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Interpretation of verbal ellipsis in monolinguals and heritage speakers

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Abstract. This study investigates how monolingual English and Turkish speakers, as well as English-dominant Turkish heritage speakers (HSs) interpret strict/sloppy ambiguity in verbal ellipsis structures (e.g., *John defended his friend, and Noah did too*). Prior work shows that HSs often diverge from monolinguals in interpreting null subjects (Laleko & Polinsky, 2017; Sorace & Filiaci, 2006), yet it is unclear whether this extends to null constructions beyond subject pro-drop. To test this, we examined the interpretations of baseline English and baseline Turkish speakers for ambiguous verbal ellipsis sentences, compared to Turkish HSs, who completed picture choosing tasks in English (Exp. 1) and Turkish (Exp. 2). Baseline English speakers preferred the strict reading, whereas baseline Turkish speakers preferred the sloppy reading in elided sentences. HSs, however, showed a strict reading preference in both English and Turkish, diverging from Turkish monolinguals and aligning more with their dominant language, English. Further analyses revealed individual differences in the interpretation of verbal ellipsis among HSs and Turkish baseline speakers, with HSs showing this variation in both of their languages. These findings offer new evidence of HSs' divergence from baseline speakers in the domain of interpretation of null elements beyond null subjects and highlight potential role of language experience.

Keywords. Ambiguity resolution; verbal ellipsis; heritage speakers; Turkish

1. Introduction. In VP-Ellipsis (VPE) constructions, the main predicate, typically together with its internal arguments, is elided (e.g., Johnson 2001; Fiengo & May 1994; Rooth 1992). In sentence (1), Δ indicates VP-Ellipsis, where the elided verb phrase (VP) is 'read a book':

(1) John read a book, and Mary did Δ too.

Resolving dependencies in VPE involves a connection between the elided information and the prior clause. VPE with pronouns (2) involves additional ambiguity (e.g., Rooth, 1992):

(2) a. John defended his friend, and Noah did Δ too.
b. John$_i$ defended his$_i$ friend, and Noah$_j$ did <$_{VP}$ defend his$_j$ friend> too.
c. John$_i$ defended his$_i$ friend, and Noah$_j$ did <$_{VP}$ defend his$_i$ friend> too.
d. John$_i$ defended his$_k$ friend, and Noah$_j$ did <$_{VP}$ defend his$_k$ friend> too.

The interpretation in (2b) is an instance of *sloppy interpretation*, where the possessive pronoun *his* is locally bound by *John* in the first clause and by *Noah* in the second (elided) clause. The interpretation in (2c) represents the *strict interpretation*, in which *his* is bound by *John* in both the first and second clauses. Finally, (2d) represents an interpretation in which an external third person is referenced. However, in the absence of a corresponding discourse referent, this interpretation is unlikely to be accessible to the comprehender. The present study primarily focuses on sloppy (2b) and strict (2c) interpretations of the possessive pronoun inside VPE.

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1.1. OVERVIEW OF TURKISH AND ENGLISH VERBAL ELLIPSIS[1]. This study focused on Turkish (3) and English (4) verbal ellipsis, where the elided clause has an ambiguous possessive anaphor:

(3) Ali$_i$ [*pro*$_i$ arkadaş-ı]-nı savun-du,
Ali friend-POSS.3SG-ACC defend-PAST.3SG
Mert$_j$ de <*pro*$_{i/j}$ arkadaş-ı-nı savun-du>.
Mert too < friend-POSS.3SG-ACC defend-PAST.3SG>
Lit. "Ali defended his friend, and Mert did <defend his friend> too."

(4) John$_k$ defended his$_k$ friend, and Noah$_l$ did <defend his$_{k/l}$ friend> too.

In Turkish (3), both sloppy (*Mert defended his own friend*) and strict interpretations (*Mert defended Ali's friend*) are possible. Likewise, in English, (4) can have the sloppy reading *John defended John's friend* and the strict reading *John defended Noah's friend*.

There are notable similarities and differences to highlight between Turkish and English verbal ellipsis. First, the elided portion is in the second clause (aka. *forward ellipsis*) in both English and Turkish, providing a comparable construction in two languages. Additionally, both Turkish and English verbal ellipsis have forward anaphora, i.e., both the local subject and the non-local subject precede the elided anaphor. On the other hand, while English only has possessive pronouns, Turkish has possessive reflexives (e.g., *kendi* 'self') in addition to possessive pronouns (*onun* 'his/her/its'), and it is common for the possessor to be expressed as a null anaphor. In sentences like (3), a silent *pro* agrees with the head noun 'friend' that is marked with the third person singular possessive, signaling possession through case morphology on the head noun, unlike English. When the possessive anaphor is overt in Turkish (e.g., *kendi* 'self' vs. *onun* 'his/her/its' in (3)) the ambiguity between possessive pronoun vs. possessive reflexive is resolved. For this reason, and because omitting the possessive anaphor is the most natural way to express possession in Turkish, this study uses null possessive pronouns in the target stimuli.

1.2. INTERPRETATION OF VERBAL ELLIPSIS. Existing work on monolinguals' interpretation of verbal ellipsis provides substantial evidence for reflexive anaphora under verbal ellipsis constructions, especially in English (e.g., Gallardo del Puerto & Gandón Chapela, 2024; Storbeck & Kaiser, 2018; Ong & Brasoveanu, 2014; Kim & Runner, 2009; Frazier & Clifton, 2006; Ying, 2005). A common finding is a preference for the sloppy interpretation (i.e., local binding) over the strict interpretation, particularly in constructions involving reflexives (Frazier and Clifton, 2006). Importantly, these interpretational preferences are influenced by various linguistic and contextual factors. One such factor is the possession relation type of the nouns used as the possessed referents in verbal ellipsis structures: Storbeck & Kaiser (2018) examined how the type of possession relation affects native English speakers' interpretations of ambiguous verbal ellipsis sentences. In a two-alternative forced-choice task, they found that animacy and the discourse salience of the possessor influenced participants' preference for the sloppy or the strict readings when resolving anaphora in verbal ellipsis constructions containing possessive pronouns.

