

## RESOLVING PRONOMINAL REFERENCE IN LOCAL CONTEXTS: A REFERENT SELECTION TASK

### RESOLVENDO A REFERÊNCIA PRONOMINAL EM CONTEXTOS LOCAIS: UMA TAREFA DE SELEÇÃO DE REFERENTES

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#### ABSTRACT

Studies on global and local discourse have shown that sign languages indeed allow for occurrence of referentially unanchored pronominal index (ix) signs referring to non-present antecedents to appear in ambiguous contexts. In local contexts, resolving the reference of these expressions has been suggested to either depend on a modality-specific anaphora resolution mechanism (localization) or on the next mention bias (first/second mention preference) influencing the salience of the referents. This paper presents a two-alternative forced choice referent selection task investigating the impact of a default localization pattern on the interpretation of referentially unanchored pronominal ix sign, in the local discourse with two competing antecedents. To do that, comparative response data was collected from right- and left-handed signers of German Sign Language (DGS) and Turkish Sign Language (TİD). Results provide evidence for second-mention or object preference for pronominal ix in both languages. In addition, the default localization pattern is identified only in restricted environments (i.e., with reciprocal verbs) to resolve pronominal reference. This modality-specific means is shown to be subject to variation across two unrelated sign languages under investigation.

**KEYWORDS:** Pronominal Index (ix), Second-mention preference, Spatial defaults, German Sign Language (*Deutsche Gebärdensprache*: DGS), Turkish Sign Language (*Türk İşaret Dili*: TİD)

#### RESUMO

Estudos existentes sobre discursos globais e locais mostram que as línguas de sinais claramente permitem que os sinais de apontação (ix) pronominais referenciais não-ancorados referindo-se a antecedentes ausentes possam ocorrer em contextos ambíguos. Em contextos locais, sugere-se que a resolução da referência dessas expressões dependeriam tanto de um mecanismo de resolução anafórica específico da modalidade visual (localização), bem como de uma tendência de que a próxima menção (uma preferência pela primeira/segunda menção) influenciasse na saliência dos referentes que serão retomados. Este artigo apresenta uma tarefa de seleção de referentes feita obrigatoriamente a partir de duas alternativas que teve por objetivo investigar o impacto do padrão de localização *default* na interpretação do sinal de apontação pronominal referencial não-ancorado no discurso local, tendo como competidores, dois potenciais antecedentes. Para realizar tal tarefa, comparamos os dados obtidos das respostas de sinalizadores destros e canhotos da Língua de Sinais Alemã (DGS) e da Língua de Sinais Turca (TİD). Os resultados evidenciam que ix pronominal retoma preferencialmente o segundo referente mencionado ou o objeto em ambas as línguas. Ainda, identificamos que o padrão de localização *default* só resolve a referência pronominal em ambientes restritos (ex: com verbos recíprocos). Mostramos que este modo de resolver a referência pronominal é específico da modalidade visual e está sujeito à variação paramétrica nas duas línguas de sinais investigadas, que não possuem relação de familiaridade

**PALAVRAS-CHAVE:** Apontação pronominal (ix); Preferência pela segunda menção; Padrões espaciais; Língua de Sinais Alemã (*Deutsche Gebärdensprache*: DGS), Língua de Sinais Turca (*Türk İşaret Dili*: TİD).

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## Introduction

Pointing signs or IX signs, which share their form related and spatial properties (i.e., an (optional) path movement and an extended index finger-handshape) with co-speech gestures, have been in the focus of attention since the beginning of sign language research (STOKOE, 1960). IX signs can have a multitude of functions: pronoun, determiner, demonstrative, locative. These functions can be differentiated based on the distribution (e.g., preceding or following nominals), certain phonological properties (e.g., direction of the pointing, type of and intensity of the path movement) or the context of occurrence of an IX sign (PFAU, 2011).

In many sign languages pronominal IX signs can refer to both present and non-present entities, for the latter loci have to be created. However not all sign languages employ both types. In fact, some rural sign languages make use of deictic pointing for both present and non-present entities. For instance, in Kata Kolok, a village sign language of Bali, the usage of IX signs for pronominal reference is only possible when the referred individuals are present, if they are not present then the IX signs pointing to distant loci in the space are used to refer only to locations of places (MARSAJA, 2008).

The focus here will be particularly on IX signs which have pronominal function and refer to non-present individuals. Their referents are not lexically determined but rather can change depending on a number of (non)-linguistic factors. Given the fact that these referential expressions were shown to possess both gestural and linguistic properties (LIDDELL 1990; CORMIER, SCHEMBRI & WOLL, 2013), I will refer to them as pronominal IX signs rather than pronouns.

The literature on pronominal reference in sign languages is mainly concerned with the cases in which pronominal IX signs are directed to the areas overtly associated with their antecedents. That is, each referent is assumed to be arbitrarily linked to a spatial point/area and can be unambiguously retrieved via direct or indirect reference to this point/area (LILLO-MARTIN & KLIMA, 1990; KEGL, 2003; LACY, 2003). This is shown in a self-constructed example (1a) below where a fingerspelled antecedent M-A-R-Y is overtly localized via IX<sub>L</sub> (a localizing sign directed to left (contralateral) side of the signing space) and is referred back via a pronominal IX<sub>L</sub> directed to the same spatial area.

(1)

a. E-M-M-A IX<sub>R</sub> M-A-R-Y IX<sub>L</sub> LOVE BECAUSE IX<sub>L</sub> KIND<sup>2</sup>.

‘Emma loves Mary because she (Mary) is kind.’

b. E-M-M-A M-A-R-Y LOVE. BECAUSE IX<sub>L</sub> KIND.

‘Emma loves Mary because she (Mary) is kind.’

In (1b) above none of the antecedents are localized and IX<sub>L</sub> is be spatially unanchored to one of the antecedents. It has also been claimed that, the referent-locus association is not clear in such cases, hence the structure becomes ungrammatical. This implies that ambiguity should be strictly avoided in pronominal contexts as also emphasized in the following quote for American Sign Language (ASL):

In English the intended reference of lexical pronouns is often unclear. The sentence “He said he hit him and then he fell down.” fails to specify which pronouns refer to the same noun, that is, which are coreferential. The spatial mechanisms used in ASL, by contrast, require that the identities of the referents be maintained across arbitrary points in space. In ASL the failure to maintain such identities results in strings that are ill- formed, rather than in strings that are simply unclear. (POIZNER, KLIMA & BELLUGI, 1987, p. 17)

On the other hand, studies focusing on larger discourse contexts have shown that one-to-many and many-to-one mappings are also quite common between pronominal signs and their referents, indicating that sign languages indeed allow for ambiguities in pronoun resolution (BARBERÀ, 2012). Particularly in unplanned narratives the association between a referent and a spatial area might not be clear, as in (1b). Given the possibility of pronominal IX signs to appear either spatially anchored or unanchored to their antecedents, those signs have been categorized as referentially specified (1a) and referentially un(der)specified (1b), respectively (FREDERIKSEN & MAYBERRY, 2017).

More recent studies looking at local utterance contexts of established sign languages and using controlled settings, have identified and tested certain mechanisms (e.g., overt/covert localization, first/second mention preference) influencing signers’ interpretive preferences of referentially un(der) specified pronominal signs (STEINBACH & ONEA, 2016; FREDERIKSEN & MAYBERRY, 2017; FREDERIKSEN, 2018; WIENHOLZ ET AL., 2018a, 2018b). However, the exact nature of those mechanisms and whether they are guided by modality-specific conventions or anaphora resolution mechanisms established for spoken languages, have not been analyzed in detail yet.

