

## Processing reflexive pronouns when they don't announce themselves

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In two experiments we investigated the comprehension of pronoun forms in Chamorro, a verb-initial Austronesian language that does not distinguish morphologically between reflexive anaphors and pronominals. In Experiment 1, on object pronouns, we found that comprehenders had a preference for reflexive interpretations despite the fact that the pronoun form was not morphologically marked as reflexive. In Experiment 2, on possessive pronouns, we found that this preference was much weaker. We conclude that when a morphological distinction between reflexive anaphors and pronominals is absent, comprehenders do prefer to assign reflexive interpretations. However, this pressure is defeasible and moderated by morphological and semantic factors, such as the competition between null and overt pronouns and the verb's argument structure.

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# 1 Introduction

## 1.1 Reflexive anaphors and Binding Theory

In the forty years since Chomsky (1981) first proposed the Binding Theory, there has been a wealth of research on the form, distribution, and interpretation of reflexive anaphors (henceforth *reflexives*). The 1981 Binding Theory consists of three syntactic principles. Two of the principles are stated in (1a), with some relevant terms defined in (1b).

- (1) a. Principle A: Anaphors are bound in their local domain.  
 Principle B: Pronominals are free in their local domain.
- b. Y is *bound* by X iff X c-commands Y and X and Y are coindexed.  
 X is *free* iff X is not bound.

Principle A requires reflexives and other anaphors to have a c-commanding antecedent in a designated local domain—a domain roughly equivalent to the clause. Principle B requires pronominals (ordinary personal pronouns) *not* have a c-commanding antecedent in this local domain. Together, Principles A and B paint a simple, appealing picture in which reflexives and pronominals are in complementary distribution: in structures in which a reflexive is grammatical, the corresponding pronominal with the same index is ungrammatical.

It quickly became clear that this picture is too simple. On the one hand, reflexives are heterogeneous, both crosslinguistically and within individual languages. The heterogeneity extends to their morphosyntax, the domains within which they must be bound, the types of DPs that can bind them, their (in)sensitivity to perspective, and so on (Reinhart & Reuland 1993; Cole et al. 2006; Kiparsky 2015; Déchaine & Wiltschko 2017; Reuland 2018; Charnavel 2021). These language-specific details must be stipulated. On the other hand, under the right discourse conditions, a pronominal can appear to have a c-commanding antecedent in its local domain. Such pronominals often have a different interpretation from the corresponding reflexive (Reinhart 1983; Heim 1998). In response to all this, numerous attempts have been made to update, revise, or replace the Binding principles in (1a) (Reinhart 1983; Burzio 1991; Levinson 1991; Pollard & Sag 1992; Reinhart & Reuland 1993; Levinson 2000; Wilson 2001; Safir 2004; Reuland 2011; Safir 2014; Kiparsky 2015). These attempts are conceptually and analytically diverse. What they share is that—unlike the 1981 Binding Theory—they are not exclusively syntactic. Instead, they account for the distribution of reflexives and pronominals by appealing to the interaction of syntax, semantics-pragmatics, and morphology. Most such approaches adopt some or all of the following assumptions:

- (i) The binding of reflexives and other anaphors is enforced by a constraint of grammar that refers to syntactic structure, either in the syntax proper or in Logical Form. This constraint requires an anaphor to be bound by a c-commanding antecedent in some designated domain.

- (ii) Reflexives must be bound because they are referentially defective—more precisely, deficient in syntactic features. The usual assumption is that they originate without phi-features (i.e. person, number, gender) and acquire these features from the antecedent that binds them.<sup>1</sup>
- (iii) A constraint that is semantic-pragmatic, or perhaps morphological, ensures that when a reflexive is grammatical, the corresponding pronominal is ungrammatical. The local domain over which this constraint holds is often defined semantically, in terms of a predicate and its arguments (Sells 1985; Farmer & Harnish 1987; Levinson 2000). To quote Farmer & Harnish (1987: 557): “The arguments of a predicate are intended to be disjoint, unless marked otherwise.”
- (iv) Within a given language, the norm is for different types of reflexives to be distinguished by their morphological form. Similarly, the norm is for reflexives to be morphologically distinguished from pronominals (e.g. the English reflexive *themselves* vs. the pronominal *them*). What is relevant here is that these norms are merely tendencies (Levinson 2000; Safir 2014; Kiparsky 2015). Languages occasionally violate them; for instance, reflexives are not morphologically distinguished from pronominals in languages such as Old English (Levinson 2000; Keenan 2002), Samoan (Chapin 1970), and—as we will see shortly—Chamorro.

One challenge for all approaches to Binding Theory is to explain why reflexives should be morphologically distinguished from pronominals in the first place. Safir (2014), who is one of the few to address this question directly, states, “One might reasonably speculate that the manifestation of this sort of morphological within-phase distinction, expressible in the syntax, might be reinforced by functional pressure for systems where semantic binding at the most local opportunity is distinguished interpretively from semantic binding that requires a longer store” (p. 119). The exact character of this functional pressure is unclear. Conceivably, it might be related to Levinson’s (2000: 273) claim that “where a coreferential interpretation is available it will generally provide an informationally richer, more informative, stereotypical, and ‘better’ interpretation” than a noncoreferential interpretation.

What functional pressure might privilege semantic binding at the most local level? This question could potentially find an answer in language processing. But previous research on the comprehension of reflexives has been limited to languages in which they are morphologically differentiated from pronominals, such as English and Mandarin (see Dillon 2014 for a review). It is unknown how comprehension proceeds in languages in which the two are not morphologically distinct. In two experiments, we probed the comprehension of reflexives in Chamorro, an

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<sup>1</sup> For Kratzer (2009), featural deficiency is characteristic not just of reflexives but of all pronouns that are interpreted as bound variables.

Austronesian language that is spoken in the Mariana Islands. Chamorro has no morphologically distinct reflexive anaphors; instead, reflexive clauses are constructed with ordinary pronoun forms. We asked two questions. First, given that Chamorro has no morphologically distinct reflexives, what cues, if any, do comprehenders rely on when deciding whether to interpret a given pronoun form as reflexive? Second, when such cues are entirely absent, is there nonetheless ‘functional pressure’ that favors a reflexive interpretation when it is available (and grammatical)?

The rest of this introduction surveys the literature on the processing of reflexive pronouns (in 1.2) and then introduces relevant aspects of the morphosyntax of Chamorro (in 1.3). Section 2 discusses Experiment 1, a touch-tracking picture-matching experiment that examined the comprehension of transitive clauses whose object could be interpreted as reflexive. Section 3 discusses Experiment 2, a picture-matching experiment that examined the comprehension of clauses in which the possessor of the object could be interpreted as reflexive. Section 4 concludes.

## 1.2 Processing reflexive anaphors

In sentence processing, anaphora resolution is construed as a set of processes for identifying the antecedent of a reflexive anaphor, pronominal, or other anaphoric element and linking the two.<sup>2</sup> This has proven to be a fruitful area of investigation because it demands theories of how the processor is able to coordinate representations across several levels—lexical, syntactic, semantic, and so on. Such coordinated representations are richly structured and Janus-like. On the one hand, they prospectively generate expectations about upcoming elements (Arnold & Tanenhaus 2011). On the other hand, these representations must be reactivated or navigated when an anaphoric element is encountered. An early suite of studies on the processing of reflexive anaphors and pronominals in English asked whether the principles of the Binding Theory act as “early filters” to generate the candidate antecedents for the anaphor or pronominal (Nicol & Swinney 1989; Badecker & Straub 2002; Sturt 2003). In the past decade, the questions addressed by this research have been recast as questions about memory retrieval (Dillon 2014) or a “mix of retrieval and expectancy-based processes” (Kaiser et al. 2009). What are those retrieval processes, and do they manifest a functional pressure for local binding?

Psycholinguistic theory was re-attuned to the associative character of working memory by the influential language processing experiments of McElree (2000), McElree et al. (2003), and Van Dyke & Lewis (2003), and the accompanying computational proposals of Lewis & Vasishth (2005) and Lewis, Vasishth, & Van Dyke (2006). The core claim is that recently-encountered linguistic material can be accessed in two ways: (i) directly, as an item or feature in the *focus of attention*; or (ii) associatively retrieved, using a set of *cues* provided by the grammar/parser

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<sup>2</sup> The terms *anaphora* and *anaphoric element* are more general than Chomsky’s (1981) use of the term *anaphor*. In the more general sense, the anaphoric elements include pronominals as well as reflexives and other types of anaphors.

in the local context. The associative character of retrieval was revealed in contexts in which the matrix verb being processed was preceded by a complex subject phrase (Van Dyke & Lewis 2003; Wagers et al. 2009). Constituents within the complex subject which are syntactically inaccessible but, critically, partially match the requirements of the matrix verb can influence processing at the verb. This is unexpected if the verb's dependents are identified by strictly traversing a hierarchical representation like a tree; however, it follows if the verb's dependents are identified by a cue-based retrieval in which recently encountered elements are re-activated as a function of their similarity, or match, to the cues. Elements that partially match are prone to cause interference (Van Dyke & McElree 2011).

Against this background, reflexives have “stuck out”: unlike subject-verb agreement or even the thematic integration of the subject, the dependency between a reflexive anaphor and its antecedent is less vulnerable to interference. This generalization, which was suggested by earlier research (Phillips et al. 2011), was directly validated by Dillon et al. (2013) in a series of eye-tracking and computational modeling studies which compared the processing of subject-verb agreement and the processing of reflexive anaphors. However, the apparently special behavior of reflexives may be a matter of degree, rather than kind. For example, Jäger et al.'s (2017) metaanalysis suggests that interference effects do exist in reflexive anaphora, but are considerably smaller than in subject-verb agreement. And Parker & Phillips (2017) provided evidence that, when a reflexive direct object pronoun mismatched the subject of its clause (the closest DP that could potentially bind it) in more than one feature, nonlocal potential binders could have an impact on comprehension and could ease the effects of ungrammaticality. Of course, this does not, on its own, explain why reflexive anaphora and subject-verb agreement show different degrees of resilience to distractors. What is responsible for the extra “protective factor” of reflexives?

Parker & Phillips (2017) relate the protective factor of reflexive pronouns to their (un-)predictability and how that affects the quality of the retrieval cues used by the comprehender. They conjecture that, because reflexive pronouns are simply less predictable than agreeing verbs, resolving the dependency between a reflexive and its antecedent will depend more on retrieval and less on prediction. Consequently, they reason, the comprehension mechanism will more strongly weight cues related to the dependency's structural requirements. In contrast, the features of agreeing verbs can routinely be predicted from their agreement controllers. This means that retrieval might simply not be needed to resolve every subject-verb dependency, as pointed out by Wagers et al. (2009). And consistent with that view, interference, in the guise of “agreement attraction”, occurs most reliably in ungrammatical strings when the prediction made about the verb's features fails.

Put in slightly different terms, the structural constraints that apply to subject-verb agreement are typically implemented prospectively, by predicting a verb of the right type and position. The

structural constraints that apply to reflexive anaphora are typically implemented retrospectively, by incorporating them as part of the cue set used during retrieval.<sup>3</sup>

Structural cues have been considered challenging to implement using standard associative memory mechanisms, because structural constraints are often conceived of as relational and open-ended. For example, the c-command relation can be evaluated for any two heads or projections in the structure, but “being a c-commander” isn’t an *inherent* feature of any given head. Thus, it cannot be recruited as a feature to use during retrieval. This problem, however, is not insuperable, because there are inherent features that could serve as reasonable surrogates. For example, in resolving a reflexive-antecedent dependency, the parser may do well to first reactivate subjects, which are the classic antecedents of reflexives, even though these might not be co-extensive with the entire set of c-commanding DPs. And an attribute like nominative case, or a similar feature involving grammatical relations, could be used to directly identify elements in “subject position” (Arnett & Wagers 2017).

