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An Asymmetry in the Spoken Production of Number Agreement in Second Language English: Adjacency or Locality?

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ABSTRACT

In English, subject-verb agreement is deemed to be 'local' if the controller (i.e., the subject) and the target (i.e., the main verb) are adjacent, but 'non-local' if these items are separated by one or more terminal nodes. Previous research indicates that second language English learners whose first languages lack subject-verb agreement tend to supply inflection for this functional category less accurately in non-adjacent than adjacent contexts in spoken production. This asymmetry could be driven by either adjacency or locality, since, for subject-verb agreement at least, these two properties are aligned with each other. Phrase-internal agreement, by contrast, is local regardless of whether the controller (i.e., a determiner or quantifier) and the target (i.e., a noun) are adjacent or non-adjacent; hence, for this type of agreement, adjacency and locality are not aligned with each other. In the present study, we gave a sentence-construction task to 64 native speakers of Vietnamese, a language without inflection for number agreement. Suppliance of inflection was lower in non-adjacent than adjacent contexts phrase-internally, and therefore within the local domain itself. We concluded that what gave rise to the asymmetries in inflectional production in our study, and, by extension, also in previous research on subject-verb agreement, was not the distinction between local and non-local domains, but rather the one between adjacent and non-adjacent contexts for agreement. In so doing, we present a more parsimonious analysis of asymmetries in the spoken production of agreement inflection than the one currently available.

Keywords: second language English; number agreement; spoken production; adjacency; locality

INTRODUCTION

It is well-known that second language (L2) learners of English have difficulty with the spoken suppliance of functional morphology in obligatory environments. Indeed, certain proposed explanations for variability in the production of these morphemes pertain specifically to the oral modality. The Prosodic Transfer Hypothesis (Goad & White, 2004; Goad et al., 2003), in particular, holds that morphological suppliance is constrained by the inventory of prosodic representations that occur in the first language (L1), and which are therefore also assumed to be

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available for redeployment in the L2. Problems with supplying a particular functional morpheme orally are also known to be especially acute if the L1 lacks the relevant functional category. For example, Lardiere (1998) reports that an end-state L1 speaker of Chinese, a language without overt marking for tense, frequently omitted inflection of this type in the L2.

Functional morphology is also known to be omitted at a higher rate in some syntactic environments than others. In this vein, a handful of studies have focused on the production of subject-verb agreement in two contrasting contexts within the same clause: when the controller and target are adjacent (i.e., local agreement), and when they are separated by one or more terminal nodes (i.e., non-local agreement; Hawkins & Casillas, 2008; Ma & Zou, 2018; Tuniyan, 2013). We distinguish between these two situations in (1a) and (1b) using examples adapted from Hawkins and Casillas (2008, pp. 605, 607; intervening nodes in italics).

(1) (a) My brother owns a house.
(b) The brother *of my best friend(s)* owns a house.

In each of the studies cited above, difficulties with inflectional suppliance were greater in the non-adjacent case than the adjacent one, suggesting that the agreement relation in the former case is being disrupted by the presence of the intervening terminal nodes. Note, however, that the adjacent/non-adjacent and local/non-local distinctions are aligned with each other in an example like (1), since, for subject-verb agreement at least, locality is defined in terms of adjacency. In this light, it is unclear which of these two properties actually gives rise to asymmetries in the production of subject-verb agreement inflection, and, by extension, morphological marking for other types of agreement as well. The overriding goal of the present study is to adjudicate between these two possibilities. To this end, we examine the spoken production of inflection for number agreement by Vietnamese learners of English (VLEs).

AGREEMENT INFLECTION IN ADJACENT AND NON-ADJACENT CONTEXTS

In English, an agreement relation can be contracted between the subject and the main verb, or between two items within a phrase (e.g., a determiner and a noun). As far as the former type of agreement is concerned, we know of only three studies that have compared the suppliance of inflection in L2 English in adjacent and non-adjacent contexts. Hawkins and Casillas (2008) investigated ten L1 lower-intermediate speakers of Spanish (which marks subject-verb agreement morphologically) and ten L1 speakers of Chinese (which does not).[2] Tuniyan (2013) built directly on the work of Hawkins and Casillas by adding proficiency as a predictor variable. In her study, ten native Chinese speakers and ten native speakers of Russian (which is another language with overt marking of subject-verb agreement) did the same type of task as in the earlier experiment; however, each L1 group consisted of five lower-intermediate and five upper-intermediate learners. In addition to a main effect of context, Tuniyan found a main effect of proficiency such that the upper-intermediate learners produced inflection more accurately than the lower-intermediates. Ma and Zou (2018) obtained data from 30 L1 speakers of Chinese at intermediate to advanced level. In each of these three studies, participants had to construct a sentence from two fragments presented sequentially: the uninflected form of the verb, followed by the subject determiner phrase