The aim of this paper is to contribute to this discussion by exploring to what extent resolution of ambiguous pronominal reference in two unrelated sign languages, Turkish Sign Language (TİD) and German Sign Language (DGS), can be guided by modality-specific device (i.e., localization

<sup>2</sup> By convention in the sign linguistics literature, examples of the signed sentences are given in small caps, with English glosses and approximate English translations. IX<sub>R</sub> refers to pointing signs directed to right (ipsilateral) area, IX<sub>L</sub> identifies pointing signs directed to left (contralateral) area, and IX<sub>N</sub> corresponds to the pointing signs directed to the neutral area (i.e., the area in front of the body of the signer) of the signing space.

mechanism). The paper is organized as following: Section 1 presents factors proposed to be active in pronominal resolution in the local contexts of sign languages. Section 2 introduces the hypotheses of the present study and presents methodological information on participants, materials and experimental procedure. Section 3 elaborates on the stages of evaluation and (co-)variable-based results of the response data. Section 4 discusses the findings and Section 5 concludes the paper.

## 1. Factors influencing pronoun resolution in sign languages

### 1.1. Spatial defaults of localization

Signers use the area in front of the body (i.e., signing space) either to express spatial relations among entities (topographic function of space) or to indicate grammatical relations among the arguments (syntactic function of space) (POIZNER, KLIMA & BELLUGI, 1987). In other words, in topographic usage of space the locations assigned to the objects are mapped from their physical locations and any modification of the spatial location is subject to change in the meaning. In (2a) the two objects, a glass and a notebook, are located on the right and left side of the table, respectively and this relation is mapped isomorphically to the signing space. If we reverse these locations, the relation between the two locations will change.

In the syntactic usage of space, spatial locations (R-loci) are assigned arbitrarily to the entities, therefore a change of locations would not affect the general meaning of the sentence/context they appear in. In (2b) the two antecedents, a boy and a girl, are localized either on the right or left of the signing space, in either case the actual meaning of the (i.e., ‘a boy called a girl.’) is not affected.

(2)

- a. TABLE GLASS<sub>R</sub> BE-LOCATED-CL(GLASS)<sub>R</sub> NOTEBOOK<sub>L</sub> BE-LOCATED-CL (NOTEBOOK)<sub>L</sub>  
 ‘A glass is located on the right side and a notebook on the left side of the table.’
- b. BOY<sub>R</sub> GIRL<sub>L</sub> CALL<sub>L</sub> / BOY<sub>L</sub> GIRL<sub>R</sub> CALL<sub>R</sub>  
 ‘A boy called a girl.’

The localization of the referents to the syntactic space describes the association of these referents to a particular spatial area that is used consistently throughout the discourse until a necessary shift of the reference takes place which requires reassignment or shift of the loci. Therefore, the localization mechanism, irrespective of its modality-specific realization serves a function of anaphoric disambiguation in a similar manner as gender in spoken languages (ENGBERG-PEDERSEN, 1993; KEGL, 2003). In her analysis of Danish Sign Language, Engberg-Pedersen (1993, p. 143) claims that loci behave like demonstratives in spoken languages, in that they serve a reference-tracking function

and in their dependency on addressee's memory of spatial and temporal structure of discourse. Moreover, the author proposes that loci reflect *discourse-dependent-semantic-pragmatic features* of the referents.

Steinbach & Onea (2016) propose that introduction of discourse referents in space and resolution of anaphora (i.e., pronominal reference) depend on morphosyntactic principles which govern subdivisions in the horizontal plane of the signing space (H-space). In particular, looking at a small-scale corpus of elicited DGS data (i.e., narrations, interviews, picture descriptions), the authors have observed that the first two discourse referents are introduced following a recurring pattern such that: "A right-handed signer may localize the first discourse referent in the ipsilateral (default) area in the H-space on its right. The second discourse referent is then localized in the opposite contralateral area of the H-space" (STEINBACH & ONEA 2016, p. 421). Hence a pronominal IX directed to the right/ipsilateral side identifies first-mentioned referents and a pronominal IX directed to the left/contralateral side identifies second-mentioned referents. An example of this pattern is given in (3a) where the first-introduced antecedent PARENTS is assigned to the right side and the second antecedent NEW TEACHER is assigned to the left side of the signing space. Consequently, a pronominal IX can either refer to the PARENTS if it is directed to the right area of the signing space or to the NEW TEACHER if it is directed to the left side of the signing space. In an event related potential (ERP) study, this pattern was confirmed to be followed for comprehension of pronominal IX by right-handed signers of DGS, also in the contexts where referents were not localized in the signing space overtly (WIENHOLZ ET AL., 2018a). This is exemplified in (3b) via an experimental stimulus, where MAN and WOMAN antecedents are not localized in the signing space, nevertheless  $IX_R$  is understood to refer to the MAN and  $IX_L$  to the WOMAN.

(3)

a. PARENTS  $IX_R$  NEW TEACHER  $IX_L$  LIKE.  $IX_R/L$  SMART.

'The parents like the new teacher. They/he is smart.'

(STEINBACH & ONEA 2016, p. 413).

b. MAN WOMAN FLIRT.  $IX_{RL}$  HAVE BEARD.

'A man flirts with a woman. S/he has a beard.'

(WIENHOLZ ET AL., 2018a, p.4).

It has been suggested that the above-mentioned default pattern of localization can be overridden

and vary in the production, within and across sign languages according to handedness, dialect, individual preference or register of a signer (FRIEDMAN, 1975; ENGBERG-PEDERSEN, 1993; GERACI, 2014; STEINBACH & ONEA, 2016). For instance, signers of TİD have been observed to differ from signers of DGS in their productions of the above-mentioned pattern. That is, in majority of the contexts containing two discourse referents, irrespective of the handedness, the first-mentioned referent is associated with the left side of signers and the second-mentioned one with the right side of signers (NUHBALAOGLU, 2018, p.142). This is exemplified in the short contexts produced by a right-handed and a left-handed TİD signer in (4a-b). In both contexts the initial sentences have been signed without localizing the sign names (i.e., nick names given to the characters) of the person referents, while the second sentences contain localization of both referents either via a IX either via the sign and/or verb. That is, in (4a) the first-mentioned referent bora is localized to the left side of the signing space via  $1\text{ ix}_L$  and the second-mentioned referent oya is localized to the right side of the signing space via an agreement verb see. This indicates the left-right default pattern employed by a right-handed signer. In (4b) the first-mentioned referent ÖMER is assigned to the signing space via locus agreement on the verb propose directed to the left side of the signing space, while müge is localized via agreement verb propose directed to the right side of the signing space. That is, a left-handed signer as well uses a left-right pattern to assign referents to the signing space.

(4)

a. YESTERDAY BORA OYA KISS. THEN  $\text{IX}_L$  BORA<sub>(L)</sub>  $\text{SEE}_R$  LOVE BECOME.

‘Yesterday Bora kissed Oya. After looking at her (for a long time) he fell in love.’

(right-handed TİD signer)

(NUHBALAOGLU, 2018, p.xxii)

b. PREVIOUSLY ÖMER MÜGE FLIRT. LPROPOSER  $\text{IX}_R$  NOT-WANT.

‘Previously Ömer flirted with Müge. (He) proposed (her) but she rejected.’

