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Cross-linguistic differences in demonstrative systems: Comparing spatial and non-spatial influences on demonstrative use in Ticuna and Dutch

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ABSTRACT

In all spoken languages, speakers use demonstratives – words like *this* and *that* – to refer to entities in their immediate environment. But which factors determine whether they use one demonstrative (*this*) or another (*that*)? Here we report the results of an experiment examining the effects of referent visibility, referent distance, and addressee location on the production of demonstratives by speakers of Ticuna (isolate; Brazil, Colombia, Peru), an Amazonian language with four demonstratives, and speakers of Dutch (Indo-European; Netherlands, Belgium), which has two demonstratives. We found that Ticuna speakers' use of demonstratives displayed effects of addressee location and referent distance, but not referent visibility. By contrast, under comparable conditions, Dutch speakers displayed sensitivity only to referent distance. Interestingly, we also observed that Ticuna speakers consistently used demonstratives in all referential utterances in our experimental paradigm, while Dutch speakers strongly preferred to use definite articles. Taken together, these findings shed light on the significant diversity found in demonstrative systems across languages. Additionally, they invite researchers studying exophoric demonstratives to broaden their horizons by cross-linguistically investigating the factors involved in speakers' choice of demonstratives over other types of referring expressions, especially articles.

1. Introduction

Demonstratives – such as English *this, that, here,* and *there* – are a paradigm case of the interplay between universals and diversity in semantic typology. On the one hand, demonstratives display strong universals: all spoken languages have them (Diessel, 1999, p. 2), and they are central to the achievement of joint attention, a fundamental part of face-to-face interaction (Bühler, 1982; Diessel, 2006; Küntay & Özyürek, 2006; Piwek et al., 2008; Tomasello, 2008). On the other hand, demonstratives also display remarkable cross-linguistic diversity, most clearly in the number of items in the lexicon: languages may have as few as two demonstratives, or as many as twelve (Anderson and Keenan, 1985; Diessel, 1999; Hanks, 2011; Levinson et al., 2018).

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One heavily debated aspect of putative linguistic diversity is the **deictic content** of demonstratives – the information that demonstratives convey about their referents. Traditional views of demonstratives in linguistics claim that the items' primary deictic content concerns the referent's **distance** from the **speaker**: proximal demonstratives (*this, here*) convey that the referent is near the speaker, distal demonstratives (*that, there*) that it is relatively far from them. For many non-Indo-European languages, however, language documentation researchers have dissented from analyses based on distance relative to the speaker. They argue that demonstratives can also convey non-distance properties of the referent – for example, visibility (Gillon, 2009) or location in a geocentric frame of reference (Grenoble et al., 2019) – and can relate referents to discourse participants other than the speaker (Hanks, 1990).

While documentary claims about diversity in demonstrative systems are provocative, they are also hard to evaluate. Most documentary work on demonstratives does not include explicit information about how the data was collected, and even when authors are explicit about their data sources and methods (as in Levinson et al., 2018), the collection of data about demonstratives in less-studied languages is often not highly controlled. Recent experimental work on demonstratives, on the other hand, has focused almost exclusively on well-known Indo-European languages (e.g., Caldano and Coventry, 2019; Coventry et al., 2008; 2014; Rocca et al., 2019). This renders it impossible to directly compare the analyses of demonstratives proposed in documentary works with the (divergent, often distance-based) analyses proposed in lab-based psycholinguistic research on more-studied languages.

This study therefore tested two common documentary claims about demonstratives against experimental data. We conducted experiments examining the production of demonstratives by speakers of two unrelated languages, Ticuna (isolate; Brazil, Colombia, Peru), an Indigenous Amazonian language which has four demonstratives, and Dutch (Indo-European; Netherlands, Belgium), which has two demonstratives. As well as examining the deictic content of demonstratives, we also asked what factors led speakers of each language to choose demonstratives over other determiners, such as articles (cf. Bangerter, 2004; Cooperrider, 2016). Before turning to the specific hypotheses tested in this study, we first provide background about the two languages and their demonstrative systems.

1.1. Language background

Ticuna is a language isolate spoken by ~60,000 people living along the course of the Amazon River in Peru, Colombia, and Brazil. Background information about the language can be found in linguistic descriptions such as Anderson (1959), Montes (1995), Santos (2004), Soares (2000), and Skilton (2017, 2019). Dutch is the national language of the Netherlands.

Both Dutch and Ticuna have noun class ("gender"). In both languages, demonstratives and definite articles agree in noun class with the nouns that they modify. Dutch has two exophoric demonstratives, traditionally interpreted as "speaker-proximal" and "speaker-distal". It also displays definite and indefinite articles.

Ticuna has a total of four demonstratives which can be used exophorically (i.e., to index referents in the surround of conversation). Skilton (2019, p. 15–17) describes the four exophoric demonstratives as a speaker-centered "proximal," "medial," and "distal," paired with an addressee-centered "proximal" term. The speaker-medial and speaker-distal demonstratives primarily index visible referents; the speaker-proximal and addressee-proximal demonstratives can index either visible or invisible referents (Skilton, 2019, p. 16). As in other languages with large demonstrative systems (e.g., Yucatec Maya; Espinosa Ochoa, 2009: 61), the four Ticuna demonstratives display substantially different frequency: in conversational data, the speaker-medial term is 60–90% less frequent than the three other demonstratives ((Skilton, 2021) p. 170-174).

Ticuna also displays two articles, one underspecified for the definite/indefinite contrast and one that is a dedicated indefinite. The literature on Ticuna does not describe the syntax or semantics of these items. However, the first author's fieldwork has found that the underspecified definite/indefinite article obligatorily introduces all noun phrases (including proper nouns) which either (a) appear as the complement of a quantifier or (b) follow the verb of their clause. The obligatoriness of the underspecified article does not vary with considerations of syntactic position, the noun class of the noun, the novel vs. familiar information status of the referent, the uniqueness of the referent, or the weak/strong quantifier distinction. For example, in (1) the underspecified article is obligatory introducing the complement of the strong quantifier *gu⁵ʔe³ma²* "all," which is the count noun *wo³ru³a¹* "mirror." In (2), the same article is obligatory introducing the complement of the weak quantifier *i⁵¹ra³ʔɨ̰⁴* "a little," which is the mass noun *de⁴³ʔa⁵* "water." This rigid requirement for an article introducing all quantified or postverbal noun phrases is very similar to the requirement for determiners on all nouns in Salish languages, such as Sḵwx̱wú7mesh (Davis et al., 2014).

(1) *gu⁵ʔe³ma² *(**a⁴**) wo³ru³a¹ ta⁴me⁴³.*
gu⁵ʔe³ma² ***(a⁴)** wo³ru³a¹ ta⁴= me⁴³
all(I) ***(DET(I))** mirror(I) 3SBJ(I)= good
'All (of the) mirrors are good.' (elicited)

(2) *e³ga⁴ i⁵¹ra³ʔɨ̰⁴ *(**i⁴**) de⁴³ʔa⁵ i²na¹ba²ʔgu², rɨ¹ ma³rɨ³ na⁴me⁴³.*
e³ga⁴ i⁵¹ra³ʔɨ̰⁴ ***(i⁴)** de⁴³ʔa⁵ i²= na¹= ba² =ʔgu² rɨ¹
if a.little(IV) ***(DET(IV))** water(IV) ASP= 3SBJ(IV). SUB= spill =SUB TOP
ma³rɨ³ na⁴= me⁴³
PERF 3SBJ(IV)= good
'If a little bit of water spills, that's fine.' (elicited)

The Ticuna indefinite article *wɨ^{43}ʔi^{4}(e^{3})* is semantically more similar to the indefinite articles of Dutch and English. It appears in noun phrases introducing discourse-new referents, as well as in predicate noun phrases in copular constructions. However, the indefinite article is syntactically different from indefinites in Dutch and English in that it cannot combine with a bare noun phrase. Instead, the indefinite article – like all quantifiers in Ticuna – can only combine with a noun phrase introduced by an underspecified article, as in (3).

(3) *wɨ^{43}ʔi^{4}ʔe^{3} **ɟa^{4}** wo^{3}ru^{3}a^{1} tɨ^{31}ʔɨ̄^{3} tʃa^{3}ɟa^{2}ʔu^{3}.*
wɨ^{43}ʔi^{4}ʔe^{3} **ɟa^{4}** wo^{3}ru^{3}a^{1} tɨ^{31} =ʔɨ̄^{3} tʃa^{3}= ɟa^{2}ʔu^{3}
INDEF(I) **DET(I)** mirror(I) 3(I) =ACC 1SGSBJ= get
'I got a mirror.' (elicited)

In sum, the articles of Ticuna share few properties with the articles of Dutch and most other Indo-European languages. In particular, while Ticuna does have an indefinite article, it clearly lacks a definite article. The underspecified article is not a definite, as it is syntactically obligatory in many environments, including all quantifier phrases; is insensitive to all factors which define (in)definiteness in more-studied languages; and is compatible with the indefinite article.

Table 1 displays the demonstratives and the articles of each language. The upper portion of Table 1 displays the demonstratives and articles of Ticuna in IPA orthography (raised numerals indicate lexical tones). The lower portion of Table 1 displays the demonstratives and articles of Dutch, presented in Dutch orthography.

Table 1
Overview of the demonstrative systems of Ticuna and Dutch. Only singular terms are presented.

