakers in utilizing semantic information, specifically implicit causality (IC) information encoded in verbs, to anticipate upcoming referents during both online and offline resolution of referential ambiguity and relative clause (RC) attachment ambiguity. Garvey and Caramazza (1974) defined IC as a semantic feature encoded in verb roots, which affects "the grammatical processes which assign pronouns to antecedents" (p. 460). They proposed that certain verbs with IC information, like *confess, join*, and s*ell* attribute the cause of an event or situation primarily to factors associated with the person mentioned as the subject (NP1, *The prisoner*) as in (1). In contrast, verbs like *kill, fear, blame*, and *punish* attribute the underlying cause of the event or situation to factors associated with the person mentioned as the non-subject (NP2, *her daughter*) as in (2).

1. "*The prisoner confessed to the guard because he…*
2. *The mother punished her daughter because she…"* (Garvey & Caramazza, 1974, p.461)

Garvey and Caramazza reported that L1 English speakers provide continuations to sentences with subject-biased IC verbs (1) referring to NP1 (the prisoner) as in ("…*wanted to be released*." (p. 461)) and those with object-biased IC verbs (2a), referring to NP2 (her daughter) as in ("*…broke*

an antique vase." (p. 461)). Each continuation offered a causal explanation about the cause of the event in the main clause.

In the area of L1 research, it is firmly established that L1 speakers apply IC verbs to anticipate who will be re-mentioned in the following clause during online pronoun resolution, (e.g., Kehler, 2002; Cozijn et al., 2011; Rohde et al., 2011; Hartshorne & Snedeker, 2012; Jarvikivi et al., 2017), and RC attachment resolution (e.g., Rohde et al., 2011; Walid, 2023). Furthermore, it has been shown that the effect of IC information emerges before the onset of connectives such as *because* (e.g., Cozijn et al., 2011; Jarvikivi et al., 2017). In L2 research, however, results are not conclusive yet. Some studies suggest that L2 speakers exhibit a reduced sensitivity to IC information, leading to less robust referential choices compared to L1 speakers (Cheng & Almor, 2018; 2019). Others propose that while L2 speakers can use IC information to anticipate referents, the timing and magnitude of the IC effect in L2 processing differ from those observed in L1 processing (Contemorie & Dussias, 2018; Kim & Grüter, 2021). Regarding L2 processing of RCs, to the best of our knowledge, only one study has examined the impact of IC verbs on RC attachment preferences (Aydin-Yildiz, 2013).

Through a comprehensive review of current L2 studies on the effect of IC information in verbs, our objective is to understand better whether L2 speakers, like their L1 counterparts, can utilize IC information in verbs to establish coherent relations between clauses and anticipate subsequent references in the discourse. We assume that the findings will offer fresh insights into how L2 speakers incorporate semantic cues during online and offline resolution of referential and RC attachment ambiguity, shedding light on whether distinctions in processing between L1 and L2 speakers align with the SSH or the RAGE hypothesis (Grüter et al. 2014). The structure of this chapter unfolds as follows: In Section 2, we briefly overview studies suggesting that L1 speakers exhibit sensitivity to IC information in verbs. Subsequently, Section 3 presents a comprehensive overview of L2 research investigating the role of IC information in online sentence processing. Section 4 engages in a discussion of the findings derived from L2 studies, culminating in concluding remarks and recommendations for future investigations in Section 5.

2. Implicit causality in L1 sentence processing

In L1 research, it has been well-established that L1 speakers utilize IC verbs during both offline and online resolution of referential ambiguity and relative clause (RC) attachment ambiguity (e.g., Koornneef & Van Berkum,

2006; Koornneef, et al. 2016; Kehler, 2008; Pyykkönen & Jarvikivi, 2010; Cozijn et al., 2011; Rohde et al, 2011; Hartshorne & Snedeker, 2013; Bott & Solstad, 2014; Jarvikivi et al., 2017). In offline sentence-completion tasks, it has been shown that using IC information of verbs in the main clause (2a-b), L1 speakers provide continuations referring to either NP1 or NP2, which has a causal explanation about NP they referred to (e.g., Kehler, 2008; Hartshorne & Snedeker, 2013; Bott & Solstad, 2014). In the online tasks, L1 studies revealed that the IC effect emerged before the onset of connective *because*. For example, Cozijn et al. (2011) examined the timing and size of IC effect testing native speakers of Dutch on a visual world paradigm task involving sentences with an NP1-biasing verb or an NP2-biasing verb as in (3a & b).

1. 1."[NP1-biasing verb] The octopus bored the crocodile in the car because ...
   a. (Neutral clause) … he was restless.
   b. (Congruent clause) … he had already told the story at least ten times during the ride.