(left-handed TİD signer)

(NUHBALAOGLU, 2018, p.xxii)

The above-mentioned difference observed in the production of the localization pattern raises the question whether signers from diverse backgrounds use the same default pattern robustly within and across sign languages, to interpret referentially unspecified pronominal IX.

## 1.2. First/second mention preference

Users of a language typically refer to the most salient referents via reduced forms (i.e., full or zero pronouns) in production and likewise identify the reduced forms with the most salient referents in comprehension. Salience of an entity is a complex notion and might be influenced by a multitude of (non-)linguistic factors. In this paper I adopt the following definition: “Salience of the antecedents defines the degree of relative prominence of a unit of information, at a specific point in time, in comparison to the other units of information.” (CHIARCOS, CLAUS & GRABSKI, 2011, p.2). The focus here will be on the linguistic salience, particularly on relative salience of entities in local discourse and its relevance for resolving pronominal reference.

Since the 1970s, psycholinguistic research on spoken languages has been investigating single and multiple factors affecting the salience of referents. Among those are the following: grammatical subject preference (e.g., CRAWLEY & STEVENSON, 1990); first mention preference (e.g., CARREIRAS, GERNSBACHER & VILLA, 1995); thematic role or semantic focusing of the verbs (e.g., STEVENSON, CRAWLEY & KLEINMAN, 1994); implicit causality of the verbs (e.g., HARTSHORNE, 2014); type of connective words (e.g., STEVENSON ET AL., 2000); information structural units such as topic and focus (e.g., ARNOLD, 1998) as well as the multiple factors appearing in interaction with each other (i.e., semantic and syntactic) (ROSE, 2005).

For sign languages, investigations of the factors influencing salience of the referents in the context of anaphora resolution at the level of local utterances have been conducted only recently. These studies focus on determining the influence of modality independent factors (i.e., first/second mention preference) on comprehension and production of pronominal *ix* (FREDERIKSEN & MAYBERRY, 2017; FREDERIKSEN, 2018; WIENHOLZ ET AL., 2018b). The effect of the order of mention (or subject/object preference) on comprehension of pronominal *ix* was tested for ASL and DGS and revealed differing results.

A series of sentence continuation tasks conducted by Frederiksen (2018) investigated the influence of next mention bias on production and comprehension of pronominal *ix* in local contexts of ASL. In a production experiment sixteen signers were presented with videos of single sentence prompts (as in (5a)) manipulated for localization of the referents (i.e., localized and non-localized) and verb bias (i.e., subject-biased/object-biased/neutral verbs). The task of the signers was to repeat and to freely continue the sentences. Results of this task showed that pronominal *ix* was preferred over other referential expressions (e.g., names or pro-drop), and it was used mainly to refer to objects

of the prompt sentences.

(5)

a. L-I-L-A<sub>(R)</sub> HATE P-E-T-E<sub>(L)</sub> WHY?

‘Lila hates Pete because...’

(a sentence prompt used for the production study)

b. L-I-L-A<sub>(R)</sub> HATE P-E-T-E<sub>(L)</sub> WHY? IX<sub>R/L/N</sub>

‘Lila hates Pete because s/he...’

(a sentence prompt used for the comprehension study)

In a comprehension experiment, Frederiksen presented fifteen signers of ASL with the same type of signed prompt sentences, as in production experiment; however, this time the continuations started with spatially anchored or unanchored/neutral pronominal *ix*, as in (5b). The signers were expected to repeat and continue the sentences with pronominal *ix*. The findings of this task showed that with neutral verbs, pronominal *ix* was interpreted as an object of the prompt sentence, while in other cases the referent preference aligned with the verb bias (i.e., *ix* signs following subject-biased verbs were interpreted as subjects and *ix* signs following object-biased verbs were interpreted as objects of the prompt sentences). In light of these findings, Frederiksen suggested that comprehension of pronominal *ix* is influenced by next mention bias of the verbs and that by default it has an object preference in ASL.

Wienholz et.al (2018b) re-examining the data from an ERP experiment Wienholz et.al (2018a) conducted with twenty-one native signers of DGS, looked for the presence of a first mention effect during pronoun resolution in ambiguous contexts in DGS. To that end, participants were presented with sentence sets containing two referents without overt localization in the first sentences and pronominal *ix* at the beginning of the second sentence directed to either the right (ipsilateral) or left (contralateral) side of the signing space (see the example stimulus in (3b)). Results show an N400<sup>3</sup> in the left/contralateral compared to the right/ipsilateral condition suggesting increased processing costs for the left/contralateral *ix* sign, which refers to the second-mentioned referent. Thus, this effect was interpreted as supporting evidence for a first mention effect in DGS.

For sign languages we are still not in a position to determine whether the observed (differing) preference can be identified as a subject/object or a first/second mention preference and whether geographically and historically unrelated sign languages differ in that respect. This exploratory study is the first step towards filling this gap in the literature.

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3 A negative-going ERP component which was shown to have a broad distribution and to peak between 200-500ms following stimulus onset. It is associated with processing of various meaning components and its modulation raises in the cases when a meaningful process appears to be incongruent. For more details see (KUTAS & FEDERMEIER, 2011).



## 2. The present study<sup>4</sup>

The present study investigated whether signers rely on a default pattern of localization for identifying antecedents of referentially unanchored pronominal IX in local contexts. This was done by looking at comparative response data from two historically and geographically unrelated sign languages, DGS and TID, including right- and left-handed signers with diverse backgrounds. The current task, partially adapted from Wienholz et al. (2018 a,b), was designed as a two-alternative forced choice referent selection task in which the participants were asked to identify the antecedent of pronominal IX by choosing between referents presented in the immediate context.

It was hypothesized that the signers will follow the pattern of localization they use in the production also in their comprehension of pronominal IX. That is, signers of DGS were expected to identify pronominal IX directed to the right side as first-mentioned referent, and identify pronominal IX directed to the left side of the signing space as second-mentioned referent, following the right-left default pattern of localization, as in (3a) (STEINBACH & ONEA, 2016; WIENHOLZ ET. AL, 2018a). On the other hand, TID signers were expected to follow the left-right default pattern, as in (4a-b), observed in their productions irrespective of their handedness (NUHBALAOGLU, 2018). In particular, they were expected to identify pronominal IX directed to the right side as second-mentioned referent and to identify pronominal IX directed to the left side of the signing space as first-mentioned referent.

Given that little is known about the influence of other factors and how they interact with modality-specific devices in terms of pronoun resolution in sign languages, it was not excluded that spatial defaults might be overridden by covariates (e.g., verb type) which were only partially controlled for due to the requirements of the design (see Section 2.2).

### 2.1. Participants

The participants were recruited either through social media or through the contact information that had been provided in previous experiments on DGS and TID. Criteria for participant acquisition were: (i) having a minimum age of 18 years; (ii) using sign language as a primary means of communication, which includes full integration in the respective Deaf Community and usage of sign language on daily basis, and (iii) handedness, as it was aimed for a balanced distribution of right- and left-handed signers (i.e., 5 right-handed and 5 left-handed participants per language).

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4 For a complementary production study the reader is referred to Nuhbalaoglu (2018, p.101).

Ten deaf signers of DGS (4 male, 6 female, age range: 26-48 years, mean: 34.4 years) from different regions of Germany took part in this study. The age of DGS acquisition varied slightly, as eight participants had acquired DGS at or before the age of 3, and two at the age of 6 years. Half of the participants had deaf parents, whereas the other half had hearing parents. They all had at least high school level of education (*Mittlere Reife* in the German education system) and some previous experience with the video camera setting.

