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## **The Role of Discourse-Level Expectations in Non-Native Speakers' Referential Choices**

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Expectation is a powerful mechanism in native-language processing. Listeners – child and adult – use information from various sources to create expectations about what is likely to come next. A variety of recent studies have probed anticipatory effects by measuring comprehenders' referential expectations, i.e., their guess about who or what the speaker will mention next. That work has found evidence that comprehenders are sensitive to cues such as the lexical semantics of a verb, which can create expectations regarding an upcoming referent in the current or next sentence (Altmann & Kamide, 1999; Pyykkönen & Järvikivi, 2010). Similarly, there is evidence that comprehenders are sensitive to the morphosyntactic properties of determiners which restrict the possible nouns to follow (Dahan et al., 2000; DeLong et al., 2005; Lew-Williams & Fernald, 2007). Expectations like these are not only characteristic of language processing in native speaking adults, but also in children (Borovsky et al., 2012). It thus appears that the ability to narrow down the potentially infinite range of upcoming information through the generation of expectations is likely to be a critical factor in explaining how we process language at the speed and with the success we typically do, at least in our native language.

The use of expectations, however, is not present in all contexts across all populations. Recent work indicates a decline in expectation generation in older adults (Federmeier et al., 2002), suggesting that “predictive processing may not be the best – or even a viable – strategy for all individuals at all phases of the lifespan and/or in all processing situations” (Federmeier, 2007, p. 495). This is because predictive processing comes with the risk of failure, that is, the possibility that built-up expectations are not fulfilled. In such cases, the processor will have to react swiftly and flexibly, and it will require sufficient resources to do so and still keep up with the ongoing flow of information. This may not always be possible, as for older adults with lower working memory capacities (Federmeier et al., 2002). Non-native speakers may be another such case; recent work points to limits in their expectation-driven processing at

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lexical and morphosyntactic levels (Kaan et al., 2007; Lew-Williams & Fernald, 2010; Martin et al., 2013).

What emerges from this recent work is a generalization that non-native speakers have **Reduced Ability to Generate Expectations**. We will refer to this as the RAGE hypothesis. If RAGE influences non-native processing, one can ask how non-native speakers' ability to engage in predictive computations varies across different levels (phonology, morphosyntax, semantics, world knowledge, pragmatic inference, etc.) and whether RAGE interacts with other factors known to affect second language (L2) processing, such as proficiency and first language (L1) background. This paper focuses on a domain that has received little attention in the literature on L2 processing, namely expectations at the discourse level. While the syntax-discourse interface has been a topic of much recent investigation in the L2 literature (see Sorace, 2011, for review), the role of *expectations* in L2 processing of discourse phenomena such as coreference has remained largely unexplored. Here we consider cross-sentence coreference and ask whether and to what extent non-native speakers use cues known to guide native speakers' expectations about who will be mentioned next in a discourse.

Using a method and context manipulation introduced in prior work (see Sections 1 and 2), we conducted a story-continuation experiment to test whether native and non-native participants make different use of available cues in coreference processing. The results are consistent with the RAGE hypothesis: Non-native speakers show native-like sensitivity to a cue that is available at the point of coreference interpretation but show weaker sensitivity to a cue whose effect requires predictive computation. An additional task rules out the possibility that our non-native speakers lacked the requisite L2 knowledge to understand the predictive cue. Their native-like performance in understanding the interpretive properties of the cue thus contrasts with their ability to use the cue to generate expectations.