   3.2 [NP2-biasing verb] The camel felt sorry for the octopus after the exam because …
   a. (Neutral clause) …he was friendly.
   b. (Congruent clause) … he could not get a passing mark for the work." (Cozjin et al., 2011, p. 385)

The results indicated that the effect of IC bias emerged before disambiguating region in that they found "more looks at the NP1-region than at the NP2 region for NP1 verbs and more looks at the NP2-region than NP1- region for NP2 verbs" (p.400), which shows that native speakers generate expectations using IC verbs. In the same vein, Jarvikivi et al. (2017) examined the time course of implicit causality information relative to both grammatical role and order of mention information in pronoun resolution in Finnish using two visual-word eye-tracking experiments. They found that semantic implicit causality information has an immediate effect on pronoun resolution.

As for the effect of IC information on RC attachment preference in L1 sentence processing, Rohde et al. (2011) proposed that IC information encoded in verbs affects L1 speakers' RC attachment preferences. They investigated L1 English speakers' expectations for high/low relative clause attachments following IC and non-IC verbs in an offline sentence-completion task under two conditions: non-IC prompt (4) and IC-prompt (5).

2. "[NON-IC PROMPT] *John babysits the children of the musician who...*

3. [IC PROMPT] *John detests the children of the musician who…*" (Rohde et al., 2011, p. 343)

In the non-IC prompt condition (4), they found L1 speakers produced RCs referring to low NP (the musician) as in (…*lives in La Jolla* (p.344)), whereas in the IC- prompt condition, RCs they produced referred to high NP (the children) as in (… *are arrogant and rude*) under the effect of IC verbs. the relative clause explains the event described by the matrix clause ("… *are left home on Friday nights"* (p. 344)). Also, RCs in the IC prompt condition involved more explanations than those in the non-IC prompt condition. These findings are interpreted as evidence that L1 English speakers use IC information to establish discourse coherence relations, which in turn affect their syntactic attachment preferences when resolving ambiguities in relative clause (RC) attachment online.÷Moreover, they indicate that the effects of discourse coherence relations are expectation-driven.

In the online experiment, Rohde et al. tested whether the attachment biases observed in the offline sentence-completion task exist in the online processing of these sentences. The stimuli involved two conditions: the non-IC condition and the IC condition as in (6-7).

4. "[Non-IC] John babysits the_ children of the_ musician who…
    a. [LOW] … is generally arrogant and rude.
    b. [HIGH] … are generally arrogant and rude.
5. [IC] John detests the_ children of the_ musician who…
    a. [LOW] … is generally arrogant and rude.
    b. [HIGH] … are generally arrogant and rude." (Rohde et al., 2011, p. 346)

It was assumed that if the relative clause (RC) attachment indicated by the finite verb did not align with the anticipated pattern, reading times would increase at the critical region, which was the RC verb (is/are).÷Additionally, there were two spillover regions, the adverb (generally) and the adjective (arrogant). The analyses of the reading times (RTs) on the critical region indicated no significant effect for verb type, attachment height (high/low), or significant interaction between verb type and attachment height. However, a significant interaction was found at the first spillover region (generally) in the predicted direction: high attachments were read more slowly than low attachments in the non-IC condition but faster in the IC condition. Further pairwise analyses of high versus low attachment in IC and non-IC conditions indicated a marginal effect of attachment level by subjects and significance by items in the IC condition. There was no significant effect in the non-IC condition.

The results of the online experiment showed that these expectation-driven effects occurred before comprehenders were exposed to complete clauses, demonstrating that expectations about inter-causal discourse coherence relations are updated incrementally and can have a moment-by-moment influence on syntactic disambiguation. In summary, these results were interpreted as evidence that L1 speakers utilize implicit causality (IC) information from verbs to anticipate an incoming relative clause (RC) and to establish discourse coherence relationships. These relationships influence their syntactic attachment preferences, demonstrating that discourse-level expectations can impact online disambiguation as quickly as lexical and morphosyntactic cues.

Similar results were obtained in a recent study on RC attachment ambiguity in Arabic by Irhaymi (2023). In Arabic, the formation of relative clauses (RCs) is similar to that in English, in that they follow noun phrases (NPs) with an overt relative pronoun. Using the same materials of Rohde et al.'s study (2011), Irhaymi tested native Arabic speakers on an offline sentence-completion (SC) task and an online self-paced reading task. In the SF task, Irhaymi found that like native English speakers, Arabic speakers produced more high-attaching RCs than low-attaching RCs in the IC-condition. In the non-IC condition, they produced more low-attaching RCs than high-attaching RCs. Moreover, high-attaching RCs in the IC condition provided more explanation than those in the non-IC condition. These results were in line with Rohde et al.'s study and confirm that IC) verbs impute causality to their direct object, leading comprehenders to generate expectations for an explanation about the cause of the event from incoming RCs.