Ten signers of TİD (4 male, 6 female, age range: 18-46 years, mean: 29.7 years), originally coming from different cities of Turkey, and all located in Istanbul at the time of recording, took part in this study. All subjects were fluent signers of TİD, however age of acquisition varied. One participant was an early learner, who acquired TİD at the age of 2 years. The remaining nine signers were late learners, eight of which had learned TİD before the age of 10 and one participant had started learning TİD after 10 years old. Only one of the participants had deaf family members, whereas the remaining nine were born into hearing families. The participants had secondary school (*Ortaokul* in the Turkish education system) or high school (*Lise* in the Turkish education system) level of education, and all had participated in video recordings for various purposes before.

## 2.2. Materials

The stimulus material is composed of forty pairs (per language) of pre-recorded mini narratives without any additional fillers. Each mini narrative consists of two sentences both having SOV, the default word order in TİD and DGS. The first (i.e., introduction) sentence contains a sentence initial adverb, a non-localized subject referent (first-mentioned referent = R1), a non-localized object referent (second-mentioned referent=R2) and a verb. The second (i.e., continuation) sentence starts with an IX oriented either towards the right (IX<sub>R</sub>) or left (IX<sub>L</sub>) area of the signing space and is followed by a semantically neutral predicate which could refer to either of the referents. By using a semantically neutral predicate, it is ensured that IX is not interpreted by relying on the properties of a predicate (i.e., context pragmatic biases). An example of a mini narrative pair from DGS differing only in the direction of IX, can be seen in (6).

(6)

a. LATER ANNIKA MARKUS MEET. IX<sub>R</sub> TALK WANT.

b. LATER ANNIKA MARKUS MEET. IX<sub>L</sub> TALK WANT.

‘Later Annika meets Markus. S/he wants to talk.’

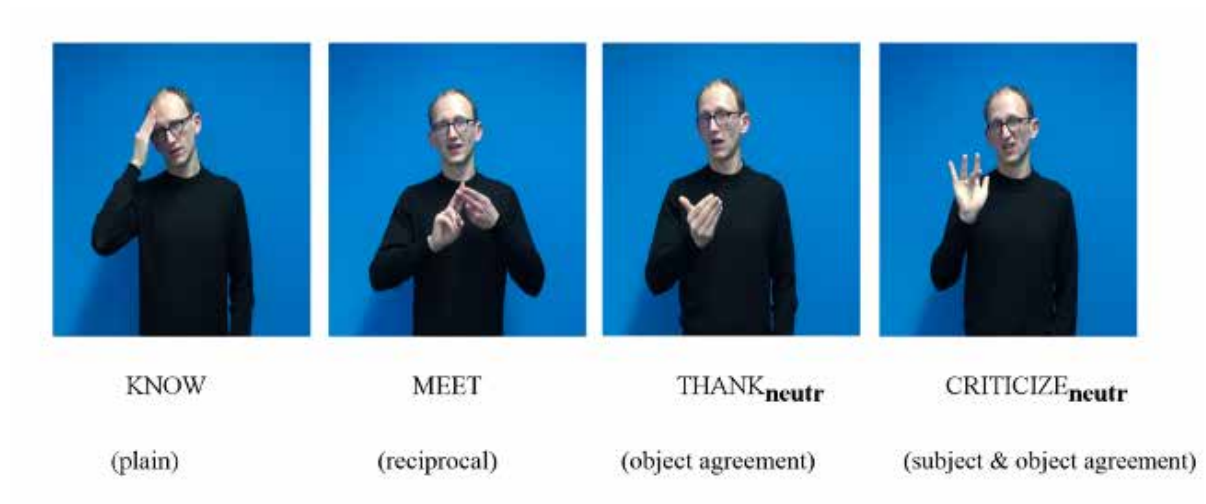
Each mini narrative contained one female and one male character, ten characters (5 female and 5 male) in total. Both in DGS and TİD, it is typical for sign names to appear with mouthing of their corresponding proper names. Therefore, each character was assigned a proper name (frequent names in German and Turkish societies) and a sign name (same for both sign languages). A pair of referent signs in each test item is combined in such a way that one sign name is repeated maximally four times across all items and occurs not more than once in combination with the same sign name. Each sign name is produced either on the upper or lower part of the head, by one or two hands and is accompanied by mouthing of the German (for DGS) or Turkish (for TİD) version of the proper name. When signed by one hand, all sign names were produced on the ipsilateral side of the informants' head.

The set of sentence-final verbs in the introduction contexts comprised twenty commonly used verbs. Since the main concern of the design was to minimize (non)-manual localization cues so that the signers do not rely on the localization cues to identify referents of pronominal *ix*, only this property of the verbs was controlled for. For that two groups of verbs were chosen<sup>5</sup>. The first group contained plain verbs, verbs which do not localize their arguments in the signing space (i.e., SEARCH, PLAY, CHEEK-KISS, GREET, LIKE, MARRY, KNOW, WARN, CONGRATULATE). The second group included verbs which are semantically reciprocal and are signed in the neutral part of the signing space (i.e., KISS, MEET, GET-TO-KNOW, FLIRT) or agreement verbs, which typically localize their arguments either in the horizontal or saggital axis of the signing space (i.e., SEE, INVITE, PICK-UP, CRITICIZE, HELP, THANK, LOOK-AFTER).

All agreement verbs selected for the stimuli were signed in their citation forms (i.e., on the saggital axis). This group contains verbs with spatial marking of both subject and object arguments (i.e. INVITE, PICK-UP, CRITICIZE, HELP) or only object arguments (e.g. SEE, THANK, LOOK-AFTER). Figure 1 represents visuals of each group of the verbs in DGS.

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<sup>5</sup> Twelve verbs were taken from the previous ERP experiment on DGS designed by Wienholz et al. (2018a); these are: KISS, MEET, SEARCH, GET-TO-KNOW, PLAY, CHEEK-KISS, FLIRT, GREET, LIKE, SEE, MARRY, KNOW.

**Figure 1:** Examples of verb types used in the stimuli videos of DGS<sup>6</sup>

Source: adapted from NUHBALAOGLU (2018, p.67)

Stimuli sentences were first created for DGS, then translated to TİD and checked with a native deaf signer of TİD, who is also fluent in DGS. These were recorded for DGS and TİD with the support of two male deaf native right-handed informants for each language, both having professional experience with video recordings for sign language research. Mini narratives were recorded in pairs, as in (6), and informants were instructed to sign them as naturally as possible but reducing the use of non-manuals. They had to take particular care that neither the referents nor the verbs of the introduction sentence were localized in signing space by means of manual (e.g., IX sign) and non-manual (e.g., eye gaze) markers. In DGS, all IX signs were produced with a head nod and without any mouthing or mouth gesture that could possibly identify one or the other referent. In TİD, all IX signs were accompanied by mouthing of the Turkish 3<sup>rd</sup> person pronoun /o/, which is a gender-neutral pronoun. Given that little is known about the influence of other potential factors (e.g., verb bias) on pronoun resolution in sign languages, the stimuli were not controlled further. Each stimulus sentence was recorded with one Camcorder Sony HDR-CX550VE, which focused on the informants from a frontal view. Video stimuli were digitized with Adobe Premiere Pro (CS36).