The literature on anaphora resolution also suggests that the preferred referent of a pronoun varies systematically with verb type, i.e., the implicit causality bias of the verbs (Hartshorne et

[1] In English, *VP-Ellipsis* commonly refers to constructions as in (1)-(4) as described above. In Turkish, however, the existence and extent of VP-Ellipsis is debated (Kornfilt, 2024; Şener & Takahashi, 2010). While this study does not aim to contribute to these debates regarding the presence or nature of verbal ellipsis in English or Turkish, we use the term *verbal ellipsis* throughout to maintain consistency across both languages when referring to elided constructions in the verbal domain. We do *not* mean to imply that the relevant structures in English and Turkish are identical.

al., 2013). Ong & Brasoveanu (2014) found that object-biased implicit causality verbs are more likely to have strict reading than subject-biased implicit causality verbs. Also, anaphor type is shown to affect interpretation preferences at ellipsis sites. Frazier & Clifton (2006), focusing on pronominal, possessive, and reflexive forms in sentences like *John saw a snake near him/himself/his backpack, and Bill did too,* found that sloppy reading occurred more frequently for reflexives than for simple pronouns, and more frequently for possessives than for pronouns. Moreover, syntactic structure is found to modulate interpretation preferences for reflexive pronouns in verbal ellipsis: in conjoined structures (*John voted for himself, and Mary did too*), participants prefer the sloppy reading, but this preference is reduced in non-conjoined structures (*John voted for himself. Mary did too*) (Kim & Runner, 2009).

While many studies on the interpretation of pronouns within verbal ellipsis focus on baseline speakers, some work has examined second language (L2) learners, too. Studies on native and L2 English speakers with diverse L1s such as Chinese (Ying, 2005) and Spanish (Gallardo del Puerto & Gandón Chapela, 2024), compared different contexts as in (5), where the ellipsis sites are ambiguous between strict and sloppy readings. Contexts like (5c) favor the strict reading, by making *Mary* a semantically more plausible referent for the possessive pronoun. In this study, participants read the context first and made their interpretation afterward, which allows the information from the final sentence to guide their interpretation:

(5) a. Mary blamed herself and Heather did Δ too.
b. Mary blamed herself and Heather did too. Heather has two brothers and a sister.
c. Mary blamed herself and Heather did too. Heather thinks Mary is a disaster.

Findings from the judgment tasks commonly show that baseline English speakers typically favor the sloppy reading in bare contexts (5a) and contexts like (5b), whereas the strict reading is more frequent in contexts like (5c) (Gallardo del Puerto & Gandón Chapela, 2024). As for L2 speakers, Ying (2005) found a preference for the sloppy reading in bare context (5a), as with the L1 group. In contexts like (5c), both groups preferred the strict reading. Conversely, in contexts like (5b), both groups preferred the strict and sloppy readings nearly equally, with sloppy reading preferred slightly higher by both. These findings suggest that comprehenders attend to the information that appears relevant to them, construct relevant representations of such information, and process these representations in a context that maximizes its relevance, and this proceeds similarly for L1 and L2 speakers. Gallardo-del-Puerto & Gandón-Chapela (2024) also examined Spanish L2 learners of English (at different proficiency levels) and baseline English speakers. As with Ying (2005), the results showed a sloppy reading preference in contexts like (5a) and (5b), and a shift towards the strict reading in contexts like (5c). In addition, proficiency-based differences emerged between the L2 and baseline groups, with the lowest L2 group diverging most from the baseline. These findings were attributed to factors such as learners' L1 background, the range of proficiency levels tested, and the baseline group's characteristics.

Specifically relevant for our work on Turkish, Gezen (2022) conducted experiments on verbal ellipsis interpretation in L1 Turkish, L1 English, and Turkish L2 learners of English. Results showed that the L1 English group had nearly equal interpretational preferences between the strict and sloppy readings in verbal ellipsis with possessive anaphora. In contrast, the L1 Turkish group had significantly higher sloppy reading preference for Turkish sentences, while their strict reading preference was comparatively low. The interpretational preference of L1-Turkish L2-English group was in-between the baseline groups: a high sloppy reading preference at nearly the same rate as both L1 groups, yet a lower strict reading preference (58.6%) that was higher than

L1 Turkish (18.2%) and lower than L1 English speakers (85.2%). As a whole, Turkish L2 learners of English clearly diverged from baseline speakers in the strict reading preference.

As for HSs, to the best of our knowledge, there exists only one study, on Russian by Polinsky (2016), that examined HSs' interpretation of pronouns in verbal ellipsis structures that allow strict and sloppy readings (6):

(6) Ty pokazal gostjam ix komnatu, a Petja sosedjam
2SG showed.M guests.DAT their room.ACC but Peter neighbors.DAT
ne pokazal [ix komnatu]. (Russian)
not showed.M their room.ACC
'You showed their room to the guests, but Peter did not show their room to the neighbors.'

In verb-stranding VPE (VVPE) in Russian (6), the sloppy reading implies that the guests and the neighbors each saw different rooms, while the strict reading implies that they all saw the same room, i.e., the one belonging to the guests. Polinsky (2016) found a preference for the sloppy reading among baseline Russian speakers. A sloppy-reading preference had also been reported for baseline English speakers by Keating et al. (2011, as cited in Polinsky, 2016), using a comparable construction in English. In contrast, Russian HSs in Polinsky (2016) preferred the strict reading in Russian but the sloppy reading in English (*The Petersons like their neighbors, and the Woolards do too*). Polinsky notes that although the strict reading places a greater load on working memory as it requires retrieval of the referent across clauses, this cognitive load can be assumed to be even higher when people are processing a sentence in the heritage language. Polinsky (2016) thus suggests that HSs' divergence from baseline Russian speakers reflects a reanalysis of VVPE as object drop. This reanalysis is linked to the vulnerability of the landing site for Russian VVPE (AspP) in heritage Russian (Polinsky, 2016; Polinsky & Scontras, 2020). Broadly speaking, Polinsky (2016)'s findings highlight the complexities that arise for processing elided elements in the verbal domain by HSs.

