Anaphoric demonstratives occur with fewer and different pointing gestures than deictic demonstratives

ABSTRACT
Speakers often produce demonstratives, such as this/that and here/there, together with pointing gestures. However, little is known about what leads speakers to produce some demonstrative tokens with points, and others without them. We examine 724 demonstrative references made by speakers of Ticuna, an Indigenous Amazonian language, in a corpus of landscape description interviews. Our analysis assessed the effects of demonstrative phoricity (deictic vs. anaphoric) and information status (mentioned vs. new) on the co-organization of demonstratives and pointing. We found that both demonstrative phoricity and information status affected Ticuna speakers’ gesture rate: references with deictic demonstratives and discourse-new references were more likely to co-occur with points. Both phoricity and information status also affected articulatory properties of the gestures, such as handshape and elbow extension. Together, these findings show that both language-specific factors, such as demonstrative phoricity, and universal ones, such as information status, influence the co-organization of demonstratives and pointing. (150 words)

KEYWORDS
Demonstratives; Deixis; Anaphora; Gesture; Language Diversity

1. Introduction

Speaker-gesturers often produce demonstratives, such as this/that and here/there, simultaneously with pointing gestures. Linguists have discovered a great deal about demonstrative words across languages (Diessel, 1999; Fillmore, 1973; Levinson, 2004), and gesture researchers know a great deal about pointing gestures (Carpenter, Nagell, & Tomaselli, 1998).
Yet, despite their frequent co-occurrence, little research has investigated how verbal and visual deixis are related.

In this paper, we examine one aspect of the relationship between demonstratives and deictic gesture: whether different types of demonstrative words vary in the frequency or form of co-occurring pointing gestures (cf. Cooperrider 2016; Piwek, Beun, and Cremers 2008). Specifically, we use field data collected with speakers of Ticuna – an Indigenous Amazonian language – to ask whether anaphoric demonstratives differ from deictic demonstratives in (a) the frequency and (b) the articulatory properties of co-occurring pointing gestures. We find that, compared to deictic demonstratives, anaphoric demonstratives are significantly less likely to co-occur with pointing gestures. Additionally, when anaphoric demonstratives do co-occur with pointing, those points are significantly less likely to display an index-finger handshape. The deictic vs. anaphoric status of demonstratives, however, is not the only factor in the frequency and form of pointing. References to previously mentioned entities, even when made with deictic demonstratives, also display reduction in the rate and form of pointing gestures – showing that information status matters as well.

These findings indicate that Ticuna speakers’ use of pointing gestures is sensitive to both the deictic vs. anaphoric status of demonstrative words and the mentioned vs. discourse-new status of demonstrative referents. This result mostly does not support the views of the relationship among deictic language, anaphora, and pointing that currently predominate in formal and functional-typological linguistics. By contrast, our results are relatively consistent with psycholinguistic research on the effects of information status on gesture rate and form. Moreover, they enrich the gesture studies literature by showing that gesture reduction can be associated not only with changes in the syntactic category of co-occurring words, but also with changes in the semantic content of those words – whether they convey information about space (as in deixis) or discourse familiarity (as in anaphora).

The paper is organized as follows. In §2, we review claims in the linguistics and gesture studies literature about the relationship of demonstratives and pointing; in §3, we identify what these claims predict for the present study. Next, in §4, we provide background information on the Ticuna language and people, including the inventory of demonstratives in spoken Ticuna. §5 introduces the methods of this study, and §6 reports the quantitative results. §7 discusses the results in light of the predictions in §§2-3, and §8 concludes.
2. Theoretical approaches to demonstratives and pointing

Researchers working in general linguistics vs. in gesture studies make categorically different claims about the relationship of demonstrative words and pointing gestures. We first review linguists’ claims, then those of gesture studies researchers.

2.1. Linguistic semantics and pragmatics

2.1.1. The concept of phoricity

Most researchers studying demonstrative words operate in the linguistic fields of semantics and pragmatics. Within these fields, spoken language demonstratives are typically divided into two main categories: deictic (also called exophoric) and anaphoric (S. R. Anderson & Keenan, 1985; Diessel, 1999; Levinson, 2004). Deictic uses of demonstratives pick out the demonstrative referent from the physical surround of interaction. Anaphoric uses of demonstratives, on the other hand, pick out their referents from the set of referents introduced in the preceding discourse.

Many languages employ the same demonstratives for both deictic and anaphoric reference – for example, the English demonstratives this and that have both deictic and anaphoric uses. However, not all demonstratives are compatible with both deictic and anaphoric use. Certain languages have some demonstratives dedicated exclusively to deixis, and others only to anaphora. Korean is one example of a well-documented language with an exclusively anaphoric demonstrative, ku ‘that’ (analyzed as exclusively anaphoric by Ahn, 2017, 41-42). Another example is Yucatec Maya, which displays an exclusively anaphoric location-referring demonstrative, tiʔ...=iʔ ‘there’ (Hanks, 1990, 448-455). Thus, in languages like Korean and Yucatec, phoricity – deictic vs. anaphoric status – is a property of demonstrative types or lexical items. In English and other Indo-European languages, on the other hand, phoricity is a property of individual demonstrative tokens.

2.1.2. Phoricity vs. information status

In languages where phoricity is a property of demonstrative types, it overlaps with – but is distinct from – the information status of the demonstrative referent as discourse-new
vs. mentioned. Anaphoric demonstratives appear only on non-first (subsequent) mentions of the demonstrative referent, while deictic demonstratives can be used on either the first mention or a subsequent mention of their referent.

To see how deictic demonstratives can be used on both first and subsequent mentions, consider the Ticuna discourse in (1). In this discourse, the speaker uses the deictic proximal demonstrative nu’a² ‘here (near me)’ (discussed further in §4.1.1) on two successive mentions of the same location. The token in line (a) represents the first mention of this location in the discourse; the token in line (b), which immediately follows (a), is the second mention.

(1) Interviewer asks, ‘Where do you go to wash your clothes?’ Interviewee responds.

<table>
<thead>
<tr>
<th>a.</th>
<th>nu’a²ta²ã⁴, pa² tfau’e’ja¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>nu’a²</td>
<td>=ta²ã⁴ pa² tfau¹ =e’ja¹</td>
</tr>
<tr>
<td>DEM:PROXIMAL</td>
<td>only voc 1SG =‘sister’</td>
</tr>
<tr>
<td>‘Right here, sister,’</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b.</th>
<th>nu’a²ta²ã⁴ ni⁴⁴ʔi⁴⁴ tʃa¹ɟau¹ʔtʃi⁵ru²</th>
</tr>
</thead>
<tbody>
<tr>
<td>nu’a²</td>
<td>=ta²ã⁴ ni⁴⁴ʔi⁴⁴ tʃa¹ = jau¹ʔ =ʔtʃi⁵ru²</td>
</tr>
<tr>
<td>DEM:PROXIMAL</td>
<td>only loc 1SG.sc= wash =ni:clothes</td>
</tr>
<tr>
<td>‘Right here is where I wash clothes.’</td>
<td></td>
</tr>
</tbody>
</table>

(1) shows that deictic demonstratives, such as the proximal nu’a² ‘here near me,’ are flexible with respect to information status: they can be used on either first mentions (line a) or subsequent mentions (line b). Anaphoric demonstratives, by contrast, are inflexible. They can only be used on subsequent mentions. (2) provides an example of one of the anaphoric demonstratives of Ticuna, contrasting it with a deictic demonstrative. In this discourse, the speaker from (1) continues the discourse after a digression. In line (a), she refers to a location on the shore of a nearby lake, using the deictic distal demonstrative je’a². In line (b), she refers back to this location using the anaphoric demonstrative ŋe’ma².

(2) Context: ‘Yesterday, because we didn’t have the running water turned on yet...’