### 2.3. Procedure

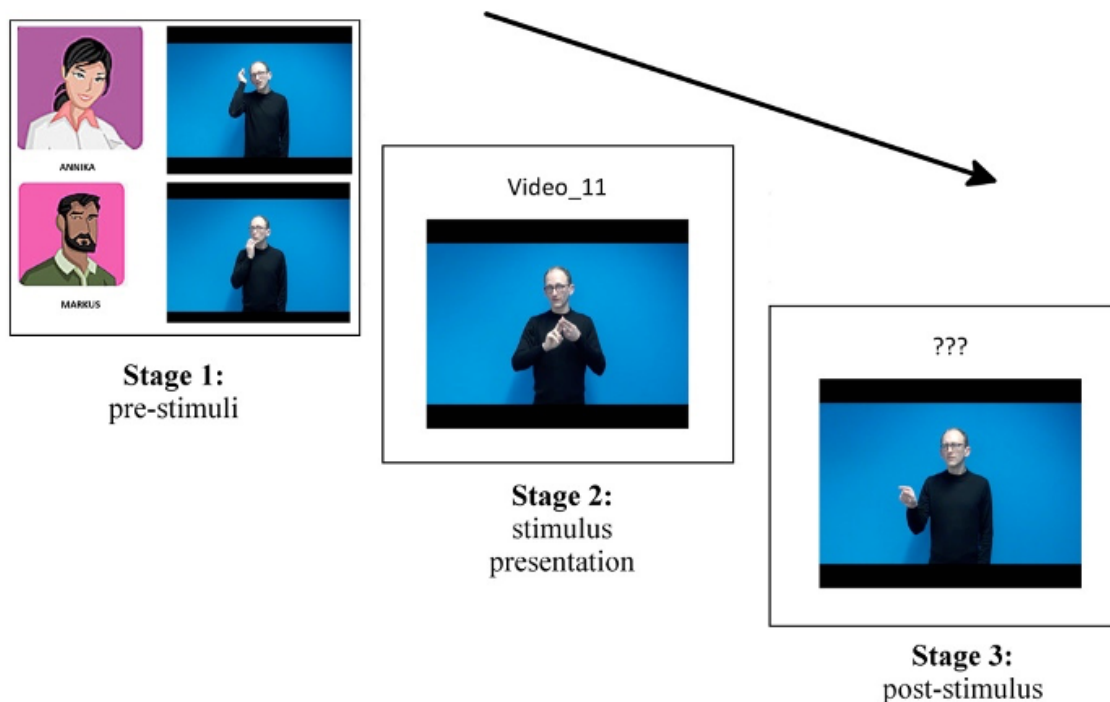
For DGS, testing took place at the Experimental Sign Language Laboratory (University of

<sup>6</sup> All figures and captures in this article are the author's own elaboration and were taken from the author's unpublished dissertation (NUHBALAOGLU, 2018), which includes a comprehensive version of the current study as well. If not indicated otherwise the provided examples are created by the author for this particular paper and correspond to the sentences in DGS.

Goettingen, Germany). For TID, testing took place at different locations: three participants were tested in the Sign Language Laboratory (Bogazici University, Turkey), four in a silent classroom of a deaf school, and three in a comfortable and private setting (i.e., a silent lounge of a Café). All instructions and explanations were provided in the sign language of the participant. In addition, all participants were asked to fill in metadata and consent forms in written German (for DGS signers) or Turkish (for TID signers) and they were paid for their participation.

Stimuli were distributed into two lists each containing twenty mini-narratives, such that the items differing only in the direction of IX did not occur in the same list. The total duration of DGS videos was 6 min (List 1 mean duration = 9 sec, List 2 mean duration = 9 sec); the total duration of TID videos was 5.28 min (List 1 mean duration = 8 sec, List 2 mean duration = 8 sec). The items in each list were pseudo-randomized so that verbs of the same type and IX signs having the same spatial direction did not immediately follow each other. Each participant watched one list of items containing twenty mini-narratives and two practice sentences presented in the explanation video. The task had a duration of 15-20 minutes depending on the time participants took for watching the videos and answering the questions.

The videos of the stimuli sentences were presented to DGS participants on PowerPoint (Version 16.13.1) slides via a laptop computer connected to a Projector, and to TID participants only on a laptop computer. DGS participants were seated facing the projection surface and TID participants facing the laptop screen. Each trial, as exemplified in Figure 2, started with the sign name familiarization (Stage 1), during which participants saw videos of the sign names together with the corresponding pictures of the cartoon characters used in the following mini narrative to ensure their understanding of the sign names. Then, the mini narrative was presented (Stage 2), which could be repeated if required, followed by a post-stimulus question (Stage 3). These questions contained an IX sign pointing either to the right or left area of the signing space followed by an interrogative pronoun WHO (i.e., IX<sub>RL</sub> WHO? ‘Who is the one on the right/left?’). Thus, at this point participants had to indicate which referent IX is referring to by naming one or the other character. Following each trial, participants were asked about the potential reasons for choosing a specific referent. All answers and explanations were entered into a checklist by the experimenter. The stimuli were presented in four blocks, containing five trials each, with an optional break of 1-2 minutes between the blocks. At the end of the task, participants were asked for their feedback regarding the difficulty of the task and their suggestions to improve it.

**Figure 2:** The structure of a single trial in the Referent Selection Task

Source: NUHBALAOGLU (2018, p.70)

### 3. Results

Responses obtained from 20 participants, each having seen 20 mini narratives (List A or List B) were manually entered into the checklists during the task and later transferred to a coding form. Out of initially coded 400 responses (200 per language) one response from DGS and three from TİD were excluded as they contained referents which were not in the introduction sentences (i.e., someone else). Thus, data used for analysis contained a total number of 396 responses from DGS (N = 199) and TİD (N = 197) signers. Initially, participants had been instructed to identify IX as one of the previously introduced two referents; however, in some cases they selected both referents as a group. These choices were also included in the analysis. That is, responses contain selections of first-mentioned referent (R1, i.e., subject), second-mentioned referent (R2, i.e., object), and both referents (R1R2, i.e., subject and object).

For the analyses, mean percentage as well as frequency of participant responses, provided as referent selections for the IX, were calculated and split according to language, spatial direction of the IX and handedness of the participants. In addition, item analyses based on the covariate, spatial type of the verbs were performed. Given the interesting pattern of distribution regarding the selected referents in the contexts of reciprocal verbs, for this sub-group of verbs further analyses were done

based on spatial direction of IX and handedness of the participants.

In addition, to determine the independence between the variables and participants' responses for each language, descriptive statistics using either Pearson's Chi-Square test or, for the cases including less than '5' data points, the Fischer's exact test was performed on the actual number of responses. All statistical analyses were done using the statistical software SPSS Version 24.0 (IBM Corp, 2016). Moreover, visual inspections of the graphical representations were reported in detail especially for cases which did not reach statistical significance but nevertheless were suggested to have importance for the interpretation of the IX, once more data is available for investigation.