Ticuna	Class I	Class II	Class III	Class IV	Class V
Demonstratives:					
"speaker-proximal"	da^{31}ʔe^{2}	da^{2}a^{2}	da^{31}a^{1}	ɲa^{4}a^{2}	ɲa^{43}a^{2}
"speaker-medial"	ɟi^{31}ʔe^{2}	ɟi^{2}a^{4}	ɟi^{2}a^{2}	ŋe^{3}a^{2}	ŋe^{43}a^{2}
"speaker-distal"	gu^{31}ʔe^{2}	gu^{2}a^{4}	gu^{2}a^{2}	ɟe^{3}a^{2}	ɟe^{43}a^{2}
"addressee-centered"	ɟi^{31}ʔe^{2}ma^{4}	ɟi^{2}ma^{4}	ɟi^{2}ma^{2}	ŋe^{3}ma^{2}	ŋe^{43}ma^{2}
Other determiners:					
Article (definite/indefinite)	ɟa^{4}	ɟa^{4}	ɟa^{1}	i^{4}	i^{2}
Indefinite article	wɨ^{43}ʔi^{4}(e^{3})	wɨ^{43}ʔi^{4}	wɨ^{43}ʔi^{4}	wɨ^{43}ʔi^{4}	wɨ^{43}ʔi^{4}

Dutch	Common gender	Neuter gender
Determiners:		
"speaker-proximal" demonstrative	deze	dit
"speaker-distal" demonstrative	die	dat
definite article	de	het
indefinite article	een	een

Below, we refer to the Ticuna demonstratives by the form for noun class IV, followed by the putative distance-based label shown at left in the Ticuna portion of Table 1. We refer to the Dutch demonstratives using the neuter gender form, followed by the putative distance-based label in the Dutch portion of Table 1.

1.2. Theoretical background and hypotheses

We identified two prominent claims from the cross-linguistic literature on demonstratives:

1. **Distance Hypothesis** – The claim that the contrasts among demonstratives primarily concern the referent's relative **distance** from the discourse participants.
2. **Egocentricity Hypothesis** – The claim that demonstratives relate the referent only to **the speaker**, not to other (sets of) discourse participants.

We chose to test these two hypotheses because they have sparked especially active debate in the literature. Traditionally, research on demonstratives in Indo-European languages has assumed both the distance hypothesis and the egocentricity hypothesis (see below). Research on non-Indo-European languages, on the other hand, has often challenged both.

1.2.1. Distance hypothesis

Classic analyses of demonstratives posit that the items' deictic content concerns only the distance of the demonstrative referent from the speaker or other discourse participants (Fillmore, 1973; Kirsner, 1993; Lyons, 1977; Levelt, 1989). We call this view the **strong distance hypothesis**. On this account, English *this*, Dutch *dit*, and other speaker-proximal demonstratives convey that the referent is near the speaker. Conversely, *that*, Dutch *dat,* and other speaker-distal demonstratives are said to convey that the referent is relatively far from the speaker. While recent theoretical accounts of demonstratives have opposed

the strong distance hypothesis (e.g., Diessel and Coventry, 2020; Peeters et al., 2020), it remains popular across both general linguistics and psycholinguistics. Formal semantic research on demonstratives – whether in English (Maclaran, 1982; King, 2001; Borg, 2000; Roberts, 2002; Wolter, 2006, 2009), German (Sichel and Wiltschko, 2018), or non-Indo-European languages such as Korean (Ahn, 2017) and the Bantu language Lugwere (Ahn and van der Wal, 2019) – consistently follows the strong distance hypothesis, taking for granted that the items' only deictic content concerns distance. For instance, in Wolter's thesis on the demonstratives of English, the sole comment on the deictic content of *this* is that "*this* requires the referent to be close to the speaker" (Wolter, 2006, p. 102). Typological work likewise holds to the strong distance hypothesis. For example, the introduction to a recent comparative volume on the use of demonstratives in discourse still claims that demonstratives "are generally defined and described in terms of distance distinctions" (Naess et al., 2020, p. 12). Similarly, the *World Atlas of Language Structures* states that "[demonstratives] indicate the relative **distance** of a referent in the speech situation vis-à-vis the deictic center" (Diessel, 2013).

The strong distance hypothesis is also sometimes taken for granted in the psycholinguistic and neurolinguistic literature on demonstratives across languages (e.g., Chu and Minai, 2018; Levelt, 1989; Stevens and Zhang, 2013; 2014). For instance, recent work investigating the comprehension of demonstratives by children learning English and Mandarin began from the assumption that adults use *this* (Mandarin *zhe*) for referents at "a proximal distance from the speaker," and *that* (Mandarin *na*) for referents at "a distant position from the speaker" (Chu and Minai, 2018, p. 1344). Other recent experimental work concludes that "[*t*]*his* refers only to entities relatively close to the speaker, whereas *that* refers only to entities relatively far from the speaker" (Bonfiglioli et al., 2009).

The strong distance hypothesis, though derived from work on English and other Indo-European languages, is usually framed as universal. Research that opposes it falls into two categories. Some authors claim, based on experimental data from speakers of Indo-European languages, that the deictic content of demonstratives concerns space, but not distance. Other authors, typically based on fieldwork with speakers of non-Indo-European languages, claim that some deictic content does not concern space at all.

First, experimentally oriented authors have argued that the spatial deictic content of demonstratives does not concern the referent's distance from the speaker, but rather its location relative to the speaker's **peripersonal space** (i.e., the space which a perceiver can reach without moving relative to the ground; Kemmerer 1999). Double dissociations in studies of people with spatial neglect, in addition to results from macaque monkey experiments, indicate that different neurophysiological mechanisms underlie the on-line representation of visual information in peripersonal space versus extrapersonal (beyond reach) space (e.g., Berti and Rizzolatti, 2002; Brain, 1941; di Pellegrino and Làdavas, 2015; Halligan and Marshall, 1991; Longo and Lourenco, 2006). These findings raise the possibility that the linguistic distinction between proximal and distal demonstratives may correspond to the perceptual distinction between peripersonal and extrapersonal space (Kemmerer, 1999). On this account, proximal demonstratives do not convey that the referent is near the speaker, but that it is **within their peripersonal space**. Correspondingly, distal demonstratives do not convey that the referent is "far" from the speaker, but that it is in their extrapersonal space (Caldano and Coventry, 2019; Coventry et al., 2008, 2014; Gudde et al., 2016).

Second, documentary linguists have argued that demonstratives and other deictic words can convey information about the **visibility** of the referent in addition to distance (see Hanks, 2011, pp. 329–330 for a summary). For example, the Salish language Nuxalk (also known as Bella Coola) has six deictic determiners (Davis and Saunders, 1975). According to Davis and Saunders, three of the Nuxalk deictic determiners convey that the referent is visible to the speaker, and contrast for distance – visible proximal vs. visible medial vs. visible distal. The other three convey that the referent is invisible to the speaker; they display the same distance contrasts as the visible determiners (Davis and Saunders, 1975, pp. 849–850).

Taken together, claims about peripersonal space and about visibility suggest an alternative to the strong distance hypothesis. We call this alternative the **weak distance hypothesis**. It posits that demonstratives' deictic content can concern the distance of the demonstrative referent from the speaker (or the referent's location relative to the speaker's peripersonal space), but can **also** convey other information. Consistent with this view, experimental findings on English and other widely studied languages indicate that speakers' use of demonstratives reflects an interplay between distance and other factors, such as the referent's visibility, ownership properties, familiarity to the speaker, manual affordances, and joint attention status (Caldano and Coventry, 2019; Cooperrider, 2016; Coventry et al., 2008, 2014; Peeters et al., 2014; Rocca et al., 2019).

Despite the extensive support for visibility's role in demonstrative use, the existence of visibility contrasts in demonstratives remains controversial. Prominent authors have argued that visibility is **never** part of the encoded deictic content of demonstratives, suggesting that all apparent visibility effects are instead epiphenomenal on demonstratives' spatial deictic content (Enfield, 2003, p. 96) or on (non-deictic) epistemic modal content (Levinson, 2018, p. 35). Their skepticism is justified, for the data about visibility available at present is murky. None of the documentary authors who make visibility claims provide any quantitative (experimental or observational) evidence to support them, and psycholinguistic authors who find an effect of visibility have, like Enfield, treated it as epiphenomenal on distance (e.g., Coventry et al., 2014).

This unresolved debate leads us to ask: Are demonstratives sensitive to referent visibility? For our object languages, the strong distance hypothesis predicts that neither Dutch nor Ticuna should show any effect of the visibility of the referent on demonstrative use. The weak distance hypothesis yields opposite predictions. Skilton (2019, pp. 68–78) suggests - based on controlled production tasks, semantic elicitation, and recordings of everyday conversation - that Ticuna has dedicated demonstratives for visible referents. The weak distance hypothesis predicts that referent visibility should affect the use of these items, and potentially also the use of other demonstratives. Likewise, even though visibility is not considered a grammaticalized feature of the demonstratives of Dutch, the weak distance hypothesis predicts that both distance and visibility may

influence demonstrative use in Dutch. Specifically, Coventry et al. (2014, p. 65) suggest that the effects of visibility on demonstrative production in English arise from a universal cognitive tendency to conceptualize invisible referents as more distant than visible ones. To the extent that this hypothesis is correct, referent invisibility should lead to greater use of (speaker-centered) distal demonstratives in Dutch, as in English.

