Bilingualism: Language and Cognition

cambridge.org/bil

Unexpected objects increase name use: effects of implicit causality and grammatical role on L2 referential production

Masaya Hosoda

Seijo University, Japan

Research Article

Cite this article: Hosoda, M. (2026). Unexpected objects increase name use: effects of implicit causality and grammatical role on L2 referential production. *Bilingualism: Language and Cognition* 1–16. https://doi.org/10.1017/S1366728926101825

Received: 31 December 2025 UTC
Revised: 15 July 2026 UTC
Accepted: 3 August 2026 UTC

Keywords:
referential form choice; referential production; L2 production; predictability; implicit causality

Corresponding author:
Masaya Hosoda;
Email: hzm127@gmail.com

This research article was awarded Open Data and Open Materials badges for transparent practices. See the Data Availability Statement for details.

Abstract

L2 processing accounts differ in how predictability (i.e., the likelihood of the next mention) affects referential form choice. This study examined whether L2 learners use predictability when selecting referential forms. A story continuation experiment, manipulating grammatical role and verbs' implicit causality (IC), tested Japanese learners of English and L1-English speakers. Learners produced fewer pronouns than L1 speakers, consistent with cross-linguistic influence from L1 Japanese. Across groups, grammatical role strongly influenced referential form choice, whereas IC-based predictability affected object references only, specifically increasing the use of names for unexpected objects. Overall, L1 and L2 speakers showed similar effects of predictability, but the effects were more limited and form-specific than grammatical role effects. Under the present task conditions, the findings are compatible with a graded, memory-interference account: Predictability is used when cues are accessible and retrieval demands are modest, yielding similar patterns in L1 and L2 referential production.

Highlights

- IC-based predictability increases name use for unexpected objects.
- Grammatical role robustly affects pronominalization.
- L2 learners use fewer pronouns overall than L1 speakers.
- Findings are compatible with a memory-interference account.

1. Introduction

When making reference, one must select appropriate forms so that addressees can identify the intended referent and that coherence is maintained in discourse. Referential form choice is influenced by multiple factors, including structural, semantic and discourse-pragmatic cues (Lindemann & Ariel, 2024). Among them, structural properties such as grammatical role consistently influence referential form choice: Previous subjects (*Mary saw Lisa. She [= Mary]…*) are more likely to be pronominalized than non-subjects (*Mary saw Lisa. Lisa…*; Arnold, 2001; Rohde & Kehler, 2014).

However, there is ongoing debate about whether and to what extent speakers consider *predictability*, the likelihood that a particular entity will be mentioned next (Bott & Solstad, 2023; Demberg et al., 2023; Fukumura & van Gompel, 2010; Hwang et al., 2022; Ye & Arnold, 2025). Predictability is determined by multiple sources of information (e.g., lexical-semantic, discourse-structural and event-based sources). The present study focuses on verbs' *implicit causality* (IC) bias, one of the most widely studied semantic sources of next-mention predictability (Bott & Solstad, 2023; Fukumura & van Gompel, 2010; Kehler et al., 2008). IC is a property of certain interpersonal verbs that biases expectations toward the causally implicated entity, especially in explanation contexts. For example, after *Mary annoyed Lisa because*, speakers typically expect *Mary* to be mentioned next (e.g., *Mary spoke loudly*) because the event denoted by *annoyed* is usually understood as being caused by the subject. Conversely, after *Mary liked Lisa because*, speakers tend to expect *Lisa* to be mentioned next (e.g., *Lisa was a kind person*) because *liked* attributes the cause to the object. In such contexts, continuations may or may not follow the verb's IC bias, a distinction referred to as bias-congruent and bias-incongruent continuations.[1] This study examines how IC-based predictability influences referential production by second language (L2) learners, using grammatical role as a baseline structural cue.

Producing appropriate referential forms is often difficult for L2 learners primarily because it requires integrating information from multiple sources. Linguistic features located at the

[1]Continuations are classified as bias-congruent when the re-mentioned referent matches the verb's IC bias (subject reference following subject-biasing verbs or object reference following object-biasing verbs) and as bias-incongruent when the re-mentioned referent does not match the IC bias.

© The Author(s), 2026. Published by Cambridge University Press. This is an Open Access article, distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives licence (http://creativecommons.org/licenses/by-nc-nd/4.0), which permits non-commercial re-use, distribution, and reproduction in any medium, provided that no alterations are made and the original article is properly cited. The written permission of Cambridge University Press or the rights holder(s) must be obtained prior to any commercial use and/or adaptation of the article.

interface between syntax and discourse semantics/pragmatics are particularly problematic for L2 learners, compared to features without this interface (Sorace, 2011). The choice of referential forms is considered a prime example of such an interface operation (Contemori & Dussias, 2016; Hendriks et al., 2014; Quesada & Lozano, 2020).[2] Here, the relevant interface computation concerns mapping grammatical and discourse-semantic cues onto referential form choice in production, rather than syntax-discourse processing in general. Existing L2 work shows that L2 learners often display production patterns that differ from L1 speakers: Some studies report that learners overuse pronouns (Contemori & Dussias, 2016; Zou & Yang, 2026), while others find greater reliance on explicit forms such as proper names (Liu et al., 2025; Pashkova & Allen, 2025; Quesada & Lozano, 2020).

At the same time, it remains unresolved how grammatical role and IC-based predictability jointly influence L2 referential form choice and how these cues are used relative to each other in L2 production. Investigating this gap is theoretically important because mapping structural and semantic properties onto referential forms is located at the syntax–semantics interface, where L1–L2 differences are likely to emerge.

Building on this background, this study examines effects of grammatical role and IC-based predictability on referential form choice in L2 production. Importantly, this study is not intended to replicate well-established grammatical role effects. Rather, it aims to explore how IC-based predictability influences referential form choice relative to grammatical role and how these structural and semantic cues interact in L2 referential production.

To this end, the present study investigates L1-Japanese learners of L2 English. Japanese is a null-subject language, in which reference is maintained via a null pronoun, in contrast to English, where overt pronouns are the most reduced forms. These cross-linguistic differences provide a valuable test case for examining how cross-linguistic differences influence L2 referential production. The findings of this study will contribute to our understanding of how L2 referential production may differ from L1 patterns and to clarifying the difficulties learners experience at the syntax-discourse interface.

1.1. Theoretical accounts of referential production

Referential production is generally assumed to be guided by entity *prominence* (also referred to as *salience* or *center of attention*). Building on this notion, referential form choice has also been discussed within frameworks of accessibility and audience design, where multiple factors (e.g., grammatical role, topicality and predictability) jointly determine prominence, which in turn guides the choice of referential forms (e.g., Arnold, 2008; Gundel et al., 1993; Lindemann & Ariel, 2024; Weatherford & Arnold, 2021). Referential production thus involves the interplay of structural, semantic and communicative cues, with prominence not reducible to any single factor.

Within this framework, one entity stands out as more prominent than others, influenced by grammatical role (Rohde, 2008; Stevenson et al., 1994), thematic role (Arnold, 2001; Vogels, 2019) and predictability (Bott & Solstad, 2023; Rosa & Arnold, 2017), among other discourse-related factors (topicality, recency). Speakers tend to use reduced referential forms (e.g., a null pronoun in a null-subject language or an overt pronoun in a non-null-subject language) for the prominent entity, assuming that addressees will interpret the pronominal expression as referring to the most likely next-mentioned entity.

Two competing accounts have been proposed to explain referential production. On the one hand, *structural accounts* (e.g., the *Bayesian model*, Kehler et al., 2008; Rohde & Kehler, 2014; the *Centering Theory*, Grosz et al., 1995) hold that speakers select referential forms primarily on the basis of structural properties. In particular, research consistently shows strong grammatical role effects (Bott & Solstad, 2023; Rohde & Kehler, 2014; Stevenson et al., 1994): Speakers pronominalize previous subjects more than non-subjects. This arises because subjects tend to be interpreted as discourse topics, hence more prominent.

On the other hand, *predictability accounts* (e.g., the *expectancy hypothesis*, Arnold, 2001; the *listener-oriented account*, Contemori & Dussias, 2016) suggest that, in addition to structure, speakers consider semantic or pragmatic expectations about the next mention. Predictability arises from multiple sources, including lexical-semantic, discourse-structural and event-based information. For example, transfer-of-possession (ToP) verbs, as in (1), bias continuations toward the Goal referent (*Bob* and *John* in 1a and 1b, respectively), reflecting event-based expectations about the endpoint of the transfer (Arnold, 2001; Rosa & Arnold, 2017).

(1) a. *John handed a book to Bob.*
b. *John received a book from Bob.*

Similarly, speakers typically continue a story with IC verbs, such as those in (2), with the referent responsible for the cause of the event (Garvey & Caramazza, 1974; Kehler et al., 2008). For example, subject-biasing IC verbs such as *annoy* (2a) elicit continuations about the subject (*Mary*), whereas object-biasing IC verbs such as *like* (2b) elicit continuations about the object (*Lisa*).

(2) a. Mary annoyed Lisa because
b. Mary liked Lisa because

Crucially, verb-based biases such as IC do not operate in isolation. Kim and Chun (2023) showed that entity topicality interacts with implicit consequentiality bias (a verb-based bias in result contexts) in L1-Korean referential interpretation, suggesting that verb-based predictability is only one of several cues to discourse prominence and does not directly correspond to prominence itself. The present study therefore focuses on IC as one specific source of predictability, without independently operationalizing prominence as a separate construct.

According to predictability accounts, the likely next mention becomes more prominent and is therefore more likely to be pronominalized. Nevertheless, empirical findings on predictability effects are mixed. Table 1 summarizes the results of relevant studies alongside their experimental designs. Overall trends are as follows:

- ToP verbs tend to yield clearer predictability effects than IC verbs.
- Effects are more likely to emerge when referents share the same gender (e.g., *Mary annoyed Lisa*) than when they differ in gender (e.g., *John annoyed Lisa*) because in same-gender contexts, pronouns cannot readily disambiguate the intended referent, thereby increasing variation in referential forms.
- Effects are more likely for object than for subject references, as object references typically allow greater variation in referential forms; subject references are often pronominalized at near ceiling due to grammatical role effects.