In the online test, unlike Rohde et al.'s online findings, the results of reaction times (RTs) on the critical region indicated a significant effect for verb type, attachment site, and a significant interaction of verb type and attachment site. Further analyses revealed that Arabic native speakers spent longer RTs on the critical region involving RC pronouns and RC verbs in RCs referring to high attachment (NP1) than those referring to low attachment in the IC condition. In the non-IC condition, RTs on the same region of the RCs referring to low attachment were significantly less than those referring to high attachment. In other words, longer RTs on RCs referring to high attachment were assumed to be due to the processing load that emerges from establishing discourse coherence relations during online resolution of RC attachment ambiguity. This processing load is thought to stem from limitations in cognitive resources, as discussed by Koornneef et al. (2016). The findings regarding faster RTs on RCs in the non-IC condition

are in line with Rohde et al.'s and confirm the prediction that syntactic information is used in the RC attachment preference in the non-IC condition.

In summary, the studies reviewed above indicate that L1 speakers actively utilize implicit causality information during offline and online sentence comprehension and production. This effect emerges before comprehenders reach the onset of the connectives 'because' in pronoun resolution. However, in L2 research, it remains unclear whether L2 speakers are as sensitive as L1 speakers to IC verbs during sentence comprehension and production. In the following section, we review studies that examined whether L2 processing is similar to L1 processing regarding the use of IC information from verbs in resolving referential ambiguity and relative clause (RC) attachment ambiguity.

3. Implicit causality in L2 sentence processing

In L2 research, several studies have examined whether L2 speakers can employ implicit causality (IC) information from verbs like L1 speakers during both offline and online sentence comprehension and production. The results of L2 studies on IC information in the offline and online resolution of referential ambiguity (e.g., Cheng & Almor, 2017, 2018; Contemori & Dussias, 2018, 2019; Kim & Grüter, 2021) or relative clause (RC) attachment ambiguity (e.g., Aydın-Yıldız, 2013) are not yet conclusive. Some of these studies propose that L2 speakers can use IC information as effectively as L1 to establish discourse coherence relations in referential resolution (e.g., Contemori & Dussias, 2019), while other studies suggest that L2 speakers are not as sensitive as L1 speakers to IC verbs (e.g., Cheng & Almor, 2017; 2018; Kim & Grüter, 2021). This divergence is often attributed to several factors, including L2 speakers' reduced ability to utilize implicit causality (IC) information (Grüter et al., 2014), difficulties in integrating multiple levels of information—such as combining semantic and discourse information—due to limited cognitive resources (e.g., Sorace & Filiaci, 2006; Roberts et al., 2008; Hopp, 2010), and the influence of L1 (Cheng & Almor, 2018). For example, Cheng and Almor (2017) conducted a study examining the impact of IC information on pronoun resolution. They assessed both L1 Chinese/L2 English speakers and L1 English speakers through two production experiments to determine if L2 speakers utilized IC verbs in pronoun resolution similarly to L1 speakers. In experiment 1 they used a sentence completion task with IC verbs such as 'like' (experiencer-stimulus (ES) verb) as in (8) and 'embarrass' (stimulus-experiencer (SE) verb) as in (9). The SE verbs further alternated between two types of structures: lexical causatives and periphrastic causatives.

6. ES: Paul likes Alan because he …
7. SE (lexical): Ben embarrassed James because he …
   SE (periphrastic): Ben made James embarrassed because he … (p. 8)

The first experiment showed that L1 English speakers favored NP1 (Ben) with SE verbs and NP2 (Alan) with ES verbs, consistent with prior L1 research. L2 speakers exhibited similar NP1 preference with SE verbs but differed significantly from L1 speakers with ES verbs. Unlike L1 speakers, they referred to NP1 more often in ES conditions, suggesting reduced effectiveness in using IC information, possibly due to limited ability with ES verbs, subject-first mention bias favoring pronouns for subject/first-mention antecedents (Almor & Nair, 2007), or L1 influence.

In the second experiment, Cheng and Almor examined the role of implicit consequentiality on L2 speakers' pronoun resolution using the same design of the first experiment but with connective 'so'. The participants were asked to complete sentences involving IC verbs as in (10).

8. "ES: Paul liked Alan so he …
   SE (lexical): Ben embarrassed James so he …
   SE (periphrastic): Ben made James embarrassed so he …" (Cheng & Almor, 2017, p. 15)

In the second experiment, L2 speakers showed more NP1 references with ES verbs compared to SE verbs, mirroring the first experiment's findings. Additionally, L2 speakers lacked NP2 references in the SE condition, attributed to their "reduced sensitivity to implicit consequentiality biases." Another explanation suggested difficulty in integrating predictions based on IC and IR biases with the strong subject hood/first-mention cue provided by the pronoun (Cheng & Almor, 2019, p. 459).