1.2.2. Egocentricity hypothesis

As well as being distance-based, traditional linguistic analyses of demonstratives are typically also **egocentric** (e.g., Fillmore, 1973; Lyons, 1977; Kaplan, 1989; Wolter, 2006). These analyses claim that the deictic content of demonstratives universally conveys the distance of the referent **from the speaker**, such that every demonstrative system represents an "egocentric coordinate system … anchored by the speaker's body" (Diessel, 2014, p. 128). According to egocentric analyses like Diessel's, proximal demonstratives convey that the referent is close to the speaker; distals convey that the referent is far from the speaker. Neither proximal nor distal demonstratives, on these accounts, convey anything about the **addressee**'s relation to the referent. We call this view the **strong egocentricity hypothesis**. It predicts that the location of the addressee relative to the speaker and referent should have no effect on demonstrative use. While the strong egocentricity hypothesis and the strong distance hypothesis have often been articulated by the same authors, such as Diessel (2014), they are conceptually distinct. The strong distance hypothesis is compatible with the existence of non-ego origos, since distance can be calculated from the addressee as well as the speaker (for further discussion, see e.g. Levinson, 2018, pp. 5–8; Skilton, 2019, pp. 54–55; Peeters et al., 2020, pp. 9–10); the strong egocentricity hypothesis, in contrast, is incompatible with any non-ego origo.

As with strong distance, some researchers have departed from strong egocentricity, arguing that demonstratives can also relate the referent to the addressee (Anderson and Keenan, 1985, pp. 282–286). For example, a classic analysis of the demonstratives of Spanish argues that *este* conveys that the referent is close to the speaker, *ese* that it is close to the addressee, and *aquel* that it is not close to either participant (Alonso, 1968; Shin et al., 2020). We call this view the **weak egocentricity hypothesis.** While weak egocentricity allows for the existence of a category of addressee-centered demonstratives, it predicts that addressee location should matter only to the use of addressee-centered terms. Other demonstratives are still predicted, as under strong egocentricity, to be insensitive to the location of the addressee.

Some field-based researchers have departed even further from strong egocentricity. In observational studies of the demonstrative system of Yucatec Maya (Mayan; Mexico), Hanks (1990; 2005) argues that the demonstratives of Yucatec fall into two categories: egocentric and sociocentric. Egocentric demonstratives relate the referent to the speaker only, while sociocentric demonstratives relate the referent to the dyad formed by the speaker and addressee. Hanks' analysis has led other researchers, including some working on Indo-European languages, to reanalyze putative "speaker-proximal" demonstratives as sociocentric proximals – conveying not that the referent is near the speaker, but that it is within the space defined by the interactive dyad (i.e., between speaker and addressee). For example, Jungbluth (2003) treats the Spanish proximal demonstrative *este*, previously seen as an egocentric proximal, as a sociocentric proximal – able to index all referents located in the psychologically shared space between speaker and addressee. Peeters et al. (2015), from comprehension experiments, argue that the Dutch proximal *dit* may also be used in this sociocentric way.

Against this background, we ask: Are demonstratives sensitive to the location of the addressee? The strong egocentricity hypothesis predicts that neither Dutch nor Ticuna should display effects of addressee location on demonstrative use. The weak egocentricity hypothesis predicts that Ticuna – which has an apparent addressee-proximal (Skilton, 2019, pp. 132–145) – should display effects of addressee location on the addressee-proximal only. Dutch, by contrast, should not display any effects of addressee location. Last, a sociocentric analysis predicts that we will observe effects of addressee location in both languages and on all demonstratives, not only on the Ticuna addressee-proximal.

To probe these questions about the distance and egocentricity hypotheses, we employed a well-established experimental paradigm, the Memory Game paradigm (Coventry et al., 2008), which arguably combines strict experimental control with ecological validity (Gudde et al., 2018). We made one substantive change to the Memory Game paradigm. While earlier work in this paradigm required participants to use demonstratives, we left participants free in their choice of determiner. In naturally occurring communication, participants are not constrained to use demonstratives to point out a referent to their addressee; they may use any determiner. Therefore, in order to enhance the ecological validity of the paradigm, participants were free to use articles as well as demonstratives.

2. Experiment 1

2.1. Method

2.1.1. Participants

Twenty native speakers of Ticuna (mean age 31.7 years, age range 21–68 years, 5 male) participated in the Experiment. At the time of the study, they were all living in Mariscal Ramón Castilla district, Loreto region, Peru. Ticuna was their single native language. They all had some L2 knowledge of Spanish, as is usual for Ticuna adults living in Peru. Data from four additional participants was excluded because the participants did not follow the experimental instructions. All participants

had normal or corrected-to-normal vision, no language or hearing impairments, and no history of neurological disease. Participants provided oral informed consent and were paid for participation. Sample size was based on the maximum number of available Ticuna participants. This relatively low number of participants – by the standards of Western, lab-based experiments – limited the potential complexity of the statistical models (see below). However, in light of the small number of previous experimental studies of Ticuna, we deemed it more interesting to manipulate three independent variables and analyze the data using a relatively simple statistical approach than, for instance, manipulate only a single independent variable and fit a more complex statistical model. The study was approved by the Institutional Review Board at UC Berkeley.

2.1.2. Materials

Stimuli were kept as similar as possible to previous studies using the Memory Game paradigm, such as Coventry et al. (2008). Participant and experimenter were seated at opposite ends (in one condition) or side-by-side at the same end (in the other condition) of a large sheet of plastic (length = 320 cm), laid on the ground. Twelve locations were marked on the plastic sheet by laminated black-and-white cards displaying images of animals (jaguar, chicken, beetle, caterpillar, cow, fish, frog, horse, turtle, mouse, pig, and squirrel) with unique names in Ticuna and Dutch. We defined the locations using the animal cards, rather than colored dots (as in Coventry et al., 2008), because Ticuna has only five unique color terms. The twelve animal cards were placed at twelve equidistant locations along the 320-cm sheet, the closest at 25 cm from the participant, and the farthest at 300 cm from the participant (see Fig. 1). In addition, forty-eight laminated object cards were made. Each object card showed a single black-and-white line drawing of a referent that could be named with a unique noun in Ticuna and Dutch.

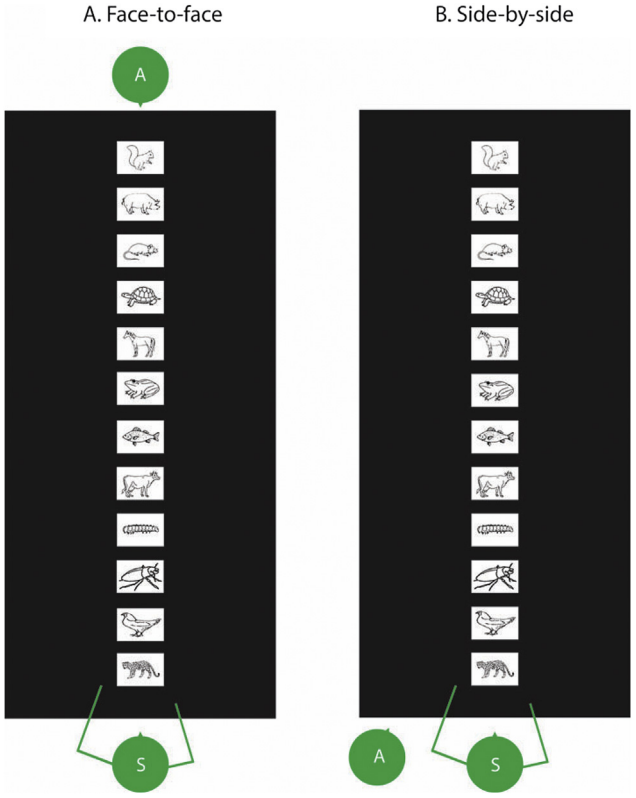

Fig. 1. Overview of the experimental set-up. Individual participants (S for Speaker) were seated on the ground at a tablecloth opposite (for one half of the participants) or next to (for the other half of the participants) the experimenter (A for Addressee). Twelve locations were marked on the tablecloth by cards showing images of familiar animals.

All images used on the animal and object cards were taken from a standardized image database (Snodgrass and Vanderwart, 1980). There was no overlap between the names of the referents shown on the animal cards and those shown on the object cards. The forty-eight object cards were placed on a single pile at the participant's side of the experimental array at the start of the experiment. The experimenter used a unique, randomized list of forty-eight one-sentence instructions for each participant, similar to instruction cards used in previous variants of the paradigm. Each instruction consisted of one sentence of the form "Place Object X over Animal Y" (e.g., the Ticuna equivalent of "*Place tree over*

horse"). To avoid biasing the participants' selection of a determiner, the instructions contained no determiners. For the visibility manipulation (see below), on half of the trials, participants were further instructed to cover the referent with an opaque pot lid after placing it at the correct location. All materials were piloted with two native Ticuna speakers and two native Dutch speakers to confirm the nameability of the animal and object cards, as well as the grammaticality of the instruction sentences.

2.1.3. Design and procedure

The experiment manipulated three factors that have previously been hypothesized to influence the use of demonstratives. First, the **distance** of the referent from the speaker and addressee was manipulated through the use of 12 different referent locations (see Fig. 1). The three referent locations closest to the speaker while they were seated were considered in the speaker's peripersonal space. Second, **addressee location** was manipulated by having the experimenter sit opposite the participant (participants 1–10) vs. next to the participant (participants 11–20). Third, the **visibility** of the referent was manipulated. On half of the trials, participants referred to a visible referent. On the other half of the trials, participants placed the referent on the correct animal card, covered it with an opaque lid, and then referred to the invisible referent. In the analyses presented below, these three independent variables are respectively called Distance, Addressee Location, and Visibility. Each referent location was used on four different trials with four different referents.