<table>
<thead>
<tr>
<th>a.</th>
<th>je’³ᵏa²⁴ma⁴ Kiʔtfiʔtu’tfiʔwa⁵ ni⁴⁴ʔi⁴⁴ tʃa¹jau¹ʔtfiʔru²³</th>
</tr>
</thead>
<tbody>
<tr>
<td>je’³ᵏa²⁴</td>
<td>=₃ᵏa⁴ Kiʔtfiʔtu¹ tfiʔi¹ =wa³ ni⁴⁴ʔi⁴⁴ tʃa¹ = jau¹ʔ</td>
</tr>
<tr>
<td>DEM:DISTAL =toward place.name =liquid =ALL LOC 1SG.sc= wash</td>
<td></td>
</tr>
</tbody>
</table>

¹Transcription in Ticuna examples uses IPA. Raised numbers represent tones (1 = lowest). Gloses follow the Leipzig Glossing Rules, with the following additional abbreviations: ni = noun incorporation, sc = subordinate clause (inflection type), sub = subordinator.
‘It was there (deictic distal), in the Cushillococha lake, that I washed clothes.’

b. *I went down to the port; it was there (anaphoric) that we washed clothes.*

As we discuss further in §4.1.1, the anaphoric demonstrative *pe’ma* only appears on subsequent mentions like the one in (2b). Deictic demonstratives like the proximal *nu’a* and distal *je’a*, on the other hand, are free to appear either on first mentions – like the token of *nu’a* in (1a) and the token of *je’a* in (2a) – or on subsequent mentions, as with the token of *nu’a* in (1b).

To provide an English parallel to the information-structural flexibility of deictic demonstratives, consider proper names like *Oakland* or first and second person pronouns like *me* in English. English proper names are not anaphoric devices, but (outside reflexive contexts) they can still be used on multiple successive mentions of the same referent, in discourses like *They were born in Oakland, and still live in Oakland.* The same is true about first and second person pronouns. Exactly like proper names, discourse-participant pronouns are never analyzed as anaphors – but they can still be used on multiple mentions in discourses like *Angel gave me a violin and Ariel gave me a drum.* Thus, what defines a demonstrative (or any other referring expression) as lexically anaphoric is not whether the expression may be used on subsequent mentions, but whether subsequent mentions represent the only context where it can be used. Lexically anaphoric demonstratives in languages like Korean, Yucatec, and Ticuna are characterized not only by acceptability on subsequent mentions of the referent, but also by unacceptability in initial mentions.

### 2.1.3. Phoricity and gesture

Linguistic research uniformly claims that phoricity – whether type- or token-level – is the most important factor in the co-organization of demonstrative words and pointing gestures. More specifically, linguists studying demonstratives claim that anaphoric (uses of) demon-
stratives **never or rarely** co-occur with points, while deictic (uses of) demonstratives usually or always do. This position is popular in both functional-typological linguistics (Diessel 1999, 2006; Fillmore 1973; Hanks 1990, 2005; a.o.) and formal semantics and pragmatics (Roberts 2002; Tonhauser, Beaver, Roberts, and Simons 2013; Wolter 2006).

Diessel (1999, 2006) is the functional-typological author who most clearly argues that the use of gesture with demonstratives turns on phoricity. In his widely cited study of the demonstrative systems of 84 languages, Diessel (1999, 111) argues that the deictic use of demonstratives is “the only use that is commonly accompanied by a pointing gesture.” In contrast, he writes, anaphoric (uses of) demonstratives “do not refer to concrete entities” and therefore “are usually not accompanied by a pointing gesture” (Diessel, 2006, 476).

Authors in formal pragmatics take a slightly different view than Diessel (1999, 2006). While Diessel does not argue that deictic demonstratives require pointing, formal pragmatics authors typically claim that pointing or indicating gestures are obligatory with deictic demonstratives (Roberts 2002, 92-93; Tonhauser et al. 2013, 73n7). Consequently, they assign deictic demonstratives a semantics in which pointing gestures can make a semantic contribution (Roberts 2002, 118; Wolter 2006, 69-70). These authors’ analyses of anaphoric demonstratives, on the other hand, do not include a semantic contribution from gesture (Roberts 2002, 123; Wolter 2006, 74-75). Unlike Diessel (1999, 2006), then, formal pragmatics authors do not take an explicit position on the probability or possibility of pointing with anaphoric demonstratives. However, their implicit position appears to be that pointing either does not occur with anaphors or does not contribute to their meaning.

While the claims by Diessel (1999, 2006), Roberts (2002), and Wolter (2006) are based primarily on qualitative data, Ahn and Davidson (2018) present more persuasive quantitative evidence for the claim that deictic and anaphoric demonstratives have categorically different relationships with pointing. Their study probed the lexical encoding of phoricity in Korean through a comprehension experiment. Korean participants viewed videos which showed speakers producing the anaphoric demonstrative *ku* and the deictic demonstrative *ce* with vs. without pointing. Participants rated stimuli with anaphoric *ku* and pointing as less acceptable than stimuli with *ku* but without pointing. Conversely, they rated stimuli with deictic *ce* and pointing as more acceptable than stimuli with *ce* but without pointing. A separate task confirmed that participants interpreted *ce* as deictic and *ku* as anaphoric...
regardless of the presence of pointing (Ahn & Davidson 2018, 7-8).

Ahn and Davidson (2018) take these results as evidence that *ku* is exclusively anaphoric and therefore degraded with pointing, while *ce* is exclusively deictic and therefore requires pointing. Thus, their results appear to be in line with the claim – expressed in the qualitative research on demonstratives cited above – that deictic demonstratives normatively co-occur with pointing, while anaphoric demonstratives do not. In the terms of gesture studies, this is a claim about gesture frequency or rate (i.e., the number of demonstratives which co-occur with gestures). The linguistic literature on demonstratives does not, by contrast, make any substantive claims about gesture form (i.e., whether gestures co-occurring with different demonstratives have different articulatory properties).

2.2. Gesture studies claims

Psycholinguistics-oriented gesture studies research has not yet examined the contrast between deictic and anaphoric demonstratives. However, this line of research has extensively studied the effects of information status – i.e., whether a referent has been previously mentioned, and the recency of its last mention – on gesture rate and form. Since information status and anaphora are related constructs, the findings of research on information status also yield predictions about anaphora. These predictions are markedly inconsistent with linguists’ prediction that anaphoric demonstratives do not occur with pointing.

2.2.1. Gesture reduction

Speakers gesture less on subsequent mentions of referents than on first mentions. This effect is seen for iconic gesture in speakers of English, German, and Dutch (Debreslioska & Gullberg 2020; Foraker 2011; Gullberg 2006). Moreover, the effect is not limited to the contrast between new and mentioned referents. It is also sensitive to more fine-grained differences in information status, such as the distinction between reintroduced vs. maintained referents: speakers of Turkish produce pointing gestures more often with reintroduced referents than with maintained ones (Azar, Backus, & Özyürek 2019). Because pronouns tend to occur on later mentions than noun phrases, speakers are also less likely to gesture with pronouns than with full NPs, a result found in Turkish (Azar et al. 2019), German (De-
breslioska & Gullberg, 2019), and L2 French (Gullberg, 2006). While pointing signs are not entirely comparable to co-speech pointing gestures (Fenlon, Cooperrider, Keane, Brentari, & Goldin-Meadow, 2019), the same effect obtains in signed languages as well. Auslan signers use fewer pointing signs in referring to discourse-old referents than discourse-new ones (Hodge, Ferrara, & Anible, 2019, 46).

While the above findings concern gesture rate, information status can also have effects on gesture form. Enfield, Kita, and De Ruiter (2007) studied the articulatory properties of manual pointing gestures by Lao speakers. They observed that when the speech co-occurring with a gesture involved “insecure reference” (which they define essentially as subsequent mention, Enfield et al., 2007, 1729-1730), speakers were less likely to engage the elbow in their pointing gestures, and less likely to orient their heads toward the pointing targets. Similarly, Peeters, Chu, Holler, Hagoort, and Özyürek (2015) analyzed the kinematics of pointing gestures made by Dutch speakers when addressees could vs. could not identify the pointing target independent of the gesture. They found that when addressees could identify the target without gesture (i.e., had more information about the referent), speakers used shorter stroke durations in their points. Like the results of Enfield et al. (2007), this finding indicates that increases in shared knowledge about pointing referents are associated with decreases in the visual salience of pointing gestures – where lower visual salience may involve either shorter stroke duration, as in Peeters et al. (2015), or engagement of fewer articulators, as in Enfield et al. (2007).

2.2.2. Predictions for deictic vs. anaphoric gesture

The findings discussed above yield three predictions about demonstratives’ relationship with pointing gestures.