To address the influence of the pronoun cue and L1 Chinese impact observed in Cheng and Almor's study (2017), Cheng and Almor (2019) conducted a new study on IC verbs in pronoun resolution involving implicit causality verbs either NP1-biased (e.g., *call*) or NP2-biased (e.g., *trust*). The sentence completion task involved sentences under two prompt conditions: pronoun prompts as in (11a-b) and free prompts as in (12).

11. a. "[NP1-biased IC verbs] "Mary called Sara because she …
    b. [NP2-biased IC verbs] Jake trusted Adam because he…
12. a. [NP1-biased] Mary called Sara because …
    b. [NP2-biased] Jake trusted Adam because …" (Cheng & Almor, 2019, p. 462)

The first experiment revealed that both L1 and L2 speakers used IC information in reference choices, favoring NP1 with NP1-biasing verbs (11a) and NP2 with NP2-biasing verbs (11b). Moreover, NP1 references were higher in the pronoun-prompt condition compared to the free prompt for both groups. While L2 speakers mirrored L1 preferences in the free-prompt condition (12b), they produced more NP1 references after NP2-biasing verbs in the pronoun-prompt condition than L1 speakers. These distinctions suggest differing approaches to pronoun resolution between L1 and L2 speakers across conditions.

In the second experiment, they asked participants to complete main clauses involving implicit consequentiality (IR) verbs (e.g., fear, (NP1-biased) or frighten (NP2-biased)). Using the same design and methods of the first experiment, they tested all participants on two prompt conditions: pronoun prompt vs. free prompt involving verb bias (NP1-biased verbs vs. NP2-biased verbs). The material sentence structure involved the order like "the verbs were embedded in sentence fragments of the form *NP1 verb-ed NP2 and as a result* with the two NPs being English names of different genders" (p.465).

They replicated the first experiment's results for the L1 group, where more NP1 references were produced in the pronoun-prompt condition compared to the free-prompt condition. This indicated the independent effect of an overt pronoun on pronoun resolution from IC bias. In the free-prompt condition, L2 speakers resembled L1 speakers in re-mention biases, but they exhibited more NP1 references than L1 speakers in NP2 contexts. These findings suggested that L2 speakers "were able to derive IR biases from the context and use them to predict which referent would be re-mentioned in the following discourse" (p. 467). Thus, L2 speakers demonstrated native-like re-mention biases, implying their ability to generate native-like predictions about coreference using IC and IR information at the discourse level.

To examine the timing of predictions based on implicit causality verbs in L2 referential processing, Contemori and Dussias (2018) conducted two experiments involving L1 Spanish/L2 English speakers and L1 English speakers: an online auditory eye-tracking experiment and an offline sentence-completion experiment. The L2 group consisted of highly proficient bilinguals with early exposure to English, and Spanish and English exhibited similarities in NP1 and NP1 bias verbs. In the eye-tracking experiment, participants were presented with sentences akin to (13-14) to assess their similarity to L1 speakers in the timing of predictions stemming from implicit causality verbs.

13. a. "NP1 Verb-Congruent: Kevin apologized to Dave in the evening because he was scared and because he had insulted him.
b.NP1 Verb-Incongruent: Kevin apologized to Dave in the evening because he was scared and because he was insulted.
14. a. NP2 Verb-Congruent: Kevin believed Dave yesterday because he was kind and because he showed him the photograph of the crime.
b. NP2 Verb-Incongruent: Kevin believed Dave yesterday because he was kind and because he had seen a photograph of the crime." (Contemori & Dussias, 2018, p. 163).

The eye-tracking results showed that L1 speakers anticipated the incoming referent before encountering the pronoun in sentences with NP1-bias IC verbs, reflecting the early emergence of L1 speakers' expectations regarding IC verb information. This effect was less evident in the NP2 bias condition. Conversely, the L2 group exhibited delayed emergence of this effect, suggesting that "while monolingual participants engaged in predictive processing, L2 participants lacked a clear anticipatory pattern" (p. 169). However, direct comparisons of the target picture look between L1 and L2 speakers revealed no difference in the speed of processing IC information. In the offline sentence-completion experiment, all participants were asked to complete sentences involving IC verbs of the first experiment as in (15).

15. "Mike despised Brain because he…" (Contemori & Dussias, 2018, p. 164)

The sentence-completion results revealed that both L1 and L2 groups demonstrated similar preferences, favoring NP1 references with NP1-bias verbs and NP2 references with NP2-bias verbs. This suggests that L2 speakers effectively utilized IC verb information to predict upcoming referents. Initially, the delay observed in the L2 group was attributed to potential differences in the quality of lexical representations of IC verbs in English (p.170). However, a re-analysis by Contemori and Dussias (2019) proposed an alternative conclusion; "bilinguals do not exhibit generally slower referential processing than monolinguals, and their processing of IC information is comparable" (p. 8).