Another open-ended relation is locality: can the parser limit the retrieval of preceding elements to just the local ones, since “being local” is not a fixed feature of any given item? Surrogates are probably available here, too. For example, Wagers (2008) proposed that all elements are encoded with a global state vector which evolves slowly with the parser’s state (cf. Howard & Kahana 2002), but changes more rapidly at clause boundaries. This would allow retrievals to initially target more local elements or, at least, elements belonging to the same clause. And some evidence suggests that the search for a reflexive’s antecedent can first target just the subject of the local clause (henceforth, the *local subject*). Dillon et al. (2014) investigated the processing of the Mandarin long-distance reflexive *ziji*. This reflexive anaphor can have a c-commanding antecedent that is the local subject or the subject of a higher clause, and can also function as a logophor (cf. Huang & Liu 2001; Cole et al. 2006). At stake in their experiment was the speed of accessing the local subject versus a more distant subject in the next higher clause. (2) illustrates this contrast, which takes advantage of the fact that the antecedent of *ziji* must be animate and sentient: in (2a), the only acceptable antecedent, *Coach Zhang* (underlined), is the more distant subject, while in (2b), the only acceptable antecedent is the local subject. Dillon et al. (2014) used the MR-SAT response-signal technique (Wickelgren et al. 1980; Martin & McElree 2008) to measure the speed-accuracy trade-off function for judging the acceptability of sentences like (2a–b). The key result was a dynamics difference in the SAT function. Participants were faster at recognizing (2b) as acceptable compared to (2a), even though participants ultimately preferred sentences in which *ziji* was bound by the more distant subject, as in (2a).

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<sup>3</sup> Van Dyke & Lewis (2003) discovered that subjects of tensed clauses are more difficult to integrate if they contain within them a subject of a tensed clause. This broadly replicated effect occurs during the processing of grammatical strings and has been attributed to retrieval interference (Van Dyke 2007; Van Dyke & McElree 2011; Arnett & Wagers 2017; Ben-Meir et al. 2019; cf. Jäger et al. 2017). It’s unclear why, if structural cues are available to reflexives that reliably identify local subjects, the same cues cannot be available to a verb. A third factor, such as the kind or complexity of the representative affected, may be relevant.

- (2) a. Coach Zhang says that the report underestimated **self**.  
 b. The auto-biography says that Coach Zhang underestimated **self**.

Dillon et al. (2014) constructed two computational models to explain these differences, both grounded in an associative memory. In their Local Search model, comprehenders initially attempt to retrieve only local antecedents—that is, antecedents that are local subjects. Only if this fails do they then proceed to cast a wider net. In the Unrestricted Search model, comprehenders do not specifically search for local antecedents, but a locality advantage can emerge due to the prominence or recency of the local subject. In both models, the characteristic that controls how well they fit the data is how often memory has to be sampled to attain a compatible antecedent (or, more precisely, the probability distribution over number of samples). In a model comparison analysis, Local Search outperformed Unrestricted Search with a 5:1 Bayes Factor advantage.

The question prompted by their study is *why* comprehenders engage in Local Search when multiple subjects are available that could serve as grammatical antecedents of *ziji*. If a locally-bounded search is necessary, or strongly incentivized for other reasons, then that could support the idea that Safir’s (2014) functional pressure for local binding is a processing pressure. What remains unknown is whether this pressure would be observed in the absence of a morphological distinction between reflexives and pronominals.

### 1.3 Chamorro

Chamorro is a verb-first language in which the word order of arguments after the verb is not fixed. Clauses can be *Verb Subject Object* (VSO) or *Verb Object Subject* (VOS), although VSO is the default. Subjects or direct objects (henceforth simply *objects*) that are personal names are preceded by the case marker *si*; otherwise, subjects and objects have no overt case marking; see (3). In this and other examples, CD identifies sentences taken from the electronic database for the Revised Chamorro-English Dictionary.

- (3) a. Ha        goddi si     Ramon i    chiba nu    i    tali.  
 AGR[3S] tie.up UNM Ramon the goat    OBL the rope  
 ‘Ramon tied up the goat with the rope.’ (CD, entry for *goddi*)  
 b. Ha        tokcha’ kalulot-tu        i    gaddu’.  
 AGR[3S] poke    finger-POSS[1S] the thorny.yam  
 ‘The thorny yam poked my finger.’ (CD, entry for *gatgãnta*)

The verb agrees with the subject through a prefix or proclitic that also indicates transitivity and mood. When the verb is transitive, this agreement registers person and number. In (3), for instance, the proclitic *ha* indicates that the subject is third person singular, the verb is transitive, and the mood is realis.

Chamorro has both overt and null pronouns.<sup>4</sup> Pronouns that are cross-referenced by agreement in person must be null. These necessarily null pronouns include the pronoun subjects of transitive verbs and pronoun possessors, such as the possessor of *kålulut* ‘finger’ in (3b). Otherwise, animate pronouns can be overt or null; see the object pronoun in (4).

- (4) Kåo un arerekla (gui’) esta?  
 Q AGR[2S] fix.PROG him/her already  
 ‘Are you already fixing her/him up?’

The overt object pronoun forms are weak pronouns, which must immediately follow the verb (in the clauses discussed here). Thus, in a transitive clause, a pronoun subject must be null and a pronoun object must immediately follow the verb.

## 2 Experiment 1: Processing object pronouns

### 2.1 Chamorro reflexive clauses

Chamorro has no morphologically distinct reflexive anaphors. Ordinary pronoun forms are used when a pronoun is interpreted as reflexive, that is, bound by a c-commanding antecedent in the local clause (= the clause most immediately containing the pronoun). Consequently, many reflexive clauses have no morphology at all that distinguishes them from nonreflexive clauses; see (5).

- (5) a. Hu tohni yu’ gi lamasa.  
 AGR[1S] brace me LOCL table  
 ‘I braced myself against the table.’ (CD, entry for *tohni*)
- b. Ha arekla gui’ para i misa i nana.  
 AGR[3S] fix her for the mass the mother  
 ‘The mother fixed herself up for mass.’

Pronouns that are interpreted as reflexive are generally overt. This is why the weak pronoun object in (6a) can be interpreted as reflexive, but the null pronoun object in (6b) cannot be. However, a null pronoun can be interpreted as reflexive when it is cross-referenced by agreement in person and therefore cannot be overt. For instance, the null pronoun possessor in (6c) can have a reflexive interpretation because it is cross-referenced by the 3sg. possessor-noun agreement suffix *-ña*.

- (6) a. Ha arekla gui’ para i misa.  
 AGR[3S] fix him/her for the mass  
 ‘She<sub>i</sub>/He<sub>j</sub> fixed herself<sub>i</sub>/himself<sub>j</sub>/her<sub>k</sub>/him<sub>l</sub> up for mass.’

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<sup>4</sup> Henceforth, we use *pronoun* to encompass items that could be analyzed as reflexive anaphors or as pronominals.



- b. Ha            arekla para i    misa.  
 AGR[3S] fix        for    the mass  
 ‘She<sub>i</sub>/He<sub>j</sub> fixed her<sub>k</sub>/him<sub>i</sub> up for mass.’ (But not: \*She<sub>i</sub>/He<sub>j</sub> fixed herself<sub>i</sub>/himself<sub>j</sub> up for mass.)
- c. Ha            fa’mâolik si    Juan i    karetâ-ña.  
 AGR[3S] fix            UNM Juan the car-POSS[3S]  
 ‘Juan<sub>i</sub> fixed his<sub>i</sub>/her<sub>j</sub>/his<sub>k</sub> car.’

Finally, *verb morphology* can signal that a pronoun object is interpreted as reflexive. In such cases, the reflexive adverb *maisa* ‘(by one)self’ combines with the verb to form a reflexive verb, as in (7).

- (7) Ha            areklan maisa    gui’ para i    misa i    nana.  
 AGR[3S] fix.L    REFLADV her for    the mass the mother  
 ‘The mother fixed herself up for mass.’

The combination of the verb plus *maisa* forms a single phonological word. This is why reduplication for the progressive aspect, which doubles the stressed CV of the verb, doubles the first CV of *maisa* in (8).

- (8) Ha            toktuk mamaisa        gui’ si    Margarita.  
 AGR[3S] hug    REFLADV.PROG her UNM Margarita  
 ‘Margarita is hugging herself.’

The presence or absence of *maisa* seems to have no semantic effect; compare (5b) and (7).

The absence of morphologically distinct reflexive anaphors raises the issue of whether Chamorro is constrained by the Binding Theory at all. The issue is whether pronouns that are interpreted as reflexive differ syntactically from other pronouns, despite the absence of any morphological distinction. In fact, Chamorro grammar does indeed distinguish pronouns that are reflexive anaphors from other pronouns (which are pronominals). We show this here for pronoun objects.

The most straightforward evidence comes from the Chamorro restrictions that ensure that subjects are salient (i.e. topical or noteworthy). Some of these restrictions demand that the subject have a minimum level of salience; others ensure that the subject is at least as salient as the object. For instance, the person-animacy restriction (PAH) prevents the object from outranking the subject in person or animacy (Chung 2014, 2020; Clothier-Goldschmidt 2015). One subcase of the PAH prevents a transitive verb from having an animate pronoun as the object when the subject is a nonpronoun. The transitive clauses (9a–b) conform to the PAH, but the ungrammatical (9c) does not.

- (9) a. Ta            lalatdi (gui').  
 AGR[1PINCL] scold him/her  
 'We (incl.) scolded him/her.' (Both the subject and the object are pronouns.)
- b. Ha            yulang si    Miguel.  
 AGR[3S] break UNM Miguel  
 'Miguel broke it.' (The object is an inanimate pronoun.)
- c. \*Ha            lalatdi (gui')    i    ma'estra.  
 AGR[3S] scold him/her the teacher  
 ('The teacher<sub>i</sub> scolded him<sub>j</sub>/her<sub>k</sub>.') (The object is an animate pronoun.)

Another such restriction is the third plural restriction (TPR), which prevents a transitive verb from having a subject that is third person plural, but not a pronoun (Chung 2020). The transitive clause (10a) obeys the TPR, but the ungrammatical (10b–c) do not.

- (10) a. Ma            fa'gasi i    kareta.  
 AGR[3P] wash the car  
 'They washed the car.' (The subject is a third person plural pronoun.)
- b. \*Ma            fa'måolik i    famagu'un.  
 AGR[3P] repair the children  
 ('The children repaired it.') (The subject is a third person plural noun.)
- c. \*Ma            sangâni yu' i    ma'estra siha.  
 AGR[3P] tell me the teacher PL  
 ('The teachers told me about it.') (The subject is a third person plural noun.)

The PAH is sometimes violated in elicitation contexts in fieldwork, but is a hard constraint in production (Clothier-Goldschmidt 2015). The TPR is never violated. Both restrictions exhibit morphological quirks that are irrelevant here.<sup>5</sup> When a clause would violate these restrictions, the typical remedy is to employ the corresponding passive, since passives are intransitive.