### 3.1. Results based on language

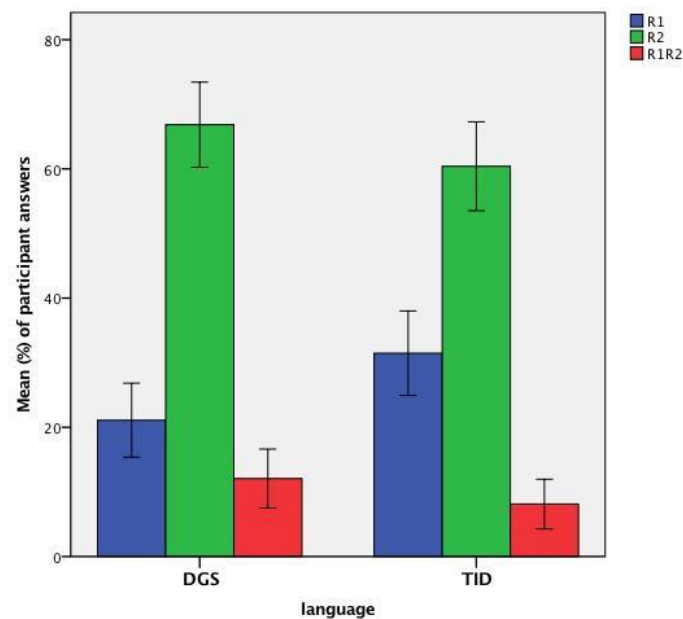
For a first general overview of selected referents, frequency of referent choices per language were calculated. The data show that IX was mainly identified as the second-mentioned referent (R2) in both languages (DGS= 67%, TID= 60%) (see Graph 1). Additionally, signers of DGS interpreted IX as plural referents (R1R2) more often (21%), as compared to TID signers (8%). On the other hand, signers of TID selected first-mentioned referents (R1) slightly more frequently (32%) than DGS signers (21%).

A Chi-Square test of independence comparing the frequency of referent choices with respect to the two languages, DGS and TID, revealed the factor language to have a significant influence on the referent choice.  $\chi^2(2, N=396) = 6.21$   $p < .05$ ). Thus, signers of DGS and TID seem to behave differently in their referent selection in the context of the stimuli constructed for the current study. However, due to only a few data points, it was not possible to statistically determine the source of this difference.

In short, a first look at the data based on the language variable has shown that participants of both languages did not select R1 and R2 equally often, but rather selected R2 considerably more frequently. As a next step, the data were analyzed according to the dependent (i.e., spatial direction of IX) and independent variable (i.e., handedness) to determine whether these factors influenced referent selection.

**Graph 1:** Overall proportions of participant responses for DGS and TID

(blue bar = R1/subject; green bar = R2/object; red bar= R1R2/ subject+object)



Source: NUHBALAOGLU (2018, p.75)

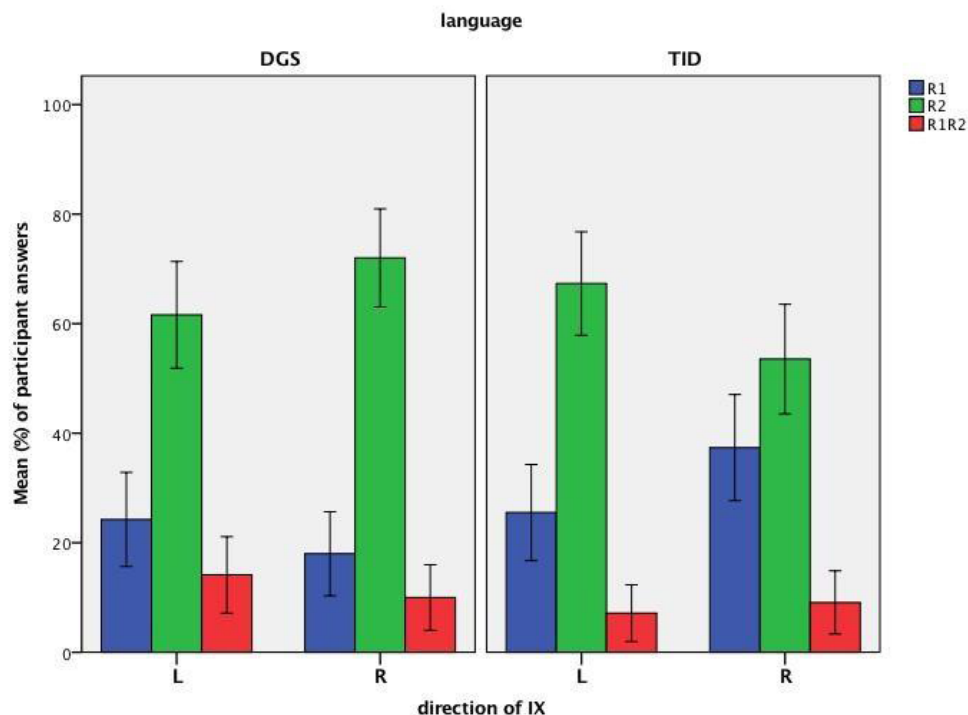
### 3.2. Results based on IX direction

The frequency of participants' referent choices for both IX directed to the right ( $IX_R$ ) and the left ( $IX_L$ ) side of the informant reveals that R2 was chosen almost equally often for  $IX_R$  and  $IX_L$  in both languages (see Graph 2). DGS signers tend to identify  $IX_R$  (72%) as R2 slightly more often than  $IX_L$  (62%). On the other hand, TID signers show a reverse pattern with  $IX_L$  (67%) being interpreted more often as R2 compared to  $IX_R$  (54%). As for R1, in DGS  $IX_L$  (24%) is identified as R1 more frequently than  $IX_R$  (18%), while in TID again the reverse pattern is observed with  $IX_R$  (37%) interpreted as R1 more often than  $IX_L$  (26%). Plural referents are selected the least in both languages, irrespective of IX direction (DGS:  $IX_R = 10\%$ ,  $IX_L = 14\%$ , TID:  $IX_R = 9\%$ ,  $IX_L = 7\%$ ).



**Graph 2:** Overall proportions of participant responses for DGS (left panel) and TİD (right panel) separated by spatial direction of IX

R refers to the Right and L to the Left side of the signing space (blue bar = R1/subject; green bar = R2/object; red bar= R1R2/subject+object).



Source: NUHBALAOGLU (2018, p.77)

A Chi-Square test of independence comparing the frequency of referent choices grouped by dependent variable IX direction for DGS and TİD, revealed that the frequencies of the referent selections did not differ by IX direction in either language (DGS:  $X^2(2, N=199) = 2.42, p > .05$ ; TİD:  $X^2(2, N=197) = 3.98, p > .05$ ). These results suggest that signers did not interpret pronominal IX signs based on their spatial direction; the spatial default (according to which the signers of DGS were expected to identify  $IX_R$  to refer to R1 and  $IX_L$  to R2, while the signers of TİD were predicted to select  $IX_R$  to refer to R2 and  $IX_L$  to R1) did not seem to play a role in the interpretation of the IX signs. Nevertheless, visual inspection of Graph 2 suggests a slight difference between  $IX_R$  and  $IX_L$ , which is more pronounced in TİD compared to DGS.

To be more precise, when comparing the frequency of IX signs, it seems that the ones directed to the right side in DGS but to the left side in TİD are preferred to be interpreted as R2, the object referent. In contrast, IX signs directed to the left side in DGS but to the right side in TİD appear to be identified R1 and R1R2. That is, R2 appears to be the preferred referent and is associated with a particular spatial region in both languages. Accordingly, there seems to be an asymmetry between DGS and TİD in terms of signers' preferences to identify certain areas in space with preferred or prominent referents (i.e., right area vs. left area).