To examine the inconclusive findings of previous research, Kim and Grüter (2021) conducted a visual-world eye-tracking experiment with L1 Korean/L2 English speakers having varying L2 proficiency. More specifically, they aimed to fill the gap that emerged from the inconclusive results of Contemori and Dussias (2018; 2019) and to examine whether their findings from highly proficient L2 speakers can be generalized to learners with varying L2 proficiency. The visual-word eye-tracking experiment involved sentences, which have either NP1 or NP2-biased verbs involving a preceding context as in (16-17).

16. "Bias-consistent ending
(Context) Nathan and Owen used to study together at the library.
(Critical) Nathan disturbed Owen all the time because he needed help with his homework.
(Question) Who needed help with his homework?
17. Bias-inconsistent ending
(Context) Patrick and Curtis were solving math problems in class.
(Critical) Patrick bothered Curtis every few minutes because he was the smartest kid in class." (Kim & Grüther, 2021, p. 140)

The study revealed differing IC effects in both L1 and L2 processing, with variations in size and timing. L1 speakers demonstrated an early and robust effect of verb bias, indicating rapid access to IC information during comprehension. In contrast, L2 speakers exhibited a weaker effect, emerging later but resembling L1 patterns post-pronoun. This suggests L2 speakers utilize IC information for real-time expectations but engage less in predictive processing compared to natives. The authors attributed these differences to the RAGE hypothesis (Grüter et al., 2017), suggesting reduced or delayed IC use and predictive engagement in L2 speakers due to lexical retrieval challenges and discourse model updates. L2 proficiency was not found to explain these differences (p. 151).

As for the effect of IC information on relative clause (RC) attachment ambiguity, Aydın-Yıldız (2013) examined L2 speakers' sensitivity to IC information during online and offline processing of RC attachment ambiguity, applying materials from Rohde et al.'s study (2011). It aimed to determine if L1 Turkish/L2 English speakers could use IC verbs to anticipate upcoming RCs and alter syntactic attachment decisions, similar to L1 speakers. Aydın-Yıldız tested L1 Turkish/L2 English speakers and L1 English speakers on an offline sentence completion task and an online self-paced reading task adapted in Rohde et al.'s study, along with an offline multiple-choice task involving sentences with IC and non-IC-verbs. In the offline sentence-completion task, all participants were asked to complete sentences with a natural continuation given in two prompt conditions: non-IC prompts and IC prompts as in (18 &19).

18. "[Non-IC prompt] John babysits the children of the musician who …
19. [IC-prompt] John detests the children of the musician who …" (Rohde et al., 2011, p.343).

In the non-IC prompt condition (18), participants were expected to complete main clauses with RCs referring to low NP (NP2, the musician), adhering to syntactic principles like the Late Closure Principle (Frazier & Clifton, 1996) or Recency Principle (Gibson et al., 1996). Non-IC verbs lack

IC information to generate expectations. In the IC-prompt condition (19), participants were expected to complete main clauses with RCs referring to NP1 (high attachment, the children) rather than NP2 using the verb's IC information. This would lead them to anticipate an explanation from the incoming RC, establishing discourse coherence relations between main clauses and RCs.

The L1 group results supported these assumptions. In the non-IC condition (18), they favoured low-attaching RCs over high-attaching ones. Conversely, in the IC condition (19), they produced more high-attaching RCs than low-attaching ones. These findings were replicated in the offline multiple-choice task, suggesting that L1 speakers use IC information to establish discourse coherence, influencing their syntactic attachment decisions, aligning with Rohde et al.'s research. In contrast, L2 speakers preferred high-attaching RCs in both non-IC and IC conditions across tasks. For instance, in the sentence-completion task, they favoured high-attaching RCs over low-attaching ones in the non-IC condition. In the IC condition, they produced more high-attaching RCs than low-attaching ones. Their consistently high attachment preference suggests a divergence from L1 speakers, particularly evident in the non-IC condition. The reason for more high-attaching RCs in the IC condition may stem from various factors mentioned above.

In the online self-paced reading task, all participants were given sentences with RCs having IC and non-IC verbs as in (20 & 21).

20. "[NON-IC] *John babysits the children of the musician who ...*
    a. [LOW] *... .is generally arrogant and rude.*
    b. [HIGH] *...are / generally/ arrogant /and rude.*
21. [IC] *John babysits the children of the musician who*
    a. [LOW] *... .is generally arrogant and rude.*
    b. [HIGH] *...are / generally/ arrogant /and rude*." (Rohde et al., 2011, p.346)

The self-paced reading task showed that L1 speakers had longer reading times (RTs) on the disambiguating region (RC verb, is/are) of high-attaching RCs in the non-IC condition, while in the IC condition, they had longer RTs on low-attaching RCs. These results reinforce previous findings and indicate that L1 speakers rely on IC information for discourse coherence during online RC attachment resolution. L2 speakers, on the other hand, had longer RTs on low-attaching RCs in both conditions, aligning with offline task results. To sum up, the L2 findings were accounted for by the Shallow Structure Hypothesis (Clahsen & Felser, 2006), suggesting that L2 speakers prioritize lexical, semantic, or other surface-level information over syntactic cues, unlike L1 speakers. In the next section, I will discuss the findings of

the reviewed L2 studies to determine the extent to which L2 speakers utilize semantic information, specifically IC information. This analysis will focus on L2 speakers' sensitivity to predictive processing, expectation generation and the formation of discourse coherence relations in L2 sentence comprehension and assess their alignment with current theories of L2 processing.