1.3. HERITAGE SPEAKERS AND NULL SUBJECTS. Extensive research has indicated that HSs often diverge from baseline speakers in their comprehension and production of null elements, even when both the heritage and dominant languages allow for null elements in similar contexts (Polinsky, 2016; Sorace & Serratrice, 2009; de Prada Pérez, 2009). This phenomenon, known as *the Silent Problem*, suggests that HSs' divergence is due to difficulty in detecting and interpreting null grammatical elements (Laleko & Polinsky, 2017). A prominent study examining this phenomenon is Sorace & Serratrice (2009), who investigated the use of null and overt pronouns in English-Italian and Spanish-Italian bilingual children, in addition to monolingual baseline groups. In an acceptability judgment task, bilingual children selected overt pronouns significantly more often than their monolingual peers in contexts where overt pronouns would be infelicitous (for baseline speakers). Moreover, even though both Spanish and Italian are null-subject languages, Spanish-Italian bilingual children exhibited inconsistency in selecting the pragmatically appropriate pronoun. These results highlight the cognitive demands of managing two linguistic systems and that processing difficulties can arise even when two languages structurally overlap.

Similar patterns of divergence were reported among HSs across different languages. Keating et al. (2014) examined Spanish-dominant Italian HSs and found that HSs were more likely than baseline speakers to interpret a null subject as co-referential with the subject antecedent, even in contexts where baseline speakers showed a preference for linking null pronouns to subjects and overt pronouns to non-subjects. This overgeneralization further supports the idea that bilingual

processing demands can lead to non-target-like interpretation of null subjects (Keating et al., 2014). In a related study, Uygun (2022) examined null-subject interpretation in adult Turkish HSs. In a self-paced reading task, German-dominant Turkish HSs exhibited greater difficulty in processing sentences with null subjects compared to sentences with overt subjects. Uygun (2022) concluded that these difficulties likely stem from the ways in which HSs process and integrate syntactic and morphological cues differently from monolinguals.

Taken together, findings from diverse bilingual populations provide robust evidence for bilinguals' divergence from baseline speakers, not only in how they overproduce overt subjects but also in how they interpret null subjects, even when both languages license null subjects. This highlights the complex interplay of linguistic input and structural overlap shaping their behavior.

2. The Present Study. While HSs' divergence from baseline speakers in the interpretation of null subjects is well-documented, HSs' interpretation of verbal ellipsis, particularly with possessive anaphora, remains understudied. Existing research has largely focused on L1 and L2 speakers (e.g., Ying, 2005), with less attention given to HSs and crosslinguistic comparisons between their heritage and dominant languages. However, studies like Scontras et al. (2017) show that HSs' interpretational patterns can be impacted by either of their languages, highlighting the need to examine both languages for a fuller picture of the underlying representations (Polinsky & Scontras, 2020). This study thus examines English-dominant Turkish HSs, a population situated between two languages with potentially distinct interpretation preferences: for sentence (3), Turkish baseline speakers are expected to prefer the sloppy reading (Kornfilt, 2024; Şener & Takahashi, 2010; Gezen, 2022), whereas for (4), baseline English speakers are predicted to exhibit either no strong preference or a preference for the strict reading (Storbeck & Kaiser, 2018; Ong & Brasoveanu, 2014; Frazier & Clifton; 2006). This brings up the question of what happens with HSs of Turkish whose dominant language is English? We explore this in our work.

Importantly, as Matsuo (2007) notes, comprehending a pronoun in verbal ellipsis involves two operations: i) identifying a suitable antecedent for the empty verb phrase, and ii) resolving the antecedent of the pronoun (e.g., *his* in (2)). Given evidence from the literature that HSs may struggle with linking anaphoric dependencies to contextual antecedents (Laleko & Polinsky, 2017), it is crucial to disentangle these processes to identify the processing patterns where HSs may diverge from baseline speakers. We address this by examining both elided and unelided forms of verbal ellipsis, which, to our knowledge, has not been tested in prior work on HSs.

Given the structural and interpretational differences between Turkish and English verbal ellipsis with possessive anaphora, this study investigates whether HSs exhibit language-specific preferences and how these align with or differ from baseline groups. This study also addresses the operations involved in verbal ellipsis interpretation, i.e., the two processes suggested by Matsuo (2007): identifying the suitable antecedent and resolving the antecedent of the pronoun in the elided clause. Such a focus allows for a more fine-grained analysis of whether HSs' divergence from baseline speakers (if any) stems from difficulties with identifying the antecedent structure, or resolving pronominal reference, or both. Hence, this study considers HSs' preferences for anaphora interpretation in both elided and unelided forms, comparing them to those of homeland English and homeland Turkish speakers. Accordingly, we address the following questions:

1. How do Turkish HSs interpret anaphora in verbal ellipsis structures in their dominant language (English) and heritage language (Turkish) in comparison to homeland English and homeland Turkish speakers?
2. What mechanisms guide Turkish HSs' interpretation of possessive anaphora within verbal ellipsis? Are HSs' interpretational preferences attributable to the difficulty in relation

to the interpretation of silent materials, and more specifically, do HSs' preferences vary across null versus overt possessive anaphora?

With respect to Research Question 1, based on findings from the previous literature and considering this study's experimental design, we make the following predictions for elided sentences:

- **Baseline English speakers** are predicted to exhibit a strict reading preference or no preference, when relevant factors are controlled for (see section 1.2., e.g., Ong & Brasoveanu, 2007; Storbeck & Kaiser, 2018; Ying, 2005).
- **Baseline Turkish speakers** are expected to demonstrate a strong preference for sloppy reading, consistent with findings from theoretical and experimental work on Turkish (e.g., Kornfilt, 2024; Şener & Takahashi, 2010; Gezen, 2022).
- **Heritage Turkish speakers** may turn out to exhibit any of three possible interpretation patterns, based on existing work on bilinguals (e.g., Polinsky, 2016; Keating et al., 2014): a sloppy reading preference, reflecting influence from Turkish-specific mechanisms; a strict reading preference, reflecting influence from English-specific mechanisms; or no clear preference, indicating the absence of strong language-specific effects. Similar to Russian HSs in Polinsky (2016), Turkish HSs in this study may also diverge from both baseline groups, even when baseline speakers prefer the same interpretation pattern.