[2]While the present study adopts an interface perspective, referential choice can also be approached from other perspectives, including information-structural and broader cognitive accounts of discourse processing (Arnold, 2008; Gundel et al., 1993; Lindemann & Ariel, 2024). This study focuses on the interface perspective to examine how information from different sources (grammatical role, IC-based predictability) is mapped onto referential form choice in production.

https://doi.org/10.1017/S1366728926101825 Published online by Cambridge University Press

Table 1. Summary of studies on predictability effects in the production of referential forms

Study	Language	Task	Verb type	Interaction or contextual support	Predictability effects found?
Arnold (2001)	English	Story continuations (free)	ToP	No	Yes
Fukumura and van Gompel (2010) Pretest	English	Story continuations (free)	IC	No	No
Ex. 1	English	Story continuations (constrained)	IC	No	No
Ex. 2	English	Story continuations (constrained)	IC	No	No
Rohde and Kehler (2014) Ex. 1–2	English	Story continuations (free)	IC	No	No
Rosa and Arnold (2017) Ex. 1	English	Picture-guided story retelling (constrained)	ToP	Yes	Yes
Ex. 2	English	Story continuation (constrained)	ToP	Yes	Yes
Ex. 3	English	Story continuation (constrained)	ToP	No	Yes (but only under some conditions, e.g., same-gender prompts)
Vogels (2019) Ex. 2	Dutch	Story continuation (constrained)	ToP + IC	No	Yes
Weatherford and Arnold (2021) Ex. 1–2	English	Story retelling (constrained)	IC	Yes	Yes
Lam and Hwang (2022) Ex. 2	Mandarin	Story continuation (free)	IC	No	No (reverse pattern: more null pronouns for less predictable referents)
Hwang et al. (2022)	Mandarin	Story continuation (free)	ToP + IC	No	No
Bott and Solstad (2023) Pilot	German	Story continuation (constrained)	IC	No	Yes (evident for object references)
Ex. 1	German	Story continuation (constrained)	ToP	No	Yes (evident for bias-incongruent objects)
Ex. 2	German	Story continuation (constrained)	IC	No	Yes (evident for bias-incongruent objects)
Ex. 3	German	Story continuation (constrained)	IC + AE	No	Yes (evident for bias-incongruent objects)
Ex. 4	German	Story continuation (constrained)	IC + ICon	No	Yes
Demberg et al. (2023) Ex. 1	English	Story continuation (free)	ToP + IC	No	No
Ex. 2	English	Story continuation (constrained)	ToP + IC	No	No
Ex. 3	English	Story continuation (constrained)	ToP	Yes	Yes
Ye and Arnold (2025)	English	Story continuation (constrained)	IC	Yes	Yes

Note: Ex. = Experiment.
Verb type: AE = agent-evocator verbs; IC = implicit causality verbs; ICon = implicit consequentiality verbs; ToP = transfer of possession verbs.
Task: (free) = participants freely produce a natural continuation; (constrained) = participants were instructed which referent to continue about.
Interaction or contextual support: Yes = richer context and/or addressee interaction; No = minimal context, no addressee interaction (beyond a single prompt sentence).

- Effects are easier to detect when contextual support is provided or when a task requires interaction with an addressee.

In addition to these accounts, speakers often produce more informative expressions than are strictly required for referent identification, a phenomenon known as *overspecification* (Engelhardt et al., 2006; Koolen et al., 2011). Overspecification has traditionally been discussed in terms of semantic redundancy (e.g., an unnecessary modifier such as *blue* when only one shirt is present). Crucially, such redundancy is not necessarily inefficient but may reflect speakers' adaptation to uncertainty, cognitive constraints or communicative demands (Koolen et al., 2011; Rubio-Fernández, 2016). Although primarily focused on semantic content, similar pressures may also operate in referential form selection, where speakers sometimes use explicit forms even when reduced forms would suffice (Liu et al., 2025; Zou & Yang, 2026). In particular, when predictions about the next mention are weak or violated, speakers may resort to more explicit forms to ensure successful reference (e.g., Bott & Solstad, 2023). This raises the possibility that predictability influences how explicitly referents are expressed, an issue remaining underexplored in L2 production.

1.2. Referential production by L2 learners

Selecting referential forms requires integrating syntactic with discourse-level (semantic/pragmatic) information. In this context, the interface computation involves mapping grammatical role and semantic predictability onto referential form choice. Two

https://doi.org/10.1017/S1366728926101825 Published online by Cambridge University Press

influential accounts explain how L2 learners choose referential expressions at this syntactic–discourse interface. On the one hand, the *Interface Hypothesis* maintains that phenomena at this interface pose persistent difficulty for L2 learners because integrating information from different sources is cognitively demanding and L2 processing is less efficient (Sorace, 2011). Thus, this account predicts that L2 learners will differ from L1 speakers when referential choice requires integrating semantically driven expectations with syntactic realization.

On the other hand, the *memory-interference model* argues that L1–L2 differences do not straightforwardly result from an interface-specific deficit. Instead, it suggests that L2 processing is more vulnerable when cue retrieval is demanding (Cunnings, 2017; Cunnings et al., 2017). Specifically, this account predicts that learners can integrate discourse cues when those cues are readily available and reliable, but they struggle to do so as retrieval demands increase—such as when multiple referents share similar features (gender, number or role), context is complex, time pressure is high, or L2 representations are underspecified (Contemori et al., 2019; Cunnings & Sturt, 2018).

Empirically, L2 learners often show different distributions of referential forms from L1 speakers (e.g., overuse of reduced or explicit forms, compared to L1 speakers). Importantly, cross-linguistic influence from the L1 often modulates the direction of deviation. For example, learners with a non-null-subject L1 (e.g., English, French and German) acquiring a null-subject L2 (e.g., Italian, Japanese and Spanish) tend to overuse names or overt pronouns where L1 speakers prefer more reduced forms (Belletti et al., 2007; Nakahama, 2009; Quesada & Lozano, 2020). Conversely, learners with a null-subject L1 acquiring a non-null-subject L2 show the reverse pattern by overusing pronouns (Contemori et al., 2024; Contemori & Dussias, 2016; Contemori & Ivanova, 2021). Cross-linguistic influence on IC processing has also been reported. Kim and Grüter (2019) showed that L1-Korean learners exhibit stronger IC effects for verbs whose Korean counterparts more transparently encode causality with morphosyntactic marking, suggesting that IC biases are constrained by L1 morphosyntactic properties.

Recent studies further suggest variation in the explicitness of referential expressions. Liu et al. (2025) reported increased use of explicit forms by bilingual speakers even in contexts where monolinguals prefer reduced forms, whereas Pashkova and Allen (2025) showed that such increases are form-specific rather than general. Conversely, Zou and Yang (2026) found that L2 learners may overuse reduced forms, suggesting reduced sensitivity to audience-related considerations. Together, these findings indicate that referential production is not uniformly shifted toward either more explicit or more reduced forms, but varies in how speakers coordinate available cues, often resulting in form-specific or asymmetric patterns. This is particularly relevant to IC-based prediction, where referential choice depends on integrating verb-based biases with discourse-level expectations.

Despite these variations, existing L2 studies converge on a robust influence of grammatical role: L2 learners typically use reduced forms for previous subjects and more explicit forms for non-subjects. This effect has been observed with both ToP and IC verbs (Cheng & Almor, 2019; Grüter et al., 2017) and across tasks (story continuation: Cheng & Almor, 2019; Grüter et al., 2017; story narration: Miyao, 2018), indicating that grammatical role constitutes a relatively accessible cue for L2 learners.

By contrast, few studies have directly tested predictability effects on L2 referential production. Notably, although Grüter et al. (2017) included ToP verbs and Cheng and Almor (2019) manipulated IC bias, both studies targeted interpretation rather than production; whether IC/ToP-based predictability modulates L2 referential form selection remains unclear.

Investigating L2 referential production is theoretically informative for at least two reasons. First, it bears on phenomena at the syntax–discourse interface. If interface computations are costly for L2 learners, as proposed by the Interface Hypothesis, referential form selection should be vulnerable, yielding attenuated predictability effects. Conversely, under the memory-interference model, predictability effects are expected to be graded, emerging when cues are accessible but weakening as retrieval demands increase.

Second, L2 referential production provides a testbed for cross-linguistic influence, as differences depend on L1–L2 properties of referential systems. L1-Japanese learners are particularly informative because Japanese overt pronouns are typologically distinctive among null-subject languages, as discussed in Section 1.3.

1.3. Properties of Japanese overt pronouns

Japanese is a null-subject language, in which prominent referents are typically maintained with null pronouns. Conversely, Japanese overt pronouns show no strong inherent preference for prominent or non-prominent referents, nor for sentence topics or focus (though relative to null pronouns, they are more likely to refer to less prominent referents; Kanno, 1997; Shoji et al., 2017; Ueno & Kehler, 2016).

One reason for these properties of Japanese overt pronouns lies in their low frequency of referential use. Gundel et al. (1993) reported that a null pronoun is used to refer to 70% of focused referents in Japanese, while overt pronouns appear in only 3% of such cases. This contrasts sharply with other null-subject languages such as Spanish and Mandarin, where overt pronouns are used to refer to focused referents in 50% and 44% of cases, respectively.

It is also notable that Japanese personal pronouns (*kanojo* [*she*], *kare* [*he*]) are more frequently used as lexical nouns, meaning *girlfriend* and *boyfriend*, respectively, rather than as referential expressions. Reflecting this, Noguchi (1997) classified Japanese overt pronouns as a non-functional noun category, in contrast to English pronouns, which are categorized as functional determiners.

In summary, Japanese overt pronouns are infrequent, belong to a lexical noun class and are relatively insensitive to entity prominence. These features distinguish Japanese from other null-subject languages and make it an intriguing testing ground for exploring cross-linguistic influence in L2 referential production. If these properties transfer to L2 production, L1-Japanese learners are expected to use English pronouns less frequently than L1-English speakers. This reduction may be particularly pronounced for object references, as subject references tend to show near-ceiling pronominalization due to grammatical role effects (Bott & Solstad, 2023).

2. The present study

2.1. Goal and research questions

This study examined L1-Japanese learners' choice of referential forms in English, focusing on how grammatical role and IC-based predictability jointly influence L2 referential production, and how learners' production differs from that of L1 speakers. The following research questions (RQs) were addressed:

RQ1: Do L1-Japanese learners of English take grammatical role and IC bias into account when choosing referential forms in L2 English?

https://doi.org/10.1017/S1366728926101825 Published online by Cambridge University Press

RQ2: How does L2 referential production by L1-Japanese learners differ from that of L1-English speakers?

2.2. Predictions from theoretical models

2.2.1. Grammatical role effects

Both the Interface Hypothesis and the memory-interference model predict similar grammatical role effects in L1 and L2 production. Mapping grammatical role onto referential forms is largely structure-driven and requires relatively limited integration with discourse-semantic information. Consistent with prior studies, L2 learners are expected to pronominalize previous subjects more than objects (Contemori & Dussias, 2016; Contemori & Ivanova, 2021; Grüter et al., 2017). Accordingly, a main effect of grammatical role and no significant Group × Grammatical Role interaction are expected.

2.2.2. Predictability effects

Unlike grammatical role, IC-based predictability may be demanding for L2 learners; it requires integrating verb semantics with discourse-level coherence relations and mapping these expectations onto referential form choice. The Interface Hypothesis posits that such integration is vulnerable in L2 processing. By contrast, the memory-interference model attributes potential difficulty to the accessibility of the relevant cues: IC-based expectations may be harder to retrieve, particularly when they are weaker, compete with other cues (e.g., grammatical role) or rely on less robust lexical representations.

Accordingly, the two accounts make partially different predictions. The Interface Hypothesis predicts weaker IC-based predictability effects in L2 learners than in L1 speakers, yielding a Group × IC Bias interaction in pronominalization (i.e., learners show a smaller increase in pronoun use for bias-congruent continuations than L1 speakers). By contrast, the memory-interference model predicts that sensitivity to predictability is conditional on the ease with which the cue is retrieved. If IC bias robustly influences next-mention prediction, predictability should function as a usable cue in referential form choice, yielding a main effect of IC bias across groups. Conversely, if learners struggle to generate IC-based predictions, effects should be attenuated, yielding a Group × IC bias interaction.

Importantly, this study employs an offline story continuation task with a causal connective (*because*) and no time pressure, which likely reduces processing demands. Under such conditions, both accounts may plausibly predict similar production patterns in L1 and L2 speakers. The presence or absence of a Group × IC Bias interaction should therefore not be taken as a decisive test between these accounts, but as evidence informing the extent to which their predictions apply under the present task conditions.

3. Method

3.1. Participants

Forty-seven Japanese university students participated (29 females; mean age = 18.71 years; age range: 18–20). L1-Japanese learners were included as a theoretically informative group, given differences between Japanese and English in overt pronoun frequency and properties. They were majoring in esthetics, education, English, history or mass communication. None of them had any study-abroad experience in English-speaking countries. Their L2 proficiency was estimated to fall within the CEFR A2–B2 range or correspond to a TOEFL iBT score between 28 and 80, based on their performance on the TOEIC IP test (M = 624.04, SD = 105.72), which had been administered three weeks prior to the study.