## 1. Expectation-driven processing

Research on expectations relies on a variety of different methods to measure comprehenders' biases about upcoming information. A compelling case for anticipation comes from eyetracking studies in which listeners can look to potential upcoming referents in a visual-world scene. For example, the selectional restrictions that a verb imposes on its direct object (e.g., *The boy is eating...*) induce anticipatory looks to semantically plausible referents (e.g., a cake rather than a toy; Altmann & Kamide, 1999). Likewise, the lexical semantics of certain verbs (*The butler frightened the guitarist* or *The guitarist feared the butler*) induces looks to a referent who is favored for re-mention via causal reasoning (the causally implicated butler; Pyykkönen & Järvikivi, 2010). Visual-world eyetracking also reveals that gender-marked determiners in French and Spanish lead native speakers of those languages, both adults and young children, to anticipate a noun of the same grammatical gender class (Dahan et al., 2000; Lew-Williams & Fernald, 2007). ERP studies have been used to probe

expectations as well (DeLong et al., 2005): Readers' ERP responses to a determiner differ depending on whether its properties are compatible with the phonological features of an expected upcoming noun (e.g., *The day was breezy so the boy went outside to fly a/an...*). In all of these studies, anticipatory effects emerge before the anticipated referent is mentioned. More indirect measures of expectation rely on processing difficulty at the point when an unexpected word is encountered. Difficulty may be observed in reading-time slowdowns or in ERP components associated with surprisal (e.g., Kutas & Hillyard, 1984).

Expectations can also be probed via offline studies, by asking participants to write a continuation following a prompt. Story-continuation tasks reveal comprehenders' biases about which referent among a set of referents they expect to be mentioned again in a subsequent sentence (Arnold, 2001; Kehler et al., 2008; Stevenson et al., 1994). A number of offline coreference results have been replicated with tasks that measure online processing (e.g., Ferretti et al., 2009; Koornneef & van Berkum, 2006), indicating that various effects of predictive processing can be captured using online as well as offline tasks. In this paper, we employ the story-continuation method to probe native and non-native speakers' coreference expectations.

While expectations are an important factor in native language processing, their role appears to be diminished in non-native processing. Recent eyetracking studies show that non-native speakers of Spanish make reduced or no use of gender-predictive determiners (Grüter et al., 2012; Lew-Williams & Fernald, 2010), and non-native speakers of English fail to show native-like ERP responses to phonologically-predictive determiners (Martin et al., 2013). Kaan et al. (2007) report reading-time results showing that non-native speakers of English do not use an extracted wh-phrase to predict a syntactic gap in contrast to native speakers. These differences appear to be modulated by general processing skills such as lexical access speed (Hopp, 2013) as well as by properties of the speakers' L1 and their L2 proficiency (Dussias et al., 2013).

What remains an open question is whether non-native speakers' RAGE persists at the discourse level. On one hand, the existing work on lexical and syntactic expectations suggests that RAGE is pervasive. A discourse-level task like tracking coreference may extend that difficulty, not only because comprehenders must integrate a variety of linguistic and world-knowledge cues, but also because there are no categorical rules dictating how those cues should combine (unlike, for example, a grammatical gender cue). On the other hand, coreference is one of the most fundamental and universal elements of comprehension since it determines who or what a discourse is about. As such, non-native speakers have abundant practice with it from their L1. If resources are spread thin during non-native processing, coreference may stand as one of the best candidates for resource allocation given its importance to understanding the speaker's message. The present study aims to delimit the scope of RAGE in non-native language processing by focusing specifically on the discourse domain.

## 2. Coreference processing

Tracking coreference across sentences depends on a variety of factors—some related to properties of the available referents such as their grammatical or thematic roles, others related to properties of the unfolding discourse and the events being described (Arnold, 2001; Caramazza et al., 1977; Kehler et al., 2008; Stevenson et al., 1994). Here we focus on two discourse-level cues that have been used in previous coreference studies with native speakers: event structure and referential form. Both cues influence native speakers' biases about who a subsequent sentence will be about, but they do so in different ways.

Event structure is a cue that can be conveyed via a verb's grammatical aspect. Rohde et al. (2006) elicited story continuations following transfer-of-possession sentences, as in (1), with either a perfective or imperfective verb. The Source referent is in subject position; the Goal is the indirect object.