With respect to Research Question 2, comparing HSs' responses to elided versus unelided sentences helps pinpoint whether any divergence from the baseline population(s) lies in interpreting the silent material or resolving pronominal ambiguity more generally. If HSs only align with baseline speakers in unelided (overt) sentence forms (i.e., *John defended his friend, and Noah did too*), this would suggest that the main reason for divergence in the interpretation of elided forms lies in processing null elements (*Silent Problem*). On the other hand, if divergence occurs across both forms, HSs' divergence may stem from difficulty in resolving antecedents, independently of difficulty in interpreting null material.

To test this, the proportion of sloppy reading preferences was examined in two picture choosing tasks (one in English, one in Turkish). In each trial, participants heard a sentence with verbal ellipsis (*John defended his friend, and Noah did too*) or with the unelided form of verbal ellipsis (*John defended his friend, and Noah defended his friend, too*) and selected between two pictures: one reflecting a strict reading, and the other, a sloppy reading.

3. Experiment 1 (English Task). Experiment 1 compared homeland English speakers' (ESs) and Turkish HSs' anaphora interpretation in elided and unelided verbal ellipsis forms in English.

3.1. PARTICIPANTS. 20 ESs (8 female, M_{age}=40.2 years, SD_{age}=15.9) and 21 HSs (16 female, M_{age}=24.4 years, SD_{age}=8.7) completed the English task. ESs were recruited on Prolific, and HSs were recruited via social media and word of mouth. Participants with catch trial accuracy below 83% (4 ESs, no HSs) and HSs that did not meet eligibility criteria (n=4) were excluded from analysis. Table 1 shows the included participants' language background and self-evaluations, along with HSs' age of arrival (AoA) at the U.S. and age of onset of bilingualism (i.e., age at start of school in the U.S.).

Both groups completed the background questionnaire in English. All ESs were native English speakers and were born and raised in the U.S. 3 ESs were L2 speakers of languages such as German, Spanish, and Mandarin. All remaining ESs reported being speakers of English only.

HSs were either 1) born and raised in the U.S. or arrived at the U.S. from Turkey before the start of school age; 2) grew up speaking Turkish as their first language; 3) dominant in English; 4) currently live in the U.S. 17 HSs met these criteria and were included in analysis. 12 HSs were

born and raised in the U.S., and the remaining 5 HSs' AoA ranged between 6 months to age 5. All HSs reported being raised by Turkish parents and were exposed to Turkish in family settings.

	Homeland English Speakers (ES) *(n=16)*	Heritage Turkish Speakers (HS) *(n=17)*
Mean Age	37.1 *(15.4)*	24.7 *(9.5)*
Mean Age of Switch to English	N/A	2.6 *(1.8)*
Self-rated Proficiency in English (1-5)	Speaking: 5 Comprehension: 5 Reading: 5 Writing: 5	Speaking: 4.9 Comprehension: 4.9 Reading: 4.9 Writing: 4.9
Self-rated Proficiency in Turkish (1-5)	N/A	Speaking: 4.2 Comprehension: 4.4 Reading: 3.5 Writing: 3.7

Table 1. Background information of the participants in the ES and HS groups

3.2. DESIGN AND PROCEDURE. 20 target stimuli, consisting of elided and unelided forms of verbal ellipsis, were used. Target sentences were constructed with special attention to each item in each sentence. Target verb selection criteria were as follows: verbs (a) have minimal or no IC-bias[2], (b) can occur with a human as the subject and object argument[3], (c) are semantically plausible in a verbal ellipsis, (d) are grammatical in both English and Turkish, (e) are commonly used in HS contexts, (f) have the accusative case on direct objects in Turkish. To ensure the naturalness and familiarity of participants with target stimuli, frequency distributions of target verbs and nouns were checked using the Corpus of Contemporary American English (COCA).

Names in the target stimuli were selected from the U.S. Social Security Database. The two names in each target had the same gender, with minimal phonological and orthographic overlap. Audio stimuli were recorded on Praat (version 6.1.38, Boersma, 2002) by a female native English speaker, with neutral prosody (to avoid effects of contrast on pronoun interpretation). The visual stimuli consisted of images with stick figures and arrows on a white background.

For each trial, participants heard an elided sentence (*"John defended his friend, and Noah did too"*) or an unelided sentence (*"John defended his friend, and Noah defended his friend too"*) and saw two images: one representing the sloppy interpretation (in Fig. 1, panel B: *"Noah defended his own brother"*) and the other representing the strict interpretation (in Fig. 1, panel A: *"Noah defended John's brother"*). Participants were asked to select the image they think best matches the sentence that they heard. Audio and visuals were presented simultaneously. Character names appeared on all screens (as shown in Fig. 1):

[2] For (a), based on studies on anaphora resolution, (Hartshorne et al., 2013; Ferstl & Garnham, 2011) and effects of implicit verb causality (IC) on VPE (Ong & Bresnaebou, 2007), IC-causality of the verbs may lead to biases in the interpretational preferences of participants. To prevent this, target verbs were selected using the norms of Harthorne et al. (2014) and Ferstl & Garnham (2011), to ensure that all verbs were close to equibiased.

[3] For (b), relational nouns in Storbeck & Kaiser (2018) were used in the target stimuli of this study as their work showed relational nouns and family relations exhibit more equal preference between strict vs. sloppy readings, compared to ownership and part-whole relations that showed unequal distributions between the two readings.