After providing informed consent, participants were instructed that they would take part in a memory game. They were told that their task was to remember the location on which they would place each object card, and that the memory game would be followed by a recall test. They were instructed that they had to use spoken words and a pointing gesture to refer to each object card, so as to test whether the use of language and gesture enhanced their memory of object locations. They were also instructed to use exactly two words per trial (determiner and noun), to ensure that each participant would produce the same number of words.

At the start of each trial, the experimenter consulted the randomized list of instructions and read aloud a sentence stating where the participant should place a specific object card (e.g., the Ticuna equivalent of *Place tree over horse*). The participant selected the correct object card from their stack of cards, placed it on the appropriate animal card, returned to their seat, and then manually pointed at the object while saying a two-word noun phrase (determiner followed by noun; e.g., *ɟe*^{3}*a*^{2} *nai*^{31} "that tree"). The experimenter wrote down the utterance, picked up the object card from the array, and returned to her seat to start the next trial by reading the next instruction sentence. At the end of the experiment, participants were shown the 48 object cards one-by-one and were asked, for each object, to indicate on which of the 12 location cards they had placed it during the experiment. The sole purpose of the recall test was to maintain the decoy that the main task was a study of memory, rather than of demonstratives. We do not analyze the post-test recall data. Audio and video recordings were made throughout the Experiment.

There was one critical difference between the current Experiment and previous studies using the Memory Game paradigm (e.g., Coventry et al., 2008; 2014; Gudde et al., 2018). In earlier studies, participants were forced to use a demonstrative as the determiner on every trial. In the current Experiment, participants were allowed to use any determiner. In Ticuna, this meant that participants could use any of the four demonstratives, or could use an article (either the indefinite article, or the underspecified definite/indefinite article), to modify the noun while pointing at the object card. Compared to previous studies, this situation is more similar to naturalistic conditions, where speakers may use any determiner while pointing at a referent.

Because of the categorical and multinomial nature of the dependent variable, data were analyzed using a multinomial logistic regression analysis. In line with earlier work (Coventry et al., 2008), the variable Distance was recoded into a 4-level factor consisting of four quadrants (Quadrant 1: 25–75 cm; Quadrant 2: 100–150 cm; Quadrant 3: 175–225 cm; Quadrant 4: 250–300 cm; all calculated from the speaker). As confirmed by inspection of video recordings made during the experiment, the Quadrant 1 locations were consistently in participants' peripersonal space (i.e., within reach), whereas the locations in the other three quadrants were in participants' extrapersonal space (i.e., beyond their reach). The "speaker-medial" term *ŋe*^{3}*a*^{2} was selected as the reference category in the analysis because it was the least frequently used term.

2.2. Results

The total raw dataset consisted of 960 data points (80 observations per referent location). Two trials were removed due to a participant using two different demonstratives on the same trial ($n = 1$) and a missing data point ($n = 1$). Hence, the final Ticuna dataset contained 958 observations. Following previous studies of deixis in languages with noun class, we collapsed demonstratives across noun class in all of our analyses. We also collapsed morphologically complex demonstratives (composed of the forms shown in Table 1 plus one or more enclitics; n = 234) with morphologically simplex demonstratives (n = 724). Overall, we elicited 241 tokens of *ɲa*^{4}*a*^{2} ("speaker-proximal"; 25.2%), 46 tokens of *ŋe*^{3}*a*^{2} ("speaker-medial"; 4.8%), 603 tokens of *ɟe*^{3}*a*^{2} ("speaker-distal"; 62.9%), and 68 tokens of *ŋe*^{3}*ma*^{2} ("addressee-centered"; 7.1%). There were no trials where speakers volunteered an article rather than a demonstrative. One participant guessed the purpose of the experiment upon debrief. Excluding him from the analyses did not change the results.

Fig. 2 shows the overall pattern of demonstrative use in the Ticuna speakers, plotted separately for each referent location (i.e., the 12 levels of the independent variable Distance) and Addressee Location condition (i.e., speaker and addressee face-to-face vs. side-by-side), but collapsed over Visibility. Table 2 presents how often each demonstrative was used per condition in the experiment.

In light of our theoretical predictions and the multinomial nature of the dependent variable, we opted for a stepwise (forward entry) multinomial logistic regression approach to data analysis, that would initially indicate which independent variables (Distance, Visibility, Addressee Location) explained significantly more variance in the dependent variable compared to a baseline, null model. The three predictors (Distance, four levels: Quadrant 1, Quadrant 2, Quadrant 3, Quadrant 4; Visibility, two levels: visible, invisible; Addressee Location, two levels: face-to-face, side-by-side) and their two-way interactions were included in this analysis. More complex models including Participant as a random effect did not converge.

Table 3 presents the coefficients of the model that fitted the data best. It was observed that Model 1, which included Distance, explained significantly more variance in the data compared to a baseline, null model, χ^2 (9) = 581.64, $p < .001$. Model 2, a subsequent model that additionally included Addressee Location, explained significantly more variance in the data compared to Model 1, χ^2 (3) = 119.09, $p < .001$. Hence, a model including both Distance and Addressee Location fitted the data best. No effects of Visibility were found.[1] Including the two-way interactions between the three predictors did not significantly improve the model's fit. The final model explained about 52% (Cox-Snell) to 61% (Nagelkerke) of variance in the dependent variable.

Table 3 shows that *ɲa⁴a²* ("speaker-proximal") was used significantly more for referents in the first quadrant compared to for referents in the second quadrant ($p < .001$). No significant differences were observed in the use of *ɲa⁴a²* when comparing the second and third quadrants ($p = .442$) or when comparing the third and fourth quadrants ($p = .823$). The contribution of the predictor Addressee Location to the final model in terms of explaining the use of *ɲa⁴a²* approached significance ($p = .054$), reflecting that *ɲa⁴a²* was used numerically more in the face-to-face condition than in the side-by-side condition (see Table 2).

Table 3 further indicates that *ɟe³a²* ("speaker-distal") was used significantly less for referents in the first quadrant than in the second quadrant ($p < .001$) and for referents in the second quadrant than in the third quadrant ($p < .001$). No significant difference was observed between the third and fourth quadrants ($p = .669$). Additionally, Addressee Location significantly predicted participants' use of this demonstrative ($p = .037$): *ɟe³a²* ("speaker-distal") was used more when interlocutors were side-by-side than when they were face-to-face.

Finally, Table 3 shows that Ticuna speakers used *ŋe³ma²* ("addressee-centered") less for referents in the second quadrant than in the third quadrant ($p = .008$). In addition, this demonstrative was used more when participants were face-to-face than when they were side-by-side ($p < .001$).

Table 2
Count of demonstratives produced per quadrant and condition in Experiment 1.

Demonstrative	Condition	*ɲa⁴a²* "Speaker-Proximal"	*ŋe³a²* "Speaker-Medial"	*ɟe³a²* "Speaker-Distal"	*ŋe³ma²* "Addressee-Centered"
Quadrant 1	Face-to-face				
	Visible	48	2	5	5
	Invisible	49	2	1	8
	Side-by-side				
	Visible	46	5	9	0
	Invisible	44	7	8	0
Quadrant 2	Face-to-face				
	Visible	12	6	37	5
	Invisible	18	4	31	7
	Side-by-side				
	Visible	6	6	48	0
	Invisible	8	5	46	1
Quadrant 3	Face-to-face				
	Visible	0	3	44	13
	Invisible	4	2	41	13
	Side-by-side				
	Visible	0	0	60	0
	Invisible	1	0	59	0
Quadrant 4	Face-to-face				
	Visible	1	2	50	7
	Invisible	4	2	45	9
	Side-by-side				
	Visible	0	0	60	0
	Invisible	0	0	59	0

[1] Prior studies, such as Coventry et al. (2008, 2014) and Gudde et al. (2018), recommend analyzing Memory Game data using separate ANOVAs for each demonstrative. When we used this protocol, we did observe a significant main effect of Visibility on *ɲa⁴a²* ("speaker-proximal"), F (1,18) = 6.91, MSE = 391, $p = .017$, $\eta^2 = .277$, indicating that *ɲa⁴a²* ("speaker-proximal") was used significantly more for invisible than for visible referents. We also observed another significant main effect of Visibility on *ɟe³a²* ("speaker-distal"), F (1,18) = 10.33, MSE = 918, $p = .005$, $\eta^2 = .365$, indicating that *ɟe³a²* ("speaker-distal") was used significantly more for visible than for invisible referents. We return to these ANOVA results in the General Discussion (Section 5.4).

Table 3
Logistic model of predictors of demonstrative variation in Experiment 1. The "speaker-medial" demonstrative *ŋe³a²* was used as the reference category. Standard errors are indicated between brackets.

Demonstrative	*b*	Sig. (2-tailed)	Lower 95% CI	Odds Ratio	Upper 95% CI
ɲa⁴a²					
Intercept	−.25 (.71)	.724			
Distance (Q1 vs. Q2)	2.42 (.73)	.001	2.69	11.20	46.76
Distance (Q2 vs. Q3)	.56 (.72)	.442	.42	1.74	7.18
Distance (Q3 vs. Q4)	−.21 (.92)	.823	.13	.81	4.96
Addressee Location	.68 (.35)	.054	.99	1.97	3.93
ɟe³a²					
Intercept	4.36 (.55)	.000			
Distance (Q1 vs. Q2)	−3.80 (.61)	.000	.01	.02	.07
Distance (Q2 vs. Q3)	−1.98 (.56)	.000	.05	.14	.41
Distance (Q3 vs. Q4)	−.29 (.68)	.669	.20	.75	2.83
Addressee Location	−.69 (.33)	.037	.26	.50	.96
ŋe³ma²					
Intercept	−2.25 (1.16)	.053			
Distance (Q1 vs. Q2)	−1.04 (.69)	.134	.09	.35	1.38
Distance (Q2 vs. Q3)	−1.76 (.67)	.008	.05	.17	.63
Distance (Q3 vs. Q4)	.31 (.75)	.683	.31	1.36	5.85
Addressee Location	4.09 (1.06)	.000	7.54	59.61	471.19

Q1 = Quadrant 1; Q2 = Quadrant 2; Q3 = Quadrant 3; Q4 = Quadrant 4.