First, subsequent mentions are associated with decreased gesture rate compared to first mentions (Debreslioska & Gullberg, 2020; Foraker, 2011). Thus, gesture studies research predicts that demonstratives which appear on subsequent mention of the referent (some of which are anaphoric) will occur with fewer pointing gestures than demonstratives which appear on first mention (all of which are deictic). This said, none of the gesture studies research discussed above has found that changes in information status cause speakers to completely refrain from gesturing. Therefore, unlike the linguistic research introduced in
2.1 gesture research does not predict that any group of demonstratives (whether defined by phoricity or by information status) will categorically fail to occur with pointing gestures.

Second, compared to pointing gestures appearing with first mentions, points appearing with subsequent mentions display (a) reduced extension of the elbow and (b) reduced orientation of the head to the pointing target (Enfield et al., 2007). Thus, gesture studies literature directly predicts that pointing gestures accompanying demonstratives used on subsequent mentions will be (a) less likely to display complete extension of the elbow and (b) less likely to include head turns than their first-mention counterparts.

Third, gesture studies research does not suggest a causal relationship between gesture reduction and changes in the content of co-occurring speech – such as shifts between full noun phrases and pronouns, or between deictic and anaphoric demonstratives. Instead, the authors discussed above argue that a third factor, information status, drives both gesture reduction and reduction in the spoken channel (Azar et al., 2019; Debreslioska & Gullberg, 2020; Holler & Bavelas, 2017). Therefore, for demonstratives, this research predicts that only the information status of the demonstrative referent – not the anaphoric vs. deictic status of the demonstrative word – will influence the rate and form of co-occurring gestures.

3. Advancing the debate

As laid out in §2, linguistic research and gesture studies research make competing predictions about the co-organization of demonstratives and gesture. Per §2.1 linguistic research on demonstratives claims that demonstrative phoricity (deictic or anaphoric status) is the key factor in determining the frequency of demonstrative-accompanying pointing gestures. By contrast, per §2.2 gesture studies research predicts that the information status of the demonstrative referent (as mentioned vs. new) will be the most important factor in determining the frequency of demonstrative-accompanying pointing gestures. Furthermore, gesture studies research predicts that information status will also impact gesture form, while narrowly linguistic research makes no claims about form.

In order to test these competing hypotheses, we need data from a language where anaphoric and deictic demonstratives clearly contrast. Data from languages where the same demonstratives can appear in both anaphoric and deictic use, such as English, are not appro-
priate, because many tokens of demonstratives in such languages are ambiguous between anaphoric and deictic readings.

Thus, this paper analyzes data from Ticuna, an Indigenous Amazonian language which – like Korean and Yucatec (§2.1), and unlike English – has a lexical contrast between anaphoric and deictic demonstratives. In light of the competing predictions of the linguistic and gesture-studies hypotheses outlined above, we ask two main questions about the relationship between demonstrative reference and deictic gesture in Ticuna.

Our first question relates to gesture rate. We examine how demonstrative phoricity and referent information status affect the proportion of demonstratives that occur with pointing gestures. As explained above, narrowly linguistic theories predict that anaphoric demonstratives will occur with fewer gestures than deictic demonstratives. Thus, phoricity will affect gesture frequency, but information status will not. Conversely, gesture studies research predicts that demonstratives used on subsequent mention will occur with fewer gestures than demonstratives used on first mention. In other words, information status will predict the frequency of demonstrative-accompanying gesture, while phoricity will not.

Our second question relates to gesture form. We test how demonstrative phoricity and information status affect the articulatory form of demonstrative-accompanying pointing gestures. The linguistic literature offers no predictions about this topic. The gesture studies literature, on the other hand, predicts that demonstratives with discourse-old referents will occur with less visually salient gestures (e.g., gestures that involve less extension of the elbow) than demonstratives with discourse-new referents. Thus, information status will matter to the articulatory properties of demonstrative-accompanying gestures, but demonstrative phoricity will not.

Before introducing the study which we conducted to test these hypotheses, we first provide an introduction to the Ticuna language and its demonstrative system.

4. Language background

4.1. Speakers and location

Ticuna is a language isolate spoken in the northwestern Amazon Basin. Contemporary Ticuna lands are located along the main course of the Amazon/Solimões river, in territory
currently occupied by Peru, Colombia, and Brazil. The Ticuna region extends roughly from the town of Cushillococha, Loreto region, Peru (3°56'30.7"S, 70°26'58.3"W) in the west to the mouth of the river Jutai, Amazonas state, Brazil (2°44'44.1"S, 66°46'34.8"W) in the east. Estimates of the total number of speakers of Ticuna range from 38,860 (Lewis, Simons, & Fennig, 2014) to 69,000 (Instituto Socio-Ambiental, 2017).

Some documentary and descriptive linguistic research on Ticuna is available. Most of this research concerns the language’s phonology (Anderson, 1959; Montes, 1995, 2004; Santos, 2004). A bilingual Ticuna-Spanish dictionary (D. Anderson & Anderson, 2017) is also available. Other than our own work on demonstratives (Redacted for anonymous review), there is no published research on semantics or pragmatics in the language.

Data discussed in this paper comes from our own fieldwork in and around the Ticuna town of Cushillococha, Peru. Cushillococha is a titled Indigenous community (i.e., a politically sovereign jurisdiction with collective land title) with roughly 5,000 residents. As of late 2019, we had spent approximately 13 months in the area. Effectively all Cushillococha residents speak Ticuna as their first and dominant language, and most adults also have at least some knowledge of Spanish.

4.1.1. Demonstrative system

The Ticuna language displays two sets of demonstratives: six nominal (entity-referring) demonstratives, equivalent to English *this*/that*, and six locative (place-referring) demonstratives, equivalent to English *here*/there*. The two sets of demonstratives differ primarily in syntax. Nominal demonstratives can act as modifiers of nouns and arguments of verbs, while locative demonstratives act only as adjuncts and predicates. Because of the distribution of nominal vs. locative demonstratives in the study materials (§5), this study analyzes only locative demonstratives.

The six locative demonstratives are speaker-proximal *nu’ä*, dyad-proximal *ŋe’a*, speaker-distal *je’a*, regional *nu’ma*, anaphoric *ŋe’ma*, and remote past anaphoric *je’ma*. As context for the analysis of the gestures which occur with each demonstrative, below we briefly describe the semantics of each of these lexical items. Our description summarizes the analysis in (Redacted for anonymous review), which is based on controlled production tasks and analysis of recordings of informal conversation.
Four of the six demonstratives of Ticuna are deictic: speaker-proximal *nu’a*, dyad-proximal *ŋe’a*, speaker-distal *je’a* and regional *nu’m*á. Speaker-proximal *nu’a* indexes places near the speaker (usually within arm’s reach) and regions that enclose the speaker. Regional *nu’m*á is a hyponym of speaker-proximal *nu’a*. It indexes only regions that enclose the speaker. Dyad-proximal *ŋe’a* typically indexes places located between the speaker and the addressee (i.e., within the interactive dyad made up by the two participants). However, it can also be used to index places that are located between the speaker and a salient landmark, similar to the expression *on the near side* in English. This landmark-oriented use accounts for most tokens of the dyad-centered demonstrative in the study materials. Speaker-distal *je’a* indexes places that are located far from the speaker (i.e., that they cannot reach and that do not enclose them).

The other two demonstratives, anaphoric *ŋe’m*á and remote past anaphoric *je’m*á, are anaphoric. More specifically, anaphoric *ŋe’m*á has two uses. First, it acts as the language’s primary locative anaphor. Second, it can also act as an addressee-centered locative demonstrative, indexing places on the addressee’s body or near them (roughly, within their reach). Because the task used to produce the study materials did not involve reference to the addressee’s location, the addressee-centered use of *ŋe’m*á never appears in the data analyzed in this study. We therefore treat *ŋe’m*á as exclusively anaphoric. Remote past anaphoric *je’m*á is semantically identical to anaphoric *ŋe’m*á, except that *je’m*á can occur only in clauses with remote past temporal reference. This is part of a broader nominal tense phenomenon in Ticuna ([Soares, 2017](#)).