4. General discussion of L2 findings

This paper has tried to examine whether L2 speakers utilize implicit causality (IC) information encoded in verbs in their referential choice and relative clause (RC) attachment preference similarly to native speakers. The L1 studies reviewed above consistently indicate that L1 speakers apply IC to predict upcoming referents during online pronoun resolution, with effects emerging as soon as the verb is processed. Additionally, they actively employ IC verbs in both online and offline RC attachment ambiguity, influencing their syntactic attachment preferences. However, in L2 processing, the results of the reviewed studies are inconclusive. Some L2 studies suggest that L2 learners cannot use IC information in pronoun resolution in the same manner as L1 speakers (Grüter et al., 2014; 2021). On the other hand, other studies propose that they can utilize IC information during both online/offline comprehension and production, despite differences in timing and the magnitude of the IC effect (Cheng & Almor, 2019; Contemori & Dussias, 2018). One issue that remains controversial in L1 research is whether subjecthood or the order of mention is a determining factor in coreference choice. Some researchers propose that accessing referents in the subject position is easier than referents in other syntactic positions, and therefore, they are more likely to be interpreted as antecedents of upcoming pronouns (Gernsbacher, 1990; Xu, 2015). Others, however, suggest that the order of mention affects pronoun resolution (Jarkiviki et al., 2017).

Several factors have been suggested to explain differences between L1 and L2 speakers' sensitivity to IC information in pronoun resolution. For example, in Cheng and Almor's (2019) study, it was proposed that L1 Chinese/L2 English speakers are similar to L1 speakers in using IC information to generate expectations about upcoming referents and to establish discourse coherence relations in offline sentence-completion tasks. However, unlike L1 speakers, they exhibit a strong preference for NP1 references in NP2-biasing contexts in the pronoun-prompt condition. This difference, they argue, might stem from either their beliefs about the likelihood of pronoun use in different conditions in their L1 Chinese or the

effect of subject/first-mention preference in pronoun resolution, which is used as a default strategy due to their reduced ability to use semantic and discourse information.

Regarding the first-mention bias, Cheng and Almor (2019) noted that it is difficult to explain the findings regarding L2 speakers' NP1 bias in the NP2-biasing context by "the effect of a subject or a first-mention preference for pronouns," given that, in their sentence fragments, the referents in the subject position were also the first-mentioned entities in the sentence (p. 471). That is, grammatical subjects were also the first-mentioned antecedents; therefore, their study cannot disentangle whether L2 speakers' NP1 preference is due to the effect of the first-mention preference or syntactic subjecthood, a question left for future research. To sum up, Cheng and Almor proposed that L2 speakers' weakened sensitivity to IC information seems to affect their referential choices and the integration of semantic and discourse information might be more difficult for L2 speakers than for L1 speakers due to inadequate working memory or other cognitive resources (e.g., Hopp, 2010; Sorace & Filiaci, 2006; Roberts et al., 2006). Additionally, another factor that can explain L2 speakers' inefficient use of IC information is L2 speakers' reduced ability to generate expectations for upcoming referents, as predicted by the RAGE hypothesis, which we discuss in the following study in detail.

In Kim and Grüter's (2021) study, it was suggested that L1 Korean/L2 English speakers could access and utilize IC information during online listening, but at a slower rate and with a weaker size compared to native English speakers. That is, they were similar to L1 speakers in their predictive processing but differed from them in terms of timing and the size of the IC effect. This difference was explained by the RAGE hypothesis, which suggests that L2 speakers have a reduced ability to use semantic information to generate predictions due to "potentially reduced utility of prediction given the nature of L2 knowledge" (p. 148), requiring further research. According to the authors, the delayed and weaker effect of IC information in L2 speakers may be due to "their difficulties with accessing and retrieving lexical representations for verbs and integrating the information to incrementally update their discourse models during real-time processing" (p. 149). Lexical access and retrieval can be more taxing for L2 speakers.