Forty-seven monolingual English speakers were recruited on Prolific (20 females; mean age = 21.80 years; age range: 19–42). All participants reported having completed university-level education. Two were excluded from the study for failing an instructional manipulation check designed to ensure they carefully read the instructions or for providing incorrect responses to "catch" items, which were intended to verify their attention to the stimuli. The final analysis included 45 L1 speakers, each of whom received US $7.00 for their participation.

3.2. Materials

3.2.1. Verbs and the story continuation task

Twenty-four IC verbs and 24 non-IC verbs were selected, drawn from Ferstl et al. (2011). Twelve of the IC verbs were stimulus-experiencer (subject-biasing) verbs, while the other 12 were experiencer-stimulus (object-biasing) verbs. All verbs were confirmed to be within the top 3,000 entries of the *New JACET (Japan Association of College English Teachers) 8,000 list* (JACET Basic Word Revision Committee, 2016).

A pilot study with 33 Japanese university students confirmed referential biases using a story continuation task in Japanese and English. Verbs that elicited 70% or more subject continuations in both languages were categorized as subject-biasing, while those with 30% or fewer subject continuations were classified as object-biasing, following previous L2 IC studies (Cheng & Almor, 2017; Hosoda, 2025b). Thus, the IC verbs elicited biases of similar strength and direction in the participants' L1 Japanese and L2 English, indicating that cross-linguistic differences in the IC bias would not influence the results. Verbs eliciting fewer than 65% subject or object continuations in both languages were categorized as non-IC verbs.[3] Crucially, IC bias is gradient (e.g., Solstad & Bott, 2022). In this sense, verbs categorized as non-IC do not entirely lack referential bias but show relatively weaker biases. Here, these verbs were grouped into a non-IC category to provide a baseline condition with weak predictability, against which the effects of stronger IC-based expectations could be assessed. This categorization was intended to facilitate comparison across conditions, although it necessarily simplifies the gradient nature of IC bias.

The context sentences were built from the 48 experimental verbs in the frame *Subject verb-ed Object because*____. Examples are presented in Table 2. Each sentence used two familiar English names of the same gender. Same-gender referent pairs were used so that gendered pronouns (*he*, *she*) would not trivially disambiguate the referent; with different-gender referents, a gendered pronoun uniquely identifies the intended referent, often driving pronoun use to ceiling and masking predictability effects (Bott &

[3]Non-IC verbs included stimulus-experiencer verbs (*surprised* and *encouraged*) and an experiencer-stimulus verb (*forgot*), which could be classified as subject- and object-biasing verbs, respectively. However, norming data from Ferstl et al. (2011) and this study showed that their percentage of subject references ranged from 42% to 55%, indicating that they do not induce a subject- or object-bias. Based on this evidence, this study categorized these verbs as non-IC verbs.

https://doi.org/10.1017/S1366728926101825 Published online by Cambridge University Press

Table 2. Example stimuli in the three experimental conditions

Context	IC bias
Mary annoyed Lisa because _____	Subject bias
Mary liked Lisa because _____	Object bias
Mary saw Lisa because _____	Non-IC

Solstad, 2023; Rohde & Kehler, 2014). Half of the items had female characters and half had male characters.

All context sentences included the causal connective *because*, which encouraged participants to construct an explanation relation and thereby strengthened IC-based next-mention predictions. This choice was motivated by prior findings showing that L2 learners do not generate IC-based predictions, particularly for subject-biasing verbs, in the absence of *because* (e.g., Hosoda, 2025b, 2026). Including *because* therefore ensured that IC-based predictability was consistently elicited across items.

Participants wrote an English continuation naturally following each context sentence. Notably, this was a genuinely free continuation task: Participants were not constrained to continue with a particular referent but could freely choose whether to refer to the previous subject or object. This design was intended to capture more naturalistic referential production, in contrast to constrained or forced-reference paradigms, although it may result in an uneven distribution of referents, as discussed later.

Participants were instructed to focus on content, not to worry about grammar or spelling mistakes and to avoid humor. They were also asked to write a complete English sentence with a subject and a verb, rather than a phrase. The instructions were provided both verbally and in written form. The exact instructions, presented in English for L1 speakers and in Japanese for L2 learners, were as follows:

> You will create continuations of stories in English. Please read the English sentences carefully to understand the story. Then, write a continuation of the story that comes to mind. Do not worry about grammar and spelling mistakes. Focus on the content of the continuation and avoid humor. Make sure to write a complete English sentence with a subject and a verb, rather than a phrase.

Two counterbalanced sets were prepared, each containing 48 experimental items and 48 filler items from a separate study on relative clause interpretation. The gender of referents was counterbalanced across sets. Items were presented in a randomized order for each participant.

3.2.2. Translation task

A translation task verified that L2 participants knew the meanings of the experimental verbs. This was essential because the effects of IC bias presuppose the knowledge of verb semantics. On each trial, participants were presented with a context sentence (e.g., *Mary annoyed Lisa*) and were instructed to translate it into L1 Japanese. The task included 48 items in total, comprising 24 IC verbs and 24 non-IC verbs.

3.2.3. Procedure

The L1 participants completed the experiment on Qualtrics. They first filled out a demographic questionnaire and completed an instructional manipulation check. Afterward, they proceeded to the story continuation task. The experiment for the L1 group took 45 min on average. For the L2 group, testing sessions involved one to four participants at a time. They first completed the story continuation task in English, followed by the translation task. The experiment for L2 learners took 70 min on average.

3.3. Coding and data treatment

3.3.1. Translation task

Two raters (including the author) independently coded each translation as correct or incorrect according to whether it conveyed the verb's target meaning. For subject-biasing IC verbs, raters verified that the translation expressed a causative reading, given differences in how this meaning is realized in Japanese, as opposed to English (Hosoda, 2021, 2025b). Alternative readings/usages (e.g., passive) were coded as incorrect. Lexical variation was allowed provided the core meaning was preserved (e.g., for *disappointed*, *shitsubou-saseta* [made X disappointed] and *gakkari-saseta* [made X feel let down] were coded as correct). Ambiguous responses were coded as incorrect. Inter-rater agreement was 92%. All discrepancies were resolved through discussion.

3.3.2. Story continuation task

Before coding, continuations were excluded if they were nonsensical (fewer than 1% of the data) or if L2 learners provided incorrect translations (9% of the L2 data). Each continuation was coded for (a) the referent (previous subject or object) and (b) the referential form (pronoun or name).

Referent. Two raters (including the author) independently determined whether the continuations referred to the previous subject or object. Following previous IC studies on referential interpretation and production (Bott & Solstad, 2023; Fukumura & van Gompel, 2010; Kehler et al., 2008), coding focused on the first re-mentioned referent; IC-based prediction primarily concerns the likely next-mentioned entity, which is usually equivalent to the first-mentioned referent in continuations. Later mentions were not considered, as they may also be influenced by developing discourse representations and therefore do not directly index IC-based next-mention expectations. When continuations contained multiple clauses, coding was based on the first clause and the first explicit mention of the previous subject or object. Overt subject expressions in the dataset were overwhelmingly realized as either pronouns or repeated names, with no systematic use of alternative referential strategies.

Continuations were coded as unclear if the intended referent was ambiguous or if neither the previous subject nor object was mentioned (e.g., referring to an entity absent from the stimuli, using a conjoined noun phrase like *Mary and Lisa* or a plural pronoun *they*). Fragmentary (L1: n = 10, L2: n = 8) or subject-omitted responses (L1: n = 26, L2: n = 3) were also coded as unclear. These responses were rare, likely because participants were instructed to produce a complete English sentence with a subject and verb rather than a phrase (see the Materials section [Section 3.2]). Unclear responses were excluded from further analysis (14% of the data). The inter-rater agreement reached 93%, with all disagreements resolved through discussion.

Referential form. The two raters coded the continuations for whether the mention used a pronoun (*she* or *he*) or name (e.g., *Mary* or *Bob*). In the present data, no response contained a noun phrase (e.g., *that woman*) or other referential expressions. Accordingly, the binary coding in this study was based on the empirical distribution of the data rather than imposing an a priori restriction. Continuations that were deemed unclear at the referent-coding stage were not entered into this coding. The inter-rater agreement was 95%. All disagreements were resolved through discussion.

https://doi.org/10.1017/S1366728926101825 Published online by Cambridge University Press

3.4. Statistical analysis

Mixed-effects logistic regression models were fit in R with the lme4 package (Bates et al., 2015). Fixed effects were evaluated with Wald z tests, and significant interactions were followed up with emmeans (Lenth, 2024). Following Barr et al. (2013), this study specified the maximal random-effects structure that converged. When the maximal model (including all random slopes and their interactions permitted by the design) did not converge, random slopes were simplified in a stepwise manner by removing the smallest-variance slope(s) until convergence was achieved.

Additionally, Bayesian multilevel regression models were fit as complementary analyses. The frequentist mixed-effects models constituted the primary analyses because they are the standard analytical approach in psycholinguistics and facilitate comparison with previous studies. The Bayesian models served as complementary robustness analyses. The two approaches provide different inferential information: The frequentist analyses evaluated the effects using sampling distributions and p values, while the Bayesian analyses estimated posterior distributions, permitting direct probability interpretation of parameter estimates given the data and priors. The Bayesian analyses were particularly useful because the free continuation paradigm yielded unbalanced data, and weakly informative priors can stabilize estimation in sparsely populated cells (Gelman et al., 2013). Agreement in the direction and magnitude of the key effects across the two approaches would provide converging evidence that the conclusions were not dependent on a single framework.

The Bayesian models used the same fixed- and random-effects structure as the frequentist models to facilitate direct comparison. The models were estimated using MCMC sampling with four chains (4,000 iterations each, 2,000 warm-up). Sampling was performed in Stan using the No-U-Turn Sampler (NUTS; Hoffman & Gelman, 2014). Weakly informative priors were specified, with normal priors for population-level coefficients and Student-t priors (Student-$t(3, 0, 2.5)$) for intercepts and group-level standard deviations. Convergence was satisfactory (all $\hat{R} \approx 1.00$, high effective sample sizes). Posterior estimates are reported on the log-odds scale with 95% credible intervals (CrIs).

3.4.1. Referent

As a preliminary analysis, this study confirmed that IC bias caused next-mention expectations. The binary choice of referents (previous subject vs. object) was analyzed with a mixed-effects logistic regression, complemented by a Bayesian model with the same fixed- and random-effects structure. Fixed effects were IC bias (subject, object, non-IC), group (L1, L2) and an IC Bias × Group interaction. Group was sum-coded to facilitate the interpretation of group differences in the presence of interactions. IC bias was dummy-coded with non-IC as the reference (IC-subject vs. non-IC, IC-object vs. non-IC). For random effects, a maximal random-effects structure converged and was therefore retained, including random intercepts for participant and item as well as a by-participant random slope for IC bias and a by-item random slope for group (Referent choice ~ IC bias * group + [1 + IC bias | participant] + [1 + group | item]).