[2] *Even though Spanish is rich in agreement inflection, the two L1 groups in Hawkins and Casillas (2008) performed similarly in terms of inflectional production. For the Spanish group, syntactic transfer of agreement from the L1 was not expected to come into play, as the participants in both L1 groups were low-proficiency learners.*

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(DP). To exemplify, if participants had to produce the sentence in (1a) above, the verb 'own' would be displayed before the subject DP 'my brother' in the experimental task.

As noted in the introduction, the asymmetry in inflectional production reported in Hawkins and Casillas (2008), Tuniyan (2013) and Ma and Zou (2018) can be attributed to either the adjacent/non-adjacent distinction or the local/non-local distinction. This problem would be no more than a matter of nomenclature if it were not for the fact that, in determiner-noun agreement, these two distinctions are *not* aligned with each other. Citing an instance of this type of agreement marking from Wen et al. (2010; i.e., 'these beautiful house*/houses'), Cheng et al. (2022) state: "[number] agreement between a demonstrative and noun can be considered a local dependency within the same phrase" (p. 5). If Wen et al.'s example is categorised as local agreement, this must also be true of a DP *without* the adjective. Thus, within the phrase, number agreement is local regardless of whether the controller and target are adjacent or non-adjacent.

In the current study, our specific objective is to determine if inflection for number agreement (i.e., plural inflection) is supplied less accurately in non-adjacent than adjacent contexts phrase-internally, and therefore within the local domain itself. Number agreement is compared in two structures: in one of these, a noun and a preceding numeral are adjacent (e.g., 'five swans'); in the other, the noun is separated from the numeral by an adjective (e.g., 'two fascinating ducks'). For our purposes, the relevant structures will be treated as quantifier phrases (QPs).[3]

The L1 of interest is Vietnamese. As illustrated in (2), this language lacks inflectional marking for number, plus comparison of (2a) with (2b) shows that there are no other items (e.g., particles) that signal this property in (2b) (CL = classifier).

(2)	(a)	*một*	*con*	*thiên.nga*	(b)	*năm*	*con*	*thiên.nga*
		one	CL	swan		five	CL	swan
		'one swan'				'five swans'		

The following prediction will be tested:

P1. Plural inflection will be supplied at a lower rate in non-adjacent than adjacent contexts.

METHODOLOGY

PARTICIPANTS

Sixty four intermediate VLEs participated in the study (41 female; age range: 18-29; μ [mean] = 21.1; σ [standard deviation] = 2.2). All were university students or recent graduates based in Vietnam. To determine whether a prospective participant was suitable, we assessed her L2 speaking skills directly using criteria loosely adapted from those in the IELTS speaking test (IELTS, n.d.). Three native-speaker controls (all female, and all based in Australia) also did the experimental task: it was important to exclude the possibility that any errors made by the VLEs were due to task effects.

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[3] *In this regard, we follow Cardinaletti and Giusti (2005; see example [65a]). Other analyses of this type of structure are also defensible; see Danon (2012), for instance.*

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MATERIALS AND PROCEDURE

The materials and procedure were based on the approach adopted in Austin et al. (2022). The main targets were eight adjacent QPs and eight non-adjacent QPs. The target QPs in each of these sets were all based on different nouns, plus the same eight nouns were used in both sets. The adjacent targets all had the structure 'numeral + noun', while the non-adjacent targets were all 'numeral + adjective + noun'. The non-adjacent targets all contained different adjectives. In addition to the plural forms of the adjacent and non-adjacent targets, singular counterparts were included as distractors; the numeral was always 'one' in these forms. For the non-adjacent targets, the same eight adjectives were used in the singular targets as the plural targets; however, in the non-adjacent targets of both types, we varied the pairings of adjective and noun (e.g., 'one *amazing cat*' cf. 'ten *cowardly cats*'). The full set of 32 targets is given in Table 1.