Significantly, the PAH and the TPR do not affect transitive clauses in which a pronoun object is interpreted as reflexive. These reflexive clauses systematically escape the restrictions. The reflexive clauses in (5b), (7), and (8) ought to violate the PAH, given that their object is an animate pronoun but their subject is a nonpronoun. Nonetheless, they are grammatical. Similarly, the reflexive clauses in (11) ought to violate the TPR, because their subject is third person plural but not a pronoun. These clauses are grammatical as well (Chung 1989).

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<sup>5</sup> The PAH ignores first person pronouns. Both the PAH and the TPR hold only for transitive clauses that show the default subject-verb agreement (Chung 2014).

- (11) a. Ma arekla siha si Sandy yan si Anicia.  
 AGR[3P] fix them UNM Sandy and UNM Anicia  
 ‘Sandy and Anicia fixed themselves up.’ (*But not: \*[Sandy and Anicia]<sub>i</sub> fixed them<sub>j</sub> up.*)
- b. Ma fa’gasin maisa siha i famagu’un.  
 AGR[3P] wash.L REFLADV them the children  
 ‘The children washed themselves.’

It is important that the pronoun object must be bound by the local subject in order for the clause to evade the PAH and the TPR. Clauses in which the pronoun object is bound instead by a c-commanding antecedent in a higher clause, or merely has an antecedent in previous discourse or a nonlinguistic antecedent, conform to the PAH and the TPR as expected. This pattern reveals that Chamorro grammar differentiates object pronouns that are interpreted as reflexive from other object pronouns. These pronouns are reflexive anaphors, even though they are not morphologically differentiated from other pronoun forms.<sup>6</sup>

The fact that reflexive anaphors are not distinguished by their morphological form raises the question of how they are recognized in comprehension. What cues are comprehenders sensitive to as they decide whether to interpret a given object pronoun as reflexive, and how does comprehension proceed when those cues are absent? Experiment 1, which investigates these questions, was designed to test two initial predictions. The first prediction was that comprehenders would be biased toward the reflexive interpretation by indirect cues, such as the reflexive adverb *maisa*, or a subject-object combination that would otherwise violate the PAH. The second was that when these cues were removed, the choice between the reflexive and nonreflexive interpretations would be essentially free. In brief, the results confirmed the first prediction, but not the second. Participants preferred reflexive interpretations, even with no direct or indirect morphological signal to guide them.

## 2.2 Participants

96 Chamorro speakers participated in Experiment 1, which took place in the U.S. Commonwealth of the Northern Mariana Islands (CNMI) in September 2016. They grew up in Saipan (39), Rota (49), Guam (5), and Tinian (3). Participants ranged in age from 22 to 70, with a median age of 45 years, and an inter-quartile range of 15.5 years. 56 participants reported that they had taken part in a previous experiment.

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<sup>6</sup> In the line with 1.1, we claim that these reflexive anaphors originate without phi-features and acquire these features from their antecedents.

### 2.3 Experiment 1: Materials and methods

The experiment followed a within-subjects and within-items design. Each itemset contained four sentences in which the object was the overt 3sg. object pronoun *gui'* and the local subject could potentially serve as its antecedent. These sentences crossed two factors: (i) Local Subject (LCLSUBJ)—whether the local subject was a (null) Pronoun or a Nonpronoun (overt DP); and (ii) Reflexive Adverb (REFLADV)—whether the reflexive adverb *maisa* was present or absent.

In addition, each itemset contained two control sentences in which participants could only access a non-reflexive interpretation. The PAH-Only control contained just one overt DP and no overt pronoun. The PAH forces the single overt DP in such clauses to be parsed as the object. The PAH + Plausibility control also contained just one overt DP, which in most cases was constrained by world knowledge to be plausible as the Theme but not the Agent.<sup>7</sup> (Throughout, we use *Agent* as a cover term for the thematic role assigned to the subject, and *Theme* for the thematic role assigned to the object.)

18 itemsets were constructed which each realized the six conditions. Thus 108 target items were created in total, and were distributed via a Latin Square so that each participant heard 3 target items per condition and no participant heard more than one target item from the same itemset. **Table 1** illustrates an itemset using the verb *patmáda* 'slap'. All verbs were progressive. 9 itemsets contained an oblique DP that appeared after the verb and before any (overt) local subject; in **Table 1**, the oblique DP is *ni panak lálu'*, 'with a flyswatter'.<sup>8</sup> Appendix A lists the verbs and any oblique DPs.

Each target sentence was preceded by a context sentence that served to introduce the two individuals in the scenario and thus to make a null pronoun felicitous. The context sentence was played simultaneously with the display of a context picture on the screen, as in **Figure 1A**. Contexts were constructed so that both the reflexive and disjoint interpretations of *gui'* in the target sentence were plausible. For the example itemset illustrated in **Table 1** and **Figure 1**, the context sentence was (12):

(12) **Example Context Sentence**

Umasagua si Felipe yan si Chai'. Umatgumentu i dos ni atdit ya mampus lalálu' i dos.  
*Felipe and Chai' are married. The two are arguing forcefully and they're very angry.*

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<sup>7</sup> In 14 of the 18 PAH + Plausibility controls, the overt DP was an implausible Agent because it was inanimate. Four out of 14 required a further manipulation to make this DP plausible as the Theme: either the nonapplicative form of the verb was used (e.g. *taitai* 'read' instead of *taitayi* 'read for') or the inanimate DP was realized as the object of a preposition (for *tanchu* 'identify, point out'). In the remaining 4 controls, the verb would not accept an inanimate argument, so the overt DP was animate, just as in the corresponding PAH-Only controls.

<sup>8</sup> Half the items contained an oblique DP because we were interested in exploring the hypothesis that, if there were an early interpretive commitment generated by just the verb and pronoun, the comprehender could show a "digging-in" effect if the subject phrase did not appear to immediately disconfirm that interpretation. We found no such effect.

REFLADV	LCLSUBJ	Example	Readings	
			REFL	DISJ
Present	<b>Non-pronoun</b>	[ Ha patmâdan <b>mamaisa</b> ] gui' ni panak lâlu' <b>si Felipe</b> AGR slap REFLADV.PROG PRON OBL swat fly Felipe 'Felipe was slapping himself with a flyswatter'	✓	✗
	<i>Pronoun</i>	[ Ha patmâdan <b>mamaisa</b> ] gui' ni panak lâlu' <i>pro</i> AGR slap REFLADV.PROG PRON OBL swat fly 'He was slapping himself with a flyswatter'	✓	✗
Absent	<b>Non-pronoun</b>	[ Ha patmâmada ] gui' ni panak lâlu' <b>si Felipe</b> AGR slap.PROG PRON OBL swat fly Felipe 'Felipe was slapping himself with a flyswatter'	✓	✗
☞	<i>Pronoun</i>	[ Ha patmâmada ] gui' ni panak lâlu' <i>pro</i> AGR slap.PROG PRON OBL swat fly 'He was slapping himself with a fly swatter' 'She was slapping him with a flyswatter'	✓	✓
Controls				
PAH-Only		[ Ha patmâmada ] ni panak lâlu' <b>si Felipe</b> <i>pro</i> AGR slap.PROG OBL swat fly UNM Felipe 'She was slapping Felipe with a flyswatter'	✗	✓
PAH + Plausibility		[ Ha patmâmada ] ni panak lâlu' i <b>fasun Felipe</b> <i>pro</i> AGR slap.PROG OBL swat fly the face.L Felipe 'She was slapping Felipe's face with a flyswatter'	✗	✓

**Table 1:** Example itemset (*patmâda*, 'slap').

The four conditions created by crossing LCLSUBJ with REFLADV are followed by the two control conditions. LCLSUBJ Nonpronouns are in bold face; LCLSUBJ Pronouns, which are null, are represented by *pro*. The critical object pronoun is the 3sg. *gui'*. The inflected verb is bracketed. Chamorro pronouns make no gender distinctions but English gendered pronouns in the translations serve to distinguish disjoint (DISJ) and reflexive (REFL) readings instead of indices. Potential readings are indicated with checks (grammatical) and crosses (ungrammatical). In the REFL reading, Felipe/he is slapping himself; in DISJ, she is slapping him/Felipe. In the PAH + Plausibility control, the single overt DP, *i fasun Felipe* ('Felipe's face'), is only plausible as the Theme. There is one critical condition in which both interpretations are possible: REFLADV Absent:LCLSUBJ Pronoun, indicated by the pointer.

The target sentence was embedded in the task instruction, which began playing immediately following the context sentence. Participants were directed to push a small icon, or 'puck', over to a depiction of the target sentence. The picture selection screen, as in **Figure 1B**, was presented simultaneously with the onset of the target sentence audio. For the example in **Table 1**, the full task instruction for the critical REFLADV Absent:LCLSUBJ Pronoun condition was (13):

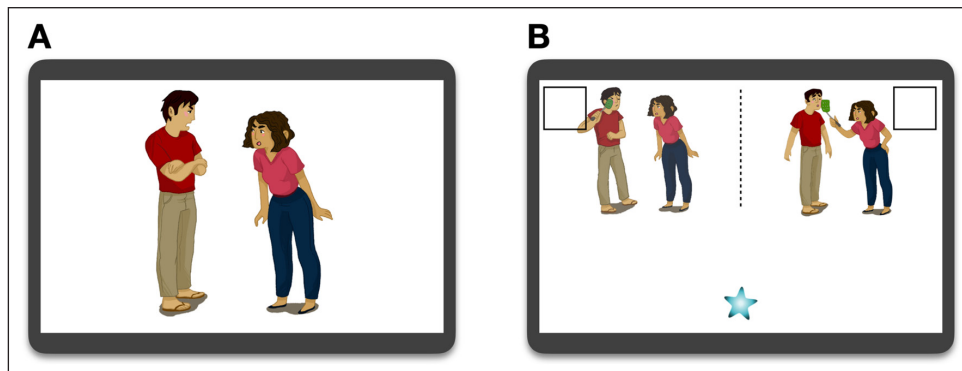
(13) **Task Instruction + Example Target Sentence**

Chonnik i puti'un guatu gi atyu na litrātu anai ha patmāmada gui' ni panak lālu'.

*Push the star over to that picture where she/he<sub>i</sub> is slapping him<sub>j</sub> with a flyswatter.*

Both pictures depicted the same type of event, e.g. a 'slapping' event. In the REFL picture, a self-directed version was depicted, and thus only one individual participated; in the DISJ picture, there were two distinct individuals participating. REFL and DISJ pictures were left-right counterbalanced on the response selection screen. Among the pictures that depicted two distinct participants, the left-right orientation of Agent/Theme participants was also counterbalanced. In the set of 18 REFL pictures, 13 depicted a single individual only and 5 depicted both individuals in the frame. Pictures were created by an illustrator working from photos and descriptions of life in the CNMI and Guam.

Participants could begin moving the puck at any point after the onset of the task instruction. Three pucks were counterbalanced across the experiment: a star, a heart, and a fish. A picture was registered as selected once the puck entered one of the two response selection boxes, at opposite corners of the screen. A small checkmark button then appeared below it. Participants had to press this button to advance to the next trial. However, they could also change their response at any time before confirming it. Once the task instruction finished playing, participants could replay both the context sentence and task instruction by pressing a small replay button which appeared in the bottom left-hand corner of the screen.



**Figure 1: Example context and picture selection screens (*patmāda*, 'slap').** Panel A shows the context screen, and Panel B shows the picture selection screen. The star (bottom center) is a draggable puck, which participants had to move to one of two response selection boxes (top corners), depending on which picture, for them, best satisfies the task instruction.