3.4.2. Referential form

The binary referential-form data (pronoun vs. name) were analyzed with a mixed-effects logistic regression model, complemented by a Bayesian model with the same fixed- and random-effects structure. Fixed effects were referents' grammatical role (subject, object), IC bias (subject, object, non-IC), group (L1, L2) and a Grammatical Role × IC Bias × Group interaction. Grammatical role and group were sum-coded. IC bias was dummy-coded with non-IC as the reference (IC-subject vs. non-IC, IC-object vs. non-IC) to test whether IC-bias-congruent and IC-bias-incongruent continuations elicited higher and lower pronominalization, respectively, relative to the non-IC baseline. Crucially, the inclusion of the non-IC condition allows the detection of asymmetries in predictability effects (e.g., increased name use for bias-incongruent continuations without increased pronominalization for bias-congruent continuations), which would be less detectable when comparing only IC-subject and IC-object contexts (see Appendix A for a direct comparison of IC contexts).[4]

For random effects, the model with a maximal random-effects structure failed to converge (including random intercepts for participant and item, by-participant random slopes for grammatical role, IC bias, and their interaction and by-item random slopes for grammatical role, group and their interaction). The random-effects structure was hence simplified stepwise. The final model included random intercepts for participant and item as well as by-participant random slopes for grammatical role and IC bias (Referential form ~ group * grammatical role * IC bias + [1 + grammatical role + IC bias | participant] + [1 | item]).

4. Results

4.1. Included and excluded trials

Before presenting the statistical results, this section reports included and excluded trials to provide an overview of the data. Table 3 presents the total number of observations and the number and proportion of pronominalization across conditions. Bias-incongruent continuations occurred less frequently than bias-congruent ones, resulting in fewer observations in some conditions, particularly for object references following subject-biasing verbs. This pattern is typical of free continuation paradigms with IC, in which participants tend to follow IC next-mention biases (Garvey & Caramazza, 1974; Kehler et al., 2008). This distribution is taken into account in interpreting the results and is revisited in the Discussion.

Table 4 shows the number of excluded trials across conditions. Non-IC verbs tended to yield more excluded trials than IC verbs, which is unsurprising given that they constrain next-mention expectations less strongly than IC verbs. Importantly, apart from translation errors, which were limited to the L2 group and were especially frequent in the IC-subject condition (as detailed in Section 4.2), no systematic differences between L1 and L2 participants were observed. This suggests that the exclusion procedure did not disproportionately affect one group over the other.

4.2. Translation task

L2 participants made more errors for subject-biasing IC verbs (22%) than for object-biasing IC verbs (5%; $\beta = -2.40$, $SE = 0.89$, $z = -2.71$, $p = .007$) and non-IC verbs (5%; $\beta = 2.11$, $SE = 0.74$, $z = 2.85$, $p = .004$). Error rates did not differ between object-biasing and non-IC verbs ($\beta = -0.29$, $SE = 0.80$, $z = -0.37$, $p = .715$). These results suggest that L2 participants had weaker knowledge of

[4]Analyses comparing IC-subject and IC-object contexts revealed a similar pattern of predictability effects to that observed in the main analysis (see Appendix A).

https://doi.org/10.1017/S1366728926101825 Published online by Cambridge University Press

Table 3. Total observations and number and proportion of pronominalization as a function of group, IC bias and referent

	Referent: Subject					
	IC-subject bias		IC-object bias		Non-IC	
	Total observations	Pronominalization	Total observations	Pronominalization	Total observations	Pronominalization
L2	363	307 (84.6%)	51	48 (94.1%)	492	401 (81.5%)
L1	488	478 (98.0%)	40	38 (95.0%)	524	515 (98.3%)
	Referent: Object					
	IC-subject bias		IC-object bias		Non-IC	
	Total observations	Pronominalization	Total observations	Pronominalization	Total observations	Pronominalization
L2	42	9 (21.4%)	454	197 (43.4%)	329	145 (44.1%)
L1	19	9 (47.4%)	479	401 (83.7%)	263	207 (78.7%)

Note: Proportions of pronominalization are calculated relative to the total observations within each condition.

Table 4. Number of excluded trials across conditions

Condition	Ambiguous	Nonsensical	Subject omission	Other	Incorrect translation	Excluded trials/total trials
IC-Subject						
L2	12 (2.1%)	5 (0.9%)	1 (0.2%)	19 (3.4%)	122 (21.6%)	159/564 (28.2%)
L1	10 (1.9%)	5 (0.9%)	8 (1.5%)	10 (1.9%)		33/540 (6.1%)
IC-Object						
L2	4 (0.7%)	11 (2.0%)	0 (0.0%)	14 (2.5%)	30 (5.3%)	59/564 (10.5%)
L1	0 (0.0%)	2 (0.4%)	8 (1.5%)	11 (2.0%)		21/540 (3.9%)
Non-IC						
L2	98 (8.7%)	14 (1.2%)	2 (0.2%)	134 (11.9%)	59 (5.2%)	307/1128 (27.2%)
L1	123 (11.4%)	2 (0.2%)	10 (0.9%)	158 (14.6%)		293/1080 (27.1%)

Note: Percentages are calculated relative to the total number of responses within each condition. Ambiguous = unclear referent. Nonsensical = responses that did not make sense. Subject omission = subject was absent. Incorrect translation = incorrect translation in the translation task (coded only for L2 participants). Other = references to entities not present in the stimuli, plural or conjoined referents, or fragmentary continuations.

subject-biasing IC verb semantics than of the other verb types, consistent with prior studies with Japanese learners (Hijikata, 2021; Hosoda, 2021, 2026).

One possible explanation is that subject-biasing verbs are less frequent in English input, particularly in Japan's textbooks and tests (Hosoda, 2025a). In addition, differences in how causative meanings are lexicalized in Japanese and English (Japanese subject-biasing verbs often have explicit causative markings [e.g., *shitsubou-saseru*], whereas their English counterparts do not [e.g., *disappoint*]) may make these verbs less transparent for Japanese learners. This result is also consistent with prior observations that stimulus-experiencer predicates are difficult for L2 learners to acquire.

4.3. Referent

To confirm that IC bias influenced next-mention predictions, participants' choice of referents was first analyzed. Rates of subject continuations are displayed in Figure 1. All statistical results are available in Appendix B. IC bias consistently influenced participants' referent choice: Relative to the non-IC baseline, continuations mentioned previous subjects more often in the IC-subject-biasing context ($\beta = 2.36$, $SE = 0.40$, $z = 5.90$, $p < .001$) and less often in the IC-object-biasing context ($\beta = -4.05$, $SE = 0.39$, $z = -10.31$, $p < .001$). Additionally, the IC-Subject Bias × Group interaction was significant ($\beta = -0.54$, $SE = 0.25$, $z = -2.16$, $p = .031$).

Follow-up tests showed IC-bias-consistent patterns in both groups: Relative to the non-IC baseline, subject continuations increased in the IC-subject-biasing (L1: $\beta = 2.90$, $SE = 0.50$, $z = 5.80$, $p < .001$; L2: $\beta = 1.82$, $SE = 0.44$, $z = 4.13$, $p < .001$) and decreased in the IC-object-biasing context (L1: $\beta = -4.40$, $SE = 0.47$, $z = -9.33$, $p < .001$; L2: $\beta = -3.70$, $SE = 0.46$, $z = -8.01$, $p < .001$). Meanwhile, learners showed reduced IC-subject bias, producing fewer subject continuations than L1 speakers in the IC-subject-biasing context ($\beta = -1.36$, $SE = 0.46$, $z = -2.95$, $p = .003$). No group differences were found in the IC-object-biasing ($\beta = 0.40$, $SE = 0.47$, $z = 0.86$, $p = .391$) or non-IC contexts ($\beta = -0.29$, $SE = 0.27$, $z = -1.08$, $p = .278$).

The Bayesian analysis yielded converging evidence with the logistic regression results. Across groups, IC next-mention biases were robustly observed: Relative to the non-IC baseline, subject continuations increased in the IC-subject-biasing context (L1: estimate = 2.83, 95% CrI [1.84, 3.87]; L2: estimate = 1.75, 95% CrI [0.82, 2.66]) and decreased in the IC-object-biasing context (L1: estimate = −4.20, 95% CrI [−5.20, −3.27]; L2: estimate = −3.52, 95% CrI [−4.45, −2.58]).

Additionally, the analysis showed evidence for an IC-Subject Bias × Group interaction (estimate = −0.55, 95% CrI [−1.07, −0.05]).

https://doi.org/10.1017/S1366728926101825 Published online by Cambridge University Press

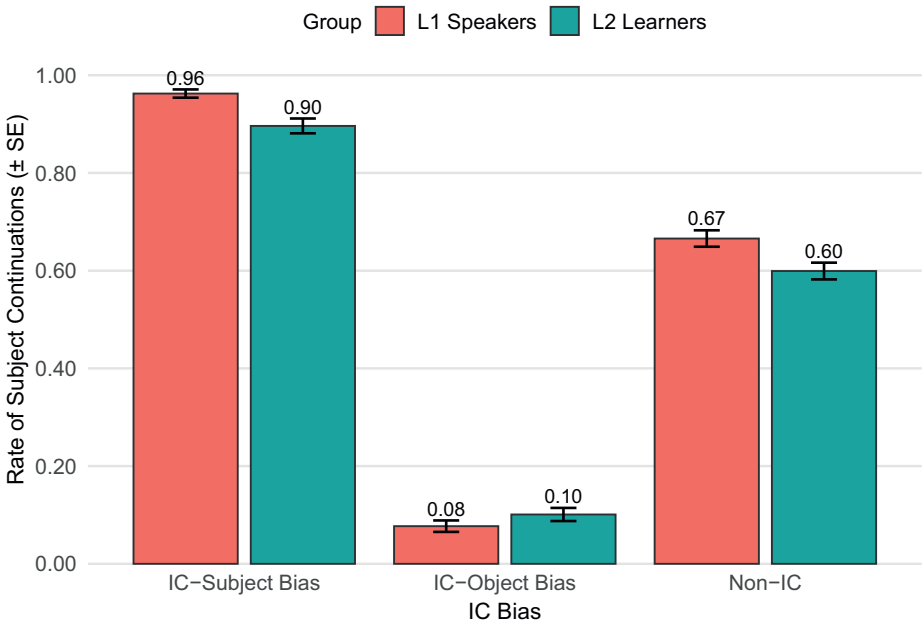


Figure 1. Rates of subject continuations.

Posterior contrasts showed that learners exhibited a reduced IC-subject bias, compared to L1 speakers (estimate = −1.36, 95% CrI [−2.33, −0.45]), whereas no reliable group differences were found in the IC-object-biasing (estimate = 0.41, 95% CrI [−0.56, 1.39]) or non-IC contexts (estimate = −0.28, 95% CrI [−0.83, 0.27]).

Both frequentist and Bayesian analyses showed that IC bias affected next-mention expectations across groups, although IC-subject bias was reduced in learners. This study next asks whether IC-based predictability and grammatical role modulated referential form choice.

4.4. Referential form

Rates of pronominalization are displayed in Figure 2. Overall, L1 speakers used more pronouns than L2 learners (a main effect of group: $\beta = -1.46$, $SE = 0.25$, $z = -5.72$, $p < .001$). Previous subjects were more pronominalized than previous objects (a main effect of grammatical role: $\beta = -1.64$, $SE = 0.21$, $z = -7.88$, $p < .001$). Grammatical role did not interact with group ($\beta = 0.04$, $SE = 0.18$, $z = 0.21$, $p = .836$), indicating that the grammatical role effects held for both groups. Crucially, the IC-Subject Bias × Grammatical Role interaction was significant ($\beta = -0.92$, $SE = 0.32$, $z = -2.92$, $p = .003$).