TABLE 1. Full set of targets

Adjacent		Non-adjacent	
Singular	*Plural*	*Singular*	*Plural*
one bat	two bats	one interesting bat	nine courageous bats
one cat	nine cats	one amazing cat	ten cowardly cats
one crab	nine crabs	one fascinating crab	ten energetic crabs
one duck	ten ducks	one energetic duck	two fascinating ducks
one frog	two frogs	one cowardly frog	five amazing frogs
one goat	five goats	one annoying goat	nine aggressive goats
one ram	ten rams	one aggressive ram	five annoying rams
one swan	five swans	one courageous swan	two interesting swans

In choosing the target nouns, we sought to minimise the likelihood of problems with pronunciation or word recognition. Low-frequency nouns were avoided; as a measure of frequency, the values in Davies (2018) were used. The lemmas of the target nouns were orthographically short and monosyllabic (e.g., 'bat', 'frog'). For consistency, the inflected form added either [s] (e.g., 'bat' → 'bats' [bæts]) or [z] (e.g., 'frog' → 'frogs' [fɹɒgz]); that is, none of the singular forms ended in a sibilant (e.g., 'horse' [hɔs] → 'horses' [hɔsəz]). All of the adjectives were three to four syllables long, plus low-frequency adjectives were avoided. We only selected nouns whose referents were animals, as this gave us maximum flexibility when combining each target noun with a semantically compatible adjective in a non-adjacent target (e.g., 'ten energetic crabs' cf. ??'ten energetic books').

Each target was located within its own stimulus sentence. Each sentence consisted of a subject DP, a verb, an object QP (i.e., the target), and a prepositional phrase consisting of 'to' plus a DP. In order to simplify the task, the verb was always 'give(s)'. In (3), we exemplify one of the stimulus sentences; the target is in italics.

(3) The swimmer gives *five interesting swans* to the actor.

Half of the subject DPs were singular and half were plural; therefore, half of the verbs were inflected and half were uninflected. Half of the prepositional-object DPs were inflected and half were uninflected. The singular vs. plural forms of the targets were counterbalanced with each other; the same was done with the singular vs. plural forms of the subject DPs, and with the singular

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vs. plural forms of the prepositional-object DPs. We also included 32 additional sentences in the task,[4] so that the whole task was based on 64 sentences.

The phonological environment for each target was controlled.[5] If we had located the plural inflection in an environment in which it could, in theory, have been resyllabified as the onset of the following word (e.g., 'ducks in' $[\text{dʌk}]_{\text{PWd}}$ $[\text{sɪn}]_{\text{PWd}}$), the suppliance of inflection would have been inflated if resyllabification had actually occurred. For this reason, the inflection was located in an environment in which resyllabification would be extremely unlikely. Note that Vietnamese does not permit consonant clusters beginning with [s] (e.g., [st]) or [z] as syllable onsets. Hence, by locating the inflection immediately before the word 'to', we were able to minimise the likelihood that inflection could be resyllabified as part of an onset (e.g., 'ducks to' $[\text{dʌk}]_{\text{PWd}}$ $[\text{stə}]_{\text{PWd}}$).[6]

In the subject DPs and prepositional-object DPs, we used nouns for occupations ending in '-er' or '-or', plus these DPs had the structure 'the + (adjective +) noun' (e.g., 'the actor', 'the courageous singers'). This approach enabled us to use disyllabic nouns in all of these DPs and, as a result, maintain consistency across task sentences such that each contained nine words and 13 syllables.

As mentioned in Footnote 4, the present task was also used to collect data for other studies. For the purpose of carrying out one of these experiments, we presented every sentence in the task to the participant separately in two forms: via an audio recording and then a written prompt.[7] In (4), we show the written prompt which corresponds to (3).

(4) the swimmer gi___ five interesting swa___ to the actor

A key feature of this prompt is that the coda of the target noun is blanked out using an underscore (_) typed four times. As a distractor, the coda of the verb is modified in the same way.

Also in order to collect data for one of the other studies based on this task, every prompt was presented sequentially to the participant as two sub-prompts, plus the ordering of the information in the sentence was altered. For example, the prompt in (4) above was split into the sub-prompts shown in (5).