The experiment was programmed in the OpenSesame environment (Mathôt et al. 2012) and deployed on Samsung Nexus 10 tablets. All stimuli and instructions were delivered auditorily in Chamorro. For each participant, the 18 target trials were randomly interspersed with 12 filler

trials with exactly the same structure—picture selection with context and target screens—using items adapted from another experiment (Wagers et al. 2018). Thus each participant heard 30 trials in total. The 12 filler trials contained target sentences with ambiguous relative clauses, each of which had two possible interpretations.

The primary analysis was two regressions of reflexive choices. First, we regressed reflexive choice on the two experimental factors (REFLADV, LCLSUBJ) for the four core conditions in the experiment. As it turned out, there were vanishingly few errors in the REFLADV Present conditions and, for some itemsets, in the Controls as well. Therefore, we used Firth’s penalized likelihood method (Firth 1993), implemented in the R package *logistf* with intercept corrections (Heinze et al. 2020). This analysis is more appropriate than mixed-effects logistic regression in this application, where quasi-complete separation occurs due to (nearly) perfect performance in some conditions, participants, and itemsets. Confidence intervals over slope estimates were reported based on penalized profile likelihood. We then separately analyzed the three PAH-constrained conditions (the REFLADV Absent conditions plus the PAH-Only control) by estimating a Bayesian multilevel logistic regression in the package *brms* (Bürkner 2017).

In a secondary analysis, we analyzed touch time (TT), or the time when participants first touched the tablet, as measured from audio offset. TTs were analyzed with a Bayesian multilevel linear regression on the experimental factors, with an LKJ(2) prior on the random effects correlation (Lewandowski et al. 2009). A targeted pairwise comparison was then performed on critical REFLADV Absent:LOCALSUBJ Pronoun conditions, contrasting TTs for REFL and DISJ readings.

## 2.4 Results

REFLADV Present conditions gave rise to reflexive responses in nearly all trials: 544 of 556 valid responses were reflexive responses (98%). Control trials, where the interpretation was constrained to be disjoint, either by the PAH alone or in conjunction with Plausibility, gave rise to reflexive responses infrequently: 57 of 557 valid responses were reflexive responses (10%). Thus, participants could perform the task accurately, and were able to discriminate two classes of sentences with unambiguous interpretations.<sup>9</sup> **Table 2** gives the percentage of reflexive choices for each condition and a logistic regression on the REFLADV × LCLSUBJ design, showing that both the REFLADV and LCLSUBJ factors affected choices.

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<sup>9</sup> In all 18 itemsets, discrimination between unambiguous sentences was positive (median  $d'$ : 3.39, range: 1.95–4.32) with an overall bias toward reflexive responses (median  $c$ : -0.30; range: -0.90–0.25). One item accounted for 7 of the 12 errors in the REFLADV Present conditions, suggesting that it strongly resisted the REFL reading: *po'lyyi*, ‘set aside for’, is an applicative verb which some speakers also treat as a simple transitive verb (‘put’). This variability may be connected to the high error rate we observed.

**Table 2:** Reflexive interpretation rates in Experiment 1.

REFL ADV	LCLSUBJ	Predicted Interpretations		% REFL Choices (N)	Logistic Regression			
		REFL	DISJ		Coef. (S.E.)	lower 95%	upper 95%	
Present	Nonpronoun	✓	×	99.6 (277)	REFLADV	2.56 (0.46)	1.81	3.69
	Pronoun	✓	×	96.1 (279)	LCLSUBJ	1.33 (0.46)	0.57	2.47
Absent <small>ES</small>	Nonpronoun	✓	×	87.4 (278)	R.ADV:L.SUBJ	1.46 (0.91)	-0.06	3.72
	Pronoun	✓	✓	79.1 (277)	Intercept	2.92 (0.23)	2.47	3.37
<i>Controls</i>					<i>Logistic Regression: Firth's, + intercept correction. Slope</i>			
PAH-Only		×	✓	13.9 (280)	C.I.s: profile penalized log-likelihood.			
PAH + Plausibility		×	✓	6.5 (277)	Unit Centered contrasts: (R.A. Present, L.S. Nonpronoun) $\sim$ (+0.5, +0.5)			



In the REFLADV Absent conditions, comprehenders made fewer reflexive choices overall. In these conditions, no special morphology marks reflexivity: only by virtue of the use of *gui*' and the PAH can the comprehender calculate when a reflexive interpretation is allowed or required. We predicted that the presence of a LCLSUBJ Nonpronoun would force a reflexive interpretation, given that the PAH should exclude the disjoint interpretation. Reflexive interpretations did, in fact, predominate, but they were not as common as in the REFLADV Present conditions. The PAH has no impact when the LCLSUBJ is a pronoun, so in this condition both the reflexive and disjoint interpretations should be possible. Here, we found fewer reflexive choices compared to the corresponding LCLSUBJ Nonpronoun condition, but comprehenders still preferred reflexive interpretations.

We further modeled reflexive choices on three related conditions: the two REFLADV Absent conditions and the PAH-Only control. These three conditions are linked because their interpretations are not constrained by verbal morphology (and they did not give rise to near-perfect performance). We constructed a Bayesian multilevel logistic regression on these conditions.<sup>10</sup> We represented the differences among them with two coefficients coded using Helmert contrasts. One coefficient, PAH STRENGTH, compared the two unambiguous conditions (LCLSUBJ Nonpronoun and PAH-Only); the other coefficient, REFLEXIVE PREFERENCE, compared the critical ambiguous condition (LCLSUBJ Pronoun) with the mean of the two unambiguous conditions. Estimates of these coefficients support the following three conclusions.

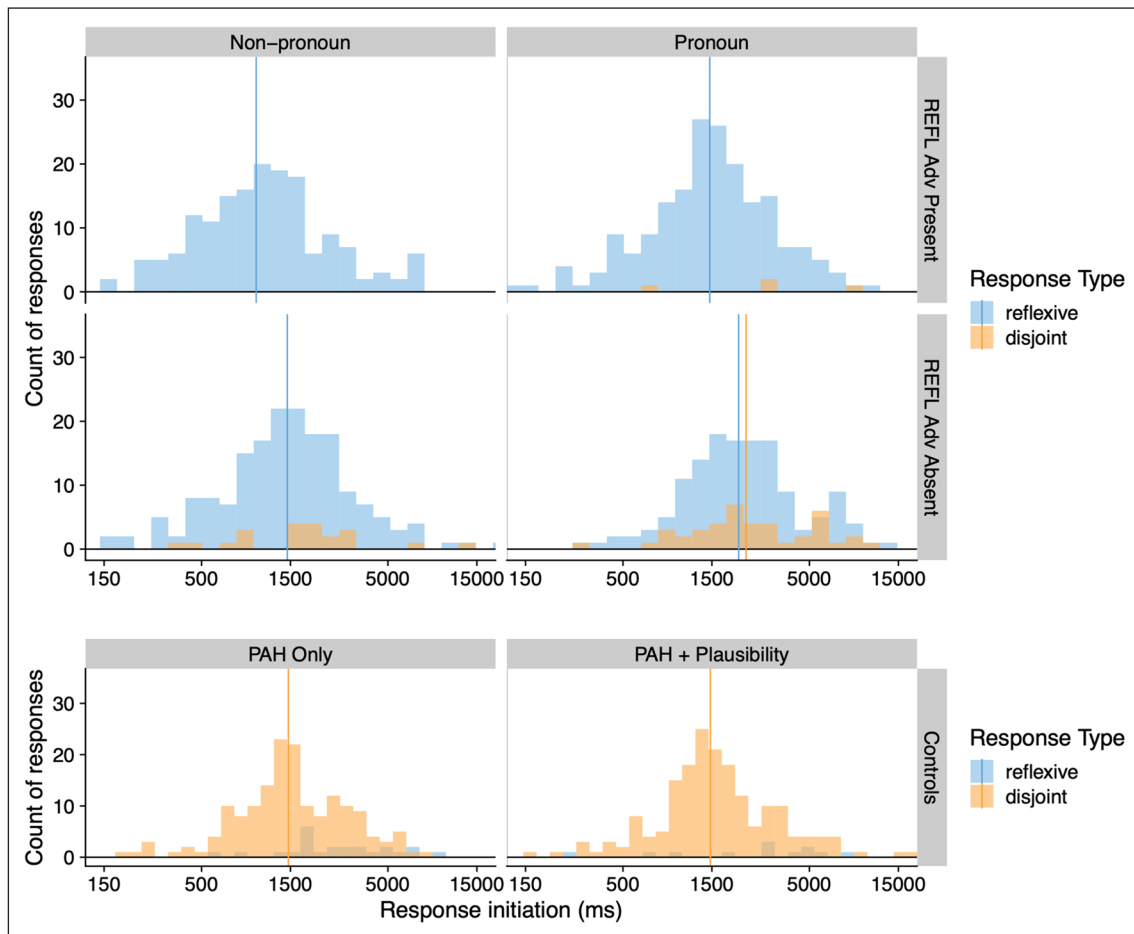
- (i) Participants were overall quite good at recognizing the environments in which the PAH applied: PAH STRENGTH, 3.92, s.e.: 0.48; 95% CredInt: 3.01–4.88; INTERCEPT, 0.51, s.e.: 0.26; 95% CrI: 0.00–1.01.
- (ii) Participants recognized the PAH environments symmetrically, making about as many errors on reflexive interpretation as they did on disjoint interpretation (13–14%). This symmetry can be revealed by deriving a median reflexive choice rate of 51% (95% CrI: 38%–63%) across posterior samples of the model.
- (iii) Participants had a clear *reflexive preference* in the LCLSUBJ Pronoun condition. REFLEXIVE PREFERENCE, 1.41 (s.e.: 0.26; 95% CrI: 0.92–1.95). Median reflexive choice rate in this condition of 81% (95% CrI: 69%–89%).

We measured when participants initiated their response by first touching the tablet. **Figure 2** plots the overall distribution of this variable, the Touch Time (TT). When we first considered the four target conditions, we found two simple effects: TTs were much faster in REFLADV Present

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<sup>10</sup> Because some items were error-free in the PAH-Only control, we added 1 reflexive and 1 disjoint response to each condition across all itemsets before estimating the model.

conditions (−1106 ms, 95% CrI [−1461 ms, −747 ms]) and in LCLSUBJ Nonpronoun conditions (−742 ms, 95% CrI [−1106 ms, −386 ms]). In this way, faster TTs correlate with conditions in which more reflexive responses were given. This is unsurprising if those conditions are the ones in which multiple grammatical constraints combine to deliver a more confident reading.



**Figure 2: Experiment 1 Touch Times.** Each panel shows histograms of response initiation times (“Touch Times”) for REFL and DISJ responses in the given condition. Vertical lines indicate median initiation times in that condition and response type for correct responses only.

If we consider just the critical REFLADV Absent:LCLSUBJ Pronoun condition, we can ask whether participants gave faster responses to the DISJ or the REFL reading. Although the DISJ reading gave rise to slightly slower TTs on average (215 ms), the 95% credible interval of TT for DISJ responses was −879 ms to 1249 ms. While we often expect minority responses to give rise to longer response times, we may simply have not had adequate power to resolve a true effect. Nonetheless, we found no evidence from TTs to suggest that the DISJ reading is somehow less accessible than the REFL reading.