Crucially, anaphoric *ŋe’m*á and remote past anaphoric *je’m*á are the only place-referencing demonstratives of Ticuna that allow anaphoric uses. The speaker-proximal, dyad-proximal, speaker-distal, and regional are exclusively deictic; they always require a particular spatial relation between the speaker (or dyad) and the referent. By contrast, anaphoric *ŋe’m*á and remote past anaphoric *je’m*á convey nothing about the spatial relations between the discourse participant and the referent. They can be coreferential with any deictic demonstrative (Redacted for anonymous review), and require only that the referent has been previously mentioned.
5. Method and materials

5.1. Data collection

Six Ticuna speakers, aged 35 to 72 years, participated in a monolingual interview about the current and historical locations of various landmarks in their community. Three participants were male and three were female. Ticuna was the participants’ sole native language; all six also knew at least some Spanish. To avoid priming effects, prior to debrief we did not inform participants that we were interested in pointing gestures or that the task was designed to elicit them. Interview questions followed Kita’s (2001) “Historically Anchored Locality Description” (HALDI) interview guide, which has also been used in other studies of deictic gesture, such as Enfield et al. (2007) and Mesh (2017). Angel Bitancourt Serra, an L1 Ticuna speaker who lives in the Cushillococha area, translated the interview guide into Ticuna and assisted us in adding location-specific questions.

The author was the interviewer for all six participants. The author is an L2 speaker of Ticuna, but speaks the language well and was able to pose questions and comprehend responses throughout the interviews. We chose not to use a native-speaker interviewer because many of the HALDI interview questions would be pragmatically odd if asked by a person from the same location as the participant. The interviews took place in the Cushillococha area in 2017 and 2018. They were recorded with one high-definition video camera, supplemented by a lavalier microphone worn by the participant. All study procedures were approved by the Institutional Review Board of the University of California Berkeley.

5.2. Speech coding

The total recording time of the 6 interviews combined was 3 hours 19 minutes. The author transcribed all speech on the recordings in ELAN (Wittenburg, Brugman, Russel, Klassmann, & Sloetjes, 2006). Angel Bitancourt Serra and Lilia Witancort Guerrero, both L1 Ticuna speakers, checked the transcriptions and translated the speech into Spanish. The first five minutes of each interview were transcribed, but excluded from all further analysis because they were occupied mostly by explanation of the task.

After transcription, we identified all locative demonstrative tokens in the speech ($n = 750$). Each demonstrative token was coded for Phoricity, treated as a binary variable with
the values Deictic and Anaphoric. Tokens of the speaker-proximal, dyad-proximal, speaker-
distal, and regional demonstrative types were coded as Deictic, while tokens of the anaphoric
and remote past anaphoric demonstratives were coded as Anaphoric. For each token, we also
identified the demonstrative referent and coded whether it had been mentioned previously in
the interview. Mention was coded as a binary variable with the values First and Subsequent.

Only locative demonstratives (equivalent to here/there) were annotated and coded, as virtually all nominal demonstratives (equivalents to this/that) in the interviews were
anaphoric. Uses of anaphoric locative demonstratives as connectives, equivalent to and then,
were annotated \( n = 20 \), but excluded because they did not contribute to place reference.
Following this exclusion, 730 locative demonstrative tokens remained in the dataset.

5.3. Gesture coding

Seven US-based research assistants coded the manual gestures in the footage. The coders
were aware of the study hypotheses, but did not have access to the speech, as they did not
understand Ticuna and were not provided with translations of the audio.

The coders identified all manual gestures in the footage. Non-manual deictic gestures,
such as chin and lip points, are prominently discussed in the literature on gesture in the
Indigenous Americas (Mihas, 2017; Sherzer, 1973). Moreover, in at least some Indigenous
American speech communities, non-manual deictic gestures are salient enough that they
are the subject of explicit metalinguistic discussion: for example, Diné (Navajo) artist Dustin
Martin titled a design collection “Point Lips, Not Fingers” (Allen, 2013). Like people from
other Indigenous groups, Ticuna speakers do produce lip and chin points in conversation,
and both of the speech coders for this study recognized non-manual gestures as pointing.
Thus, coders were instructed to look for non-manual gestures in the study footage. However,
they did not identify any non-manuals which were not accompanied by a hand movement.

After identifying gestures, the coders coded each gesture for five variables: (1) hand-
shape, (2) articulators, (3) motion, (4) arm extension, and (5) head orientation. Due to issues
of reliability (discussed below), only the handshape and arm extension data are analyzed in
\( \S 6 \); we discuss the other variables solely in the interest of transparency.

\[2\]
Martín’s discussion of his title suggests that he sees Diné lip pointing as so salient that it is obvious even to visitors: “like many Navajos who grow up on the rez, I learned that pointing my lips was a polite alternative to conventional hand gestures. Anyone who’s spent time in Navajo land will know what I’m talking about” (emphasis mine) (Allen, 2013).
Coders coded handshape based on a controlled vocabulary with seven categories, shown in Table 1. For the articulators variable, they coded which hand(s) were involved in the gesture, using a left/right (not dominant/non-dominant) vocabulary. For the motion variable, coders coded for the presence of circling and tracing motions during the gesture. This variable was included because the presence of circling and tracing motion was used as an exclusion criterion in Enfield et al. (2007).

For the arm extension variable, coders described the flexion of the participant’s elbow at the gesture peak, again using a controlled vocabulary. Gestures were coded as involving “full” extension of the elbow if the forearm attained an angle of 180° with the upper arm at the gesture peak. They were coded as “acute” extension if the forearm attained an angle of less than 180° with the upper arm at the peak. Last, gestures were coded as involving “no change” in arm extension if the angle of the forearm relative to the upper arm did not change in the course of the gesture. For the head orientation variable, coders described whether, at the peak of the gesture, the participant’s head was oriented toward vs. away from the gesture target. This variable was coded only for gestures displaying handshapes associated with pointing (index, index+1, index+2, thumb, and flat).

To assess inter-rater reliability, a secondary coder re-coded footage for all five variables. The secondary coder used the same gesture segmentation as the primary coder, but coded the variables independently. Codes were compared for 25% of the annotations made by the primary coder. Coders displayed inter-rater agreement of 69.6% for handshape (Cohen’s κ = 0.584), 94.1% (κ = 0.956) for articulators, 24.4% (κ = 0.618) for motion, 82% (κ = 0.688) for arm extension, and 68.9% (κ = 0.473) for head orientation. Because secondary coding was conducted only to measure reliability, we use the primary coders’ data for all analyses.

Following Debreslioska and Gullberg (2019), presence/absence of a gesture was treated as a binary variable for the analyses reported in §6. Handshape and arm extension codes were also transformed to binary variables. Handshape was transformed to a binary variable distinguishing between index-finger points (defined as index, index+1, and index+2 handshapes) and all other handshapes. After the transformation, the handshape data displayed inter-rater agreement of 91.9% (κ = 0.831). Arm extension was transformed to a binary variable distin-
guishing full arm extension and all other values. It then displayed inter-rater agreement of 93.3% ($\kappa = 0.849$).

5.4. Post-processing

After the speech and gesture annotation was complete, we identified all demonstrative tokens that overlapped with gestures for at least 100ms. This procedure identified 530 demonstrative-gesture composite utterances in the data set. We reviewed the video for each composite utterance to confirm that a gesture was present and plausibly included a deictic component. The review identified 43 composite utterances where there was actually no gesture overlapping the demonstrative ($n = 15$) or where the gesture which co-occurred with the demonstrative had no apparent deictic component ($n = 28$, including 14 iconic gestures, 7 emblems, 5 beats, and 2 pointing gestures where the pointing target was not coreferential with the demonstrative). The other 487 demonstrative-accompanying gestures all appeared to have some deictic component.

Referent animacy has pervasive effects on pointing form and frequency in both gesture and signed languages. In terms of form, while American English speakers nearly always use index-finger handshapes to point at objects and locations (Cooperrider, Slotta, & Núñez 2018, 1382), they frequently use the entire hand (in the American Sign Language B handshape) to point at people (Fenlon et al., 2019, 12-13, 17). Similarly, in terms of frequency, Hodge et al. (2019, 46) show that Auslan signers more often use pointing signs to introduce human referents than to introduce animal and inanimate referents. Given this context, it is important to observe that the points in our dataset – all of which overlapped with locative (place-referring) demonstratives – were directed at locations, not people, animals, or objects. Because all points were directed at locations, we did not include animacy or place vs. object distinctions as independent variables in our models.