(5) to the actor
the swimmer gi ___ five interesting swa___

In order to view the whole prompt, the participant pressed the spacebar; in this respect, the task was self-paced. The first sub-prompt was displayed for 3 seconds; then, after a 0.5-second delay, the second sub-prompt was displayed indefinitely. As soon as the participant saw the second sub-prompt, she constructed the sentence using the sub-prompts.

The task was delivered in the form of a PowerPoint slideshow. For the VLEs, the instructions on the slides were in Vietnamese. All of the participants did the task individually. The slideshow was structured slightly differently for the VLEs and the controls; we will deal with the Vietnamese version first. To start with, each VLE was shown some slides containing an

[4] These additional sentences were included in order to elicit data for two other studies (concerned with other linguistic phenomena). For our immediate purposes, it is sufficient to note that the 32 additional sentences in the task contained equal numbers of counterbalanced singular and plural DPs, and no QPs.
[5] We thank Heather Goad for input on this aspect of the task design.
[6] There were no instances of this type of resyllabification in our VLE data.
[7] Only the latter set of data was relevant to the current study; accordingly, the former set was discarded.

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alphabetically-ordered list of English words from the task which, on account of their frequencies, might have been unfamiliar to her. Each item in this list was accompanied by a Vietnamese translation. As a further attempt to reduce any pronunciation-related difficulties, we also provided an mp3 recording of any word whose pronunciation could not be readily determined from its spelling (cf. 'pig'); this recording was embedded in the slide next to the word, and could be activated by clicking on a speaker icon. The VLE was asked to study the vocabulary list. For each of the words with pronunciation recordings, she also had to click on the icon and repeat after the recording.

After that, the VLE did a practice run. She was presented with four warm-up sentences on a slide and instructed to read them silently. For each sentence, the participant clicked on the speaker icon, listened to the mp3 recording, and repeated the sentence. The participant was then shown the prompts for the same four sentences one by one, and used them to produce these sentences.[8] This procedure was employed for the 64 experimental sentences as well, except that, to minimise any effects of fatigue, these sentences were presented to the participant in eight blocks of eight each, separated by short breaks.

Also to minimise any fatigue effects, the task was done over two sessions; hence, 32 experimental sentences were covered in each one. To reduce any trial-order effects, we created two versions of the task, each based on a different pseudo-randomised ordering of the 64 sentences. The two versions were allocated to equal numbers of participants in the Vietnamese group, plus each version of the task was done by equal numbers of male and female participants; otherwise, the allocation of participants to groups was random. The native-speaker controls did the same task as the VLEs, except that the vocabulary list was omitted. Two native-speaker participants did one version of the task, and the remaining participant did the other.

When identifying cases of inflectional suppliance, we focused only on the opposition between '[s] supplied' and '[s] deleted' in an obligatory instance; all remaining instances (e.g., no target noun produced) were treated as 'other'.

RESULTS

NATIVE SPEAKERS OF ENGLISH

The three native-speaker controls all supplied plural inflection accurately. We take this as confirmation that any omission of either type of inflection in the spoken production of the VLEs was not due to task effects, but could be reasonably traced to L2-specific factors. In this light, the data from the controls served its purpose, and will not be discussed any further in this paper.

VIETNAMESE LEARNERS OF ENGLISH

Apart from some cases which were treated as 'other' (see below for more details), eleven of the 64 participants supplied plural inflection, plus one participant deleted inflection, in all obligatory instances. This suggested that these 12 participants were either too proficient or not proficient enough to be deemed intermediate (or, less likely, had misunderstood what the task required, at least as far as plural inflection was concerned). On these grounds, these VLEs were excluded from the analysis. The data from the remaining 52 learners is summarised in Figure 1.[9]

[8] *The practice-run data was discarded.*
[9] *Instances categorised as 'other' have been excluded from this summary. These made up approximately 2% of all instances.*