Inspection of individual item rates suggests that considerable variation was linked to specific item properties. We believe that the source of this variability was the verb’s argument structure—specifically, whether its Theme argument (which was always realized as the direct object in our stimuli) must be animate. Seven of our verbs require their Theme to be animate (e.g. *na’chotchu*, ‘feed’, *suda’i*, ‘find for’). When we split the data by this feature, the average percentage of reflexive choices for the critical ambiguous sentences was only 57% for verbs that require an animate Theme (n = 7) versus 93% for verbs that do not require this (n = 11; e.g. *litratu*, ‘photograph’, *tãmpi*, ‘cover’). To further explore the strength of the relationship between argument structure and reflexive interpretation, we added VERB TYPE and its interaction with the experimental conditions as a covariate to our model. Estimates from this richer model are plotted in **Figure 3B**, which shows an overall *decrease* in reflexive choices when the verb requires its Theme to be animate. This is reflected in a simple effect of VERB TYPE, 1.54 (s.e.: 0.43; 95% CrI: 0.70–2.39). The interaction of VERB TYPE with PAH STRENGTH – the comparison between the two unambiguous conditions – was nearly zero (0.01, s.e.: 0.99; 95% CrI: –1.93–1.99). The averages plotted in **Figure 3** suggest that the effect of VERB TYPE is strongest for the ambiguous condition (REFLADV Absent:LCLSUBJ Pronoun). The interaction of VERB TYPE with REFLEXIVE PREFERENCE, which would quantify this impression, was positive (0.64, s.e.: 0.52), but the 95% CrI includes many negative values (–0.38–1.66). Therefore, it would be premature to conclude that this effect is confined only to the ambiguous condition. We instead interpret it as an across-the-board effect.<sup>11</sup>

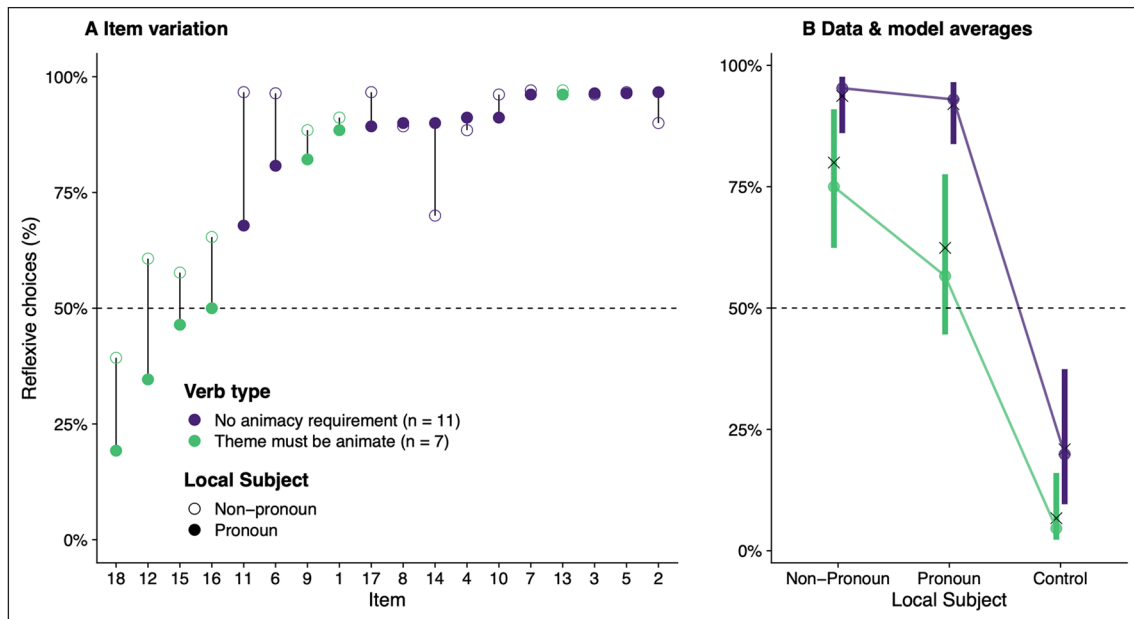
While this analysis is exploratory, we tentatively conclude that the verb’s argument structure modulates how the comprehender interprets the object pronoun *gui’*. Further research would be needed to establish whether this effect is independent of the reflexive adverb.

## 2.5 Experiment 1: Discussion

The results from Experiment 1 show that comprehenders can accurately parse sentences whose object is unambiguously reflexive, even though Chamorro has no morphologically distinct reflexive pronouns. Sentences in which the reflexive adverb *maisa* appeared were almost invariably interpreted as reflexive. Sentences in which the local subject was a nonpronoun, and therefore a disjoint interpretation was excluded by the PAH, were interpreted as reflexive almost as frequently. The PAH was not as effective a cue as the reflexive adverb. We attribute this to the fact that *maisa* is a direct morphological signal of reflexivity, whereas the PAH’s impact on

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<sup>11</sup> It is hard to extend this conclusion to the REFLADV Present data, because those conditions engendered only 12 errors across the entire experiment. However, 10 of these errors came from verbs that require an animate Theme, consistent with the generalization that such verbs favor disjoint interpretations. As mentioned in footnote 9, over half of these errors came from item 18 (*polu’yi*, ‘set aside for’). Given the arguable exceptionality of this verb or its context, we re-estimated the 3-condition VERB TYPE model with item 18 excluded. The relative effect size estimates did not change appreciably: PAH STRENGTH, REFLEXIVE PREFERENCE, and VERB TYPE all remained positive with 95% CrIs far from zero. See the Supplementary files.



**Figure 3: Verb Type influences reflexive choice.** Panel A plots the reflexive choice rate for the two REFLADV Absent conditions, namely, LCLSUBJ Pronoun (filled symbol) and LCLSUBJ Nonpronoun (open symbol). Items are ordered by reflexive choices in LCLSUBJ Pronoun. Color indicates whether the verb requires its Theme to be animate (green) or does not require this (purple). Panel B plots average reflexive choice rates by condition and verb type. Bars represent 95% credible intervals; black crosses mark model averages, and filled symbols the data averages. Control condition refers to the PAH-Only control.

interpretation can only be calculated once the subject and object DPs are identified and their lexico-semantic content is compared. It is not surprising that comprehenders might make an interpretive choice before the evidence provided by these calculations is available.

When the local subject was a pronoun and the reflexive adverb was absent, the object pronoun was technically ambiguous between the reflexive and disjoint interpretations. However, comprehenders' choices revealed a strong preference to interpret these sentences as reflexive. We attribute this *reflexive advantage* to two morphosyntactic factors. First, the object pronoun *gui'* contrasts with the null object pronoun, which is never reflexive and, therefore, always disjoint from the local subject. Armed with this knowledge, comprehenders might reasonably infer that had a disjoint interpretation been intended, the speaker would have chosen the null object pronoun. The second factor is the PAH. The verbs in the REFLADV Absent conditions show 3sg. subject-verb agreement and are immediately followed by the 3sg. object pronoun *gui'*. The subject, if overt, is encountered only later. Consequently, an early commitment to a reflexive interpretation of *gui'* is a safe choice, because the result will always be grammatical. In contrast, an early commitment to a disjoint interpretation comes with the risk that the subject might be a nonpronoun, in which case the PAH would be violated and reanalysis would be required.

How can we be sure that the reflexive advantage is a real preference, and not merely response bias? If participants had an overall bias to make reflexive responses, we should have found fewer errors in the REFLADV Absent:LCLSUBJ Nonpronoun condition, and more errors in the PAH-Only Control condition. In fact, the error rates were identical: 13% (see **Table 2**). This suggests that, in Experiment 1, neither reflexive nor disjoint interpretation was favored.

We were surprised to find a correlation between the proportion of reflexive interpretations and the verb's argument structure. When the verb required its Theme to be animate, the reflexive advantage was very slight indeed. When the verb did not require this, the reflexive advantage was as strong as in the REFLADV Present conditions and the PAH-Only controls, when the sentence had only a reflexive interpretation. We speculate that the reflexive advantage is generally strong in sentences of this type, but can be depressed by a semantic-pragmatic factor—the verb's argument structure—as follows. Recall that a predicate's arguments are “intended to be disjoint, unless marked otherwise” (Farmer & Harnish 1987, p. 557). Animate entities are known to be more salient in general than inanimate entities (Ferreira 1994; Prat-Sala & Branigan 2000; cf. Nairne et al. 2013), and animacy requirements have been shown to be especially prone to trigger predictive processing (Wagers & Pendleton 2016; Wang et al. 2020). We conjecture that when the comprehender encounters a verb that requires its Theme to be animate, a robust prediction develops for the features of the upcoming DP that will realize this argument. This raises the salience of the two animate referents in the discourse and, by doing so, enhances the default for the predicate's arguments to be disjoint. As a result, the reflexive advantage is largely neutralized. Put more succinctly, the verb's argument structure jump-starts the default disjoint interpretation of the Theme before the object pronoun is encountered, preempting any processes that favor a reflexive interpretation.

Experiment 1 shows that Chamorro comprehenders can easily access the reflexive interpretation of ambiguous sentences containing an object pronoun, even in the absence of direct morphological signals of reflexivity. Reflexive interpretations do have at least two indirect cues. First, a reflexive interpretation forecloses the possibility of a PAH violation triggered by combining a pronoun object with a nonpronoun subject. Second, only overt object pronouns can be reflexive, so the use of the overt 3sg. object pronoun *gui'* as opposed to the null object pronoun is possibly informative. A comprehender who tries to predictively interpret a sentence based only on a transitive verb and the object pronoun *gui'* will find themselves effectively hemmed in by the unspoken alternatives.

What would happen if this conspiracy of constraints and unspoken alternatives was removed? In Experiment 2, we investigate pronoun possessors of the object. Possessor pronouns, like object pronouns, have no dedicated reflexive forms. In addition, because of Chamorro's flexible word order, a possessor pronoun within the object can precede or follow the local subject. Possessor pronouns differ from object pronouns in that they (i) are not arguments of the verb, (ii) must

be null, and (iii) are generally not constrained by the PAH.<sup>12</sup> They therefore provide a neutral testing ground to assess whether the reflexive interpretation, in and of itself, has any privileged role in the comprehension of Chamorro pronouns.

### 3 Experiment 2: Processing possessor pronouns

#### 3.1 Chamorro possessors

Nouns in Chamorro can be preceded by an article and followed by a possessor. A possessed noun either agrees with the possessor in person and number (see (14a)) or else is joined to the possessor by a morpheme called the linker (14b).

- (14) a. i magagun-ñiha i famagu'un  
 the clothes-POSS[3P] the children  
 'the children's clothes'
- b. i magagun i famagu'un  
 the clothes.L the children  
 'the children's clothes'

When the possessor is a pronoun, the possessed noun must agree with it; there is no linker option. This means that possessor pronouns are cross-referenced by agreement in person, and therefore must be null; see (15).

- (15) a. i magagu-hu  
 the clothes-POSS[1S]  
 'my clothes'
- b. i magagun-ñiha  
 the clothes-POSS[3P]  
 'their clothes'

Like object pronouns, possessor pronouns can serve as reflexive anaphors or as pronominals. Evidence for this is provided by the TPR. Recall that the TPR prevents a transitive verb from having a subject that is third person plural, but not a pronoun (see 2.1). This restriction is systematically evaded by clauses in which the object is a reflexive anaphor. In addition, the TPR is evaded by clauses in which a pronoun *possessor* of the object is bound by the local subject. The transitive clauses in (16) are grammatical, despite the fact that their subject is third person plural but not a pronoun, because their object's possessor is a (null) pronoun that is bound by the subject.

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<sup>12</sup> Exceptionally, the PAH prevents the *possessor* of the object from outranking the subject when the object is introduced by the null nonspecific article (Chung & Wagers 2021). None of the stimuli in Experiments 1 or 2 had objects of this type.