6. Results

We analyzed the data with mixed-effects logistic regression using the glmer function of the lme4 library in R (Bates, Mächler, Bolker, & Walker, 2015; R Core Team, 2020). As described in §5.3, the dependent variables were binary; we therefore specified binomial error
structure for the models. Additionally, in order to account for random variation between participants, we included random intercepts for participants and (initially) by-participant random slopes in each model (Baayen, Davidson, & Bates, 2008; Barr, Levy, Scheepers, & Tily, 2013). Many of these “maximal” models either did not converge or displayed singular (boundary) fits, indicating overfitting. Below, we explain the processes that we used to remedy non-convergence and overfitting for each model.

6.1. Demonstrative tokens in speech

Participants produced a total of 730 tokens of demonstratives in the dataset. 508 (69.6%) demonstrative tokens were deictic and 222 (30.4%) were anaphoric. Among deictic demonstrative tokens, 299 (58.9%) were speaker-proximal, 168 (33.1%) were speaker-distal, 31 (6.10%) were dyad-proximal, and 10 (1.97%) were regional. Among anaphoric demonstrative tokens, 162 (73.0%) were tokens of the anaphoric demonstrative, and 60 (27.0%) were tokens of the remote past anaphoric demonstrative.

Demonstratives were distributed asymmetrically between first and subsequent mentions of the referent. Among the 730 overall tokens of demonstratives, 176 tokens (24.1%) appeared on first mention of the demonstrative referent, and 554 (75.8%) appeared on subsequent mentions. Not all demonstrative tokens that appeared on subsequent mentions of their referent were tokens of anaphoric demonstratives. Rather, of the 508 deictic demonstrative tokens, only 170 tokens (33.5%) appeared on first mention of the referent. The other 338 deictic tokens (66.5%) appeared on subsequent mentions.

By contrast, of the 222 anaphoric tokens, 216 tokens (97.3%) appeared on subsequent mention. Only 6 anaphoric tokens (2.7%) appeared on first mention of the referent. Most of the 6 anaphoric tokens appearing on first mention did not independently accomplish place reference, but instead functioned as relative pronouns introducing a location relative clause. In light of this nonreferentiality, and as well as the small size of this group, the 6 anaphoric demonstrative tokens used on first mention were excluded from all further analyses.

Following this exclusion, 724 demonstrative tokens remained in the dataset. These tokens were exhaustively divided into three groups: (1) deictic demonstratives used on first mention of the demonstrative referent (170 tokens), which are labeled as “Deictic First” in all following figures and analyses; (2) deictic demonstratives used on non-first mentions
of the demonstrative referent (338 tokens), which are labeled “Deictic Subsequent”; and
(3) anaphoric demonstratives used on non-first mentions (216 tokens), which are labeled
“Anaphoric Subsequent.”

Visual inspection of deictic vs. anaphoric demonstrative-gesture composite utterances
immediately suggested differences between these three groups. For example, Figures 1, 2, and 3 provide video stills of the same participant, Lucinda Gómez Cordero, producing a
first-mention deictic reference (Figure 1); a subsequent deictic reference to the same referent
(Figure 2); and an anaphoric reference (Figure 3) with deictic gestures.

The speech in the composite utterances in Figures 1 through 3 was previously shown
as examples (1) and (2). Recall from the examples that, immediately before the composite
utterance shown in Figure 1, the interviewer (the author) asks Lucinda where she goes to
wash clothes. She replies, nu’á’ta’á⁴ ‘right here,’ using the speaker-proximal deictic demon-
strative nu’á⁴ ‘here (near me),’ and makes the gesture shown in Figure 1. She then returns
her hand to rest and is silent for 300ms. Then, as the interviewer turns to look at the referent,
Lucinda repeats the same demonstrative, with the same referent, as part of a location focus
construction, saying nu’á’ta’á⁴ ni⁴¹ʔĩ⁴ tʃa¹ɟau¹ʔtʃi⁵ru² ‘right here is where I wash clothes.’
As Lucinda repeats the demonstrative from her first reference to this location, she also repeats
a very similar deictic gesture, as shown in Figure 2. (1) provides an interlinear gloss of the
speech accompanying the gestures in Figures 1 and 2.

Following the composite utterance shown in Figure 2, Lucinda and the interviewer
discuss for 12 seconds how she went to wash clothes in a different location the previous day.
Lucinda refers to this discourse-new location several times with noun phrase descriptions
and deictic demonstratives. Then, she produces a location focus construction summarizing
what she has just said, using the anaphoric demonstrative ne’ma⁷ ‘there (anaphoric).’ As
she says ne’ma⁷ ni⁴¹ʔĩ⁴ ta’jau’ʔtʃi⁵ru⁶ ‘there (anaphoric) is where we (exclusive) washed
clothes,’ she produces the deictic gesture shown in Figure 3. (2b) provides an interlinear gloss
of the speech accompanying the gesture shown in Figure 5.
The gestures shown in Figures 1 and 2, which accompany deictic demonstratives, are noticeably different from the one shown in Figure 3 which accompanies an anaphoric demonstrative. For example, the two gestures that accompany deictic demonstratives display extension of the index finger, while the gesture that accompanies the anaphoric item does not. In order to quantitatively assess such differences between gestures accompanying initial deictic references (as in Figure 1), subsequent deictic references (Figure 2), and anaphoric references (Figure 3), we conducted the statistical analyses reported below.

6.2. Gesture rate

6.2.1. Analyses

We first analyzed the effect of Phoricity (deictic vs. anaphoric category) and Mention on participants’ use of demonstrative-accompanying deictic gestures. 484 of the 724 total demonstrative tokens (66.9%) occurred with deictic gestures and 240 tokens (33.1%) did not. The group of 240 demonstrative tokens which did not occur with deictic gestures included 213 tokens with no gesture (29.4% of all tokens) and 27 tokens which occurred with non-deictic (e.g., iconic) gestures (3.7% of all tokens).

Figure 4 reports the proportion of demonstratives occurring with deictic gestures for each of the three groups of demonstratives defined by the Phoricity x Mention interaction, i.e., Deictic First, Deictic Subsequent, and Anaphoric. To represent the variation between participants, proportions in Figure 4 and all subsequent figures are calculated by participant.

To model the effects of phoricity and information status on the use of deictic gestures, we constructed a model with the presence of a deictic gesture as the dependent variable; demonstrative Phoricity and referent Mention as fixed effects; random by-participant slopes for Phoricity and Mention; and random by-participant intercepts. We did not include a Phoricity x Mention interaction in the model because, since the dataset did not include anaphoric demonstratives used on first mention, not all values of the interaction would have been defined.

This maximal model failed to converge. Following the advice for troubleshooting non-converging models given in Brauer and Curtin (2018), we first tried forcing the random slopes and random intercept
to be uncorrelated. The model still failed to converge; thus, we dropped the random intercepts for participants. The resulting model displayed a singular fit, suggesting overfitting. Therefore, we dropped the random slopes and re-added the by-participant random intercepts. Because the resulting model converged without a singular fit, we chose it as our final model of gesture rate. Because this model includes random intercepts for participants, but not random slopes, it assumes that participants vary in baseline gesture rate but do not vary in the effects of Phoricity or Mention on gesture rate.

Thus, our final model included the presence of a deictic gesture as the dependent variable; Phoricity and Mention as fixed effects; and by-participant random intercepts. The model indicated significant effects of Phoricity and Mention. Anaphoric demonstratives were less likely to occur with deictic gestures than deictic demonstratives ($\beta = -1.5910, SE = 0.2024, z-value = -7.859, p = 3.87e-15$). Additionally, demonstratives used on subsequent mention were less likely to occur with deictic gestures than demonstratives used on first mention ($\beta = -1.2304, SE = 0.2935, z-value = -4.192, p = 2.76e-05$).