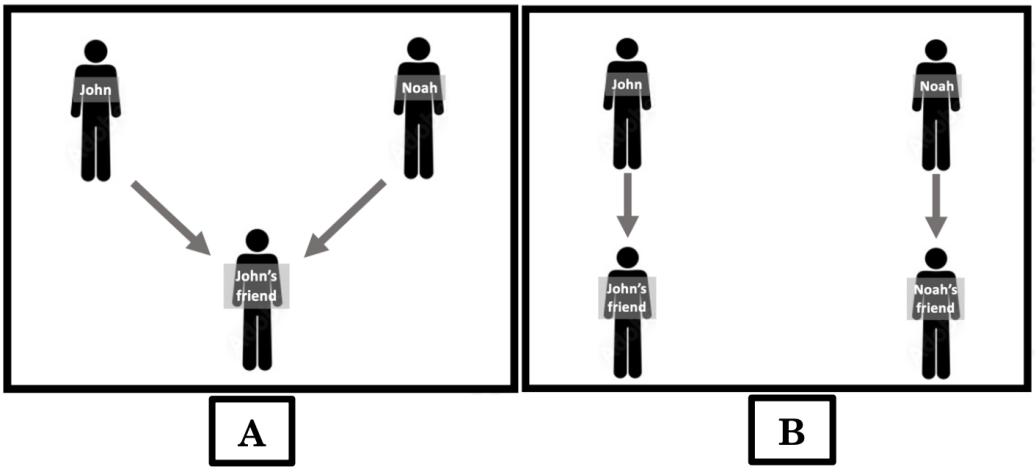

Figure 1. Visual Representation of the Picture Choosing Task. Turkish version is analogous.

20 target stimuli were presented on two experimental lists using a Latin Square design. Each participant saw 10 targets per condition (elided vs. unelided), as well as 36 fillers, for a total of 56 sentences.

3.3. DATA COLLECTION. Experiment 1 was conducted over the internet using Qualtrics (Version Mar. 2024). Before the main task, participants completed three practice trials. The study was untimed. After the main task, HSs additionally completed a vocabulary task which served as a proxy for lexical proficiency. At the end, all participants completed a background questionnaire about language, immigration (if applicable), and education.

3.4. DATA PREPROCESSING AND ANALYSIS. For statistical analyses, we fit a general linear mixed effects model, with sloppy interpretation responses coded as 1 and strict interpretation responses coded as 0 as the dependent variable. Group (contrast-coded, ES=-0.5, HS=0.5), Form (contrast-coded, elided=- 0.5, unelided=0.5), TrialID (presentation order) as well as an interaction between Group and Form were included as predictors in the starting model. Models were estimated using the lme4 package (version 1.1.21) (Bates et al., 2015) and p-values were estimated using the Satterthwaite method in lmerTest (Kuznetsova, Brockhoff, & Christensen, 2017) in R studio (R Core Team, 2019). Each model initially included the maximal random-effects structure, with random intercepts and random slopes grouped by participant and by item where possible. By employing backwards elimination, the model was gradually simplified until convergence was reached. When a model's random effects structure needed to be reduced, the inclusion of random slopes for participants was prioritized. The best-fit model was selected starting with the most complex model and reducing it by removing main effects one by one via ANOVA model comparisons. The best-fit generalized linear mixed effects model included the fixed effects of Group and Form, and their interaction, as well as participant and item as grouping factors for random intercepts.

3.5. RESULTS. Results are shown in terms of the proportion of sloppy interpretations. Figure 2 shows the proportions of sloppy-interpretation choices for the ES and HS groups for the elided and unelided sentence forms.

The best-fit generalized linear mixed effects model indicated significant main effects of Group ($\hat{\beta}$=1.26, p=0.04) and Form ($\hat{\beta}$=4.36, p<0.001), but no significant interaction ($\hat{\beta}$=0.24, p=0.7): HSs had a significantly higher preference for sloppy reading than ESs, and the overall

sloppy reading preference for the unelided form was significantly higher than the sloppy reading preference for the elided form, yet no significant difference was found between HSs' and ESs' sloppy reading preference across the elided and unelided forms.

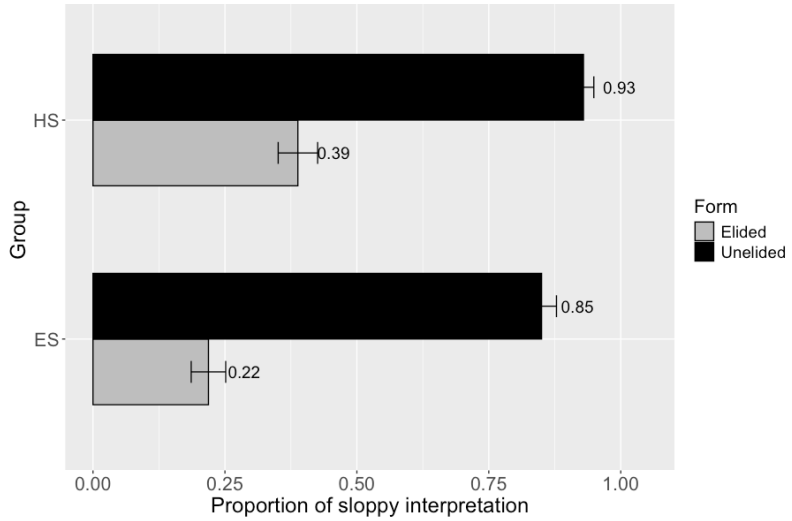

Figure 2. Mean proportion of sloppy interpretation in ESs and HSs in Exp. 1 (English task)

Despite the lack of a significant interaction between Group and Form, to better understand the source of the main effects of Group and Form, we ran pairwise comparisons by subsetting the data into elided and unelided forms. The model predicting responses to the elided form with Group as a fixed effect, and participant and item as grouping factors for random intercepts, showed no significant effect of Group ($\hat{\beta}$=1.34, p=0.12): the numerical difference in the sloppy reading proportions of elided sentences between the ES and HS groups (Fig. 2) was not significant. As for the unelided form, the model predicting responses by Group, with participant and item as grouping factors for random intercepts similarly also showed no significant main effect of Group: the sloppy reading preferences of HSs and ESs were not significantly different in the unelided form ($\hat{\beta}$=1.62, p=0.14). However, these null effects may be due to the reduced power in these subset analyses and should be interpreted with caution.