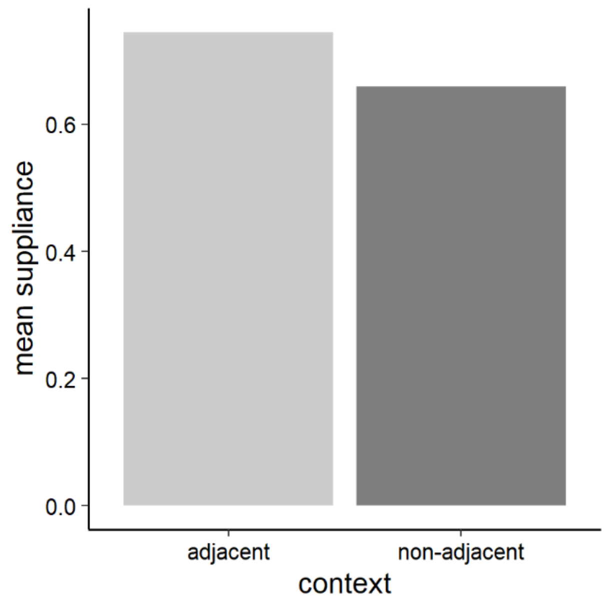

FIGURE 1. Mean rate of plural suppliance by syntactic context

Notice that, as anticipated, the mean rate of suppliance is lower in non-adjacent than adjacent contexts.

In order to analyse these findings, a Bayesian approach was used. To date, this approach has not been widely adopted in L2 research in general; two recent implementations can be found in Austin et al. (2022) and Garcia (2020). For discussion of the advantages of the Bayesian method over its frequentist counterpart within language-related research, see Nicenboim and Vasishth (2016, pp. 592-593). Kruschke (2015) provides a detailed but accessible introduction to this approach, while tutorials in using R to analyse linguistic data from a Bayesian standpoint are provided in Nalborczyk et al. (2019) and Vasishth et al. (2018).

Our analysis followed the one in Austin et al. (2022), except that, as mentioned below, we also conducted a prior-predictive check. The analysis was performed within R (R Core Team, 2020) in Stan (Carpenter et al., 2017) via the `brms` package (Bürkner, 2018). To account for the dependencies within the data (e.g., each participant responded to a set of eight stimulus sentences based on the same type of target), the model was hierarchical. One fixed effect was included for `context` (levels: *adjacent*, non-adjacent; reference level in italics). The response variable was `suppliance`; as this was binary (i.e., 'supplied' = 1; 'omitted' = 0), our model was logistic. We included random intercepts for `item` and `participant`: the random intercept for `item` modelled variance in inflectional suppliance due to differences between target nouns, while the inclusion of the random intercept for `participant` enabled us to account for individual differences. Given that every participant responded to every item, `item` was crossed with `participant`. The random-effects structure of each initial model was then expanded by adding by-participant random slopes for `context`: this accounted for the sensitivity of each participant to the contrast between adjacent and non-adjacent contexts for inflection. The specification for the model is given in (6) (R brms syntax):

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(6)
```
suppliance ~ 0 + Intercept + context + (1 + context |
participant) + (1 | item).
```
[10]

A key feature of the model was our use of informed priors for both parameters: the intercept and `context`. This pair of priors was obtained from the posterior distributions for the naïve model in Austin et al. (2022), a study which compared the production of plural inflection on short- and long-stemmed nouns by Korean learners of English.[11] The authors of that paper only report the value of μ for each of the posterior distributions for the intercept and for stem length; therefore, in order to obtain the value of σ as well, we analysed Austin et al.'s plural data afresh. The posteriors in the earlier study were suitable choices for the priors in our own investigation because, like the present one, Austin et al.'s experiment was concerned with an asymmetry in the production of L2 English number marking by speakers of a plural-less L1—though the contrast that gave rise to the asymmetry in the earlier experiment was, admittedly, phonological rather than syntactic in nature. The following pair of priors was used in the present study: the intercept: $b \sim \mathcal{N}(2.62,0.48)$; `context`: $b \sim \mathcal{N}(-0.98,0.59)$. In order to verify that the data in our study could be plausibly generated by these priors, we carried out a prior predictive check (Gabry et al., 2019); this confirmed that our choice of priors was reasonable.

All models were run using Markov-Chain Monte Carlo sampling with four chains; each chain consisted of 4000 iterations, including a warm-up of 1000. The trace plots, the values of $\hat{R}$ (i.e., the ratio of cross-chain to within-chain variance) and effective sample sizes showed that the model had converged successfully. Model fit was evaluated visually using posterior predictive-checks (Gelman et al., 2014); this showed adequate fit.