6.2.2. Interim Discussion

Both the lexical Phoricity of demonstrative words (anaphoric vs. deictic) and the information status of referents (Mentioned vs. new) affected whether participants in this study made deictic gestures while they produced demonstratives. Even when information status was taken into account, participants were less likely to point when producing anaphoric demonstratives than when producing deictic demonstratives. This finding demonstrates that participants’ use of demonstrative-accompanying pointing gestures was sensitive to the lexical or type-level property of demonstrative Phoricity. At the same time, the token-level property of referent Mention also affected participants’ gesture rate. When participants produced demonstratives indexing previously mentioned referents, they were less likely to point than when they produced demonstratives indexing discourse-new referents. This held across Phoricity categories. As Figure 4 suggests, not only anaphoric demonstratives, but also deictic demonstratives used on subsequent mentions of the referent, displayed decreased rates of co-occurring deictic gesture. Moreover, anaphoric demonstratives displayed even fewer co-occurring gestures than deictic demonstratives used on subsequent mention, indi-
cating that the effects of Phoricity and Mention were additive.

6.3. Gesture form: Elbow Flexion

6.3.1. Analyses

Following the gesture rate analyses, we investigated the effects of Phoricity and Mention on two articulatory properties of pointing gestures: elbow flexion and handshape. We report first the elbow flexion analyses, then the handshape analyses. These analyses were conducted only on the set of 484 demonstratives with accompanying deictic gestures.

First, to test the prediction from §3 that anaphoric demonstratives would occur with less visually salient gestures, we analyzed the effects of Phoricity and Mention on elbow flexion in participants’ demonstrative-accompanying deictic gestures. Following Enfield et al. (2007), we assumed that gestures with 180° extension of the elbow, because of their large size, have greater visual salience than gestures with lesser extension of the elbow. Our analysis treated elbow extension as a binary variable, contrasting gestures where the speaker’s elbow attained full (180°) extension from those where it did not. We expected that Anaphoric values of Phoricity and/or Subsequent values of Mention would be associated with a reduced probability of 180° elbow extension.

Figure 5 reports the proportion of deictic gestures co-occurring with demonstratives that displayed 180° extension of the elbow, across the three groups of demonstratives defined by the Phoricity x Mention interaction. Overall, 170 demonstrative-accompanying deictic gestures (35.1%) displayed 180° extension of the elbow, while 314 (64.9%) did not.

[Figure 5 about here.]

To analyze the effect of phoricity on elbow extension, we constructed a model with the presence of 180° elbow extension as the dependent variable; demonstrative Phoricity and referent Mention as fixed effects; random by-participant slopes; and random intercepts for participants. This model displayed a singular fit, suggesting overfitting. We therefore forced the random intercepts and slopes to be uncorrelated. When the resulting model still displayed a singular fit, we additionally dropped the by-participant random intercept. This too produced a singular fit. Thus, we dropped the by-participant random slopes and re-added
the by-participant random intercepts. When this model converged without a singular fit, we chose it as our final model for elbow action. Since this model contains random intercepts but no random slopes, it – like our rate model – assumes that participants varied in their baseline propensity to use 180° extension of the elbow, but not in the effects of Phoricity or Mention on elbow extension.

Our final model of elbow extension included the presence of 180° elbow extension as the dependent variable, demonstrative Phoricity and referent Mention as fixed effects, and random intercepts (only) for participants. This model indicated a significant effect of referent Mention on elbow extension. Pointing gestures which accompanied demonstratives used on non-first mentions of the referent were significantly less likely to display 180° extension of the elbow than pointing gestures which accompanied demonstratives used on first mention of the referent ($\beta = -0.8332, SE = 0.2216, z-value = -3.759, p = 0.000171$). The model did not, however, indicate a significant effect of demonstrative Phoricity ($\beta = -0.1608, SE = 0.2865, z-value = -0.561, p = 0.08878$).

6.3.2. Interim Discussion

The information status of demonstrative referents as Mentioned vs. new affected participants’ propensity to use 180° extension of the elbow in their demonstrative-accompanying pointing gestures. When participants produced a demonstrative and pointed, their point was less likely to display 180° extension of the elbow if the demonstrative referent had been previously mentioned. In contrast, we did not find statistically significant evidence that the lexical Phoricity of demonstrative words affected participants’ propensity to use 180° extension of the elbow.

6.4. Gesture form: Handshape

6.4.1. Analyses

To further probe the prediction that anaphoric and/or discourse-old demonstratives would occur with less visually salient gestures, we also analyzed the effect of demonstrative Phoricity and referent Mention on handshape. While many speech communities have conventional non-index pointing forms (Wilkins 2003 and cf. §7.3 below), pointing displays a strong
A cross-cultural association with extension of the index finger (Liszkowski, Brown, Callaghan, Takada, & De Vos, 2012). We assume that this pattern is driven at least partly by visual salience, and thus that pointing handshapes which display an extended index finger are more visually salient than handshapes which do not. Reflecting this assumption, our analysis treated handshape as a binary variable, distinguishing handshapes that displayed an extended index finger from handshapes that did not.

Figure 6 reports the proportion of demonstrative-accompanying deictic gestures that displayed index handshapes, across the three groups of demonstratives defined by the Phoricity x Mention interaction. Overall, 212 demonstrative-accompanying deictic gestures (43.8%) displayed index handshapes, while 272 (56.2%) displayed non-index handshapes. Most non-index points displayed either open handshapes (48.9% of all non-index tokens) or flat handshapes (22.1%). Thus, our analysis of handshape is effectively an analysis of the use of index vs. whole-hand handshapes, as in most other quantitative studies of pointing form (Fenlon et al., 2019; Liszkowski et al., 2012; Mesh, 2017).

To model the effects of Phoricity and Mention on the use of index handshapes, we constructed a model with the presence of an index handshape as the dependent variable; demonstrative Phoricity and referent Mention as fixed effects; random by-participant slopes for Phoricity and Mention; and random intercepts for participants. This maximal model displayed a singular fit, suggesting overfitting. In response, we forced the random slopes and intercepts to be uncorrelated. The resulting model still displayed a singular fit, leading us to remove the random intercepts but retain the by-participant random slopes.

The model with no random intercepts converged and did not indicate a significant effect of either Phoricity or Mention (through Phoricity approached significance, $\beta = -0.7478, SE = 0.4239, z - value = -1.764, p = 0.0777$). However, the model with no random intercepts assumes that participants vary in the effects of Phoricity and Mention on the frequency of index handshapes, but are identical in baseline propensity to use index handshapes. The assumption of invariance in baseline use of index handshapes is false: in fact, participants’ overall proportion of points with index handshapes ranged from 0.208 to 0.549 (mean = 0.397, SD = 0.135). Therefore, we also constructed a model which removed
the by-participant random slopes and re-added the random intercepts for participants. The model with no random slopes assumes that participants vary in their baseline propensity to use index handshapes, but not in the effect of Phoricity or Mention on the frequency of index handshapes. The model with random intercepts but no random slopes converged, did not have a singular fit, and displayed an Akaike Information Criterion (AIC) of 652.6, while the AIC of the model with random slopes but no random intercepts was 661.2. Since the model with random intercepts but no random slopes displayed a significantly lower AIC, we chose it as our final model.

Consequently, our final handshape model treated the presence of an index handshape as the dependent variable, demonstrative Phoricity and referent Mention as fixed effects, and participant as a random effect (with a random intercept only). This model indicated a significant effect of Phoricity, but not of Mention. Pointing gestures which accompanied anaphoric demonstratives were significantly less likely to display index handshapes than pointing gestures which accompanied deictic demonstratives ($\beta = -0.7154, SE = 0.2830, z - value = -2.527, p = 0.0115$). However, pointing gestures which accompanied demonstratives used on subsequent mention were no less likely to display index handshapes than pointing gestures which accompanied demonstratives used on first mention ($\beta = -0.1146, SE = 0.2108, z - value = -0.544, p = 0.5867$).

6.4.2. Interim Discussion

The lexical Phoricity of demonstrative words (anaphoric vs. deictic) affected participants’ propensity to use extended-index handshapes in their demonstrative-accompanying pointing gestures. When participants produced a demonstrative and pointed, their point was less likely to display an index handshape if the accompanying demonstrative was anaphoric than if it was deictic. However, our analysis produced no evidence that the information status of referents, operationalized as Mention, affected participants’ propensity to use index handshapes. When we controlled for Phoricity, speakers were equally likely to use index handshapes with Mentioned or discourse-old referents as with discourse-new ones.