4. Experiment 2 (Turkish Task). Experiment 2 compared baseline Turkish speakers' (TSs) and HSs' interpretation of anaphora in elided and unelided forms of verbal ellipsis in Turkish.

4.1. PARTICIPANTS. 23 adult TSs (15 female, M_{age}=28.4 years, SD_{age}=8.3) and 27 adult HSs of Turkish (19 female, M_{age}=24.13 years, SD_{age}=5.2) completed the Turkish task. Both TSs and HSs were recruited via social media platforms and via word of mouth. Participants with low catch trial accuracy (below 83%; 2 TSs and 1 HSs) and HSs that did not meet the participant inclusion criteria (n=7) were removed from the analysis.

The same background questionnaire as in Experiment 1 was administered. Table 2 shows the included participants' language background and self-ratings, along with HSs' age of arrival (AoA) in the U.S. and age at start of schooling in the U.S., typically regarded as the age at which English starts to become dominant.

All TSs reported being native speakers of Turkish, born and raised in Turkey. 20 TSs reported learning English as a second language and rated their proficiency around 2.6 (out of 5), averaging across four skills (Table 2). 9 TSs reported learning a third language other than English and Turkish (e.g., German, Italian, French, Arabic), between ages 12-20, with 1-4 years of

instruction. Thus, this suggests that TS participants were functionally monolingual speakers. The same inclusion criteria for HSs in Experiment 1 was applied to Experiment 2. 20 HSs met these criteria and were included in the analysis. 10 HSs were born and raised in the U.S.; 9 HSs arrived later, with AoA ranging between ages 1 to 7 (2 HS participants' AoA was 7).

	Homeland Turkish Speakers (TS) *(n=21)*	Heritage Turkish Speakers (HS) *(n=19)*
Mean Age	27.1 *(6.2)*	23.4 *(4.3)*
Mean Age of Switch to English	N/A	2.5 *(2.1)*
Self-rated Proficiency in English (1-5)	Speaking: 2.4 Comprehension: 2.7 Reading: 2.9 Writing: 2.5	Speaking: 4.9 Comprehension: 4.9 Reading: 4.9 Writing: 4.9
Self-rated Proficiency in Turkish (1-5)	Speaking: 4.8 Comprehension: 4.9 Reading: 4.8 Writing: 4.7	Speaking: 4.6 Comprehension: 4.7 Reading: 4.3 Writing: 3.6

Table 2. Background information of the participants in the TS and HS groups

4.2. DESIGN AND PROCEDURE. The Turkish task included 20 targets that were translational equivalents of the target stimuli used in Experiment 1, with minor adjustments to avoid lexical repetition and to ensure that HSs are familiar with these words.

To further ensure lexical familiarity, target word frequencies were measured using the Boğaziçi University's HS corpus and the general BOUN corpus (Sezer & Sezer, 2013). Turkish names were selected from the Turkish Demographic Statistics Database; as in Experiment 1, phonological and orthographic overlap between names in a given target sentence was minimized, and the two names in each target item had the same stereotypical gender. Audio stimuli were recorded in Turkish by a male native Turkish speaker linguist, following the same procedure as in Experiment 1. Visual stimuli were the same as in Experiment 1.

The same experimental procedure as in Experiment 1 was used, with one change: HSs were also provided English translations of the Turkish instructions to minimize confusion about the task.

4.3. DATA PREPROCESSING AND ANALYSIS. Based on the vocabulary task results, two verbs (i.e., *küçümsemek* 'snub' and *yatıştırmak* 'appease') were removed from the analysis of the HS data due to nearly half of HS participants indicating unfamiliarity with these verbs.

A generalized linear mixed effects model was fit, with participant response for sloppy reading coded with 1 and strict reading coded with 0 on the dependent variable. Group (contrast-coded, HS=-0.5, TS=0.5), Form (contrast-coded, elided=-0.5, unelided=0.5), and TrialID, as well as an interaction between Group and Form were included as predictors in the initial model. Model-fitting proceeded as in Experiment 1. The best-fit generalized linear mixed effects model included the fixed effects of Group, Form, and TrialID, and an interaction of Group and Form, as well as random intercepts for participant and item.

4.4. RESULTS. Figure 3 depicts the proportions of sloppy-interpretation preferences for the TS and HS groups in the elided and unelided sentence forms.

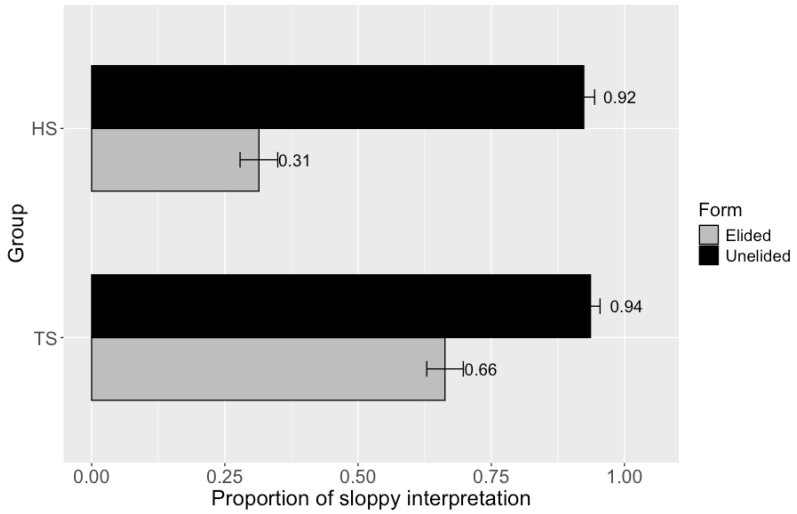

Figure 3. Mean proportion of sloppy interpretation in TSs and HSs in Exp. 2 (Turkish task)

The best-fit generalized linear mixed effects model indicated significant main effects of Group ($\hat{\beta}$=1.35, p=0.01), Form ($\hat{\beta}$=4.11, p<0.001), TrialID ($\hat{\beta}$=-0.02, p=0.04), and a significant interaction of Group and Form ($\hat{\beta}$=-1.47, p=0.01): TSs had a significantly higher sloppy reading preference than HSs, and the sloppy reading preferences for the unelided form was significantly higher than the sloppy reading preferences for the elided form. Also, the difference in HSs' sloppy reading preference between elided and unelided forms significantly differed from that of TSs.