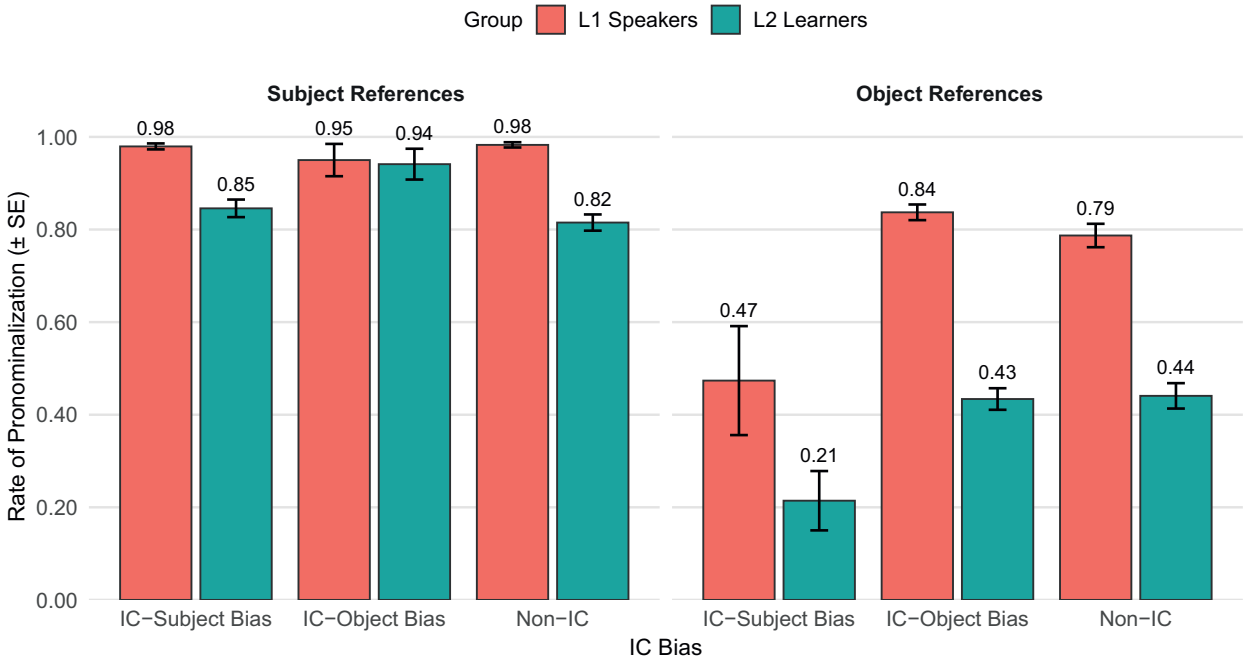


Figure 2. Rates of pronominalization.

https://doi.org/10.1017/S1366728926101825 Published online by Cambridge University Press

Follow-up tests showed different predictability effects between subject and object references. For subject references, pronominalization did not differ across IC-bias conditions (all contrasts, *p*s > .05). For object references, pronominalization was lower (thus name use was greater) in the IC-subject-biasing context than in the non-IC baseline ($\beta = -1.73$, $SE = 0.50$, $z = -3.49$, $p = .001$). Conversely, pronominalization did not increase from the non-IC to the IC-object-biasing context ($\beta = 0.23$, $SE = 0.22$, $z = 1.01$, $p = .571$). These results indicate that IC-based predictability increased name use specifically for IC-bias-incongruent object references.

The Bayesian analysis again yielded converging evidence with the logistic regression results. The model indicated a clear effect of grammatical role (estimate = −1.67, 95% CrI [−2.07, −1.29]), with higher pronominalization for subject than for object references, and a clear group difference (estimate = −1.41, 95% CrI [−1.92, −0.92]), with L1 speakers producing more pronouns than L2 learners. Crucially, the IC-Subject Bias × Grammatical Role interaction was also supported (estimate = −0.89, 95% CrI [−1.47, −0.35]).

Posterior contrasts confirmed that IC effects were restricted to object references. For subject references, no reliable differences were found across IC-bias conditions, with all 95% credible intervals overlapping zero (see Appendix B.2 for full results). For object references, however, greater name use was observed in the IC-subject-biasing context, relative to the non-IC baseline (L1: estimate = −1.21, 95% CrI [−2.40, −0.17]; L2: estimate = −1.99, 95% CrI [−3.50, −0.52]). No reliable difference was found between the non-IC and IC-object-biasing contexts (L1: estimate = 0.06, 95% CrI [−0.50, 0.63]; L2: estimate = 0.46, 95% CrI [−0.20, 1.10]).

Finally, to examine potential proficiency effects, an additional model including centered L2 proficiency test scores was fit to the L2 data and compared with the base model. Model comparison revealed that including proficiency did not improve model fit ($\chi^2(6) = 8.77$, $p = .187$). Furthermore, proficiency showed no significant main effect ($\beta = 0.0003$, $SE = 0.0027$, $z = 0.12$, $p = .905$). A small Grammatical Role × Proficiency interaction reached significance ($\beta = -0.002$, $SE = 0.001$, $z = -2.04$, $p = .041$). However, the effect size was negligible, and the model comparison above did not support including proficiency. Furthermore, this effect was not supported by additional analyses testing non-linear proficiency effects (reported below). Given its minimal magnitude and lack of robustness across analyses, this interaction is unlikely to represent a meaningful proficiency effect. No other interactions involving proficiency approached significance (all *p*s > .05).

To explore potential non-linear proficiency effects, an exploratory analysis including a quadratic proficiency term was conducted. The quadratic model did not significantly improve model fit ($\chi^2(4) = 8.71$, $p = .069$) and provided no reliable evidence for non-linear effects: Neither the linear ($\beta = -0.06$, $SE = 0.26$, $z = -0.24$, $p = .807$) nor quadratic term ($\beta = -0.002$, $SE = 0.21$, $z = -0.01$, $p = .991$) was significant. Together, these analyses provide no reliable evidence that referential form choice was modulated by L2 proficiency.

5. Discussion

5.1. Effects of grammatical role and IC-based predictability in referential production

Overall, L2 learners used fewer pronouns than L1 speakers, consistent with cross-linguistic influence (Nakahama, 2009; Quesada & Lozano, 2020; for IC, Kim & Grüter, 2019). Japanese has a much lower rate of overt pronoun use than English (Gundel et al., 1993), and its personal pronouns rarely serve anaphoric functions, often behaving more like non-functional lexical nouns (Noguchi, 1997). These properties likely reduced L1-Japanese learners' pronoun use in English. Thus, the present findings support a cross-linguistic influence explanation of L2 referential production, suggesting that pronoun use is quantitatively reduced when pronouns are infrequent in L1.

In addition to the pronominal system, broader discourse-organizational patterns in Japanese may also underlie the L2 results. Japanese frequently omits arguments and relies on null anaphora when referents are recoverable from context, and discourse continuity is usually maintained with minimal overt reference (Clancy, 1980; Noguchi, 1997). In addition, person reference in Japanese is guided by discourse-pragmatic factors such as topic structure and politeness, which may further limit use of overt pronouns (Ide, 1989; Kuno, 1973). These characteristics may also explain the reduced use of overt pronouns observed in L2 learners here. Nevertheless, this study did not include a direct comparison group (e.g., L1 Japanese speakers or learners with a different L1), and the explanation of cross-linguistic influence is thus inferential, based on prior literature. Future studies including appropriate comparison groups are warranted to more directly examine L1 transfer effects.

Regarding grammatical role, both L1 speakers and L2 learners pronominalized previous subjects more often than objects. This replicates the robust grammatical role effect reported in prior studies (Arnold, 2001; Stevenson et al., 1994). The particularly low rate of object pronominalization may reflect the lower discourse prominence of object referents, which are less strongly maintained and thus more likely to be expressed with explicit forms (names) to ensure successful reference. This finding meshes with structural accounts of referential production, in which subjecthood correlates with discourse prominence and in turn greater use of reduced forms (Grosz et al., 1995; Kehler et al., 2008; Rohde & Kehler, 2014).

Most importantly, IC-based predictability affected referential form choice asymmetrically. When continuations re-mentioned previous objects, pronoun use was reduced, and thus name use was increased after subject-biasing IC verbs (*Mary annoyed Lisa because Lisa*…) compared to the non-IC baseline (*Mary saw Lisa because she*…), whereas no corresponding pronominalization increase was observed in the IC-object-biasing context, a finding that held for both L1 speakers and L2 learners. Furthermore, IC bias did not affect subject references, likely because subject pronominalization was already high, leaving little room for IC to come into play (Bott & Solstad, 2023; Weatherford & Arnold, 2021). Crucially, the Bayesian analyses confirmed these key effects, suggesting that the results are robust and unlikely to be driven by data imbalance.

These results converge to provide partial support for predictability accounts of referential production: Participants used a more explicit form (name) for less expected referents but did not increase a reduced form (pronoun) for more expected ones. This pattern is consistent with Bott and Solstad's (2023) results, where predictability effects emerged primarily as increased name use for unexpected referents. It is also consistent with recent findings that the use of referential expressions in bilingual or heritage speakers is not uniformly shifted toward either more or less explicit forms but varies across conditions and contexts, resulting in form-specific or asymmetric patterns (Liu et al., 2025; Pashkova & Allen, 2025; Zou & Yang, 2026). Combined, these findings suggest that predictability

https://doi.org/10.1017/S1366728926101825 Published online by Cambridge University Press

may be more readily reflected in increased use of explicit forms than in reduced forms.

The form-specific predictability effects may further relate to overspecification, whereby speakers increase explicitness under uncertainty (Koolen et al., 2011; Rubio-Fernández, 2016). Here, the observed increase in name use may relate to speakers' uncertainty about whether a reduced form (pronoun) would be successfully interpreted. This interpretation suggests that predictability effects in referential production may, in part, reflect broader communicative strategies for managing uncertainty.

One explanation is that referring to an unexpected entity involves overriding the default prominence assigned by the bias. When producing a continuation referring to a bias-incongruent referent, speakers must foreground a less-prominent referent at the expense of the more prominent, bias-congruent one. This reconfiguration may prompt speakers to more carefully select referential forms and, in turn, encourage explicit forms (names in English) to signal the unexpected entity. Consider, for example, *Mary annoyed Lisa because…* At the point of comprehending this context, the IC-subject bias, coupled with the explanation relation signaled by *because*, makes *Mary* the likely next mention, rendering *Mary* more prominent than *Lisa*. To continue about *Lisa* against this expectation, speakers must suppress the activation of *Mary* and elevate *Lisa*; in doing so, they may be more likely to select a name than a pronoun to overtly mark this shift.

By contrast, when referring to a bias-congruent referent, speakers proceed in line with the initial expectation, with no need to boost a less-prominent referent. Consequently, there may be less pressure to monitor referential form choice. Note that the present study employed an offline production task. Therefore, it does not provide direct evidence regarding monitoring processes or processing costs. This account should hence be considered tentative.

A remaining question is why the present continuation task without contextual support or interaction detected predictability effects (albeit partial). One possible explanation is the inclusion of the connective *because* in the experimental items. By making an upcoming explanation relation explicit, *because* may have directed participants' attention to causal relations between event participants and facilitated the use of IC-based predictability in production. Support for this account is provided by the strong IC effects on referent choice: Both L1 speakers and L2 learners preferentially produced IC-bias-congruent continuations. Although the effect of IC-subject bias was weaker for L2 learners than for L1 speakers, learners still produced subject references at 90% after subject-biasing verbs (vs. 96% for L1 speakers), which is higher than the 70–80% range reported in prior L2 studies (e.g., Cheng & Almor, 2017; Hosoda, 2021). This fact suggests that the explanation relation was activated sufficiently strongly to yield 90% or more selection of the causally implicated entity across groups. A comparison with Fukumura and van Gompel (2010), which did not observe IC-based predictability effects with *because*, is discussed in Appendix C.

The relatively high error rate for subject-biasing verbs also suggests that IC-based predictability might not be equally reliable across verb types for L2 learners. In this sense, subject-biasing verbs might provide a weaker predictive cue than object-biasing verbs. At the same time, the observed predictability effects in bias-incongruent object references indicate that even relatively weak predictability can, at least partially, influence referential form choice, further supporting its role in referential production.