We now interpret these findings in light of the theoretical context established in §2.
7. General Discussion

This study investigated how demonstrative Phoricity (status as deictic vs. anaphoric) and referent Mention (information status as previously mentioned vs. discourse-new) impact the frequency and properties of co-speech pointing gestures in Ticuna, a language where phoricity is encoded as a property of demonstrative types. We video-recorded six Ticuna speakers describing locations of landmarks in their community, then analyzed the number and articulatory form of the pointing gestures which the participants produced with deictic vs. anaphoric demonstratives. Our analysis also distinguished between deictic demonstratives used on first mention of the referent vs. on subsequent mentions.

Phoricity – the encoded, type-level status of Ticuna demonstratives as anaphoric or deictic – affected the number and the form of participants’ deictic gestures. When participants produced anaphoric demonstratives, they were less likely to point, and less likely to use an index-finger handshape, than when they produced deictic demonstratives. As well as Phoricity, Mention – the token-level status of demonstrative referents as discourse-old or discourse-new – also affected participants’ gesture rate and form. When participants produced demonstratives indexing discourse-old referents, they were less likely to point, and less likely to use 180° extension of the elbow in their gestures, than when they produced demonstratives indexing discourse-new referents.

7.1. Both demonstrative category and information status affect gesture rate

Per §3, we tested two competing theoretical predictions about the relationship among demonstrative category, referent information status, and the frequency of co-speech pointing gestures.

Linguistic research on demonstratives claims that anaphoric demonstratives never or rarely occur with pointing gestures, while deictic demonstratives always do (Ahn & Davidson 2018; Diessel 1999, 2006; Roberts 2002). Therefore, this strand of research predicts that demonstrative Phoricity will affect the rate of demonstrative-accompanying pointing gestures, and specifically, that anaphoric demonstratives will be associated with a gesture rate that approaches zero. In contrast, these theories do not treat the information status of referents influencing the co-organization of demonstratives and gesture. Linguistic theories
therefore predict no effect of Mention on gesture rate in this study.

By contrast, gesture studies research has shown that speakers use fewer co-speech gestures when they refer to mentioned or hearer-old referents than when they refer to discourse-new or hearer-new referents (Debreslioska and Gullberg 2020; Gullberg 2006; Holler and Stevens 2007, a.o.). Reduction in gesture rate often coincides with reduction in the number of words or semantic richness of co-occurring speech. Yet this research tradition does not construe reduction in speech as causing reduction in gesture rate (or vice versa). Instead, gesture researchers typically view both forms of reduction as arising from a third factor, the information status of the referent (Holler & Bavelas 2017). Therefore, gesture studies research predicts that only Mention will affect gesture rate – that is, that speakers will point less when they produce demonstratives on subsequent mention of the referent than on first mention. There is no prediction that demonstrative Phoricity will affect gesture rate, or that the gesture rate with any category of demonstratives will approach zero.

Our results for gesture rate do not fully conform to either of these sets of predictions. In line with the linguistic hypothesis, we do observe an effect of demonstrative Phoricity on gesture rate: participants point less with anaphoric demonstratives than with deictic demonstratives. Contrary to the linguistic hypothesis, though, this effect is not categorical. Participants do sometimes point with anaphoric demonstratives, and they sometimes omit pointing with deictic ones (Figure 4). Furthermore, in line with the gesture studies hypothesis, we also observe an effect of Mention on gesture rate. Exactly as predicted, participants point more with demonstratives used on first mention than those used on subsequent mention. The linguistic hypothesis does not predict this effect of Mention, just as the gesture studies hypothesis does not predict the effect of Phoricity.

For linguistic research on demonstratives, then, this study partially confirms the theoretical position that deixis and anaphora have different relationships with gesture, and partially challenges it. Because we observe an effect of Phoricity, our findings do support the core argument of linguistic research on demonstratives and gesture – that deictic demonstratives rely more on gesture for their reference than anaphoric ones (Roberts 2002). However, our findings do not support linguistic claims that anaphoric demonstratives are semantically unacceptable with pointing (Ahn & Davidson 2018) or that deictic demonstratives always occur with points, while anaphoric demonstratives never do (Diessel 1999, 2006).
For gesture studies research, on the other hand, this study makes two contributions. First, we replicate in a less-studied language the finding that first mentions are associated with higher gesture rates than subsequent mentions ([Debreslioska & Gullberg, 2020]; [Foraker, 2011]). Second, we show that different referring expression types – of the same syntactic category and with similar informativity – can be associated with different gesture rates. This finding has precedent in results by Gullberg (2006), Azar et al. (2019), and Debreslioska and Gullberg (2019), among others, showing that speakers (of European languages) gesture more with noun phrases than with pronouns. Authors in the existing literature interpret this result as showing that gesture rate is sensitive to the “semantic richness” of the co-occurring speech, arguing that NPs are associated with higher gesture rates because they are “richer” – i.e., convey more information about the referent – than pronouns ([Azar et al., 2019, 568]).

In contrast to these earlier findings, our findings about the association between deixis and higher gesture rates cannot be explained by appealing to the informativity of the co-occurring speech. Deictic demonstratives and anaphoric demonstratives vary not in the quantity of information they convey about their referents, but the kind of information they convey. Deictic demonstratives convey information about the location of the referent in space, while anaphoric demonstratives convey that the referent has been mentioned before. As such, our findings on gesture rate support the conclusion that gesture rate is sensitive not only to the quantity of information that the co-occurring speech conveys, but also to whether this information is spatial. Speakers gesture more when they produce referring expressions that convey spatial information about the referent (deictic demonstratives) than when they produce equally informative expressions, of the same syntactic category, which convey non-spatial information (anaphoric demonstratives).

7.2. Information status, but not demonstrative category, affects elbow extension

In addition to our analysis of gesture rate, we also tested predictions about the effect of demonstrative Phoricity and referent Mention on gesture form. Because linguistic research on demonstratives and gesture has made no claims about gesture form, all of these predictions come from the gesture studies literature. This literature predicts that as the familiarity of a referent (in terms of information status) increases, speakers decrease the visual salience of their gestures ([§2.2]).
We analyzed two measures of visual salience, handshape and elbow extension. In the domain of elbow extension, Enfield et al. (2007) directly predicts that as the familiarity of a referent increases, speakers’ propensity to use 180° elbow extension in their deictic gestures will decrease. Therefore, speakers should use 180° elbow extension less when pointing to Mentioned referents than when pointing to discourse-new ones.

Our results were fully consistent with this prediction: speakers were significantly less likely to use 180° elbow extension when pointing to Mentioned referents. In contrast, the effect of demonstrative Phoricity approached but did not achieve significance. This is extremely similar to findings on elbow extension by Enfield et al. (2007) and elbow height by Mesh (2017). Enfield et al. (2007, 1734) found that Lao speakers were more likely to engage the elbow in pointing gestures when they produced initial location references than when they produced subsequent ones. This result indicates an effect of Mention; the authors did not analyze other properties of the co-occurring speech, making it impossible to identify effects of Phoricity. In contrast, Mesh (2017) did analyze effects of co-occurring speech. In a study of pointing gestures by speakers of San Juan Quiahije Chatino (Oto-Manguean; Mexico), she found no relationship between elbow height and demonstrative lexical item in demonstrative-accompanying gestures – even though elbow height did make a semantic contribution in the gestures, conveying referent distance (Mesh, 2017, 121). Though Mesh’s study examines contrasts only among deictic demonstratives, our conclusions are similar to hers: we confirm that lexical properties of demonstratives do not affect the action of the elbow in co-occurring pointing gestures.

To summarize, our findings on elbow extension show that the contrast between deixis and anaphora affects only some – not all – characteristics of gesture form. While Phoricity mattered to participants’ use of index handshapes, it failed to affect their use of 180° elbow extension. Importantly, the absence of an effect of Phoricity does not mean that the content of co-occurring speech was irrelevant to elbow action. Mention did affect participants’ use of 180° elbow extension, showing that elbow action can reflect properties of the reference, such as the Mentioned vs. new contrast, as well as properties of the referent, such as distance (cf. Mesh, 2017). We note that our analysis of elbow extension has the methodological limitation that – like all of the authors that we cite – we coded elbow extension using a controlled vocabulary (i.e., as a factor), based on coders’ visual perception. However, elbow
extension is theoretically a continuous phenomenon. Coding and analyzing elbow extension as a continuous variable, for example using computer vision (Pouw, Trujillo, & Dixon, 2020), could have produced different results.