(1) John<sub>Source</sub> handed/was handing a book to Bob<sub>Goal</sub>. He \_\_\_\_\_

Perfective aspect, which describes a completed event, was shown to favor continuations that described what happened next or as a result. Imperfective aspect, which describes an event as ongoing, was shown to favor continuations that elaborated or explained the transfer event. The different ways that the continuations relate to the context sentence (their discourse coherence relation) yield different coreference biases: Source continuations are more frequent in the imperfective condition than the perfective, presumably because elaborations and explanations favor the referent at the start state of an event, i.e., the Source, whereas the referent associated with the end state or result of a transfer event is likely to be the Goal. As such, verb aspect guides coreference biases via a fairly complex predictive computation which depends on the comprehender's ability to build a mental model of the transfer event being described, to reason about the coherence relation between the context sentence and a likely continuation, and to predict which referent will be re-mentioned in that continuation.

Referential form, on the other hand, has been shown to influence coreference biases via another discourse-level mechanism: information structure (Rohde & Kehler, to appear). Specifically, the presence of a *pronominal* form—even the ambiguous one in (1)—favors continuations about the subject referent more so than a non-pronoun prompt. This follows from the fact that pronouns are the preferred referential form for re-mentioning the topic of the discourse (e.g., Gundel et al., 1993), and in a short passage like (1), the discourse topic is typically assigned to be the subject of the context sentence. Referential form hence only influences coreference biases via prompt type at the onset of the continuation; no predictive computation is required beforehand.

In this paper, we examine the role of expectations in guiding referential choices for native and non-native speakers. Note that this goes beyond previous L2 work in which the focus has either been on non-expectation-driven processing of coreference (e.g., Roberts et al., 2008; Sorace, 2011) or on

expectations at non-discourse levels. Using the story continuation paradigm from Rohde et al. (2006), we test whether non-native speakers show sensitivity to manipulations of event structure (perfective vs. imperfective) and prompt type (pronoun vs. free). Under the RAGE hypothesis, we predict non-native speakers to show a weaker effect of aspect on their referential choices than native speakers. At the same time, we can expect native and non-native speakers to be similar in their sensitivity to the referential form in the prompt. This is because the aspect cue requires a predictive computation about how the upcoming discourse will unfold (appearing at a point before any coreferring element has been encountered), whereas referential form is a cue available only at the point of coreference interpretation (when the participant encounters the prompt at the beginning of the continuation and must make a decision about who that continuation will be about).

Given that our study tests non-native speakers of English whose L1 is either Japanese or Korean, it is worth noting that the predictive cue of interest, verb aspect, induces the above-mentioned coreference effects for both Japanese and Korean speakers in their native languages. Two recent studies confirm the effect of aspect on coreference biases in transfer-of-possession contexts in Japanese and Korean, despite differences in the inventory of pronominal forms (notably the availability of null pronouns) between these languages and English. Ueno and Kehler (2010) report that native Japanese speakers write more Source continuations following imperfective than perfective context sentences, although this pattern is restricted to overt pronoun prompts. Kim et al. (2013) report a similar effect of aspect for native Korean speakers, in both overt and null-pronoun conditions. Given that Japanese and Korean speakers show expectation-driven effects in their native language, any reduction in these effects that we observe in the current study in English cannot be attributed to L1 transfer and is therefore likely to be a property of non-native language processing.

### **3. Method**

#### **3.1 Participants**

All participants were recruited from the University of Hawai'i community. Participants in the native-speaker (L1) group (N=39) indicated that English was the only language used systematically in their childhood homes. Participants in the non-native speaker (L2) group (N=48) were primarily international or exchange students at the time of testing (23 L1-Japanese; 25 L1-Korean). They were first exposed to English between the ages of 8 and 13 years in school in Japan/Korea; their length of exposure to English in the U.S. varied considerably, ranging from 2 months to 16 years, yet most had spent less than one year in the U.S. at the time of testing (median = 6 months).