- (16) a. Ma       pula'    i    magagun-ñiha    i    lalâhi.  
 AGR[3P] take.off the clothes-POSS[3P] the men  
 'The men<sub>i</sub> took off their<sub>i</sub> clothes.'
- b. Ma       sugun i    famañão'an i    karetan-ñiha.  
 AGR[3P] drive the women       the car-POSS[3P]  
 'The women<sub>i</sub> drove their<sub>i</sub> car.' (*But not: \*The women<sub>i</sub> drove their<sub>j</sub> car.*)

Reflexive clauses of this type are grammatical whether the subject precedes or follows the object. As long as the object's possessor is a pronoun bound by the local subject, the clause escapes the TPR. But if the possessor pronoun had been bound by a c-commanding antecedent in a higher clause, or had had a discourse antecedent or a nonlinguistic antecedent, the TPR would take effect as expected. This is evidence that the possessor pronouns in (16) are reflexive anaphors; they differ syntactically from possessor pronouns that are pronominals, even though the two are morphologically indistinguishable (since all possessor pronouns are null).

### 3.2 Participants

114 Chamorro speakers participated in Experiment 2, which took place in the CNMI in June 2019. They grew up in Saipan (58), Rota (51), Guam (5), and Tinian (1). Participants ranged in age from 18 to 76, with a median age of 47 years, and an inter-quartile range of 20 years. 37 participants reported that they had taken a previous experiment.

### 3.3 Materials and methods

The experiment followed a within-subjects and within-items design. Each itemset contained four complex sentences in which a transitive verb was accompanied by overt subject and object DPs. The object contained a possessor pronoun that could either be interpreted as reflexive or else anteceded by the subject of a different clause. These sentences crossed two factors: (i) Local Subject (LCLSUBJ)—whether the local subject preceded or followed the object; and (ii) Distant Subject (DISTSUBJ)—whether the nonlocal subject, which always preceded the possessor pronoun, was in a higher clause or an adverbial clause. The local subject is always a potential binder for the object's possessor, since it c-commands the object (and its possessor) whether the clause is VSO or VOS. A distant subject in a higher clause c-commands the possessor as well, and can therefore serve as a potential binder for it. A distant subject in an adverbial clause does not c-command the possessor, but it could serve as its discourse antecedent in our examples, because it always preceded the possessor. We included these two types of Distant Subjects in an attempt to tease apart whether the reflexive advantage we found in Experiment 1 was due to the presence of a local antecedent or a c-commanding antecedent. These two factors were confounded in Experiment 1: the local antecedents were exactly the c-commanding antecedents. In Experiment 2, Distant Subjects in a

higher clause provided the comprehender with potential antecedents for the possessor that were nonlocal but c-commanding. If the reflexive advantage in Experiment 1 stemmed exclusively from the presence of a c-commanding antecedent, then these Distant Subjects should be more effective antecedents of the possessor than a Distant Subject in an adverbial clause.

In addition, each itemset contained matched control sentences in which participants could access only the interpretation in which the distant subject was the antecedent of the possessor. In these controls, the local clause was passivized, so that the DP containing the possessor was now the local subject. A possessor pronoun in this configuration cannot be bound by the passive agent (PASSAGT), because the passive agent does not c-command it. (A separate Chamorro restriction prevents a pronoun in this configuration from having the passive agent as its discourse antecedent; see Chung 1989, 2020.)

32 itemsets were constructed which each realized the eight conditions. Thus 256 items were created in total, and were distributed via a Latin Square so that each participant heard 4 items per condition and no participant heard more than one item from the same itemset. **Table 3** illustrates the itemset constructed from the verb phrase *sugun i karetã-ña* ‘drive her/his car’. All verbs were in the realis mood. The verbs in the adverbial clauses were either progressive (e.g. *mamaigu* ‘sleep (PROG)’) or stative (e.g. *gaigi* ‘be (at a location)’); all other verbs were nonprogressive. The LCLSUBJ and DISTSUBJ were personal names that differed in their conventional gender association. Each pair of names was used twice, across two itemsets, and their order was swapped between these itemsets, so that LCLSUBJ in item N became DISTSUBJ in item N + 16). Appendix A contains a list of the names and verb phrases.

Each trial began with a context sentence that served to introduce the two individuals named in the target sentence. The context sentence was played simultaneously with the display with a pair of “portraits” on the screen, as depicted in **Figure 4**. Contexts were constructed so that the possessor pronoun in the target sentence could plausibly refer to either individual. For the itemset shown in **Table 3** and depicted in **Figure 4**, the context sentence was (17):

(17) **Example Context Sentence**

Parentis si Isidro yan si Maria.

*Isidro and Maria are related.*

The target sentence was immediately followed by a question, which asked (i) which individual was the possessor (an Antecedent Question) or else (ii) which individual was performing the action denoted by the verb (a Thematic Role Question). We included Thematic Role Questions to ensure that participants were attending to the meaning of the sentence and not just to the identity of the possessor. Antecedent Questions and Thematic Role Questions were equally balanced across trials. The Antecedent Question for the itemset shown in **Table 3** is given in (18a) and the Thematic Role Question is given in (18b).



DISTSUBJ	LCLSUBJ	Example
In higher clause	Precedes <b>Possessor</b>	Sen siguru <u>si Isidro</u> na ha sugun <u>si Maria</u> i <b>karetâ-ña</b> very sure UNM Isidro C AGR drive UNM Maria D car-POSS guatu gi tenda there LOCL store 'Isidro was very sure that Maria drove her/his car over to the store'
	Follows <b>Possessor</b>	Sen siguru <u>si Isidro</u> na ha sugun i <b>karetâ-ña</b> guatu gi tenda <u>si Maria</u> 'Isidro was very sure that Maria drove her/his car to the store'
In adverbial clause	Precedes <b>Possessor</b>	Anai mamaigu' <u>si Isidro</u> , ha sugun <u>si Maria</u> i <b>karetâ-ña</b> When sleep.PROG UNM Isidro AGR drive UNM Maria D car-POSS guatu gi tenda there LOCL store 'While Isidro was sleeping, Maria drove her/his car over to the store'
	Follows <b>Possessor</b>	Anai mamaigu' <u>si Isidro</u> , ha sugun i <b>karetâ-ña</b> guatu gi tenda <u>si Maria</u> 'While Isidro was sleeping, Maria drove her/his car over to the store'
Passive Controls (LCLSUBJ contains <b>Possessor</b> )		
DISTSUBJ	PASSAGT	
In higher clause	Precedes <b>Possessor</b>	Sen siguru <u>si Isidro</u> na sinigun as Maria i <b>karetâ-ña</b> very sure UNM Isidro C drive.PASS OBL Maria D car-POSS guatu gi tenda there LOCL store 'Isidro was very sure that his/*her car was driven by Maria to the store'
	Follows <b>Possessor</b>	Sen siguru <u>si Isidro</u> na sinigun i <b>karetâ-ña</b> guatu gi tenda as Maria 'Isidro was very sure that his/*her car was driven by Maria to the store'
In adverbial clause	Precedes <b>Possessor</b>	Anai mamaigu' <u>si Isidro</u> , sinigun as Maria i <b>karetâ-ña</b> When sleep.PROG UNM Isidro drive.PASS OBL Maria D car-POSS guatu gi tenda there LOCL store While Isidro was sleeping, his/*her car was driven by Maria to the store'
	Follows <b>Possessor</b>	Anai mamaigu' <u>si Isidro</u> , sinigun i <b>karetâ-ña</b> guatu gi tenda as Maria 'While Isidro was sleeping, his/*her car was driven by Maria to the store'

**Table 3:** Example itemset (*sugun i karetâ-ña*, 'drove her/his car').

In the top rows are the four conditions derived by crossing LCLSUBJ with DISTSUBJ. In the bottom rows are the matched passive controls. Note that the passive verb shows the passive infix *-in-* and the passive agent is marked with the oblique case marker *as*. Throughout, DPs containing possessor pronouns are in bold face; the DISTSUBJ and the LCLSUBJ are underlined. Chamorro pronouns make no gender distinctions. However, translations use gendered English pronouns (e.g. 'her', 'his') to highlight the distant ('his') and local ('her') readings without the use of indices.

- (18) a. **Example Antecedent Question**  
 Kao karetan Isidro pat karetan Maria masugun?  
*Was it Isidro's car or Maria's car that was driven?*
- b. **Example Thematic Role Question**  
 Kao si Isidro pat si Maria mañugun?  
*Was it Isidro or Maria who drove?*

Thematic Role Questions were counterbalanced across itemsets to ask about the event denoted by the local clause (e.g. driving in **Table 3**) or the event denoted by the adverbial clause (e.g. sleeping in **Table 3**). Participants selected their answer by touching the appropriate portrait.



**Figure 4: Example portrait selection screens.** A screen with two labeled portraits was displayed while the context sentence, the target sentence, and the question were played successively. Participants selected one of the two portraits by tapping on it. The panel on the left is part of two itemsets about Maria and Isidro. The panel on the right comes from two itemsets about Juan and Bek.

Experiment 2 departed from Experiment 1 in the structure of its trials and its response selection method. In Experiment 1, the different potential antecedents for the object pronoun corresponded to different events that could be easily distinguished by means of line drawings (e.g. self-slapping vs. other-slapping), so it was straightforward to present side-by-side depictions of these events and ask participants to select the correct depiction. In Experiment 2, the different potential antecedents for the possessor pronoun often corresponded to different events that could not be reliably distinguished in this way. Although the events of Maria driving her own car and Maria driving Isidro's car are different, it would be challenging for a single line drawing to capture the driving event and the car's ownership simultaneously. For this reason, we defaulted to a simplified response style, in which participants merely responded to a question that probed the referent of the possessor directly. We would have preferred a response selection method which provided data about the time course of processing the target sentence and which was (arguably) less taxing for participants. But we were unable to come up with a feasible version of such a method.

The experiment was programmed using the OpenSesame environment (Mathôt et al. 2012) and deployed on Samsung Nexus 10 tablets. All linguistic stimuli and instructions were delivered

in Chamorro, while participants listened over headphones. Each participant responded to 32 trials in total. There were no filler sentences in this experiment, given the variety of sentence structures in the target trials and given the different question types.

The primary analysis was two sets of regressions of reflexive possessor responses to the Antecedent Question, i.e. responses in which participants selected the portrait depicting the local subject of the target sentence. We also analyzed participants' accuracy on the Thematic Role Question. In each of these analyses, we estimated a Bayesian multilevel logistic regression in the package *brms* (Bürkner 2017). Fully-nested random effects were estimated with an LKJ(2) prior on the random effects correlation (Lewandowski et al. 2009).

For analyses of the Antecedent Question, we first regressed reflexive choice on the two experimental factors (DISTSUBJ, LCLSUBJ) for the four core conditions in the experiment, in which the target clause was in the active voice. We then separately analyzed the four passive conditions, defined by the cross between DISTSUBJ and PASSAGT.

Finally, we made a programming error that led to unequal distribution of the lists, with the consequence that we did not collect equal amounts of data for all items in all conditions. In particular, for some items, we did not get any responses to the Antecedent Question for Higher Clause conditions. We took two precautions in the analysis, to make sure that the imbalance does not misleadingly influence our conclusions. First, we always report three rates when we report the Reflexive Interpretation rates (Table 4): the aggregate reflexive interpretation rate, the average of the reflexive interpretation rate over participants, and the average of the reflexive interpretation rate over items. For each average, we report the number of participants or items that went into that average, therefore making it clear how much data was lost. Second, we supplemented our analysis with a composite analysis, which split the dataset by the Distant Subject factor and regressed on the Local Subject factor separately in both cases.