7.3. Demonstrative category, but not information status, affects handshape

As a second dimension of visual salience, we also analyzed handshape. In light of the cross-cultural association between pointing and extension of the index finger (Cooperrider et al., 2018; Liszkowski et al., 2012), we assume that handshapes with an extended index finger have greater visual salience than non-index handshapes. Taking this for granted, the gesture studies literature predicts that speakers will be less likely to use index handshapes when pointing to Mentioned referents than when pointing to discourse-new ones.

Our result was not consistent with this prediction. We observed an effect of demonstrative Phoricity on the use of index handshapes in demonstrative-accompanying gestures, but no effect of referent Mention. Points that accompanied deictic demonstratives were more likely to display index handshapes than points that accompanied anaphoric demonstratives. Once this effect of Phoricity was accounted for, points to Mentioned referents and points to discourse-new referents were, statistically, equally likely to display index handshapes.

Our finding that anaphoric demonstrative reference is associated with greater use of non-index handshapes differs substantially from other research on pointing, which has never suggested an association between index handshapes and specific demonstrative lexical items. For example, Mesh (2017) examined the use of index vs. open handshapes in co-speech pointing gestures by speakers of San Juan Quiahije Chatino. She observed no effect of the contrast between demonstratives and other referring expression types, and no effect of any individual demonstrative, on speakers’ use of the open handshape (Mesh, 2017, 99-100). The same is true for Wilkins’s (2003) study of index and non-index pointing gestures by speakers of Arrernte (Pama-Nyungan; Australia). Wilkins (2003, 193) suggests that Arrernte speakers are more likely to use index points on first mention of the referent, but – in his extensive discussion of the relationship between various demonstrative lexical items and pointing forms – does not suggest any influence of lexical item on handshape.

While studies of demonstratives provide little precedent for our results on index handshapes, studies of other deictic resources provide more. Fenlon et al. (2019) investigated the
use of index vs. open handshapes in American English speakers’ points during talk show inter-
views. They found that speakers were more likely to use B-handshapes when pointing to
the self or an addressee than when pointing to other entities (Fenlon et al. 2019, 12-13). This
result demonstrates that conventions of co-speech gesture can include associations between
particular handshapes (in Fenlon et al. 2019’s study, B-hand) and particular lexical items or
referents, such as the pronoun I or the self. While we examined place rather than person
references (§5.4), our findings are conceptually similar to Fenlon et al.’s: we also observe a
characteristic association between (a class of) lexical items – the deictic demonstratives –
and a handshape, the index point.

We propose two reasons why previous research has generally not observed effects of
demonstrative Phoricity on handshape. First, most non-index points in our data involve the
entire hand. Quantitative gesture studies often exclude whole-hand pointing gestures from
analysis, as in Enfield et al. (2007, 1725), or treat whole-hand gestures as reaching rather than
pointing (as in many developmental studies, e.g. Cameron-Faulkner, Theakston, Lieven, and
Tomasello 2015, 579). In contrast, we avoided the use of form-based criteria for identification
of pointing gestures by examining only gestures which co-occurred with demonstratives.
Because the speech that accompanies these gestures is deictic (or anaphoric), we assume –
absent strong evidence to the contrary – that the gestures are points.

Second, research on non-index pointing tends to focus on how properties of the point-
ing referent, such as its shape or distance, affect the use of non-index handshapes (Havi-
land, 2003; Le Guen, 2011; Meshi, 2017; Wilkins, 2003). Studies of non-index pointing less
often evaluate the relation between properties of the reference, such as information status,
and handshape (though cf. Kendon and Versante 2003). The same is true for discussions of
non-manual pointing gestures, which often focus on describing the target gesture’s form
and non-deictic functions (Mihas 2017; Orie 2009; Sherzer 1973) rather than its deictic uses
(though cf. Enfield 2001, 196-198). Thus, we observed a novel result about non-index point-
ing in part because we asked a novel question.

Against this background, our findings indicate that the contrast between deixis and
anaphora can shape gesture form – specifically, the use of non-index handshapes – as well
as gesture rate. When we control for the information status of the referent, deictic demon-
stratives are more likely to co-occur with index pointing than anaphoric demonstratives.
This result shows that speakers’ use of non-index pointing forms can reflect properties of the reference (i.e., the content of co-occurring speech), not only properties of the referent (Wilkins, 2003) and broader conventions in the speech/gestural community (Mesh, 2017).

8. Conclusion

This study investigated the effects of two pragmatic contrasts – the contrast between deictic and anaphoric demonstratives, and the contrast between first and subsequent mentions – on co-speech pointing gestures by Ticuna speakers. In line with linguistic hypotheses about the relationship between deictic demonstratives and pointing gestures, we found that the contrast between deictic and anaphoric reference affected speakers’ gesture rate. While speakers did routinely point with anaphoric demonstratives, deictic demonstratives were more likely to occur with points. Additionally, in line with psycholinguistic theories about gesture reduction and information status, we also observed effects of information status on gesture rate: demonstratives used on first mention of the referent were more likely to occur with points. Deictic vs. anaphoric status and information status also affected gesture form. Deictic demonstratives were more likely to occur with index finger points, and first-mention demonstrative references were more likely to involve complete extension of the elbow.

These results indicate that both language-specific factors, such as a demonstrative’s lexical features, and universal ones, such as the information status or familiarity of a referent, influence the co-organization of demonstratives and pointing gestures. Some properties of demonstrative-accompanying gesture, such as rate, respond to both language-specific and universal factors. Other gesture features, such as handshape, reflect primarily language-/culture-specific conventions; and still others, such as elbow extension, are controlled by universal, domain-general factors like information status. Together, these results underline the importance of studying deictic language and gesture as an integrated system, rather than examining demonstrative words and non-verbal deictic practices in isolation.
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References


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Table 1. Controlled vocabulary for handshape coding.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>The index finger is extended to the exclusion of all other fingers.</td>
</tr>
<tr>
<td>Index+1</td>
<td>The index finger is extended, and so is exactly one additional finger. Coders identified the additional finger; it was always either the middle finger or the thumb.</td>
</tr>
<tr>
<td>Index+2</td>
<td>The index finger is extended, and so are exactly two additional fingers. Coders identified the additional two fingers; they were always the middle finger and thumb.</td>
</tr>
<tr>
<td>Thumb</td>
<td>The thumb is extended to the exclusion of all other fingers.</td>
</tr>
<tr>
<td>Flat</td>
<td>Four fingers are extended in parallel, such that the hand forms a plane, regardless of the action of the thumb. (Similar to the American Sign Language Flat B handshape.)</td>
</tr>
<tr>
<td>Open</td>
<td>All four fingers are extended, but they are distributed in space rather than forming a plane; the thumb is also extended. (Similar to the American Sign Language 5 handshape.)</td>
</tr>
<tr>
<td>Other</td>
<td>All other handshapes.</td>
</tr>
</tbody>
</table>
Figure 1. Gesture accompanying deictic demonstrative used on first mention: "Where do you go to wash clothes?" "Right here."
Figure 2. Gesture accompanying deictic demonstrative used on subsequent mention: "Right here (where I said) is where I wash clothes."
Figure 3. Gesture accompanying anaphoric demonstrative: “There (anaphoric) is where we (exclusive) washed clothes”
Figure 4. Proportion of demonstrative tokens with pointing gestures, by demonstrative phoricity (anaphoric vs. deictic status) and, for deictic demonstratives, information status (first vs. subsequent mention).
Figure 5. Proportion of demonstrative-accompanying gestures with 180° extension of the elbow, by demonstrative phoricity (anaphoric vs. deictic status) and, for deictic demonstratives, information status (first vs. subsequent mention).
Figure 6. Proportion of demonstrative-accompanying gestures with index handshapes, by demonstrative phoricity (anaphoric vs. deictic status) and, for deictic demonstratives, information status (first vs. subsequent mention).