Three measures of English language proficiency were collected from L2 participants: (i) performance on a written cloze test, (ii) self-ratings of their English language ability, and (iii) performance on the Versant English Test, a commercially available assessment of oral fluency (Pearson, 2011). L1

participants also completed (i) and (ii). Cloze test scores and self-ratings were significantly higher in the L1 than in the L2 group ( $p < .001$ ). No substantial differences were found between the L1-Japanese and L1-Korean subgroups on any measures. For the experimental measures, we therefore report only aggregated results from all L2 participants regardless of L1 background here.

### 3.2 Materials and procedure

Participants completed two experimental tasks: a written story continuation task adapted from Rohde et al. (2006) and a truth value judgment task designed to assess participants' understanding of verb aspect in English. The first task (3.2.1) is the measure of interest, addressing our key research question: Do non-native speakers show sensitivity to manipulations of event structure and referential form? For outcomes from this task to be interpreted meaningfully, however, independent evidence is required to establish that participants understand the basic semantics of grammatical aspect in English, namely that perfective denotes completed events, whereas imperfective describes ongoing or incomplete events. The second task (3.2.2) was included for this purpose.

#### 3.2.1 Story continuation task

The experiment employed a 2×2 design, varying grammatical aspect of the verb in the context sentence (perfective/imperfective) and referential form of the continuation prompt (pronoun/free), as in (2). In the pronoun-prompt condition, an ambiguous pronoun was provided as the first word of the continuation. In the free-prompt condition, there were no restrictions on the continuation.

- (2) a. Patrick gave a towel to Ron. (He) \_\_\_\_\_ [perfective]  
b. Patrick was giving a towel to Ron. (He) \_\_\_\_\_ [imperfective]

Twenty critical items with transfer-of-possession verbs (5 per condition) and 20 fillers were distributed in one of four counterbalanced lists. As in (2), the Source of the transfer-of-possession event was always the syntactic subject of the context sentence, and the Goal was the indirect object. Participants were instructed to imagine a natural continuation of the story, and write the first continuation that came to mind, avoiding humor.

#### 3.2.2 Knowledge-of-aspect task

The goal of this task was to assess whether L2 participants consistently associate perfective and imperfective aspect with completed and incomplete events respectively. In English, the interpretation of the imperfective *be -ing* as incomplete occurs with verbs of all event classes. In Japanese, however, the imperfective marker *-te i-* denotes incomplete events when combined with most verbs, yet yields a resultative reading with others, specifically achievement

verbs (Gabriele, 2009). Prior work on aspect in L2 acquisition has shown that Japanese learners of English, even at advanced levels of proficiency, do not consistently rule out resultative interpretations of achievement verbs in English (Gabriele, 2009). Given that transfer-of-possession verbs are typically considered achievement verbs, potential null effects on the story continuation task in the L2 group could thus be attributed to learners' deriving the same resultative interpretations from the context sentences in both the perfective and imperfective condition, i.e., not distinguishing between the two. The knowledge-of-aspect task, inspired by a story compatibility task originally designed by Gabriele (2009), was included so that this possibility could be ruled out.

Participants read stories describing events that were either complete or incomplete. Following the story, they were asked to judge the truth of a (written) test sentence uttered by an observer (the cartoon character Pikachu) at a particular point in time, by clicking *true*, *false* or *not sure*, as illustrated in (3).

(3) *Story beginning:*

Patrick and Ron are at the pool together. [picture of towel]

This is the towel that Patrick will give to Ron.

At 4:00, Ron is done swimming and ready to shower.

*Story end, completed condition:*

At 4:05, Ron disappears into the showers with the towel in his hand.

*Story end, incomplete condition:*

At 4:05, Patrick grabs the towel for Ron and walks over to the side of the pool.

*Test sentence:*

At 4:05, Pikachu says: "Patrick is giving the towel to Ron."