The posterior distribution for the main parameter of interest (i.e., `context`) is shown in Figure 2.

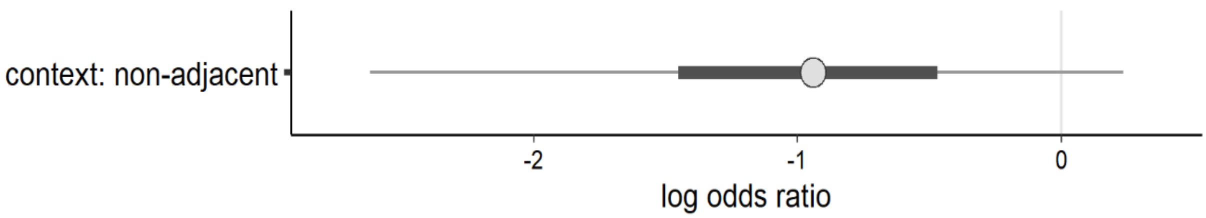

FIGURE 2. Posterior distribution for the effect of syntactic context on plural suppliance

Note. The reference level for `context` was 'adjacent'. The thick line is the 89% highest density interval (HDI): this spans the range of the 89% most credible values for b. The thin line indicates the full range of values in the posterior distribution. The estimate ($\hat{b}$) is the mean of these values, and is shown as a circle. As our model was logistic, $\hat{b}$ is expressed in terms of the log odds ratio for the parameter.

[10] *Recall from the methodology section that two versions of the task were created, each based on a different ordering of the sentences in the task. To gauge the effect of sentence (and therefore target) ordering on the production of plural inflection, a variable we named* `list` *(levels: A, B) was initially added to the regression model as a covariate. We then compared the predictive accuracy of the model with and without this covariate included; for this purpose, expected log-point-wise predictive density (ELPD) leave-one-out cross validation (LOO-CV; Vehtari et al., 2017) was employed. Based on the results of this comparison,* `list` *was removed from the model.*

[11] *The model was 'naïve' in the sense that Austin et al. (2022) put the following 'flat' prior on the intercept and on the parameter stem length:* $b \sim \mathcal{N}(0,10^6)$*, where '*$\mathcal{N}$*' stands for 'normal', '0' is the* μ *of the prior distribution of credible values for* b*, and '*10^6*' is the* σ *of this distribution. A short stem is one in which the rhyme consists of two segments (e.g., 'doll' [dɒl]; rhyme in italics), while a long stem contains three (e.g., 'tank' [tæŋk]).*

Notice that the HDI lies entirely to the left of zero. Our conclusion is that, consistent with what we gleaned from Figure 1, plural inflection was supplied less reliably in the non-adjacent than the adjacent condition.[12,13]

Table 2 presents our findings in greater detail.[14]

TABLE 2. Effect of syntactic context on plural suppliance

Parameter	$\hat{b}$	***SD***	***L***	***U***	***pd***	$\hat{R}$	n_{eff}
intercept	1.91	0.29	1.46	2.39	1.00	1.00	5549
context: non-adjacent	-0.95	0.31	-1.47	-0.47	1.00	1.00	4689

Note. *SD* = standard deviation of the full range of values in the posterior distribution. 89% HDI: *L* = lower bound; *U* = lower bound; *pd* = probability of direction. n_{eff} = effective sample size. The probability of direction is the proportion of the probability mass in the entire distribution that lies either to the left or right of zero, depending on whether the sign of $\hat{b}$ is negative or positive, respectively.[15] It tells us the probability that the effect exists in the direction indicated by this sign.

The odds ratio indicates the size of the experimental effect. This can be calculated in a straightforward way by exponentiating the value of $\hat{b}$ in Table 2. Thus, the odds of supplying inflection were lower in the non-adjacent than the adjacent condition by a factor of $e^{-0.95}$ (= 0.39).

DISCUSSION AND CONCLUSION

In this experiment, we tested the following prediction concerned with the effect of syntactic context on phrase-internal number agreement in L2 English spoken production:

P1. Plural inflection will be supplied at a lower rate in non-adjacent than adjacent contexts.