Together, these findings suggest that IC-based predictability influences L2 learners' referential form choice, specifically when they refer to unexpected objects. Given the scarcity of work on predictability in L2 referential production, these findings provide rare evidence showing that L2 learners do use predictability—beyond grammatical role—when selecting a referential expression.

5.2. Implications for theoretical accounts of L2 referential production

The present findings indicate broadly similar referential patterns for L1 and L2 speakers. In both groups, grammatical role is a dominant cue, whereas IC-based predictability exerts more limited effects, both in scope (primarily affecting object references) and form (promoting name use for unexpected referents yet not increasing pronoun use for more expected ones).

The absence of group differences in predictability effects is more readily compatible with the memory-interference model (Cunnings, 2017; Cunnings et al., 2017), which posits that L2 processing is unsuccessful when cue retrieval is demanding (e.g., when cues are weak, in competition or insufficiently supported by context), than with the Interface Hypothesis, which would predict attenuated IC-based predictability effects in L2 production. The present results suggest that the phenomena at the syntax–discourse interface are not uniformly vulnerable in L2 processing. Rather, attenuation is likely task- or context-dependent.

One important factor plausibly responsible for the present findings is the offline nature of the task. This may have reduced time pressure and afforded additional planning, allowing participants to reflect on the preceding context (see Grüter et al., 2017, for discussion of offline tasks). Furthermore, in the present design, grammatical role functioned as a readily accessible cue (evidenced by the strong subject-pronoun preference across groups), and IC generated strong next-mention expectations (as reflected in the high rate of IC-bias-congruent continuations). Because both cues were retrievable at production, both groups showed similar overall patterns. This also explains the selective predictability effects on increased name use for bias-incongruent object references: When speakers must override a default next-mention expectation, they appear to be more cautious in selecting referential forms and recruit explicit forms to signal a discourse shift, a strategy available to both L1 and L2 speakers when IC yields robust expectations and the time pressure is modest, as in this study.

Importantly, these task characteristics also bear on the theoretical implication of the findings. Because the task involved explicit cues and relatively low processing demands, both the Interface Hypothesis and the memory-interference model can, in principle, predict similar patterns of performance. At the same time, the present findings may be more readily accommodated by the memory-interference model under such conditions, as, under this model, predictability effects are expected to emerge when relevant cues are explicit and retrieval demands are relatively low. The results should therefore be interpreted as evidence for how grammatical role and IC-based predictability influence referential choice under these conditions, rather than as a decisive test between the accounts.

This account yields clear, testable predictions. If non-L1-like patterns reflect memory retrieval limitations, then L1–L2 differences should widen when (a) similarity-based interference is increased (e.g., adding more feature-matching competitors in the prior context; Contemori & Ivanova, 2021; Contemori et al., 2024), (b) time pressure is increased (speeded production, early time windows in eye-tracking; Cunnings et al., 2017) and (c) the cue is weaker (e.g., replacing *because* with other connectives that counter

https://doi.org/10.1017/S1366728926101825 Published online by Cambridge University Press

the explanation relation [e.g., *and*, *although*] or using verbs with weaker IC bias, Ferstl et al., 2011; Hartshorne & Snedeker, 2013). Testing these predictions is an important direction for future research. Conversely, when cues are strong and planning time is ample, L1 and L2 performance should converge, with predictability effects likely concentrating on explicit forms (e.g., names) rather than reduced forms (e.g., pronoun). Overall, the present findings are broadly compatible with a graded, memory-interference account, in that L2 speakers can use predictability to select referential forms when processing demands are low and cues are explicit and reliable. The consistency of these effects appears to depend on cue reliability, (cross-linguistic) interference and time.

5.3. Limitations

The primary limitation of this study concerns the task design. The study employed an offline story continuation task without time pressure and used same-gender referent pairs. The findings therefore cannot rule out more subtle L1–L2 processing differences that may emerge under greater time pressure or in online measures, nor can they inform how gender, a strong cue in natural discourse, may influence referential production. The findings may thus reflect a constrained version of the referential system. In addition, the context sentences consistently included *because*, which strongly cues an upcoming explanation relation and may facilitate predictability effects. This factor should be considered when interpreting the present findings.

Testing conditions also differed across groups: L2 participants were tested in person, whereas L1 participants completed a web-based task. Although prior research suggests that web-based and lab-based experiments yield largely comparable results (Gastmann et al., 2026), such differences may introduce variability in attention, fatigue or writing style. Future research that systematically controls testing conditions across groups is warranted.

Some data limitations should also be noted. Bias-incongruent continuations were infrequent, resulting in fewer observations in some conditions. Research using a forced-reference task would provide more balanced observations across conditions. Additionally, a non-negligible number of trials were excluded from the L2 data. Crucially, excluded responses may reflect cases where mapping verb semantics onto referential choice was particularly difficult for L2 learners. If so, the present analysis may underestimate L1–L2 differences. Because this study used an offline task, it cannot determine whether such difficulties directly influenced referential production. Future research using online measures (e.g., eye-tracking, ERP) will be important for examining item-level variation in processing difficulty.

Furthermore, the observed referential forms in the present data consisted of pronouns and proper names, with no other referential expressions (e.g., descriptive noun phrases). Although the binary coding here reflects the data distribution, it may limit the generalizability of the findings, as it does not capture the full range of referential strategies that speakers may employ. Research examining a broader set of referential forms would be valuable.

Finally, the relatively broad proficiency range of the L2 group (CEFR A2–B2) may have introduced additional variability, particularly in the quality of lexical representations of IC verbs. While this reflects the heterogeneity typical of university EFL populations and enhances ecological validity, future research would benefit from more tightly controlled proficiency groups.

6. Conclusion

The present study investigated how grammatical role and predictability influence L2 learners' referential form choice. Grammatical role consistently affected referential production in both L1 speakers and L2 learners. By contrast, IC-based predictability influenced referential form choice only for object references, specifically increasing name use when the object was unexpected given IC bias. Additionally, L2 learners produced fewer pronouns overall than L1 speakers, consistent with cross-linguistic influence from the low frequency and distinct properties of Japanese overt pronouns.

These findings provide new evidence that L2 learners can use predictability in referential production, with effects emerging specifically as increased use of explicit forms (names) for unexpected objects. They further suggest broadly similar referential patterns across groups, with L1–L2 differences being primarily quantitative rather than qualitative in nature. Overall, the findings are consistent with a graded, memory-interference account: Predictability effects emerge when cues are accessible and retrieval demands are modest.

Data availability statement. All materials, data, analysis code and statistical results are available at https://osf.io/dshqr/.

Funding statement. This study was supported by JSPS KAKENHI Grant-in-Aid for Early-Career Scientists (Grant No. 24K16137).

Competing interests. The author declares none.

References

Arnold, J. E. (2001). The effect of thematic roles on pronoun use and frequency of reference continuation. *Discourse Processes*, **31**(2), 137–162. https://doi.org/10.1207/S15326950DP3102_02

Arnold, J. E. (2008). Reference production: Production-internal and addressee-oriented processes. *Language and Cognitive Processes*, **23**(4), 495–527. https://doi.org/10.1080/01690960801920099

Barr, D. J., **Levy, R.**, **Scheepers, C.**, & **Tily, H. J.** (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language*, **68**(3), 255–278. https://doi.org/10.1016/j.jml.2012.11.001

Bates, D., **Maechler, M.**, **Bolker, B.**, & **Walker, S.** (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, **67**(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Belletti, A., **Bennati, E.**, & **Sorace, A.** (2007). Theoretical and developmental issues in the syntax of subjects: Evidence from near-native Italian. *Natural Language & Linguistic Theory*, **25**(4), 657–689. https://doi.org/10.1007/s11049-007-9026-9

Bott, O., & **Solstad, T.** (2023). The production of referring expressions is influenced by the likelihood of next mention. *Quarterly Journal of Experimental Psychology*, **76**(10), 2256–2284. https://doi.org/10.1177/17470218231157268

Cheng, W., & **Almor, A.** (2017). The effect of implicit causality and consequentiality on nonnative pronoun resolution. *Applied Psycholinguistics*, **38**(1), 1–26. https://doi.org/10.1017/S0142716416000035

Cheng, W., & **Almor, A.** (2019). A Bayesian approach to establishing coreference in second language discourse: Evidence from implicit causality and consequentiality verbs. *Bilingualism: Language and Cognition*, **22**(3), 456–475. https://doi.org/10.1017/S136672891800055X

Clancy, P. M. (1980). Referential choice in English and Japanese narrative discourse. In W. L. Chafe (Ed.), *The pear stories: Cognitive, cultural, and linguistic aspects of narrative production* (pp. 127–202). Ablex.

Contemori, C., **Asiri, O.**, & **Perea Irigoyen, E. D.** (2019). Anaphora resolution in L2 English: An analysis of discourse complexity and cross-linguistic interference. *Studies in Second Language Acquisition*, **41**(5), 971–998. https://doi.org/10.1017/S0272263119000111

Contemori, C., & **Dussias, P. E.** (2016). Referential choice in a second language: Evidence for a listener-oriented approach. *Language, Cognition and Neuroscience*, **31**(10), 1257–1272. https://doi.org/10.1080/23273798.2016.1220604

Contemori, C., & **Ivanova, I.** (2021). Bilingual referential choice in cognitively demanding situations. *Bilingualism: Language and Cognition*, **24**(1), 83–95. https://doi.org/10.1017/S1366728920000176

Contemori, C., **Tsuboi, N.**, & **Armendariz Galaviz, A. L.** (2024). Referential choice in two languages: The role of language dominance. *International Journal of Bilingualism*, **28**(3), 494–512. https://doi.org/10.1177/13670069231170545

Cunnings, I. (2017). Interference in native and non-native sentence processing. *Bilingualism: Language and Cognition*, **20**(4), 712–721. https://doi.org/10.1017/S1366728916001243

Cunnings, I., **Fotiadou, G.**, & **Tsimpli, I. M.** (2017). Anaphora resolution and reanalysis during L2 sentence processing: Evidence from the visual world paradigm. *Studies in Second Language Acquisition*, **39**(4), 621–652. https://doi.org/10.1017/S0272263116000292

Cunnings, I., & **Sturt, P.** (2018). Retrieval interference and semantic integration in sentence processing. *Journal of Memory and Language*, **102**, 16–27. https://doi.org/10.1016/j.jml.2018.05.001

Demberg, V., **Kravtchenko, E.**, & **Loy, J. E.** (2023). A systematic evaluation of factors affecting referring expression choice in passage completion tasks. *Journal of Memory and Language*, **130**, 104413. https://doi.org/10.1016/j.jml.2023.104413

Engelhardt, P. E., **Bailey, K. G. D.**, & **Ferreira, F.** (2006). Do speakers and listeners observe the Gricean maxim of quantity? *Journal of Memory and Language*, **54**(4), 554–573. https://doi.org/10.1016/j.jml.2005.12.009

Ferstl, E. C., **Garnham, A.**, & **Manouilidou, C.** (2011). Implicit causality bias in English: A corpus of 300 verbs. *Behavior Research Methods*, **43**(1), 124–135. https://doi.org/10.3758/s13428-010-0023-2

Fukumura, K., & **van Gompel, R. P. G.** (2010). Choosing anaphoric expressions: Do people take into account likelihood of reference? *Journal of Memory and Language*, **62**(1), 52–66. https://doi.org/10.1016/j.jml.2009.09.001

Garvey, C., & **Caramazza, A.** (1974). Implicit causality in verbs. *Journal of Verbal Learning and Verbal Behavior*, **13**(2), 170–180. https://doi.org/10.1016/S0022-5371(74)80062-9

Gastmann, F., **Schimke, S.**, & **Poarch, G. J.** (2026). Conducting psycholinguistic research online: Comparable evidence of second language lexical and sentence-level processing in web-based versus lab-based studies. *Bilingualism: Language and Cognition*, **29**(3), 615–628. https://doi.org/10.1017/S136672892510028X

Gelman, A., **Carlin, J. B.**, **Stern, H. S.**, **Dunson, D. B.**, **Vehtari, A.**, & **Rubin, D. B.** (2013). *Bayesian data analysis* (3rd ed.). CRC Press.