For native English speakers, the test sentence in (3) is false in the completed condition and true in the incomplete condition. The task consisted of 10 experimental items with an imperfective-marked transfer-of-possession verb following a completed (k=5) or incomplete (k=5) event, as illustrated in (3). The transfer-of-possession verbs were the same as those used in the story continuation task. An additional 12 items were included as controls to ensure that native and non-native speakers respond similarly in this task when no relevant interpretive differences exist crosslinguistically.

#### 4. Results

We begin by reporting the results from the knowledge-of-aspect task, as this task constitutes a critical prerequisite for the interpretation of the results from the story continuation task. In general, participants in all (sub)groups showed a good understanding of verb aspect: They judged sentences with imperfective aspect predominantly as 'true' in contexts with incomplete events and 'false' in contexts with completed events; their judgments were reversed for perfective aspect. T-tests were used to compare the percentage of 'true' responses for the

two different event types. Critically, L2 participants' percentage of 'true' judgments for sentences with imperfective aspect differed significantly depending on the completedness of the event (complete: 12%, incomplete: 82%;  $t(47)=19.5, p<.001$ ), indicating that they consistently associate the imperfective with incomplete events, like L1 participants (complete: 2%, incomplete: 87%;  $t(38)=32.5, p<.001$ ). We thus conclude that the L2 participants understand the interpretive consequences of aspect when combined with transfer-of-possession verbs in English. We now turn to the question of whether they use this knowledge to create expectations about next-mentions in a discourse.

Following protocols established by Rohde and colleagues in previous work, two trained judges annotated continuations for intended reference of the syntactic subject (Source, Goal, ambiguous, other), referential expression chosen for the subject in the free prompt conditions (pronoun, name, other), and coherence relation between the two sentences (not reported here). Examples of continuation types are given in (4).

- (4) Context: Patrick gave/was giving a towel to Ron. (He) \_\_\_\_\_
- He made sure to give him a clean dry one. (Source continuation)
  - He said "Thank you." (Goal continuation)
  - He did not notice the puddle of water on the floor. (ambiguous)
  - The towel was still warm from the drying machine. (other)

Responses were classified as 'ambiguous' if both judges indicated that the continuation was ambiguous or if one judge assigned a classification of Source while the other assigned a classification of Goal. Ambiguous responses accounted for 3.8% of the data in the L1 group, and 3.9% in the L2 group. 'Other' responses (12.8%/12.3% of L1/L2 data) and ambiguous responses were excluded from further analysis. We thus report outcomes in terms of percentage of Source-continuations out of Source- and Goal-continuations combined. Figure 1 and the text report subject means. Analyses of variance were conducted on the percentages; we report significance for effects and interactions that achieved  $p<0.05$  in both the by-participants and by-items analyses.

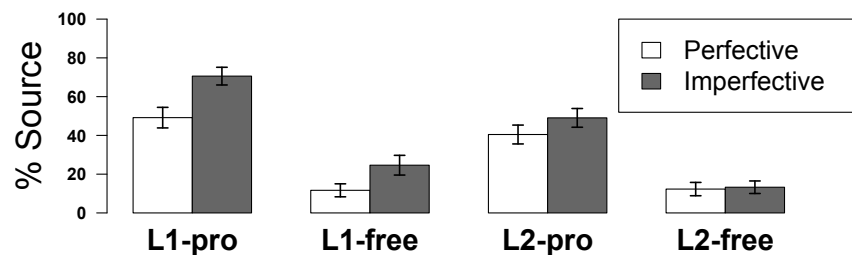


Figure 1. % Source reference by aspect, prompt type, and group

A 2 (aspect) × 2 (prompt type) × 2 (group) mixed ANOVA showed the predicted main effect of aspect ( $F(1,84)=13.7, p<.001$ ,  $F(1,19)=11.0, p<.005$ ),



whereby imperfective yielded more Source references than perfective (42.8% vs. 30.0%). Aspect did not interact reliably with group ( $F(1,84)=5.1, p<.05$ ;  $F(1,19)=2.3, p=.15$ ). Follow-up analyses within each group indicated that the effect of aspect was robust in the L1 group ( $F(1,39)=19.9, p<.001$ ;  $F(1,19)=9.7, p<.01$ ), but non-significant in the L2 group ( $F(1,45)=1.2, p=.28$ ;  $F(1,19)=1.6, p=.22$ ), consistent with the predictions of the RAGE hypothesis.