### 3.3. Results based on handedness

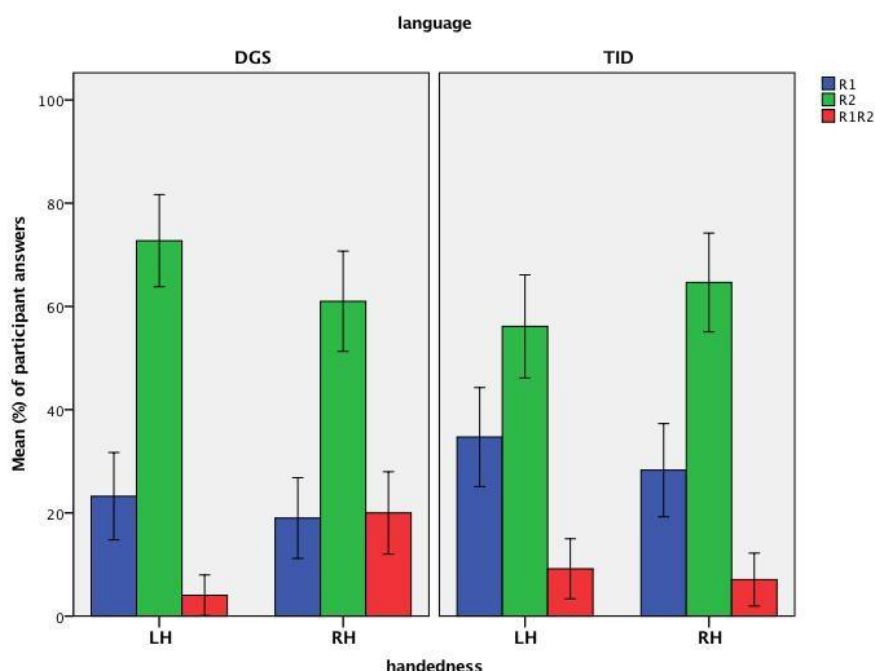
Response data were further grouped by handedness of the participants for each language (see Graph 3). This analysis reveals that in DGS, overall selection of R2 over R1 is higher in left-handers (R1 = 23%, R2 = 73%) than in right-handers (R1 = 19%, R2 = 61%), while the proportion of plural referent selections (R1R2) is higher in right-handers (20%) than in left-handers (4%).

On the other hand, in TID the proportion of R2 selections is higher in right-handers (65%) than in left-handers (56%), while the selection of both R1 and R1R2 is higher in left-handers (R1 = 35%, R1R2 = 9%) compared to right-handers (R1 = 28%, R1R2 = 7%). A Fisher's Exact Test finds that handedness is a significant factor for selection of the referents in DGS ( $p=0.002$ ), but not in TID ( $p=0.46$ ).

These results suggest that handedness of the participants might affect their referent selections differently in the two sign languages under investigation. It was not possible to identify the source of this difference statistically; however, a visual inspection of Graph 3 suggests a reverse pattern for the two languages, as right-handers in DGS and left-handers in TID select R1 and R2 in closer proportions than their respective left-handed (DGS) and right-handed (TID) peers.

**Graph 3:** Overall proportions of participant responses for DGS (left panel) and TID (right panel) separated by handedness of the participants

RH indicates right-handed and LH left-handed signers (blue bar = R1/subject; green bar = R2/object; red bar = R1R2/subject+object).



Source: NUHBALAOGLU (2018, p.80)

To recap the findings so far, the signers of both DGS and TID seem to differ in their selection of referents. Both groups of signers preferred to select R2 in the majority of the cases. The visual inspection suggests that  $ix_r$  in DGS and  $ix_L$  in TID is identified as R2, whereas  $ix_L$  in DGS and  $ix_r$  in TID select R1 or R1R2. The handedness of a signer does appear to play a role in referent selection in DGS, but not in TID.

### 3.4. Results based on verb type

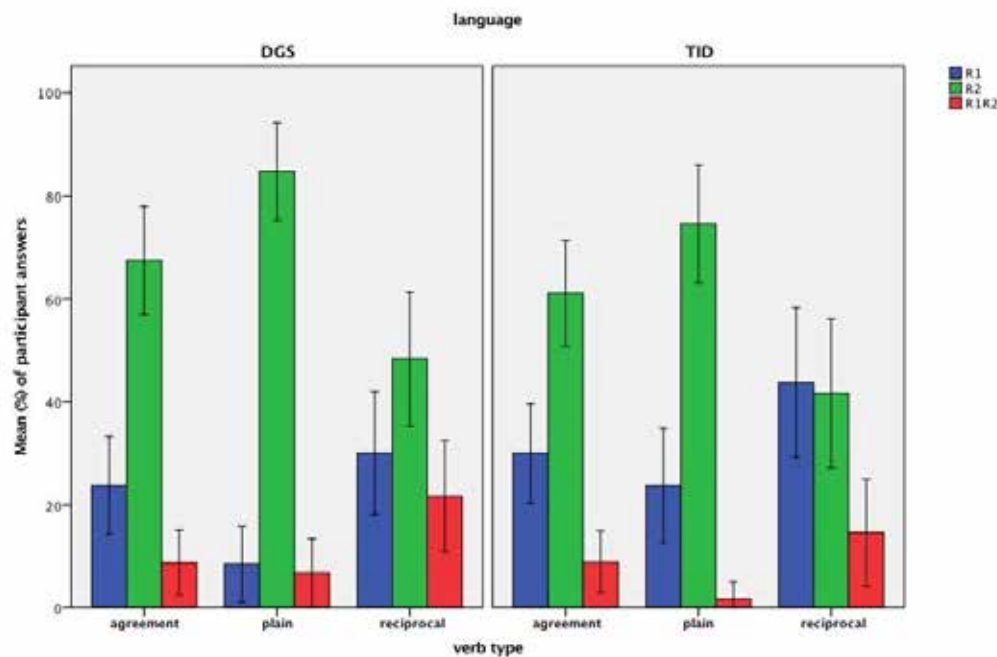
As mentioned in Section 2.2, except for the localization cues, the stimuli were not controlled for further properties of the final verbs in the introduction sentences. However, given an increased number of R2 choices, it was considered necessary to have a closer look at this co-variable, which potentially might have affected the interpretation of IX. Therefore, response data were further grouped according to types of verbs occurring in the introduction sentences. The first group consists of plain verbs, the second group includes, semantically reciprocal verbs signed in the neutral area of the signing space and the third group contains agreement verbs (both subject and object agreement and object agreement verbs); no further distinctions were made for this latter group since all sub-groupings show a similar pattern in the response data with a high amount of R2 selections.

The findings show that referent choice differed between verb types (see Graph 4). Those are as following: for agreement verbs (DGS: R1 = 24%, R2 = 67%, R1R2 = 9%; TID: R1 = 30%, R2 = 61%, R1R2 = 9%), for plain verbs (DGS: R1 = 8%, R2 = 85%, R1R2 = 7%; TID: R1 = 24%, R2 = 74%, R1R2 = 2%), and for reciprocal verbs (DGS: R1 = 30%, R2 = 48%, R1R2 = 22%; TID: R1 = 44%, R2 = 42%, R1R2 = 15%).

A Chi-Square test of independence applied to the data, comparing referent choice frequencies grouped by verb type, showed that verb type was a significant factor in the choice of referents in both languages (DGS:  $X^2(4, N = 199) = 19.5, p < .05$ ; TID:  $X^2(4, N = 197) = 13.7, p < .05$ ). This suggests that the type of the verb might have an influence on the interpretation of IX signs. To be more specific, R2 was selected most frequently with plain verbs, then agreement verbs, and lastly with reciprocal verbs where the numbers of R1 and R2 selections were the closest. Accordingly, it seems that plain verbs and agreement verbs behave differently from reciprocal verbs in that R2 was selected more frequently with the former two groups than with the latter. Given that R1 and R2 were chosen equally often with reciprocal verbs, both in DGS and TID, a more detailed analysis of this grouping based on the direction of IX and handedness was performed and is presented in the following section.