While there is a consensus among L2 findings regarding the assumption that L2 speakers are as sensitive as L1 speakers to IC information in L2 reference resolution, recent research has yielded inconclusive results concerning the timing and magnitude of the IC effect in L2 processing (Contemori & Dussias, 2018, 2019; Kim & Grüter, 2021). Further research

is needed to determine 'whether the reduced and/or delayed effects observed in studies are due to a diminished ability to utilize information predictively or reduced predictive utility resulting from the nature of L2 knowledge' (Kim & Grüter, 2021, p. 148). The effect of IC information on RC attachment preferences remains unclear due to the limited number of studies available. Consequently, more research is required. As for the assumption that L2 proficiency modulates access and retrieval to lexical representations, results are not yet conclusive (e.g., Kaan, 2014; Kim & Grüter, 2021). Further research is necessary to understand the effect of L2 proficiency on the online L2 processing of IC information. Overall, the L2 studies reviewed above suggest that the level of sensitivity of L2 speakers in online sentence processing, as compared to L1 speakers, remains unclear. Additionally, these studies do not support the notion that L2 speakers are more sensitive to semantics than L1 speakers, as proposed by the Shallow Structure Hypothesis (Clahsen & Felser, 2006; 2018).

5. Conclusion and suggestions for further research

In this review, we investigated whether L2 speakers can use Implicit Causality (IC) information as effectively as L1 speakers in both offline and online resolution of referential ambiguity and Relative Clause (RC) attachment ambiguity. However, we found that the findings of L2 studies are inconclusive at present. Further research is necessary to gain a better understanding of the delayed and slower processing of IC information. This may arise from several factors: difficulties in integrating multiple levels of information, reduced access to and retrieval of lexical information, a preference for subjects or first-mentioned entities in pronoun resolution, influence from the L1, or the effects of L2 proficiency. Future studies should address these questions, considering the limitations of previous research in terms of study design, materials, sample size, and proficiency levels.

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CHAPTER TWO

AN OVERVIEW OF L2 RESEARCH ON RC ATTACHMENT AMBIGUITY: L1 VERSUS L2 RC ATTACHMENT PREFERENCES

WALID IRHAYMI

Abstract

The present chapter explores whether L1 and L2 relative clause attachment preferences differ in terms of comprehenders' use of parsing strategies. It also reflects on the information the human parsing mechanism initially uses to incorporate a new word into a sentence. To fulfil this purpose, two main theories can be discussed: principle-based parsing, which emphasizes syntactic information, and constraint-based parsing, which considers multiple cues simultaneously. Theories of sentence processing across languages are also reviewed across languages, discussing attachment preferences and the role of lexical biases in relative clause attachment. Furthermore, the chapter delves into the comprehension of sentence parsing in both first language speakers and second language learners, exploring the influence of semantic, pragmatic, and discourse effects on relative clause attachment preferences. Throughout the chapter, various experimental studies are referenced to provide insights into the mechanisms and complexities of sentence parsing in different linguistic contexts. The aim is to demonstrate that L1 comprehenders of certain languages, such as Greek, employ distinct parsing strategies, contrasting with L2 learners who rely more on lexical cues than the structurally based parsing strategies used by L1 speakers. The chapter emphasizes the effect of implicit discourse, pragmatic and/or semantic information on RC syntactic decision and thus L2 as L1 change their syntactic decision from low to high.

1. Introduction

The present chapter presents studies conducted on L1 native speakers and L1 second language learners to find an appropriate answer to the question of how language-specific factors, working memory capacity, and contextual cues influence sentence parsing and relative clause attachment preferences by both native speakers and second language learners. The chapter discusses whether L1 comprehends use the same parsing strategies L2 learners use when parsing relative clauses. Sentence parsing refers to the process through which comprehenders (readers and/or listeners) attempt to assimilate each incoming word progressively into the speech or written discourse (Fodor, 1998, 286). It comprises quickly assigning categories to words and hierarchical structure to strings of words, which takes place without conscious awareness. When parsing fails to a significant extent, as in garden path phrases, native speakers become aware of processing problems (Bever, 1970, 9; Pritchett, 1992, 14). As a result, one of the most contentious challenges in phrase parsing research is determining what type of information the human parsing mechanism employs first when integrating a new word into a sentence. The debate is over whether the human processer is modular, with only syntactic information taken into account first (Frazier, 1987; Frazier & Clifton, 1989, 26), or whether syntactic, lexical, and discourse cues interact simultaneously to produce a single interpretation of an utterance (MacDonald et al., 1994, 7).