As in previous work with native speakers (Rohde & Kehler, to appear), a significant main effect of prompt type was observed ( $F(1,82)=112.1, p<.001$ ,  $F(1,19)=285.5, p<.001$ ), whereby pronoun prompts yielded more Source references than free prompts (52.3% vs. 14.8%). Prompt type did not interact reliably with group ( $F<1$ ;  $F(1,19)=6.1, p<.05$ ). Follow-up analyses within each group indicated that the effect of prompt was robust in both the L1 group ( $F(1,39)=61.1, p<.001$ ;  $F(1,19)=162.5, p<.001$ ) and L2 group ( $F(1,45)=51.4, p<.001$ ;  $F(1,19)=176.4, p<.001$ ), indicating that L1 and L2 participants were equally sensitive to information structural properties of referential expressions in English. This interpretation is further supported by an analysis of referential forms chosen by participants in the free-prompt condition: Both L1 and L2 participants chose pronouns far more often when referring back to the Source (L1: 65% pronouns, 34/52; L2: 82%, 32/39) than to the Goal (L1: 4%, 10/241; L2: 20%, 63/308). There was no prompt type  $\times$  aspect interaction ( $F(1,84)=2.8, p=.10$ ;  $F(1,19)=1.6, p=.22$ ), nor a 3-way prompt type  $\times$  aspect  $\times$  group interaction ( $F_s<1$ ).

Finally, the  $2 \times 2 \times 2$  ANOVA yielded a significant main effect for group ( $F(1,84)=7.1, p<.01$ ;  $F(1,19)=18.0, p<.001$ ), driven by an overall bias for Goal continuations in the L2 compared to the L1 group. This effect was not predicted, yet fits with recent evidence from a story continuation task conducted with children aged 5 to 6 years, where an analogous Goal bias was observed (Kehler et al., 2011). We concur with these authors that this effect is most likely a recency bias, given that the Goal is mentioned just before the prompt. These results suggest that both children and adult L2 learners are more strongly affected by recency in their referential choices than adult native speakers are.

## 5. Discussion

The main goal of this study was to investigate the extent to which non-native speakers create expectations about who will be mentioned next in a discourse based on linguistically encoded information about event structure, i.e., grammatical aspect, in the preceding context. We also asked to what extent non-native speakers' referential choices in our story continuation task were affected by biases associated with different referential forms (pronouns vs. names, or more specifically, pronoun prompts vs. unconstrained prompts that allowed participants to produce names in their continuations). Our findings indicate different answers to these two questions. Non-native speakers made appropriate form choices in the free prompt condition, and showed the same sensitivity to the prompt manipulation as the native speakers. Yet their referent choices were less affected by the grammatically encoded event structure cue (aspect) in the

previous sentence than those of native speakers. This was the case even though native and non-native speakers performed equivalently on an independent task assessing knowledge of grammatical aspect in English.

Looking first at the prompt effect, findings from both groups of speakers show more Source references with a pronoun than with a free prompt. This is consistent with previous results and the widely accepted analysis that pronouns are the preferred form (in languages like English) for reference to a recently mentioned topic (e.g., Gundel et al., 1993). Since the prompt effect appears equally robust for non-native and native speakers, we have no indication that non-native speakers have reduced knowledge of the associations between pronouns and topic maintenance and between fuller referring expressions and shifts in reference. Critically, choices induced by the form of referring expression (the prompt type) do not obviously depend on expectations. These choices are forced at the point when forms are encountered, when a processing decision regarding subject reference is necessary, and hence they draw on information already present in the discourse. For example, when encountering 'he' (as in the pronoun prompt condition), a comprehender must access salient entities consistent with the pronominal form to fully integrate the linguistic material and proceed with language processing. Similarly, when encountering the beginning of a new sentence (as in the free prompt condition), a processing decision about the subject referent must be made *at that point*. Although it is possible that these form-related biases are influenced by prior expectations, they are *forced* when the prompt in our task is encountered, similar to how processes such as lexical retrieval and structural integration are forced in reaction to incrementally incoming cues that helps the comprehender derive meaning. Since expectations are not critically involved in this process, the similar pattern for native speakers and non-native speakers is fully consistent with the RAGE hypothesis.