Data from two participants were excluded from further analysis because they attained very low accuracy on Thematic Role Questions (38% and 42%). Accuracy was otherwise high (see Tables 5 and 6).

## 3.4 Experiment 2: Results

### 3.4.1 Responses to Antecedent Questions

We report our main results in terms of the percentage of reflexive possessor responses to the Antecedent Question. In these responses, the participant's portrait choice identified the antecedent of the pronoun as a DP in the local clause. For the target conditions, these choices identified the Local Subject as antecedent, and for the passive controls, they identified the Passive Agent as antecedent. (We use the term *reflexive* in this experiment for the purposes of uniformity in reporting. The term is convenient but inaccurate for the passive controls; see below.) Table 4 reports these values along with coefficients from the logistic regressions. Here REFL refers to reflexive possessor choices, and DISJ refers to choices of the Distant Subject as antecedent.

In the target conditions, the DP containing the possessor pronoun was the object of a transitive verb in the active voice. We found an overall preference to choose the local subject as the antecedent, but this Weak Locality Preference was a slight 57% (95% CrI: 50%–64%); results are given in **Table 4** (top panel). Notably, it did not matter whether the local subject preceded or followed the pronoun, or whether the distant subject was in a higher clause or in an adverbial clause. The referent selection task thus gives *prima facie* evidence that the local subject enjoys some privilege as the antecedent of the possessor pronoun. However, any such privilege must be relatively weak and defeasible.

DISTSUBJ	LCLSUBJ	Predicted Interpretations		% REFL Choices (N)	Logistic Regression			
		REFL	DISJ			Coef. (S.E.)	lower 95%	upper 95%
In higher clause	Precedes Possessor	✓	✓	53.3 (334) 55.3 <sub>P110</sub> , 54.6 <sub>T25</sub>	Local Subj.	-0.07 (0.19)	-0.45	0.30
	Follows Possessor	✓	✓	52.2 (301) 53.1 <sub>P109</sub> , 51.7 <sub>T23</sub>	Distant Subj.	-0.26 (0.18)	-0.61	0.10
In adverbial clause	Precedes Possessor	✓	✓	55.7 (228) 56.5 <sub>P109</sub> , 56.4 <sub>T16</sub>	D.S.:L.S.	0.25 (0.31)	-0.37	0.86
	Follows Possessor	✓	✓	59.4 (192) 59.5 <sub>P97</sub> , 59.7 <sub>T16</sub>	Intercept	0.29 (0.15)	0.01	0.59
DISTSUBJ	PASSIVE-AGENT	Predicted Interpretations				Coef. (S.E.)	lower 95%	upper 95%
		REFL	DISJ					
In higher clause	Precedes Possessor	✗	✓	21.3 (334) 21.6 <sub>P110</sub> , 22.1 <sub>T25</sub>	Passive Agent	1.14 (0.27)	0.61	1.67
	Follows Possessor	✗	✓	8.3 (300) 8.3 <sub>P110</sub> , 8.3 <sub>T23</sub>	Distant Subj.	0.07 (0.24)	-0.39	0.54
In adverbial clause	Precedes Possessor	✗	✓	13.7 (189) 16.0 <sub>P108</sub> , 15.7 <sub>T16</sub>	D.S.:P.A.	0.64 (0.46)	-0.25	1.55
	Follows Possessor	✗	✓	12.2 (226) 12.6 <sub>P95</sub> , 11.9 <sub>T16</sub>	Intercept	-2.31 (0.25)	-2.81	-1.85
Unit Centered contrasts: (LCLSUBJ/PASSAGT Precedes, DISTS Higher) $\sim$ (+0.5, +0.5)								

**Table 4:** Reflexive interpretation rates in Experiment 2.

REFL choices are reported as a percentage, calculated in 3 ways: an aggregate (ungrouped) rate, whose denominator is reported in parentheses; as an average over participant rates, with subscript P; and over item rates, with subscript T. The number following each subscript is the effective number of groups in each average, dropping participants and items who contributed no data (due to a list imbalance error, reported in 3.3). E.g., P110 means that the average is over 110 participants, out of 114; T25 means the average is over 25 items, out of 32. Population effects for the regressions are reported in the right columns.

In the passive controls, the DP containing the possessor pronoun was the local subject, and the other DP in the local clause was the passive agent. Results for these conditions are in the bottom half of **Table 4**. Here, as expected, there was a strong preference *against* choosing the passive agent as the antecedent. On average, participants chose the passive agent 9% of the time (95% CrI: 6%–14%). Participants largely chose correctly, by selecting the distant subject as the antecedent. This was true whether the distant subject was in a higher clause and therefore a potential binder of the pronoun, or in a preceding adverbial clause and therefore a potential discourse antecedent for it. Interestingly, on the relatively few occasions when participants did choose the passive agent as the antecedent, there was a Linear Order Effect: these choices were made more often when the passive agent preceded the possessor pronoun than when the word order was the reverse (about 9% more often, 95% CrI: 4–15%).

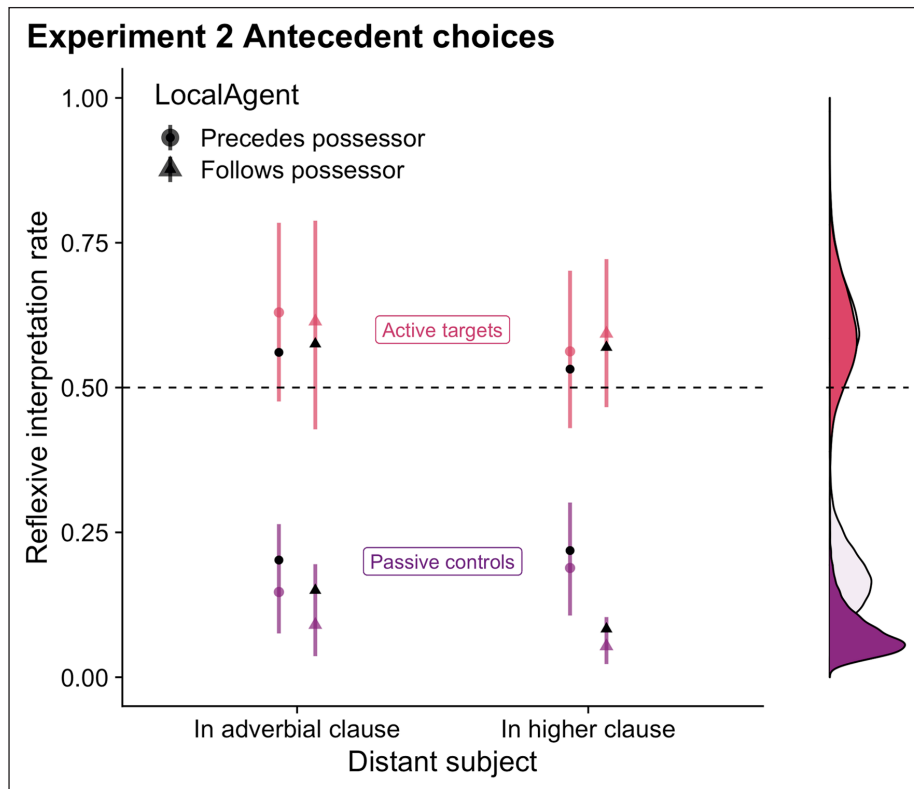
The Linear Order Effect arguably adds support to the claim that (legal) binding is not involved when the passive agent is chosen as the antecedent, because binding in Chamorro is otherwise insensitive to the linear order. As for the possibility of discourse anaphora, a separate Chamorro restriction prevents the passive agent from serving as the discourse antecedent of a pronoun possessor of the subject. We therefore treat the responses in which the passive agent was chosen as the antecedent as errors. (In our data archive, we present a supplementary analysis of this effect.)

With these potential generalizations in hand – the Weak Locality Preference for reflexive interpretations in the target sentences, and the Linear Order Effect in the passive controls – we proceeded to a composite analysis that estimated two models: one for 16 items in the four Higher Clause conditions (2 targets, 2 controls), and the other for 16 items in the four Adverbial Clause conditions. This was intended to address the list distribution error described in Section 3.3. The results, given in **Figure 5**, cross-validate the initial generalizations, albeit with greater uncertainty. According to the composite analysis, the reflexive preference rate in the target sentences was 59% (95% CrI: 48%–69%) in Higher Clause items; and 62% (95% CrI: 49%–75%) in Adverbial Clause items. In the passive controls, a preceding Passive Agent increased the reflexive interpretation rate by 14% (95% CrI: 4%–24%) in the Higher Clause items; and 5% (95% CrI: –6%–18%) in Adverbial Clause items. **Figure 5** visualizes these findings.

### 3.4.2 Responses to Thematic Role Questions

Participants answered an Antecedent Question in 20 of the 32 trials. In the other 12 trials, they answered a Thematic Role Question that probed the reference of the verb’s highest argument, either in the local clause (when it was realized as the local subject or the passive agent; 8 trials) or else in the adverbial clause (when it was always the local subject; 4 trials).

For Thematic Role Questions concerning the adverbial clause, participants responded accurately, with an average percentage correct of 90%. Many participants and many items showed



**Figure 5: Experiment 2 antecedent choices (composite analysis).** Main panel shows model estimates and 95% Credible Intervals for the eight sentence types in Experiment 2. Black symbols represent means over participants. Two separate models are represented: one for Distant Subject In Adverbial Clause conditions, and the other for Distant Subject In Higher Clause conditions. Density plots along the right margin show (combined) posterior distributions of the reflexive interpretation rate when Local Subject/Passive Agent Precedes Possessor (lighter) and when Local Subject/Passive Agent Follows Possessor (darker). Dashed line indicates 50%, or no preference for antecedent choice.

perfect performance. Lowest accuracy obtained in Passive Controls in which the Passive Agent preceded the Local Subject, even though the Thematic Role Question probed the reference of the highest argument in the *adverbial clause*, not the local clause. This gives additional evidence that this condition was the most difficult to process overall. See **Table 5**.

For Thematic Role Questions concerning the local clause, participants were generally accurate, with an average percentage correct of 84%. See **Table 6**. But here, there were stronger effects of experimental factors, particularly when the Local Subject *followed* the possessor pronoun. On average, this led to a decrease in accuracy of 10% (95% CrI: 1%–20%) in the target active conditions. Moreover, there was an effect of Distant Subject, such that Higher Clause conditions were on average 7% less accurate (95% CrI: 1%–15%) than Adverbial Clause conditions. In our data archive, we present supplementary analyses that address the source of the Local Subject effect, and whether it interacts with the Antecedent Questions.

	LOCALSUBJECT/ PASSIVEAGENT	% Correct	Logistic Regression			
				Coef. (S.E.)	lower 95%	upper 95%
Target sentences	Precedes Possessor	90.7 (111)	Local Subj.	-0.65 (0.35)	-1.35	0.01
	Follows Possessor	91.0 (107)	Voice	1.33 (0.46)	-0.81	0.55
Passive Controls	Precedes Possessor	85.3 (114)	L.S.:Voice	1.46 (0.91)	-0.10	2.62
	Follows Possessor	95.6 (109)	Intercept	2.35 (0.18)	2.00	2.69
Unit Centered contrasts: (L.S./P.A. Precedes, VOICE Active) $\sim$ (+0.5, +0.5)						

**Table 5:** Accuracy on Thematic Role Questions for the adverbial clause.

Because the adverbial clause did not vary with the syntactic structure of the local clause, we analyzed accuracy in a single regression that included *Voice* (whether the local clause was Active or Passive) as a fixed effect along with its interaction with Local Subject.