According to principle-based parsing theories, the parser employs syntactic or structural information at the beginning of a phrase (Frazier, 1987, 3). The word class of each processed lexical item (noun, verb, etc.) conveys syntactic information. Furthermore, the laws governing these word categories are regarded to be universal, therefore only one structural possibility may be considered at a time. If the structural representation acquired after the initial parse is judged to be insufficient owing to semantic and plausibility concerns, the parser is forced to reanalyze the text to discover a more suitable configuration. The Garden Path Model (Frazier, 1987) is the most prominent model applied in this approach, focusing particularly on two principles: low attachment and late closure. The necessity to link a new word without producing superfluous structural nodes or clauses is referred to as minimal attachment. The second idea, "late Closure," states that when a new word is discovered, the parser seeks to include it in the sentence being processed. The two approaches aim to increase parsing efficiency and economy by focusing on one structural option at a time for both native and non-native sentence processors. Constrained-based parsing explanations, on the other hand, see sentence

processing as a competition between several structural alternatives that are engaged and evaluated concurrently. According to the assumptions of this model, each new word encodes a set of clues, including semantic, lexical, pragmatic, and discourse cues, which are supplemented by contextual cues from previous speech. All of these cues are activated simultaneously and compete until one combination exceeds a particular threshold, pronouncing it the winner over the other cue combination. This framework has no rules that need a single interpretation at a time; instead, all potential configurations are assessed concurrently.

2. RC Attachment Ambiguity: L1 studies

This section delves into the sentences consisting of complex NPs followed by a relative clause as in "someone shot the servant of the actress who was on the balcony." The relative clause "who was on the balcony" may refer either to NP1 or NP2 since the verb "was" is singular and both NPs are singular. For instance, "recency" (Gibson et al.: 1996), "right association" (Kimball: 1973), and "late closure" (Frazier: 1987) are considered universal processing strategies that account for the preference for low attachment of relative clauses. Parsers of such a sentence sought the least cognitive effort by using these strategies. The essence of these strategies is that the parser resorts to the option with the least cognitive effort. Consequently, the parser attaches the RC as a low attachment to [NP2] rather than the first noun phrase; this preference is believed to be universal as it relies on cognitive needs not tied to language-specific features. Although there are different attachment preferences across languages, some researchers posit the existence of a universal approach to resolving ambiguity.

Some researchers suggest that language-specific factors, such as the distance between a verb and its arguments, influence relative clause attachment preferences. In the English language, with its shorter distances and an SVO word order, there is a preference for low attachment. In Spanish, though, which allows more distance and has VOS and SVO word orders, there is a tendency toward high attachment. This difference is attributed to the varying strengths of predicate proximity in Spanish for example (Gibson et al., 1996, 91).

1. *Adam resembled the representative of the employee who was always wearing safety goggles.*

In a similar context, the attachment-binding theory proposes that in languages like German, where the relative phrase is preceded by a relative pronoun, attachment preferences are more sensitive to general pronoun

restrictions. It is particularly sensitive to discourse-level limits on anaphoric binding based on the pronouns assigned to significant discourse elements. For example, in situations where NP-1 is a verbal argument, it takes precedence over NP-2 (Hemforth et al., 2000, 267). As a result of anaphoric binding constraints, strong relative clause attachment is preferred in German sentences similar to sentence 1. Furthermore, to further investigate cross-linguistic variations in relative clause attachment, Mitchell and colleagues offer the Tuning hypothesis. This hypothesis proposes that the distribution of adjunct attachments correlates directly to parsers' attachment preferences in occasionally confusing constructs. In other words, people who have been exposed to languages where RC attachments are frequently described as high attachment are more likely to choose NP-1 (high attachment) in ambiguous situations, whereas those who have been exposed to low attachment languages are more likely to prefer DP-2. Mitchell et al. propose that RC attachment preferences reported in experimental research match directly with attachment distribution.

L1 native speakers are classified into two groups based on RC attachment studies: those who prefer high RC attachment, and those who prefer low RC attachment. In general, research on L1 English speakers indicates a preference for low attachment for relative clause attachment disambiguation (e.g., Carreiras and Clifton, 1999; Cuetos and Mitchell, 1995; Gibson et al., 1996). Low attachment has also been reported in Norwegian, Swedish, Romanian, and Brazilian Portuguese, according to Papadopoulou and Clahsen (2003). Yet, Spanish (Cuetos & Mitchell: 1988), Dutch (Brysbaert, 1996), French (Frenck-Mestre & Pynte: 1997), and Greek (Papadopoulou & Clahsen: 2003) are languages with high attachment.

Researchers have debated whether ambiguity resolution in language processing is consistent across different languages. Some propose universal strategies such as “right association,” “late closure,” and “recency” to explain a preference for low attachment of relative clauses. These strategies suggest that attaching the relative pronoun to the second noun phrase (NP2) is preferred because it minimizes cognitive effort, a concept believed to be universal. On the other hand, some argue that language-specific features also influence relative clause attachment. They introduce the “predicate proximity” theory, which considers the structure of a language. For instance, in English, with shorter distances between verbs and arguments, a default “late closure” strategy with low attachment is preferred. In contrast, Spanish, with more flexible word orders and greater distances, is more prone to high attachment due to stronger predicate proximity. The same could be applied to Arabic, but the prevalence of SVO word order might still lead to a late closure strategy.