Grosz, B. J., **Joshi, A. K.**, & **Weinstein, S.** (1995). Centering: A framework for modeling the local coherence of discourse. *Computational Linguistics*, **21**(2), 203–225.

Grüter, T., **Rohde, H.**, & **Schafer, A. J.** (2017). Coreference and discourse coherence in L2: The roles of grammatical aspect and referential form. *Linguistic Approaches to Bilingualism*, **7**(2), 199–229. https://doi.org/10.1075/lab.15011.gru

Gundel, J. K., **Hedberg, N.**, & **Zacharski, R.** (1993). Cognitive status and the form of referring expressions in discourse. *Language*, **69**(2), 274–307. https://doi.org/10.2307/416535

Hartshorne, J. K., & **Snedeker, J.** (2013). Verb argument structure predicts implicit causality: The advantages of finer-grained semantics. *Language and Cognitive Processes*, **28**(10), 1474–1508. https://doi.org/10.1080/01690965.2012.689305

Hendriks, P., **Koster, C.**, & **Hoeks, J. C. J.** (2014). Referential choice across the lifespan: Why children and elderly adults produce ambiguous pronouns. *Language, Cognition and Neuroscience*, **29**(4), 391–407. https://doi.org/10.1080/01690965.2013.766356

Hijikata, Y. (2021). The time course of the effects of implicit causality bias on anaphora resolution by Japanese learners of English. *Annual Review of English Language Education in Japan: ARELE*, **32**, 1–16. https://doi.org/10.20581/arele.32.0_1

Hoffman, M. D., & **Gelman, A.** (2014). The No-U-Turn sampler: Adaptively setting path lengths in Hamiltonian Monte Carlo. *Journal of Machine Learning Research*, **15**, 1593–1623.

Hosoda, M. (2021). Proactive use of verbs' implicit causality bias for making predictions in Japanese EFL learners. *Annual Review of English Language Education in Japan: ARELE*, **32**, 17–32. https://doi.org/10.20581/arele.32.0_17

Hosoda, M. (2025a). Implicit causality verbs in high school English textbooks: A corpus-based study focusing on verb biases and forms. *JASELE Journal*, **36**, 145–160. https://doi.org/10.20581/jaselejournal.36.0_145

Hosoda, M. (2025b). Verbs' implicit causality in coreference and coherence processing during L2 comprehension. *Frontiers in Language Sciences*, **4**, 1494500. https://doi.org/10.3389/flang.2025.1494500

Hosoda, M. (2026). Mechanism of implicit causality in L2 comprehension: Testing the empty-slot theory through coreference and coherence biases. *Second Language Research*. Advance online publication. https://doi.org/10.1177/02676583261438627

Hwang, H., **Lam, S. Y.**, **Ni, W.**, & **Ren, H.** (2022). The role of grammatical role and thematic role predictability in reference form production in Mandarin Chinese. *Frontiers in Psychology*, **13**, 930572. https://doi.org/10.3389/fpsyg.2022.930572

Ide, S. (1989). Formal forms and discernment: Two neglected aspects of universals of linguistic politeness. *Multilingua*, **8**(2–3), 223–248. https://doi.org/10.1515/mult.1989.8.2-3.223

JACET Basic Word Revision Committee. (2016). *The new JACET list of 8000 basic words*. Kirihara Shoten.

Kanno, K. (1997). The acquisition of null and overt pronominals in Japanese by English speakers. *Second Language Research*, **13**(3), 265–287. https://doi.org/10.1191/026765897673070746

Kehler, A., **Kertz, L.**, **Rohde, H.**, & **Elman, J. L.** (2008). Coherence and coreference revisited. *Journal of Semantics*, **25**(1), 1–44. https://doi.org/10.1093/jos/ffm018

Kim, H., & **Chun, E.** (2023). Effects of topicality in the interpretation of implicit consequentiality: Evidence from offline and online referential processing in Korean. *Linguistics*, **61**(1), 77–105. https://doi.org/10.1515/ling-2020-0197

Kim, H., & **Grüter, T.** (2019). Cross-linguistic activation of implicit causality biases in Korean learners of English. *Bilingualism: Language and Cognition*, **22**(3), 441–455. https://doi.org/10.1017/S1366728918000561

Koolen, R., **Gatt, A.**, **Goudbeek, M.**, & **Krahmer, E.** (2011). Factors causing overspecification in definite descriptions. *Journal of Pragmatics*, **43**(13), 3231–3250. https://doi.org/10.1016/j.pragma.2011.06.008

Kuno, S. (1973). *The structure of the Japanese language*. MIT Press.

Lam, S. Y., & **Hwang, H.** (2022). How does topicality affect the choice of referential form? Evidence from Mandarin. *Cognitive Science*, **46**(1010), e13190. https://doi.org/10.1111/cogs.13190

Lenth, R. (2024). *emmeans: Estimated marginal means, aka least-squares means* (Version 1.10.6) [R package]. Comprehensive R Archive Network (CRAN). https://CRAN.R-project.org/package=emmeans

Lindemann, S., & **Ariel, M.** (2024). Accessibility theory in linguistics. In M. Aronoff (Ed.), *Oxford bibliographies in linguistics*. Oxford University Press. https://doi.org/10.1093/OBO/9780199772810-0319

Liu, Y., **Sorace, A.**, & **Smith, K.** (2025). Mandarin speakers undergoing attrition produce more explicit referring expressions. *Bilingualism: Language and Cognition*, Advance online publication. https://doi.org/10.1017/S1366728925100655

Miyao, M. (2018). *The processing of referential expressions in discourse by Chinese, English, and Japanese native speakers and by Chinese and Japanese learners of English* [Unpublished doctoral dissertation]. University of Hawai'i at Mānoa.

Nakahama, Y. (2009). Cross-linguistic influence on referent introduction and tracking in Japanese as a second language. *The Modern Language Journal*, **93**(2), 241–260. https://doi.org/10.1111/j.1540-4781.2009.00859.x

Noguchi, T. (1997). Two types of pronouns and variable binding. *Language*, **73**(4), 770–797. https://doi.org/10.2307/417326

Pashkova, T., & **Allen, S. E. M.** (2025). Explicitness of referring expressions in heritage speakers' majority English. *Lingua*, **314**, 103854. https://doi.org/10.1016/j.lingua.2024.103854

Quesada, T., & **Lozano, C.** (2020). Which factors determine the choice of referential expressions in L2 English discourse? New evidence from the COREFL corpus. *Studies in Second Language Acquisition*, **42**(5), 959–986. https://doi.org/10.1017/S0272263120000224

Rohde, H. (2008). *Coherence-driven effects in sentence and discourse processing* [Unpublished doctoral dissertation]. University of California, San Diego.

https://doi.org/10.1017/S1366728926101825 Published online by Cambridge University Press

Rohde, H., & **Kehler, A.** (2014). Grammatical and information-structural influences on pronoun production. *Language, Cognition and Neuroscience*, **29**(8), 912–927. https://doi.org/10.1080/01690965.2013.854918

Rosa, E. C., & **Arnold, J. E.** (2017). Predictability affects production: Thematic roles can affect reference form selection. *Journal of Memory and Language*, **94**, 43–60. https://doi.org/10.1016/j.jml.2016.07.007

Rubio-Fernández, P. (2016). How redundant are redundant color adjectives? An efficiency-based analysis of color overspecification. *Frontiers in Psychology*, **7**, 153. https://doi.org/10.3389/fpsyg.2016.00153

Shoji, S., **Dubinsky, S.**, & **Almor, A.** (2017). The repeated name penalty, the overt pronoun penalty, and topic in Japanese. *Journal of Psycholinguistic Research*, **46**(1), 89–106. https://doi.org/10.1007/s10936-016-9424-4

Solstad, T., & **Bott, O.** (2022). On the nature of implicit causality and consequentiality: The case of psychological verbs. *Language, Cognition and Neuroscience*, **37**(10), 1311–1340. https://doi.org/10.1080/23273798.2022.2069277

Sorace, A. (2011). Pinning down the concept of "interface" in bilingualism. *Linguistic Approaches to Bilingualism*, **1**(1), 1–33. https://doi.org/10.1075/lab.1.1.01sor

Stevenson, R. J., **Crawley, R. A.**, & **Kleinman, D.** (1994). Thematic roles, focus, and the representation of events. *Language and Cognitive Processes*, **9**(4), 519–548. https://doi.org/10.1080/01690969408402130

Ueno, M., & **Kehler, A.** (2016). Grammatical and pragmatic factors in the interpretation of Japanese null and overt pronouns. *Linguistics*, **54**(6), 1165–1221. https://doi.org/10.1515/ling-2016-0027

Vogels, J. (2019). Both thematic role and next-mention biases affect pronoun use in Dutch. In A. K. Goel, C. M. Seifert, & C. Freksa (Eds.), *Proceedings of the 41st Annual Conference of the Cognitive Science Society* (pp. 3029–3035). Cognitive Science Society. https://research.rug.nl/files/1272736593/0509.pdf

Weatherford, K. C., & **Arnold, J. E.** (2021). Semantic predictability of implicit causality can affect referential form choice. *Cognition*, **214**, 104759. https://doi.org/10.1016/j.cognition.2021.104759

Ye, Y., & **Arnold, J. E.** (2025). Implicit causality can affect pronoun use in fragment completion tasks. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, **51**(10), 1623–1641. https://doi.org/10.1037/xlm0001435

Zou, Y., & **Yang, Y.** (2026). Bilinguals show reduced sensitivity to audience-related considerations in language production: Corpus evidence from Mandarin referring expressions. *Linguistics Vanguard*, Advance online publication. https://doi.org/10.1515/lingvan-2025-0014

A. Appendix A: Direct comparison of subject- and object-biasing IC verbs in referential form choice

Additional analyses were conducted to directly compare subject- and object-biasing IC verbs, excluding non-IC verbs. A mixed-effects logistic regression model with the same fixed- and random-effects structure as in the main analysis was fit to the subset of IC data. The results revealed a pattern consistent with the main findings: A significant IC Bias × Grammatical Role interaction was observed ($\beta = -0.60$, $SE = 0.21$, $z = -2.91$, $p = .004$), indicating that IC-based predictability effects differed across referential positions.

Follow-up analyses using the emmeans function showed that predictability effects were specific to object references: Pronominalization for object references was lower in the bias-incongruent (subject-biasing) context than in the bias-congruent (object-biasing) context ($\beta = -1.59$, $SE = 0.55$, $z = -2.88$, $p = .004$), whereas no significant difference was observed for subject references ($\beta = 0.82$, $SE = 0.72$, $z = 1.15$, $p = .252$).

The Bayesian analysis showed a similar pattern for the IC Bias × Grammatical Role interaction (estimate = −0.40, 95% CrI [−0.81, 0.03]), although the 95% credible interval slightly overlapped zero. These results converge with the analyses reported in the main document, demonstrating that the observed selective predictability effects (i.e., effects were limited to object references) do not depend on the inclusion of non-IC verbs as a baseline. Full model outputs and pairwise contrasts are reported in Tables A1–A4.