We unpacked the interaction effect by fitting models to data within each condition, predicting responses to elided/unelided form with Group as a fixed effect, and participant and item as grouping factors for random intercepts. The model predicting responses to elided forms showed a significant main effect of Group ($\hat{\beta}$=2.62, p<0.001): With elided forms, TSs showed a significantly stronger preference for the sloppy reading than HSs. With unelided forms, the model showed no significant main effect of Group ($\hat{\beta}$=0.69, p=0.37): The strength of HSs' and TSs' sloppy reading preferences did not differ with unelided forms.

5. Comparing Heritage Speakers in English vs. Turkish. To observe any influence from either language-specific preference on HSs' interpretations for verbal ellipsis, we compared the sloppy reading preference of the HS group that completed the English task and the HS group that completed the Turkish task. (These were different participants.) The striking similarity between HSs across the two tasks (Figures 2 and 3), although the language of the tasks and the HS participants completing the tasks were different, also motivated this analysis. A generalized linear mixed effects model predicting responses to elided/unelided forms was fit, with the main effects of Experiment (contrast-coded, English=-0.5, Turkish=0.5) and Form (contrast-coded, elided=-0.5, unelided=0.5), as well as the interaction between Experiment and Form. Model fitting proceeded as in Experiments 1 and 2.

The best-fit generalized linear mixed effects model indicated a significant main effect of Form ($\hat{\beta}$=4.41, p<0.001) but no significant effect for Experiment ($\hat{\beta}$=-0.51, p=0.38), or the interaction between the two ($\hat{\beta}$=0.08, p=0.88): overall, the preference for sloppy reading for the unelided form was significantly higher than for the elided form, yet the two HS groups showed no significant difference across the two experiments: In other words, HSs doing the task in their dominant language (English) pattern like HSs doing the task in their heritage language (Turkish).

6. Individual Differences. To observe the extent to which participants exhibit individual differences, we examined the average responses for each participant in the different groups and conditions. Given the heterogeneity among HSs in language experience and proficiency, we wanted to evaluate how much individual-level variation is present in our data. While we did not formally analyze the influence of specific variables such as language exposure or AoA, this exploratory inspection serves to determine whether group-level patterns reflected consistent preferences or masked substantial individual variability. Figure 4 shows individual baseline speakers' (ESs on the left, TSs on the right) proportion of sloppy reading preference in the English (left) and Turkish (right) tasks, respectively:

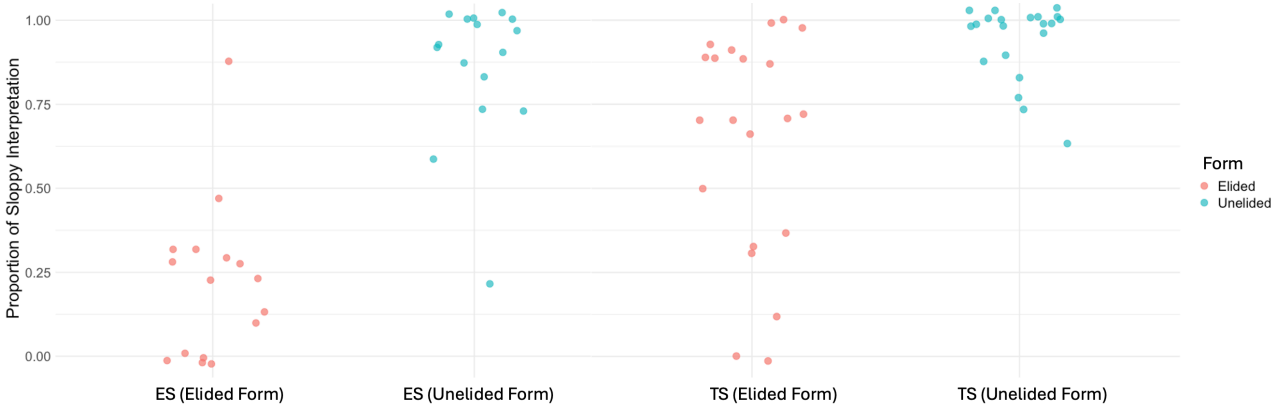

Figure 4. Individual ES (left) and TS (right) participants' mean proportion of sloppy interpretation for the stimuli in English (ES) and Turkish Tasks (TS). Each dot represents the average sloppy interpretation preference of each participant.

Visual inspection of Figure 4 suggests that, (a) with elided forms, individual participants in both baseline groups consistently showed a high rate of sloppy-reading choices, but (b) with unelided forms, TSs exhibited relatively a greater variability in the elided Turkish sentences compared to ESs in English. Figure 5 shows individual HSs' proportion of sloppy reading choices in the English (left) and Turkish tasks (right):