Our main finding was that inflection was produced less accurately in the non-adjacent than the adjacent condition; thus, P1 is confirmed. We conclude that what gave rise to the asymmetries in our study, and also in previous research on subject-verb agreement (Hawkins & Casillas, 2008; Ma & Zou, 2018; Tuniyan, 2013), was not the distinction between local and non-local domains, but rather the one between adjacent and non-adjacent contexts for agreement. Note also that this analysis is more parsimonious than one based on locality. Local dependencies impose different syntactic requirements on the controller and target for different types of inflection in English: adjacent for subject-verb agreement, and not necessarily adjacent for plural inflection. An analysis in terms of adjacency obviates the need for these construction-based stipulations.

The present study is significant in three other respects as well. To begin with, our findings have implications for the relationship between comprehension and production in L2 acquisition. These implications become clear when we consider the results of two similar experiments on L2

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[12] *In interpreting the effect of syntactic context on plural suppliance, we use an approach which is broadly in keeping with the one advocated by Kurz (2021).*

[13] *We also carried out a prior sensitivity analysis; this is included in the appendix. The results of this analysis indicate that the inference we have drawn from our data regarding P1 holds up under a variety of related priors, and not just under the one we actually used.*

[14] *Earlier in this section, we mentioned that 12 VLEs were excluded as (probably) too high or low for this experiment. We ran the analysis again with these participants included: the results were similar to the ones reported in Table 2; in particular, the inference that we drew from this expanded data set regarding P1 was no different from the actual inference.*

[15] *In Figure 2, notice that a tiny part of the entire posterior distribution lies to the right of zero, yet the value of the posterior probability for context in Table 2 is 1.00. This apparent discrepancy is because this value was rounded upwards from 0.9995.*

English that were carried out within the receptive modality. Both of these studies investigated the comprehension of number agreement in DPs containing a demonstrative pronoun (i.e., 'this/these') and a noun by advanced learners who were native speakers of Korean—a language which, to all intents and purposes, can be regarded as plural-less (Austin et al., 2022). Cho (2017) used a moving-window self-paced reading task ($N = 16$), while Cho et al. (2018) measured event-related potentials (ERPs; $N = 18$).[16] In each study, the processing of the agreement relation was compared when the demonstrative pronoun and the noun were adjacent, and when they were separated by an adjective,[17] plus the grammaticality of both structures was manipulated (e.g., Cho, 2017: 'this student/*students' vs. 'these young German beauties/*beauty'). Both experiments yielded the same main result: learners were sensitive to number-agreement violations in the adjacent condition but not the non-adjacent one.[18]

The results obtained by Cho (2017) have some bearing on how we interpret our own. Note that we cannot be certain whether the asymmetry in inflectional suppliance in the current experiment was due to a deficit at the level of underlying grammatical representation (e.g., McCarthy, 2008; Tsimpli & Dimitrakopoulou, 2007), or to production-specific difficulties with retrieving this morpheme from the lexicon under communicative pressure (e.g., Prévost & White, 2000), as our findings are compatible with either of these possibilities. Note, however, that Cho and colleagues report essentially the same asymmetry in the receptive modality as the one that we observed in the productive modality. This indicates that the omission of inflection in the present experiment could not have been due only to a production-specific issue, and must therefore have reflected a more general representational deficit at least to some extent.

Another significant characteristic of our experiment is that it focuses on the acquisition of English by Vietnamese learners. This group has garnered relatively little attention within L2 research to date, plus most studies concerned with the acquisition of functional morphology by these learners have examined items other than inflectional suffixes (e.g., articles: Nguyen, 2018; prepositions: Hung, 2017; Nghi et al., 2021).

Finally, the present study used a cutting-edge approach to the analysis of quantitative data in general. Recent years have seen an upsurge in interest in using Bayesian methods within the social sciences, along with a growing recognition of the advantages of the Bayesian approach over its frequentist counterpart. Our study contributes to this burgeoning area of scholarly activity.

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[16] Granted, our own study differs from those conducted by Cho and colleagues in that, whereas we used a numeral as the controller in the agreement relation, Cho and colleagues used a demonstrative. Even so, in both cases, there is a contrast between the singular and plural contexts for inflection vis-à-vis the choice of controller. In this regard, the difference between Cho and colleagues' work and our own is not critical.
[17] Unlike Cheng et al. (2022) and also us, Cho and colleagues treat the non-adjacent condition within the DP as involving non-local agreement. Hence, their research did not seek to answer the same overarching question as ours did.
[18] In Cho et al. (2018), this was only true of learners with high working-memory capacity, however.