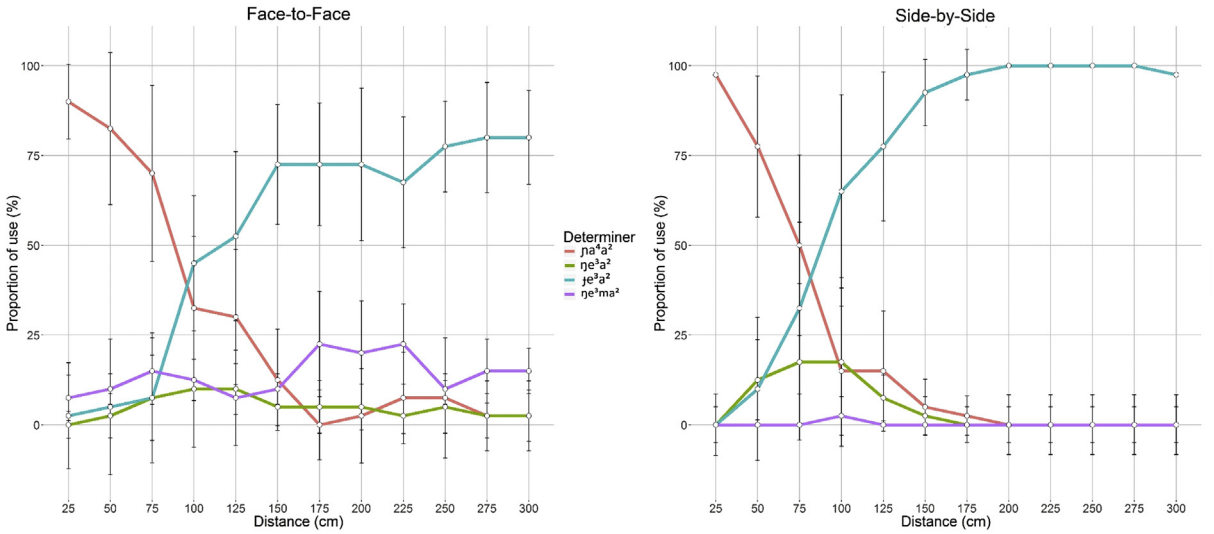

Fig. 2. Overall proportion of determiner use by speakers of Ticuna (Experiment 1), plotted separately for each referent location and addressee location. Error bars represent 95% confidence intervals around the mean. Note that *ɲa⁴a²* represents the Ticuna "speaker-proximal," *ŋe³a²* the "speaker-medial," *ɟe³a²* the "speaker-distal," and *ŋe³ma²* the "addressee-centered" demonstrative.

2.3. Interim discussion

Experiment 1 used the Memory Game paradigm to investigate how referent distance, referent visibility, and the relative location of speaker and addressee impact demonstrative choice in Ticuna. We observed clear effects of both distance and addressee location. The "speaker-proximal" term *ɲa⁴a²* was consistently used for referents close to the speaker, i.e., within the first quadrant (25–75 cm). The "speaker-distal" term *ɟe³a²* was used for referents further away from the speaker, i.e. in the second, third, and fourth quadrants. Furthermore, it was used significantly more when interlocutors were located side-by-side than when they were face-to-face. In contrast, "addressee-centered" *ŋe³ma²* was almost exclusively used when interlocutors were face-to-face. Theoretical implications of these findings are discussed in the General Discussion.

3. Experiment 2

3.1. Method

3.1.1. Participants

Twenty native speakers of Dutch (mean age 32.5 years, age range 21–61 years, 5 male), living in Nijmegen, the Netherlands, participated in the experiment. They all had at least some knowledge of English, as is common for Dutch adults. All participants had normal or corrected-to-normal vision, no language or hearing impairments, and no history of neurological disease. They provided written informed consent and were paid for participation. Dutch participants were matched with the Ticuna participants (Experiment 1) in sample size, age, and gender.

3.1.2. Stimuli, design, and procedure

Stimuli and design were identical to Experiment 1. There were three procedural differences compared to Experiment 1. First, the experiment took place in a lab at the Max Planck Institute for Psycholinguistics, not in participants' homes (as in Experiment 1). Second, the experiment took place in Dutch and the experimenter was a native speaker of Dutch. Third, because the post-game recall test was included solely to facilitate the cover story, and was considered relatively long by Ticuna participants, we limited the number of trials in the recall test to 12 for Dutch participants.

3.2. Results

The total raw dataset consisted of 960 observations (80 observations per referent location). Overall, we elicited 766 definite articles (79.8%), 127 instances of *dat* or *die* ("speaker-distal"; 13.2%), 42 instances of *dit* or *deze* ("speaker-proximal"; 4.4%), and 25 indefinite articles (2.6%). Twelve out of 20 participants used only articles, and only one participant used more demonstratives than articles. Thus, articles (82.4%) were clearly preferred over demonstratives (17.6%), contrasting with Ticuna participants' exclusive use of demonstratives.

Fig. 3 shows the overall pattern of demonstrative/article use by speakers of Dutch in Experiment 2, plotted separately for each referent location, collapsed over Visibility and Addressee Location. Table 4 presents how often each determiner was used per condition in the experiment.

Because of the low number of elicited demonstratives, the fact that a majority of participants did not use a demonstrative at all, and the fact that our experimental design included three distinct independent variables, we deemed any statistical analysis on the (small number of) elicited demonstratives by definition underpowered and therefore not reliably capable of contrasting different theoretical positions. We note, however, that the experiment yielded the meaningful finding that speakers of Dutch prefer to use definite articles in situations where Ticuna speakers prefer to use demonstratives.

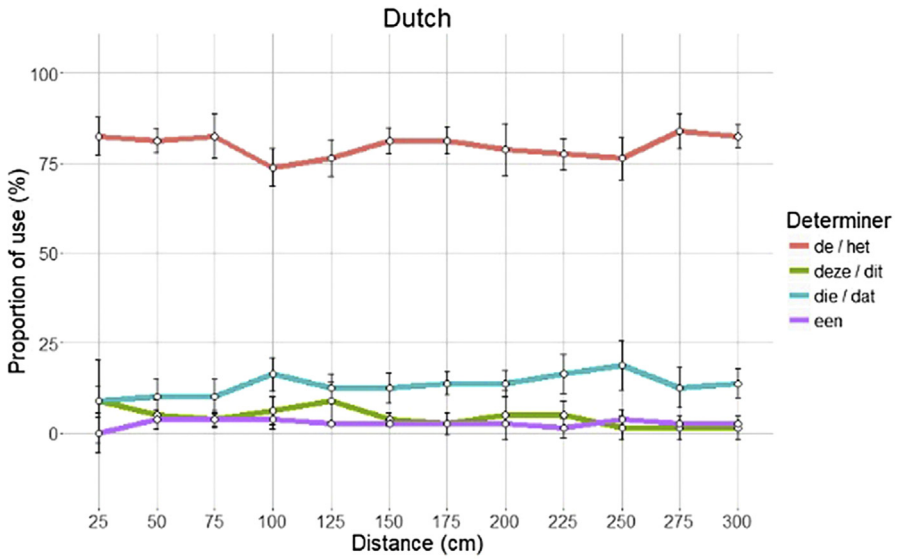

Fig. 3. Overall proportion of determiner use by speakers of Dutch (Experiment 2), plotted separately for each referent location. Error bars represent 95% confidence intervals around the mean. Note that *de/het* represents the Dutch definite article, *deze/dit* the "speaker-proximal" demonstrative, *die/dat* the "speaker-distal" demonstrative, and *een* the indefinite article.

Table 4
Count of demonstratives produced per quadrant and condition in Experiment 2.

Determiner	Condition	*dit/deze* "Speaker-Proximal"	*dat/die* "Speaker-Distal"	*de/het*, definite article	*een*, indefinite article
Quadrant 1	Face-to-face				
	Visible	3	12	45	0
	Invisible	3	11	46	0
	Side-by-side				
	Visible	3	0	55	2
	Invisible	5	0	51	4
Quadrant 2	Face-to-face				
	Visible	1	13	46	0
	Invisible	4	11	45	0
	Side-by-side				
	Visible	4	7	48	1
	Invisible	6	2	46	6
Quadrant 3	Face-to-face				
	Visible	0	13	47	0
	Invisible	1	13	46	0
	Side-by-side				
	Visible	4	8	48	0
	Invisible	5	1	49	5
Quadrant 4	Face-to-face				
	Visible	0	14	46	0
	Invisible	0	14	46	0
	Side-by-side				
	Visible	2	6	50	2
	Invisible	1	2	52	5

3.3. Interim discussion

Experiment 2 used the Memory Game paradigm to investigate how referent distance, referent visibility, and the relative location of speaker and addressee impact demonstrative choice in Dutch. As in Experiment 1, participants were left free in their choice of determiner, such that they could use either an article or a demonstrative in their referential utterance. In response to this instruction, Dutch speakers primarily used definite articles, while Ticuna speakers used exclusively demonstratives, producing extremely disparate sample sizes of demonstratives for each participant group. The theoretical consequences of this surprising and unforeseen cross-linguistic difference are discussed in the General Discussion. To allow for a valid comparison between the use of demonstratives in Ticuna and Dutch, we carried out a third experiment in which Dutch participants were instructed to use a demonstrative on every trial (cf. Coventry et al., 2008).