Turning to the aspect manipulation, we assume based on previous research (e.g., Kehler et al., 2008) that native speakers use aspect to build a mental model that represents either an ongoing or completed event. These different types of events then lead to different expectations about what kind of information will appear next in a discourse, such as the probability of an explanation of the event versus a description of the result of it. These different coherence expectations in turn drive predictions for reference. Therefore, the aspect alternation does not directly make the Source or Goal more salient in the speaker's discourse representation. Rather, the aspect effect is mediated by expectations about coherence. If a non-native speaker understands the aspectual distinction between imperfective and perfective (as our knowledge-of-aspect task shows), and understands the associations between event structure and coherence patterns (which are analogous in Korean and Japanese; see Section 2), but nevertheless does *not* anticipate a coherence relation for upcoming sentences, s/he will encounter the pronoun or free prompt without a coherence-mediated bias for Source or Goal reference—which could yield a reduced effect of aspect on referential choice. Our findings are thus consistent with the predictions we

derived from the RAGE hypothesis, which states that non-native speakers have reduced ability to generate expectations, that is, reduced ability to engage in proactive processing, while their abilities in information integration, or reactive processing, may be more closely aligned with those of native speakers.

We take these findings as a first indication that expectation generation at the discourse level is reduced in a non-native language, consistent with evidence from recent studies looking at anticipatory processing at the lexical and syntactic level. At the same time, we must emphasize that our conclusions about anticipatory processing are indirect, as they rely on assumptions about different processing decisions involved in an offline task in which what we see is only participants' final choices. Based on evidence from story continuation tasks, we cannot definitively exclude the possibility that the event-structure cue provided by grammatical aspect is processed only at the point when the referential decision has to be made, rather than the cue being used proactively when encountered to incrementally update expectations. In addition, there are multiple dimensions along which our two factors differ, including the point at which they occur relative to decisions about reference, the strength of their effect within native speakers, and the degree to which they draw on knowledge of real-world event structures. Additional research will be necessary to tease apart these various dimensions.

The results we have presented here from a written story continuation task can thus provide preliminary support for the RAGE hypothesis at the level of discourse processing. Further investigation is required to corroborate these findings and probe the nature and scope of RAGE in non-native language processing more fully. The intuition underlying the RAGE hypothesis is that a limited capacity (L2) processor is stretched to its limits by processes that are immediately required for dealing with incrementally incoming information, such as lexical access and structural integration. In other words, it is fully occupied by reactive processing, with little or no resources left for taking up non-essential cues to update expectations, or severely limiting the scope of expectations to immediately upcoming choices, such as the next word in a sentence. Testing whether this intuition is on the right track will require the use of methodologies that allow more control over and insight into incremental computations as information is encountered. Moving from written stimuli—which allow for variation in reading rate and assignment of implicit prosody—to oral stimuli will be a first step in this direction. Combining the presentation of such oral stimuli with analyses of participants' eye gaze patterns to a visual-world scene that depicts competing referents could reveal expectation-driven effects in real time (see e.g., Pyykkönen & Järvikivi, 2010). Finally, the inclusion of non-native speakers with a broader range of proficiency levels than those in the present study will be necessary to probe the interaction of RAGE with general L2 proficiency, and to determine whether RAGE is a developmental phenomenon, or a more persistent characteristic of processing a non-native language. Studies exploring these additional dimensions are currently under way in our laboratory.

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