DISTSUBJ	LCLSUBJ	% Correct	Logistic Regression			
				Coef. (S.E.)	lower 95%	upper 95%
In higher clause	Precedes Possessor	84.9 (86)	Local Subj.	1.16 (0.50)	0.16	2.14
	Follows Possessor	72.6 (117)	Distant Subj.	-0.85 (0.39)	-1.67	-0.10
In adverbial clause	Precedes Possessor	91.8 (85)	D.S.:L.S.	-0.40 (0.75)	-1.94	1.06
	Follows Possessor	82.1 (123)	Intercept	2.23 (0.38)	1.56	3.02
DISTSUBJ	PASSIVE AGENT	% Correct				
				Coef. (S.E.)	lower 95%	upper 95%
In higher clause	Precedes Possessor	81.9 (83)	Passive Agent	-0.46 (0.48)	-1.44	0.44
	Follows Possessor	90.2 (123)	Distant Subj.	-0.40 (0.42)	-1.26	0.40
In adverbial clause	Precedes Possessor	90.5 (84)	D.S.:P.A.	-0.79 (0.77)	-2.22	0.82
	Follows Possessor	88.3 (120)	Intercept	2.31 (0.31)	1.78	2.98
Unit Centered contrasts: (LCLSBJ/PASSAGT Precedes, DISTS Higher) $\sim$ (+0.5, +0.5)						

**Table 6:** Accuracy on Thematic Role Questions for the local clause.

For the passive controls, there were no consistent effects of the Distant Subject or of the relative order of the Passive Agent and the possessor pronoun.

### 3.5 Experiment 2: Discussion

There were two main results from Experiment 2. The first is that comprehenders have a slight preference for the local subject as antecedent, but it is slight indeed. If we compare across the two experiments, we find that the preference for the local subject as antecedent in the active target conditions of Experiment 2 is comparable to the weakest preference for the local subject as antecedent shown in Experiment 1's ambiguous LCL SUBJ Pronoun conditions, i.e., when the verb required an animate Theme (Exp. 1: 62%, 95% CrI, 45%–76%; Exp. 2: 57%, 95% CrI, 50%–64%). Overall, we interpret this as evidence for a local antecedent advantage, albeit one qualified in strength and clearly defeasible in the face of other constraints.

The second result from Experiment 2 is the lack of convincing evidence that there is privilege for c-commanding antecedents over non-c-commanding antecedents – or, put another way, a preference for bound variable anaphora over discourse anaphora. Such evidence would come from a positive difference in reflexive interpretation rates between Adverbial Clause and Higher Clause conditions. The distant subject in the Higher Clause conditions c-commands the possessor pronoun, whereas the distant subject in Adverbial Clause conditions does not. If there were a preference for c-commanding antecedents over non-c-commanding antecedents, that should have rendered the distant subject a stronger competitor to the local subject in Higher Clause conditions, and we should have observed fewer choices of the local subject as antecedent in those conditions. (No such effect should have been observed in the Adverbial Clause conditions, given that the distant subject in those conditions does not c-command the possessor pronoun.) Average reflexive interpretation rates did conform to this prediction numerically: 58% in Adverbial Clause conditions v. 53% in Higher Clause conditions. However, the uncertainty around this difference reveals enough imprecision in the estimate to be circumspect (95% CrI, difference ranging from –3% to 14%). In a Bayes Factor analysis we directly compared the logistic regression reported above – which included Distant Subject as a factor – to a null model without it. This revealed moderate support for the null model (BF: 0.22).

## 4 General discussion

In two experiments, we tested how Chamorro speakers processed pronoun forms that serve as the object of a transitive verb or as the object's possessor. Pronoun forms in these functions can be reflexive anaphors that are bound by the local subject. But in neither function do these reflexives have a dedicated morphological form that distinguishes them from the corresponding pronominals (which *cannot* be bound by the local subject). A direct morphological cue that



signals whether the pronoun is bound by a c-commanding antecedent in the local clause is thus missing. Perhaps the null hypothesis about how pronoun forms are processed in a language like this is that the choice between reflexive and pronominal interpretations is random; when both interpretations are available and grammatical, the comprehender simply ‘flips a coin’. Experiment 1 evaluated this hypothesis for clauses with an object pronoun, a syntactic configuration which, in Chamorro, can offer indirect cues as to which interpretation the speaker may have intended. Experiment 2 examined clauses with a possessor pronoun, which offer no such indirect cues. We briefly rehearse the main findings, which are straightforward.

In Experiment 1, the object pronoun was always an argument of the verb (the Theme). There was a strong overall tendency for this pronoun to be interpreted as reflexive. The reflexive interpretation was essentially forced when the verb was combined with the reflexive adverb *maisa* or when the local subject was a nonpronoun. But even when these conditions did not hold, there was a preference for the reflexive interpretation that was somehow inherent to processing these pronoun forms. Participants selected the reflexive picture in 79% of the ambiguous trials. It seems unlikely that this figure reflects a response bias in the task, given that participants made about as many errors when the PAH forced them to select the reflexive picture as when it forced them to select the nonreflexive picture. Nonetheless, two effects from Experiment 1 warrant further scrutiny. The first involves argument structure: reflexive interpretation rates were much lower when the verb required its Theme to be animate. Otherwise, when no animacy requirement was imposed, the reflexive advantage in the ambiguous trials was comparable to that found in trials involving *maisa* or the PAH, where a reflexive interpretation was essentially forced. The second concerns the dynamics of response selection: although participants preferred the reflexive interpretation, they were not faster to select it. These effects suggest that the reflexive advantage is more of a defeasible nudge than an inescapable mandate.

Experiment 2 largely supports this view. The pronoun forms in this experiment were possessors, which are not arguments of the verb, always null, and not constrained by the PAH. Consequently, they offer a potentially clearer window into the inherent advantage of a reflexive interpretation. Here, we found that the reflexive advantage was present but weak, on the order of 57% with a 95% Credible Interval of 50–64%. This small effect appears to be neatly aligned with the percentage of reflexive choices made in Experiment 1 for verbs that required their Theme to be animate.

The view that emerges is that Chamorro comprehenders do not simply ‘flip a coin’ when processing these pronoun forms. Instead, the reflexive interpretation has a consistent advantage whose strength is affected by other factors in the local clause, such as the pronoun form’s syntactic function (object versus possessor) and the verb’s argument structure. The idea that

the reflexive advantage can be modulated by these other factors is broadly compatible with the multifactorial approaches to the Binding Theory sketched in Section 1. One might be tempted to draw more specific connections between our findings and, say, competition-based accounts of the distribution of anaphors and pronominals (e.g. Wilson 2001, Safir 2004, Kiparsky 2015, a.o.), or accounts of reflexivity and/or disjoint reference that are framed in terms of predicate-argument relations (e.g. Reinhart & Reuland 1993, Levinson 2000, Kiparsky 2015, a.o.). Our own view is that the findings of Experiments 1 and 2 are too preliminary to justify such a move. We have two reasons. First, the concept of competing constraints in theoretical linguistics does not have an obvious relation to competition in language processing. Second, although many linguistic theories hold predicate-argument relations to be an important determinant of reflexivity and disjoint reference, our results are not fine-grained enough to choose among these theories.

Finally, we want to return Safir's (2014) speculation that the crosslinguistic prevalence of morphologically distinct reflexive anaphors might be reinforced by functional pressure for "semantic binding at the most local opportunity [to be] distinguished interpretively from semantic binding that requires a longer store" (p. 119). Is there pressure of this sort in systems like Chamorro? Safir's conjecture brings to mind certain findings about memory architecture, such as Dillon et al.'s (2014) claim that reflexive anaphors are resolved by a series of retrieval operations which target first a local domain and then a more global domain. The idea of a two-stage process for identifying antecedents is not new (cf. Berwick & Weinberg 1984), and we can identify a benefit in distinguishing what kind of "stores" need to be consulted in binding.

Significantly, Experiment 2 uncovered no evidence of any pressure for Chamorro pronoun forms to be bound at the most local opportunity—namely, within the local clause. Had there been such pressure, comprehenders should have strongly preferred the local subject over the distant subject as the antecedent for the possessor pronoun. In fact, the overall preference for the local subject as the antecedent was slight. Similarly, had there been pressure for pronoun forms to be bound by a(ny) c-commanding antecedent, as opposed to merely antecedent in discourse, comprehenders should have selected a distant subject as the antecedent when it was in a higher clause, but not when it was in an adverbial clause. In fact, the selection rates for the two types of distant subjects were roughly comparable. These observations point to a more nuanced view of the reflexive advantage we found for object pronouns in Experiment 1—which, recall, was strong under some circumstances. This advantage probably does not reflect any general pressure for local binding, but might conceivably result from some slightly different, more targeted pressure, such as a pressure for anaphoric elements *that are arguments* to be bound at the most local opportunity, or to have an argument of the same predicate as their binder.

What, then, is responsible for the crosslinguistic tendency for reflexive anaphors to be morphologically distinguished from pronominals? We suggest that this tendency might be attributable to a functional pressure for quick resolution of ambiguity. In Chamorro, the reflexive advantage is present but, under many circumstances, weak. Comprehenders might not resolve the interpretation of a pronoun form immediately (see the analysis in the data archive), and they apparently do not choose a reflexive interpretation for such a form more quickly than they do a pronominal interpretation (see 2.4). At the same time, thematic role assignment is accomplished incrementally and efficiently. And the default is for the verb's arguments to be disjoint. All this suggests that one way that a language might increase the likelihood of speedy reflexive interpretations for arguments could be to give reflexive anaphors a distinctive morphological form. Put another way, a morphological differentiation between reflexive anaphors and pronominals might well serve to compensate for the inherent weakness of the reflexive advantage.

One question lurking in these speculations is whether a reflexive advantage is present but weak in other languages in which reflexives and pronominals are not differentiated morphologically. We leave this question for others to resolve.

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## Abbreviations

The following abbreviations are used in the glosses of the Chamorro examples: 1 = first person, 2 = second person, 3 = third person, AGR = subject-verb agreement, C = complementizer, D = determiner, INCL = inclusive, L = linker, LOCL = local case, OBL = oblique case, P = plural, POSS = possessor-noun agreement, PROG = progressive, PRON = 3 sg. object pronoun, Q = question, REFLADV = reflexive adverb, S = singular, UNM = unmarked case. CD identifies examples taken from the Revised Chamorro-English Dictionary database.

## Data availability

Experimental materials, data, analysis scripts, Appendix A, and other supplementary materials are available at <https://osf.io/bwczt/>.

## Ethics and consent

Potential participants were informed at the outset that their participation was anonymous and they could discontinue participation at any time. Their positive oral consent was then obtained. The UC Santa Cruz IRB waived the requirement for written informed consent, on the grounds that the need to sign a consent form might frighten participants or discourage their participation. Participants were compensated with a high-capacity flashdrive. After the debriefing, they were presented with a one-page information sheet in Chamorro and English that gave a lay description of the purpose of the research and the particular experiment, stated that participation was anonymous, and provided the names and contact information of the three researchers.

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## Competing interests

The authors have no competing interests to declare.

## Author contributions

Borja, Chung and Wagers contributed jointly to Investigation. Chung and Wagers contributed jointly to Conceptualization, Project Administration, and Writing. Wagers was the lead contributor to Data Curation, Formal Analysis, Methodology, Visualization and Software.

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