4. Experiment 3

4.1. Method

4.1.1. Participants

Twenty native speakers of Dutch (mean age 32.8 years old, age range 19–67 years old, 5 male), living in Nijmegen, the Netherlands, participated in the experiment. They all had at least some knowledge of English, as is common for Dutch adults. All participants had normal or corrected-to-normal vision, no language or hearing impairments, and no history of neurological disease. None of them participated in Experiment 2. They provided written informed consent and were paid for participation. Participants were matched with the participants in Experiments 1 and 2 in sample size, age, and gender.

4.1.2. Stimuli, design, and procedure

Stimuli, design, and experimenter were identical to Experiment 2. The only difference between the two experiments was that in Experiment 3, participants were instructed to use a demonstrative and a noun on each trial. In other words, in line with earlier work using the Memory Game paradigm (e.g., Coventry et al., 2008; 2014; Gudde et al., 2018), they were not allowed to introduce the noun with an article.

4.2. Results

The total raw dataset consisted of 960 observations (80 observations per referent location). Overall, we elicited 696 instances of *dat* or *die* ("speaker-distal"; 72.5%), and 264 instances of *dit* or *deze* ("speaker-proximal"; 27.5%). In line with previous studies of Dutch (e.g., Peeters et al., 2015; Piwek et al., 2008), and as in the analysis of Ticuna, demonstratives were

collapsed across grammatical gender in the analysis. Three participants upon debrief guessed that the experiment was about demonstratives. Excluding these participants from the analyses did not change the results.

Fig. 4 shows the overall pattern of demonstrative use by speakers of Dutch in Experiment 3, plotted separately for each referent location, and collapsed over Visibility and Addressee Location. Table 5 presents how often each demonstrative was used per condition in the experiment.

In order to test the predictive power of referent distance in relation to the visibility of the referent and the location of the addressee, we carried out a binary logistic regression analysis on the elicited demonstratives. The binary dependent variable in this analysis was the use of a "speaker-proximal" (*dit*, *deze*, coded as 0) or "speaker-distal" (*dat*, *die*, coded as 1) demonstrative. In light of our theoretical predictions and the categorical, binary nature of the dependent variable, we opted for a hierarchical, binary logistic regression approach to data analysis (forced entry), comparing a model (Model 1) that included Distance as the single factor to a model (Model 2) that additionally included Visibility (2 levels: visible, invisible) and Addressee Location (2 levels: face-to-face, side-by-side) as categorical predictors. More complex models including Participant as a random effect did not converge.

Table 6 presents the coefficients of the models. Model 1 explained significantly more variance in the data compared to a baseline, null model, $\chi^2\,(3) = 361.62$, $p < .001$, $R^2 = .31$ (Cox-Snell), .45 (Nagelkerke). As such, the referent's distance from the speaker explained about 31% (Cox-Snell) to 45% (Nagelkerke) of the variance in the dependent variable (i.e., participants' choice of a proximal *vs.* a distal demonstrative). Table 6 shows that participants used significantly more distal demonstratives when the referent was located in Quadrants 2, 3, or 4 than when it was located in Quadrant 1. Model 2, in which Visibility and Addressee Location were added as additional predictors, did not explain significantly more variance in the data compared to Model 1, $\chi^2\,(2) = 3.27$, $p = .195$. Indeed, neither Visibility ($p = .447$) nor Addressee Location ($p = .106$) significantly explained variance in the dependent variable. Thus, based on these two models, we conclude that only the referent's distance from the speaker significantly contributed to variation in Dutch speakers' demonstrative use. Exploratory fitting of a third model that additionally included all two-way interactions also did not explain significantly more variance ($p = .061$) than Model 2.

Because the dependent variable differed in number of levels between Dutch (two levels) and Ticuna (four levels), no direct statistical comparison between Exp. 1 and Exp. 3 was made.

4.3. Interim discussion

Experiment 3 observed clear effects of referent distance on the selection of demonstratives in Dutch. Dutch speakers used more proximal demonstratives for referents located near them (i.e., in the first quadrant) than for referents located further away (i.e., in the second, third, and fourth quadrants), and vice versa for distal demonstratives. None of the other manipulations significantly affected the Dutch participants' use of demonstratives.

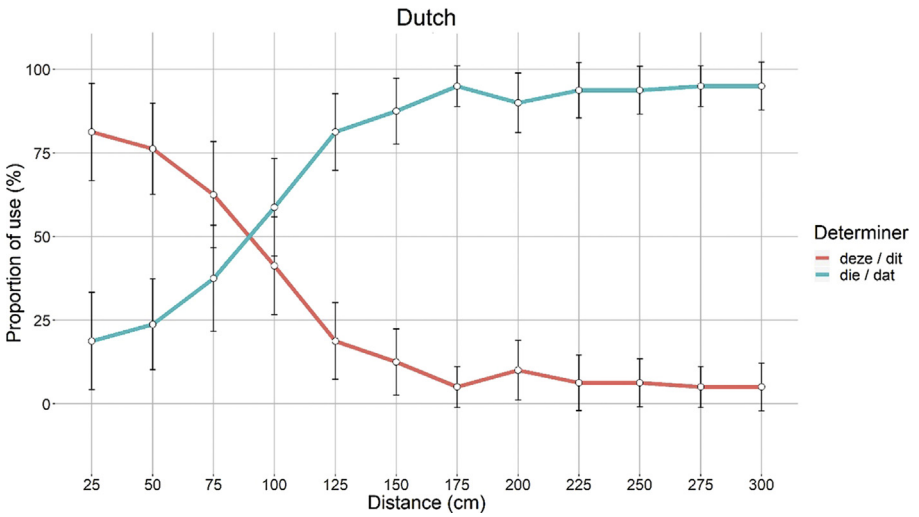

Fig. 4. Overall proportion of demonstrative use by speakers of Dutch (Experiment 3), plotted separately for each referent location. Error bars represent 95% confidence intervals around the mean. Note that *deze/dit* represents the Dutch "speaker-proximal" demonstrative, and *die/dat* the "speaker-distal" demonstrative.

Table 5
Count of demonstratives produced per quadrant and condition in Experiment 3.

Determiner	Condition	*dit/deze* "Speaker-Proximal"	*dat/die* "Speaker-Distal"
Quadrant 1	Face-to-face		
	Visible	49	11
	Invisible	48	12
	Side-by-side		
	Visible	40	20
	Invisible	39	21
Quadrant 2	Face-to-face		
	Visible	16	44
	Invisible	16	44
	Side-by-side		
	Visible	16	44
	Invisible	10	50
Quadrant 3	Face-to-face		
	Visible	3	57
	Invisible	4	56
	Side-by-side		
	Visible	8	52
	Invisible	2	58
Quadrant 4	Face-to-face		
	Visible	0	60
	Invisible	5	55
	Side-by-side		
	Visible	4	56
	Invisible	4	56

Table 6
Logistic models of predictors of demonstrative variation in Experiment 3 (95% BCa bootstrap confidence intervals based on 1000 samples in brackets). Reference categories were Quadrant 1 (for Distance), invisible referent (for Visibility), and face-to-face (for Addressee Location).

	b	Sig. (2-tailed)	Lower 95% CI	Odds Ratio	Upper 95% CI
Model 1					
Constant	−1.01 [−1.32, −.74]	.001			
Distance (Q2)	2.16 [1.77, 2.62]	.001	5.72	8.63	13.02
Distance (Q3)	3.59 [3.03, 4.21]	.001	20.40	36.07	63.80
Distance (Q4)	3.87 [3.29, 4.63]	.001	25.63	48.02	89.97
Model 2					
Constant	−1.10 [−1.51, −.74]	.001			
Distance (Q2)	2.17 [1.79, 2.65]	.001	5.79	8.75	13.23
Distance (Q3)	3.60 [3.08, 4.24]	.001	20.73	36.74	65.11
Distance (Q4)	3.89 [3.32, 4.66]	.001	26.06	48.93	91.86
Visibility	−.14 [−.51, .22]	.447	.61	.87	1.25
Addressee Location	.30 [−.06, .68]	.106	.94	1.36	1.95

Q2 = Quadrant 2; Q3 = Quadrant 3; Q4 = Quadrant 4.

5. General Discussion

This study used the Memory Game paradigm to compare the deictic content of demonstratives in two unrelated languages with typologically different demonstrative systems: Ticuna and Dutch. Speakers of these two languages referred to objects placed at different locations in space, while seated either face-to-face or side-by-side with their addressee. In half of the trials, the referent was visible; on the other half of the trials, it was invisible, covered by an opaque container.

Surprisingly, we observed clear differences in whether speakers of the two languages spontaneously used demonstratives in our experimental paradigm. Even when left free to use articles, Ticuna speakers used demonstratives in all of their referential utterances. On the other hand, when Dutch speakers were left free to use any determiner, they primarily used definite articles.