Table A1. Logistic regression results for referential form choice (IC verbs only)

Fixed effect	*β*	*SE*	*z*	*p*
Intercept	1.94	0.32	6.07	< .001***
IC bias	−0.19	0.24	−0.79	.429
Group	−1.11	0.28	−3.91	< .001***
Grammatical role	−1.72	0.28	−6.23	< .001***
IC bias × group	−0.19	0.21	−0.93	.351
IC bias × grammatical role	−0.60	0.21	−2.91	.004**
Group × grammatical role	−0.36	0.24	−1.54	.124
IC bias × group × grammatical role	0.29	0.19	1.49	.136

Note: **p < .01, ***p < .001. Formula: Referential form ~ IC bias * group * grammatical role + (1 + IC bias + grammatical role | participant) + (1 | item).

Table A2. Results of contrasts (emmeans) for IC bias × grammatical role interaction for referential form choice (IC verbs only)

Contrast	*β*	*SE*	*z*	*p*
Object reference: IC-subject vs. IC-object bias	−1.59	0.55	−2.88	.004**
Subject reference: IC-subject vs. IC-object bias	0.82	0.72	1.15	.252

Note: **p < .01.

Table A3. Results of contrasts (emmeans) for grammatical role within IC conditions for referential form choice (IC verbs only)

Contrast	*β*	*SE*	*z*	*p*
IC-subject bias: Object vs. subject reference	−4.64	0.68	−6.88	< .001***
IC-object bias: Object vs. subject reference	−2.23	0.71	−3.16	.002**

Note: **p < .01, ***p < .001.

Table A4. Bayesian logistic regression results for referential form choice (IC verbs only)

Fixed effect	Estimate	Est. Error	95% CrI
Intercept	2.17	0.33	[1.55, 2.86]
IC bias	−0.42	0.24	[−0.90, 0.04]
Group	−1.07	0.29	[−1.66, −0.50]
Grammatical role	−1.97	0.27	[−2.53, −1.48]
IC bias × group	−0.12	0.21	[−0.55, 0.28]
IC bias × grammatical role	−0.40	0.21	[−0.81, 0.03]
Group × grammatical role	−0.29	0.24	[−0.77, 0.16]
IC bias × group × grammatical role	0.32	0.20	[−0.09, 0.70]

Note: Estimates are on the log-odds scale. CrI = credible interval. The reference level for IC Bias is IC-subject bias.

https://doi.org/10.1017/S1366728926101825 Published online by Cambridge University Press

B. Appendix B: Statistical results for referent choice and referential form choice

B.1. Referent choice (subject vs. object)

Table B1. Logistic regression results for referent choice (subject vs. object)

Fixed effect	β	SE	z	p
(Intercept)	0.89	0.20	4.34	< .001***
IC bias (subject)	2.36	0.40	5.90	< .001***
IC bias (object)	−4.05	0.39	−10.31	< .001***
Group	−0.14	0.13	−1.08	.278
IC bias (subject) × group	−0.54	0.25	−2.16	.031*
IC bias (object) × group	0.35	0.25	1.37	.170

Note: *p < .05, ***p < .001. Reference Level = IC Bias (non-IC). Formula: Referent choice ~ IC bias*group + (1+ IC bias|participant) + (1 + group|item).

Table B2. Results of contrasts (emmeans) on the IC bias (subject) × group interaction for referent choice

Contrast	β	SE	z	p
L1: IC-subject bias vs. non-IC	2.90	0.50	5.80	< .001***
L1: IC-object bias vs. non-IC	−4.40	0.47	−9.33	< .001***
L1: IC-subject vs. IC-object bias	7.29	0.63	11.51	< .001***
L2: IC-subject bias vs. non-IC	1.82	0.44	4.13	< .001***
L2: IC-object bias vs. non-IC	−3.70	0.46	−8.01	< .001***
L2: IC-subject vs. IC-object bias	5.53	0.57	9.68	< .001***
Non-IC: L2 vs. L1	−0.29	0.27	−1.08	.278
IC-subject bias: L2 vs. L1	−1.36	0.46	−2.95	.003**
IC-object bias: L2 vs. L1	0.40	0.47	0.86	.391

Note: **p < .01, ***p < .001.

Table B3. Bayesian logistic regression results for referent choice (subject vs. object)

Fixed effect	Estimate	Est. Error	95% CrI
Intercept	0.87	0.22	[0.43, 1.33]
IC bias (IC-subject bias vs. non-IC)	2.30	0.42	[1.47, 3.12]
IC bias (IC-object bias vs. non-IC)	−3.86	0.41	[−4.67, −3.06]
Group	−0.14	0.14	[−0.42, 0.14]
IC bias (IC-subject bias) × group	−0.55	0.26	[−1.07, −0.05]
IC bias (IC-object bias) × group	0.35	0.26	[−0.16, 0.86]

Note: Estimates are on the log-odds scale. CrI, credible interval. The reference level for IC bias is non-IC.

Table B4. Results of Bayesian pairwise contrasts for referent choice

Contrast	Estimate	95% CrI
L1: IC-subject bias vs. non-IC	2.83	[1.84, 3.87]
L1: IC-object bias vs. non-IC	−4.20	[−5.20, −3.27]
L1: IC-subject vs. IC-object bias	7.04	[5.82, 8.36]
L2: IC-subject bias vs. non-IC	1.75	[0.82, 2.66]
L2: IC-object Bias vs. non-IC	−3.52	[−4.45, −2.58]
L2: IC-subject vs. IC-object bias	5.26	[4.10, 6.48]
Non-IC: L2 vs. L1	−0.28	[−0.83, 0.27]
IC-subject bias: L2 vs. L1	−1.36	[−2.33, −0.45]
IC-object bias: L2 vs. L1	0.41	[−0.56, 1.39]

Note: Estimates are on the log-odds scale. CrI, credible interval.

B.2. Referential form choice (name vs. pronoun)

Table B5. Logistic regression results for referential form choice (name vs. pronoun)

Fixed effect	β	SE	z	p
(Intercept)	2.36	0.28	8.40	< .001***
IC bias (subject)	−0.81	0.34	−2.36	.018*
IC bias (object)	−0.06	0.35	−0.16	.871
Group	−1.46	0.25	−5.72	< .001***
Grammatical role	−1.64	0.21	−7.88	< .001***
IC bias (subject) × group	0.33	0.28	1.18	.239
IC bias (object) × group	0.38	0.32	1.18	.237
IC bias (subject) × grammatical role	−0.92	0.32	−2.92	.003**
IC bias (object) × grammatical role	0.28	0.32	0.89	.373
Group × grammatical role	0.04	0.18	0.21	.836
IC bias (subject) × group × grammatical role	0.10	0.28	0.37	.711
IC bias (object) × group × grammatical role	−0.48	0.31	−1.55	.121

Note: *p < .05, **p < .01, ***p < .001. Reference level = IC bias (non-IC). Formula: Referential form ~ group*grammatical role*IC bias + (1 + grammatical role + IC bias|participant) + (1 |item).

Table B6. Results of contrasts (emmeans) on the IC bias (subject) × grammatical role interaction for referential form choice

Contrast	β	SE	z	p
Subject reference: IC-subject bias vs. non-IC	0.11	0.43	0.26	.965
Subject reference: IC-object bias vs. non-IC	−0.34	0.63	−0.54	.853
Subject reference: IC-subject vs. IC-object bias	0.45	0.69	0.66	.788
Object reference: IC-subject bias vs. non-IC	−1.73	0.50	−3.49	.001**
Object reference: IC-object bias vs. non-IC	0.23	0.22	1.01	.571
Object reference: IC-subject vs. IC-object bias	−1.96	0.50	−3.90	< .001***
Non-IC: object vs. subject reference	−3.28	0.42	−7.88	< .001***
IC-subject bias: object vs. subject reference	−5.12	0.63	−8.16	< .001***
IC-object bias: object vs. subject reference	−2.72	0.65	−4.18	< .001***

Note: **p < .01, ***p < .001.

https://doi.org/10.1017/S1366728926101825 Published online by Cambridge University Press

Table B7. Bayesian logistic regression results for referential form choice

Fixed effect	Estimate	Est. Error	95% CrI
Intercept	2.37	0.28	[1.84, 2.96]
IC bias (subject vs. non-IC)	−0.72	0.32	[−1.33, −0.08]
IC bias (object vs. non-IC)	0.15	0.35	[−0.52, 0.86]
Group	−1.41	0.25	[−1.92, −0.92]
Grammatical role	−1.67	0.20	[−2.07, −1.29]
IC bias (subject) × group	0.30	0.28	[−0.24, 0.84]
IC bias (object) × group	0.26	0.32	[−0.39, 0.89]
IC bias (subject) × grammatical role	−0.89	0.29	[−1.47, −0.35]
IC bias (object) × grammatical role	0.11	0.32	[−0.52, 0.69]
Group × grammatical role	0.07	0.18	[−0.27, 0.42]
IC bias (subject) × group × grammatical role	0.08	0.27	[−0.45, 0.60]
IC bias (object) × group × grammatical role	−0.46	0.32	[−1.07, 0.17]

Note: Estimates are on the log-odds scale. CrI, credible interval. The reference level for IC Bias is non-IC.

Table B8. Bayesian pairwise contrasts for referential form choice (subject references)

Contrast	Estimate	95% CrI
L1: IC-subject bias vs. non-IC	−0.38	[−1.09, 0.22]
L1: IC-object bias vs. non-IC	−0.74	[−2.36, 0.58]
L1: IC-subject vs. IC-object bias	0.35	[−1.08, 2.01]
L2: IC-subject bias vs. non-IC	0.05	[−1.09, 1.12]
L2: IC-object bias vs. non-IC	0.72	[−1.39, 2.51]
L2: IC-subject vs. IC-object bias	−0.67	[−2.56, 1.51]

Note: Estimates are on the log-odds scale. CrI, credible interval.

Table B9. Bayesian pairwise contrasts for referential form choice (object references)

Contrast	Estimate	95% CrI
L1: IC-subject bias vs. non-IC	−1.21	[−2.40, −0.17]
L1: IC-object bias vs. non-IC	0.06	[−0.50, 0.63]
L1: IC-subject vs. IC-object bias	−1.27	[−2.51, −0.21]
L2: IC-subject bias vs. non-IC	−1.99	[−3.50, −0.52]
L2: IC-object bias vs. non-IC	0.46	[−0.20, 1.10]
L2: IC-subject vs. IC-object bias	−2.45	[−3.95, −0.94]

Note: Estimates are on the log-odds scale. CrI, credible interval.

C. Appendix C: Discussion of differences between Fukumura and van Gompel (2010) and this study

Fukumura and van Gompel (2010) also included *because* in their materials yet did not observe IC-based predictability effects among English speakers. One possible explanation for the difference between the studies relates to how the context is structured. In their design, an IC verb and its arguments were followed by a subordinate temporal clause (e.g., *Gray scared Anna after the long discussion ended in an argument*), which did not elaborate the causal relations. In addition, continuations were elicited with a separate sentence (*This was because…*). Compared to the present materials, this structure is more complex but not causally elaborative, which likely increased the cognitive demands of building a causally coherent mental model. Consistent with this view, their subject-reference rates showed weaker IC bias (76.5% after subject-biasing verbs and 23.1% after object-biasing verbs) than in the present study (94% and 9%, respectively), suggesting that constructing a causal mental model was more demanding in their paradigm.

At the same time, the two studies differ in several aspects of task design that were not controlled (e.g., same- vs. different-gender referents, free- vs. forced-reference tasks). In particular, Fukumura and van Gompel used different-gender referents, which may have made pronoun interpretation more transparent and reduced the need for explicit reference. The present explanation is therefore one possible account rather than a definitive one.

https://doi.org/10.1017/S1366728926101825 Published online by Cambridge University Press