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APPENDIX

Recall that, in our main analysis, plural inflection was supplied less accurately in the non-adjacent than the adjacent condition; hence, P1 was confirmed. However, it is a theoretical possibility that this result was due, at least in part, to our choice of priors. Generally speaking, the aim of a prior sensitivity analysis is to rule out this possibility when a Bayesian approach is employed. For more background plus citations of relevant sources, see Austin et al. (2022).

In the main analysis, the following pair of informed priors was used: the intercept: $b \sim \mathcal{N}(2.62,0.48)$; `context`: $b \sim \mathcal{N}(-0.98,0.59)$. For the sensitivity analysis, we ran our regression model using several alternative prior pairs as well. These pairs were based on values of μ and σ that differed systematically from the ones in the main pair. The pairs included in the sensitivity analysis are shown in Table A1.

TABLE A1. Prior pairs in the sensitivity analysis

Pair	*Intercept*	*Context*
priors[0]	2.62,0.48	-0.98,0.59
priors[1]	2.42,0.48	-0.98,0.59
priors[2]	2.82,0.48	-0.98,0.59
priors[3]	2.62,0.48	-1.18,0.59
priors[4]	2.62,0.48	-0.78,0.59
priors[5]	2.62,0.38	-0.98,0.59
priors[6]	2.62,0.58	-0.98,0.59
priors[7]	2.62,0.48	-0.98,0.49
priors[8]	2.62,0.48	-0.98,0.69

Note. 'priors[0]' is the pair we used in the main analysis. All of the priors in our sensitivity analysis follow a normal distribution.

Notice, for example, that, in 'priors[1]', the value of μ for the intercept is decreased from 2.62 to 2.42 (i.e., by 0.2), while in 'priors[1]' this value is increased from 2.62 to 2.82. Similarly, in 'priors[5]' and 'priors[6]' respectively, the values of σ for the intercept are decreased and increased by 0.1 with respect to the values used in 'priors[0]'.

In Figure A1, we show the posterior distributions for the main parameter of interest (i.e., `context`) when the prior pairs in Table A1 were used.

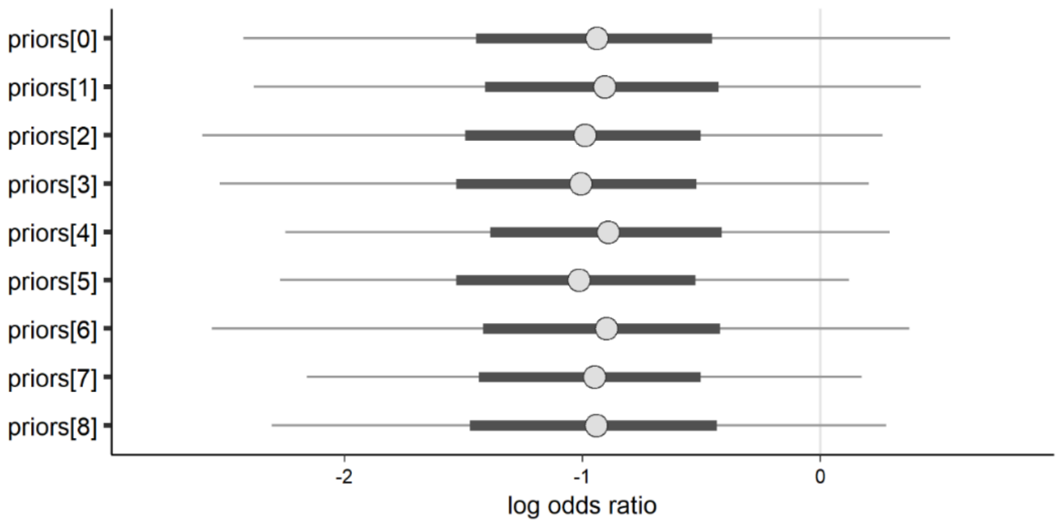

FIGURE A1. Posterior distributions for the effect of `context` under various prior pairs

This figure tells us that when we ran our regression model with each alternative prior pair, the position of the whole HDI with respect to zero shifted only slightly, and never enough to overturn the inference that we drew from our data when 'priors[0]' was used.

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