Likewise, Ticuna speakers and Dutch speakers differed in their sensitivity to addressee location. Ticuna participants' demonstrative use displayed effects of addressee location; Dutch participants' responses did not. The populations did have some similarities: both groups were sensitive to the referent's location in space, and neither group displayed effects of referent visibility. We now interpret these findings in light of the hypotheses proposed in the Introduction.

5.1. Distance impacts demonstrative use in both Ticuna and Dutch

For both Ticuna and Dutch, our results support the idea that the deictic content of demonstratives includes spatial information. In the Ticuna experiment, we observed that both ɲa^{4}a^2 ("speaker-proximal") and ɻe^{3}a^2 ("speaker-distal") were

sensitive to the referent's distance from the speaker. Distance was also important to the use of *ŋe³ma²* ("addressee-centered"), though the item was used only in the face-to-face condition. Likewise, in the Dutch data, both *dit* ("speaker-proximal") and *dat* ("speaker-distal") displayed distance effects.

A recent variant of the distance hypothesis posits that the spatial deictic content of demonstratives concerns location relative to peripersonal (reaching) space, rather than distance (Coventry et al., 2008; Kemmerer, 1999). Consistent with this proposal, among the demonstratives that displayed effects of distance, we observed clearly non-linear relationships between the distance of the referent and participants' demonstrative use in both Dutch and Ticuna. Ticuna speakers' proportion of use of "speaker-proximal" *ɲa⁴a²* dropped off steeply at the boundary between peripersonal and extrapersonal space (~75 cm), while their use of "speaker-distal" *ɟe³a²* displayed a steep rise (cf. Fig. 2). Much the same was true for Dutch speakers in Experiment 3: their use of "speaker-proximal" *deze/dit* fell steeply at the ~75 cm boundary between peripersonal and extrapersonal space (cf. Fig. 4). Additionally, the analysis for Ticuna showed that speakers' proportion of use of the "speaker-proximal" demonstrative did not significantly differ among the three quadrants located in extrapersonal space. In contrast, the proportion of use of the Ticuna "speaker-proximal" and "speaker-distal" demonstratives within the first quadrant – that is, within peripersonal space – clearly differed from all three of the quadrants in extrapersonal space.

These findings are broadly in line with peripersonal space-based accounts of the contrast between speaker-proximal and speaker-distal demonstratives (Coventry et al., 2008). Earlier studies using the Memory Game paradigm with speakers of English and Spanish have interpreted similar results as evidence in favor of this parallel – contrary to Kemmerer's initial conclusions (Coventry et al., 2008, 2014; Gudde et al., 2016). The Ticuna data further confirm the importance of the binary distinction between peripersonal and extrapersonal space in demonstrative use in speakers of a non-Western language with a rich demonstrative system. Further, the Dutch data precisely mirror this distinction in another Indo-European language. We note that the binary distinction between peripersonal and extrapersonal space is a more specific and measurable implementation of previously proposed distance contrasts of a more flexible binary nature (relatively close vs. relatively further away). In this vein, we also note that the relation between peripersonal space and demonstrative use only seems to hold for the peripersonal space in front of the speaker, as speakers often use different demonstrative for referents within reach, but behind them, than for referents within reach and in front of them (Levinson et al., 2018).

However, not all effects of distance in the Ticuna data can be explained by a peripersonal space analysis. A pure peripersonal space analysis predicts that speakers' demonstrative use should be identical for all of the quadrants of extrapersonal space – quadrants 2, 3, and 4 – in our paradigm. In fact, as shown in Table 3, Ticuna participants' demonstrative use was significantly different for quadrants 2 and 3. Participants were more likely to use "speaker-distal" *ɟe³a²*, as well as "addressee-proximal" *ŋe³ma²*, for referents in quadrant 3 than in quadrant 2; a peripersonal space analysis cannot account for this pattern.

We thus conclude, in line with the weak distance hypothesis, that the deictic content of demonstratives can include information about the referent's location relative to the speaker. We use the term "location," rather than "distance," to highlight that the spatial deictic content of **some** demonstratives concerns location in peripersonal vs. extrapersonal space (a binary value) rather than distance (a continuous one). Our data supports a peripersonal space account of the spatial deictic content of "speaker-proximal" demonstratives in both Ticuna and Dutch, as well as "speaker-distal" demonstratives in Dutch. It does not, however, support an exclusively peripersonal space-based analysis of the spatial deictic content of "speaker-distal" and "addressee-proximal" demonstratives in Ticuna.

5.2. Addressee location impacts demonstrative use in Ticuna, but not in Dutch

In the Introduction, we identified the view that demonstratives relate the referent to the speaker as the **egocentricity hypothesis**. We further contrasted strong and weak forms of this view. Strong forms of egocentricity claim that all demonstratives relate the referent only to the speaker. Weak forms treat demonstratives as potentially relating the referent to either speaker or addressee, but not to both participants.

Our results for Ticuna are consistent with weak, but not strong, versions of the egocentricity hypothesis. We show that addressee location affects speakers' use of "speaker-distal" *ɟe³a²* and "addressee-centered" *ŋe³ma²*. Recall from Table 3 that "speaker-distal" *ɟe³a²* and "addressee-centered" *ŋe³ma²* displayed effects both of distance and of addressee location. These results reflect that when speaker and addressee were face-to-face, Ticuna participants used *ŋe³ma²* ("addressee-centered") more often for referents relatively distant from them – in the third and fourth quadants – and therefore near the addressee. By contrast, when speaker and addressee were side-by-side, *ŋe³ma²* ("addressee-centered") was effectively never used. These results differ considerably from Coventry et al.'s (2008) results for the Spanish demonstrative *ese*, which has also been analyzed as addressee-centered (Alonso, 1968; Shin et al., 2020). Coventry et al. (2008) found a main effect of distance (from the speaker) on the use of *ese*, but did not find an interaction between addressee location and distance. Instead, speakers used *ese* for the second and third quadrants of the space regardless of the addressee's location. Ticuna speakers, on the other hand, used *ŋe³ma²* ("addressee-centered") **only** when the addressee was seated opposite them.

Based on these results, we propose that *ŋe³ma²* ("addressee-centered") conveys that the demonstrative referent is within the addressee's interactive space (following the use of that term by Coventry et al., 2014). The addressee's interactive space is projected forward from their body. In the face-to-face condition, it appears to include the entire half of the referential space nearer to the addressee (not only the addressee's peripersonal space). In the side-by-side condition, on the other hand, the addressee's interactive space does not include any of the referential space. Instead, this condition leads participants to behave

egocentrically, construing referents that are equidistant from speaker and addressee according to their location relative to the speaker. This analysis claims that *ŋe³ma²* ("addressee-centered") relates the referent to the addressee; as a consequence, it is incompatible with strong egocentricity.

By contrast to the results for the Ticuna addressee-centered demonstrative, our Dutch results – as well as the results for *ɲa⁴a²* ("speaker-proximal") in the Ticuna experiment – are broadly consistent with strong egocentricity. In Dutch, we did not observe effects of addressee location on the use of *dit* ("speaker-proximal") or *dat* ("speaker-distal"). Likewise, in Ticuna, we did not observe effects of addressee location on the use of *ɲa⁴a²* ("speaker-proximal"), though we did observe such effects for *ɟe³a²* ("speaker-distal") – speakers' use of this item declined in the face-to-face condition, proportional to the increase in their use of *ŋe³ma²* ("addressee-centered"). The absence of addressee effects for the speaker-centered demonstratives is consistent with the findings of other Memory Game studies, which have generally not observed effects of addressee location on "speaker-proximal" demonstratives in English (Coventry et al. 2008, 2014).

We thus conclude that demonstratives **can** be sensitive to the location of the addressee. More specific, we propose that demonstratives can relate the referent to either of the two core discourse participants: speaker or addressee. Among the demonstratives examined in this study, four items – the "speaker-proximal" and "speaker-distal" demonstratives of Ticuna, and the "speaker-proximal" and "speaker-distal" of Dutch – appear to relate the referent only to the speaker. One, the "addressee-centered" demonstrative of Ticuna, relates the referent to the addressee. Contrary to other studies of Dutch (Peeters et al., 2015) and Ticuna (Skilton, 2019, pp. 178–190), we do not observe evidence that any of the demonstratives are sociocentric, relating the referent to both speaker and addressee. This strongly suggests an influence of context affordances and/or task in influencing whether demonstratives are used from an egocentric or sociocentric perspective. In the Memory Game paradigm, interlocutors do not know each other well; have hierarchically different roles (participant *vs*. experimenter) in the task; and are highly restricted in what they can say and do. Thus, compared to naturally occurring conversation, the Memory Game's experimental conditions may reduce participants' tendency to jointly conceptualize the referential space in a sociocentric way (see also Peeters et al., 2020).

More generally, assuming that a jointly construed shared space is required for interlocutors to use demonstratives in a sociocentric way, the broader (task) setting should influence how interlocutors jointly negotiate the extension of this shared space. It is a question for further research whether and how task setting influences whether the same demonstrative is anchored to the speaker, the addressee, or the dyad. In addition, due to the limited availability of Ticuna speakers, the current study remains relatively low in statistical power. Subtle sociocentric effects, which may be intrinsically difficult to detect in strict experimental settings, may require more statistical power to observe than salient spatial manipulations.

In sum, we conclude that the demonstrative origo may **vary** across languages and between the demonstratives of a single language. Our findings for Ticuna indicate that only some of that language's demonstratives are egocentric, while others are addressee-centered. By contrast, the findings for Dutch are fully consistent with even strong forms of the egocentricity hypothesis. We therefore suggest that the egocentricity hypothesis may hold a kernel of truth. Egocentric demonstratives may be universally present, and available even in pragmatically unusual tasks such as the Memory Game. By contrast, the existence of non-egocentric demonstratives may be a locus of cross-linguistic diversity, and their use potentially dependent on task demands.