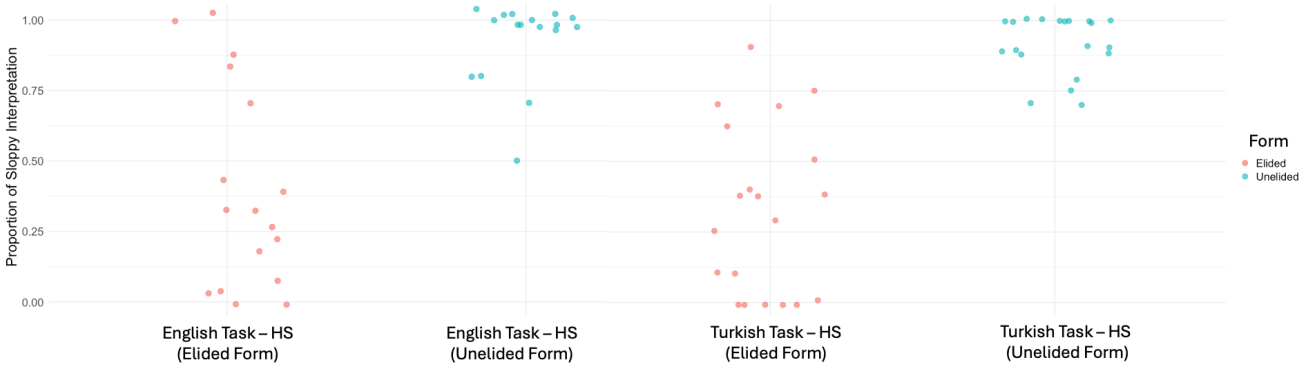

Figure 5. Individual HS participants' mean proportion of sloppy interpretation for the stimuli in English (left) and Turkish tasks (right). Each dot represents the average sloppy interpretation preference of each participant.

Visual inspection of Figure 5 suggests that, with unelided forms, HSs displayed a consistent sloppy-reading preference in the unelided form across both languages, similar to both baseline groups. For the elided forms, the pattern is more complex. Interestingly, although the two HS

groups were different participants that completed either the English (left) or the Turkish task (right), both HS groups' participants exhibited a larger individual variation – similar to TSs (Fig. 4) – with some participants showing a strong sloppy reading preference and others favoring a strict reading preference, regardless of the language.

7. General Discussion and Conclusions. This study aimed to investigate how Turkish HSs, in comparison to baseline Turkish speakers (TSs) and baseline English speakers (ESs) interpret the elided and unelided forms of verbal ellipsis sentences that are ambiguous between strict vs. sloppy readings. Specifically, we aimed to determine whether the well-documented divergence of HSs from baseline speakers in the domain of null subjects (e.g., Sorace & Serratrice, 2009) also extend to other kinds of 'missing' anaphoric elements, namely in verbal ellipsis constructions, particularly in a case where the interpretational preferences of the two baseline groups diverge.

As predicted based on prior work, ESs showed a preference for the strict reading in verbal ellipsis sentences in English, whereas TSs exhibited a strong preference for the sloppy reading in Turkish. As for the unelided forms, both TSs and ESs preferred the sloppy reading. The preferences observed among ESs partially align with earlier studies on English (e.g., Storbeck & Kaiser, 2018; Frazier & Clifton, 2006; Ong & Brasoveanu, 2014), which reported either a stronger tendency toward the strict reading preference (Frazier & Clifton, 2006) or no clear preference (Storbeck & Kaiser, 2018). The findings for TSs also align with our predictions made based on prior work that suggests that the null *pro* in Turkish is typically locally bound, thereby leading to the sloppy reading preference in Turkish (Şener & Takahashi, 2008; Gezen, 2022; Kornfilt, 2024).

In both their heritage and dominant languages, with unelided forms, HSs patterned with the two baseline speaker groups, showing a strong sloppy reading preference with no significant differences across any group comparisons. In contrast, when it comes to the interpretation of elided forms, HSs' interpretation patterns diverged from baseline speakers: in English, HSs patterned with ESs in preferring the strict reading, but in Turkish, HSs diverged from TSs by still preferring the strict reading. These findings suggest that while HSs are able to resolve anaphora reliably in the overt form (unelided sentences) in a target-like manner, they may exhibit divergences from baseline speakers when resolving dependencies in elided structures. This pattern is consistent with the divergence in interpreting elided material in heritage grammars (Laleko & Polinsky, 2017), however, the results revealing individual-level variation in both HS groups (i.e., those completing the English task vs. the Turkish task) and the baseline Turkish speakers, may potentially challenge the assumptions of *the Silent Problem*. That is, the Silent Problem suggests that HSs' divergence from monolinguals stems from the difficulty in interpreting null grammatical elements, yet our findings indicate that such divergence may not necessarily point to a certain level of difficulty, may not even be exclusive to HSs, and may instead reflect broader patterns of variability that could be observed in baseline speakers (i.e., TSs), as well. Specifically, our results showed that the two separate HS groups that were randomly assigned either the Turkish task or the English task exhibited similar interpretational preferences, despite completing the task in different languages: for elided forms, both HS groups showed similar rates of sloppy interpretation (31% in Turkish, 39% in English), with no significant difference (see Section 5). However, closer inspection of individual differences revealed that while, at first glance, HSs' mean proportion of sloppy reading preference in elided English sentences aligned with ESs' preference for strict reading in elided forms, individual HSs widely ranged in their responses (Fig. 5). This high individual-level variation is similar to the variation observed in TSs in Turkish elided sentences,

who, unlike ESs that were mostly consistent in their interpretation preferences in the elided forms, also exhibited high individual variation (Fig. 4).

Taken together, these results suggest that while HSs generally align with baseline speakers in resolving overt anaphora in unelided forms, they diverge in interpreting anaphoric dependencies in elided forms, including non-subject positions. Echoing findings from production studies where HSs overuse overt subjects (e.g., Sorace & Filiaci, 2006), HSs in this study patterned with baseline speakers only in their interpretation of unelided forms. The high individual variation observed in the elided forms in both HS groups and TSs may stem from the ambiguity of null *pro* in Turkish, which can correspond to *kendi* (possessive reflexive) or *onun* (possessive pronoun). In the absence of overt cues, individual participants may default to one interpretation, and for HSs, this interpretation may be influenced by dominant-language preferences to some extent. HSs' individual variation might also reflect differing degrees of exposure to each form (*kendi* vs. *onun*) across participants, resulting in individual-level differences in the interpretations for elided sentences, particularly under higher processing demands in the absence of overt cues (Laleko & Polinsky, 2017). Consistent with Scontras et al. (2017) that showed that Mandarin HSs apply their heritage language's interpretation preferences on their dominant language, English, the Turkish HSs in the present study may also draw on interpretation preferences shaped by their heritage language (influenced by their individual exposure to each form) in both languages.

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