5.3. *Visibility does not impact demonstrative use in either Ticuna or Dutch*

In the Introduction, we identified the traditional view that demonstratives' deictic content concerns referent distance as the **distance hypothesis.** The strong version of the distance hypothesis claims that demonstratives convey **only** distance, and not non-spatial information such as visibility. Thus, for the experiments presented here, the strong distance hypothesis predicts that participant responses will be identical in the visible and invisible conditions.

In line with these predictions, we did not observe an effect of visibility on participant responses in either Dutch or Ticuna. For Ticuna, however, this lack of an effect is contingent on our choice of statistical analysis. Other Memory Game studies, such as Coventry et al. (2008, 2014) and Gudde et al. (2018), analyze data using separate ANOVAs for each demonstrative. If we had analyzed the Ticuna data with ANOVA, then as reported in footnote 1, we would have concluded that both "speaker-proximal" *ɲa⁴a²* and "speaker-distal" *ɟe³a²* displayed visibility effects – specifically, that visible referents were more likely to elicit "speaker-distal" *ɟe³a²*, while invisible referents were more likely to elicit "speaker-proximal" *ɲa⁴a²*. Analyzing the Dutch data with ANOVA, in contrast, still would not have produced visibility effects.

Our use of logistic regression for data analysis, rather than ANOVA, deviates from the recommendations by Gudde et al. (2018) and earlier studies using the Memory Game paradigm (Coventry et al., 2008, 2014). Because the dependent variable in Memory Game data is intrinsically categorical, rather than continuous, ANOVA is not an appropriate technique for analyzing data collected with the Memory Game paradigm. Thus, the fact that we observed an effect of Visibility when (incorrectly) analyzing our data with ANOVAs, but not when using the more appropriate logistic regression technique, suggests that findings from studies using individual ANOVAs (e.g., Coventry et al., 2008; 2014) should be revisited using more appropriate statistical analyses.[2]

[2] Future studies should also consider including Participant and Item as random effects in a mixed model, if the available number of participants and research design allow for the construction of more complex statistical models.

Additionally, we note that these findings on visibility are specific to the visibility manipulation in our experimental protocol (adapted from Coventry et al., 2008). This manipulation has several properties which may attenuate visibility effects. For example, participants saw the invisible referents immediately before they were covered, and participants saw the opaque covers – which were in precise spatial counterpart relations with the invisible referents, possibly facilitating acts of deferred reference (Hanks 2005) – even when they did not see the referents themselves. Future cross-linguistic research on demonstratives should investigate whether visibility manipulations that do not have these properties – for example, the experimenter placing an opaque screen between the participant and the invisible referent – lead to stronger effects.

5.4. Cross-linguistic differences in the use of articles versus demonstratives

Experimental studies of exophoric demonstratives typically focus on variation between demonstratives as such. In previous studies using the Memory Game paradigm, for instance, participants were instructed to use a demonstrative (and not any other type of determiner) on every trial of the experiment (e.g., Coventry et al., 2008; 2014; Gudde et al., 2018). Conversely, in Experiments 1 and 2 of the present study, we left participants free in which determiner to use. This increase in ecological validity allowed us to observe a novel, unexpected cross-linguistic difference in the use of referring expressions. Whereas Ticuna speakers consistently used demonstratives in all referential utterances in our experimental paradigm, speakers of Dutch clearly preferred definite articles in the same context. This finding suggests that the complexity of a language's demonstrative system may play a role in whether speakers use a demonstrative versus an article in the same communicative situation.

The fact that Dutch participants preferred articles to demonstratives in our paradigm supports the idea that, in Dutch, definite articles are more natural than demonstratives in **non-contrastive** reference to an object that is highly accessible to both speaker and addressee. Earlier work on Dutch (Kirsner, 1993, p. 82) suggested that Dutch demonstratives contrast with the definite article "in indicating that the noun's referent … has to be 'picked out' from other, competing referents." Likewise, unpublished results indicate that, in the Memory Game paradigm, Dutch speakers naturally use demonstratives in up to 80% of trials when asked to make contrastive reference to two identical objects (Peeters, in prep.). Thus, Dutch speakers may prefer articles over demonstratives in non-contrastive exophoric settings.

However, contrast is arguably not the only dimension that matters to the choice between articles and demonstratives in Dutch. Kirsner (1993) suggests that Dutch speakers are more likely to use demonstratives in establishing joint attention on a new referent than when referring to an entity that the speaker and/or addressee have attended to previously. In our experimental paradigm, participants were never required to call attention to a completely disattended referent, since – at the start of each trial – the participant and experimenter needed to attend to the referent in order to place it on the correct location. Given these experimental details, it may not be surprising that Dutch speakers used definite articles rather than demonstratives in their multimodal referential utterances (cf. Coello and Bonnotte, 2013).

Nevertheless, our Dutch findings (but not our Ticuna findings) are remarkable in light of earlier literature on the **endophoric** use of demonstratives, where speakers or writers refer to referents known primarily from the ongoing discourse. In the endophoric domain, demonstratives are typically compared to other types of referring expressions, such as personal pronouns and definite noun phrases. The choice between these types of referring expression is typically analyzed as reflecting the cognitive status of the referent for the addressee (e.g. Ariel, 1988; Gundel et al., 1993; Prince, 1981). Influential theories in this field, such as the **givenness hierarchy** (Gundel et al., 1993) and the **accessibility hierarchy** (Ariel, 1988), claim that demonstrative noun phrases (e.g., *this/that book*) are used in reference to entities that are relatively **more** accessible than those referred to by definite noun phrases (e.g., *the book*). These theories also argue that definite expressions are optimal for introduction of new referents, while demonstratives are not. Against this background, it is surprising that Dutch participants predominantly used definite articles when allowed to do so – given that all referents were highly accessible to the participants, and that all referents were verbally introduced by the experimenter at the start of each trial. These results suggest potential differences between languages, and between exophoric and endophoric contexts, in how the cognitive accessibility of a referent impacts speakers' choice of determiner. In endophoric contexts in English, high accessibility is analyzed as favoring demonstratives; by contrast, in exophoric contexts in Dutch, high accessibility appears to favor articles. Our findings therefore invite researchers studying exophoric demonstratives to broaden their horizons by investigating the factors involved in speakers' choice of demonstratives over other types of referring expressions, especially articles (cf. Bangerter, 2004; Cooperrider, 2016). The extent to which the same factors influence a speaker's choice of demonstratives in an exophoric versus an endophoric remains an open question for future research (cf. Peeters et al., 2020).

We further note that our participants, as in previous studies employing the Memory Game paradigm (e.g., Coventry et al., 2008; 2014; Gudde et al., 2018) were required to produce a pointing gesture on every trial. Although pointing gestures and demonstratives are often seen as connected (e.g., Cooperrider, 2016), the experimental requirement to point generally did not lead Dutch participants to produce demonstratives in Exp. 2. Future studies using the Memory Game paradigm may shed light on the interplay between pointing and demonstrative use by leaving participants free to use gesture or not during the experiment. Previous studies investigating the link between deictic gesture and the use of spoken-language referring expressions suggest that speakers may flexibly adapt the relative importance of the spoken vis-à-vis the gestural part of a composite signal in response to the communicative situation at hand (Bangerter, 2004; Cooperrider, 2016).

Finally, it is crucial to note that the difference between the Dutch and Ticuna participants' production of articles versus demonstratives is not due to narrowly grammatical differences between the languages. Though Dutch has demonstratives,

Dutch speakers almost exclusively use definite articles in the extralinguistic context represented by our experimental paradigm (Exp. 2). Equivalently, though Ticuna has articles, Ticuna speakers exclusively use demonstratives in this context. This result indicates that cross-linguistic diversity in exophoric deixis concerns not only the deictic content of demonstratives, but also whether speakers preferentially use demonstratives or articles in virtually identical communicative situations. More research is needed in this domain to further investigate the implications of such cross-linguistic differences.

6. Conclusion

This study investigated the role of referent distance, referent visibility, and addressee location on speakers' choice of demonstratives in two unrelated languages. In line with the weak distance hypothesis, referent location impacted participants' demonstrative use in both Ticuna and Dutch. For "speaker-proximal" demonstratives in both languages, as well as "speaker-distal" demonstratives in Dutch, the location effects can clearly be analyzed as reflecting a binary division between location inside vs. outside the speaker's peripersonal (reaching) space. For "speaker-distal" and "addressee-proximal" demonstratives in Ticuna, however, not all location effects could be attributed to location inside vs. outside egocentric peripersonal space. This raises to the issue of egocentricity, where our findings for the two languages again diverged. Addressee location impacted participants' demonstrative use in Ticuna – suggesting that certain demonstratives of that language relate the referent to discourse participants other than the speaker, consistent with views of deixis that are not strictly egocentric. Our results for Dutch, on the other hand, displayed no effect of the location of the addressee. Visibility did not impact demonstrative use in either language, though we would have observed an effect in Ticuna if we had followed prior Memory Game authors' analysis protocol. Finally, our findings indicate that, in identical contexts, speakers of one language (Ticuna) may use demonstratives, while speakers of another language (Dutch) prefer definite articles. Together, these observations emphasize the importance of investigating fundamental properties of human communication – like the management of attention via deixis – in genetically and typologically diverse languages.

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