**Graph 4:** Overall proportions of participant responses of referent selections for DGS (left panel) and TID (right panel) separated by verb type

(blue bar = R1/subject; green bar = R2/object; red bar= R1R2/subject+object)



Source: NUHBALAOGLU (2018, p.83)

### 3.5. Results based on handedness and ix direction for reciprocal verbs

The results show that, in DGS, right-handed signers selected R2 and R1R2 equally often and more frequently than R1 for  $ix_R$  (R1 = 17%, R2 = 42%, R1R2 = 42%). Likewise,  $ix_L$  was also interpreted mostly as R2 and then as R1R2 (R1 = 22%, R2 = 44%, R1R2 = 33%), but compared to  $ix_R$ , the selection of R1 was slightly higher. Left-handed DGS signers showed a clearer asymmetry in their referent selections. Thus,  $ix_R$  was mainly identified as R2 (R1 = 22%, R2 = 78%, R1R2 = 0%) while  $ix_L$  was mostly identified as R1 (R1 = 67%, R2 = 17%, R1R2 = 17%).

In TID, right-handed signers selected R1 for  $ix_R$  more often than R2 (R1 = 54%, R2 = 31%, R1R2 = 15%), and  $ix_L$  was interpreted more often as R2 than as R1 (R1 = 17%, R2 = 67%, R1R2 = 12%). Left-handed TID signers showed a similar pattern such that  $ix_R$  was identified most frequently as R1 (R1 = 67%, R2 = 8%, R1R2 = 25%) while  $ix_L$  was mainly identified as R2 (R1 = 36%, R2 = 65%, R1R2 = 0%).

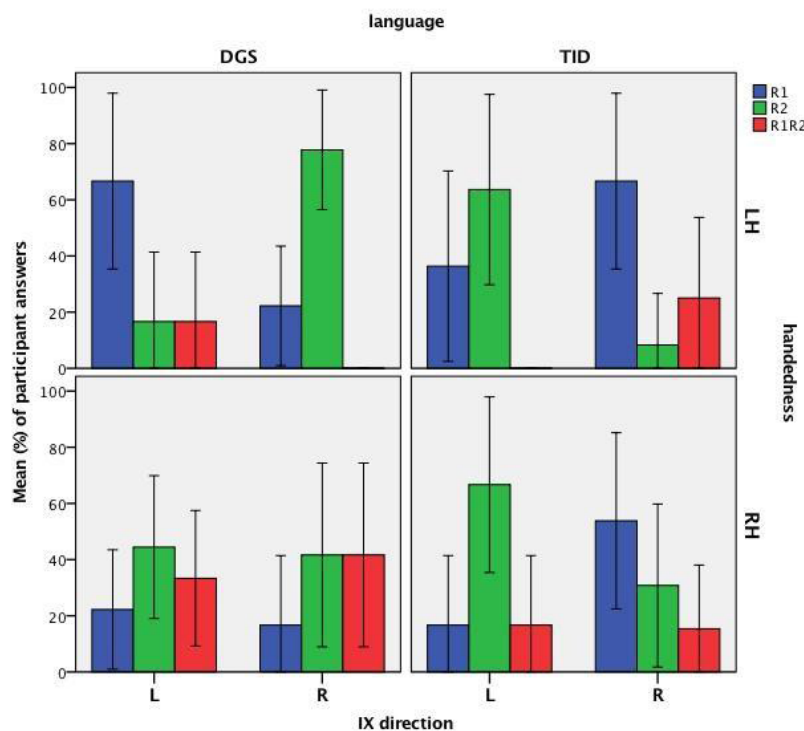
A two-tailed Fisher's Exact Test revealed that for left-handed signers, the directionality of ix was found to be a significant factor in referent selection in DGS ( $p=0.002$ ) and TID ( $p=0.007$ ). On the other hand, for right-handed signers, direction of ix was not found to be significant in DGS ( $p=0.99$ )

or in TID ( $p=0.16$ ). Nevertheless, the visual inspection of Graph 5 suggests that for right-handed signers of DGS and TID, there might be a preference for  $ix_L$  to be interpreted as R2, and at least for TID,  $ix_R$  seems to be preferred to be selected as R1.

To sum up, TID signers interpreted  $ix_R$  as R1 and  $ix_L$  as R2 irrespective of their handedness. On the other hand, left-handed DGS signers showed a reverse pattern, selecting  $ix_R$  as R2 and  $ix_L$  as R1. However, no clear asymmetry can be seen between  $ix_R$  and  $ix_L$  for right-handed signers. Thus, R1 was selected the least for both areas targeted by  $ix$ . But only for  $ix_L$ , R2 appeared to be selected more frequently than R1R2, while for  $ix_R$  the referents other than R1 were selected equally often.

**Graph 5:** Overall proportions of participant responses by referent selections and by spatial direction of  $ix$  occurring in the context of reciprocal verbs in DGS and TID

R refers to the Right and L to the Left side of the signing space. RH indicates right-handed and LH left-handed signers (blue bar = R1/subject; green bar = R2/object; red bar = R1R2/subject+object).



Source: NUHBALAOGLU (2018, p.87)

#### 4. Discussion

When given two newly introduced, but non-localized, discourse referents, the right-left default assigns the linearly first one to the right (ipsilateral) and the second one to the left (contralateral) area of the signing space (STEINBACH & ONEA, 2016). The results of an ERP study conducted with right-handed signers of DGS confirmed that this pattern was followed in covert localization

of the referents and used for comprehension of pronominal IX (WIENHOLZ ET AL., 2018a). For signers of TİD the reverse pattern, whereby the first-mentioned referent is assigned to the left and the second-mentioned one to the right side of the signing space, irrespective of the handedness, was observed in production (NUHBALAOGLU, 2018). So far there were no comprehension studies examining this pattern in TİD. The study presented in this paper examined the impact of the default localization pattern on the interpretation of pronominal IX signs occurring in a local discourse with two potentially competing antecedents using data obtained from right- and left-handed signers of DGS and TİD. Participants' responses (i.e., referent selections) were analyzed for pronominal IX directed to the right or left area in the signing space. Those IX signs were preceded by introduction sentences containing no localization cues.

The response data revealed the following patterns: (i) in general, signers of DGS and TİD preferred to identify pronominal IX as referring to the second-mentioned referent (R2); (ii) R2 as the most prominent referent was not selected equally often for right and left IX direction, but rather there seems to be an asymmetry between the two languages: IX<sub>R</sub> in DGS, but IX<sub>L</sub> in TİD, was identified mainly as referring to R2; (iii) the preference of R2 to resolve pronominal IX in both languages seems to be influenced by the spatial type of the verb immediately preceding the pronominal IX (plain and agreement verbs causing R2 interpretations); (iv) in the context of reciprocal verbs, signers of both languages were observed to follow the default localization pattern to resolve pronominal reference; however, usage of this pattern differed across languages; (v) in DGS, this pattern was observed as left-right for left-handed signers while in TİD it appears to be right-left irrespective of the handedness.

Given these observations, it seems reasonable to describe the default pattern used for interpreting pronominal IX in DGS in terms of the dominant hand used by the signers (i.e., ipsilateral and contralateral or ipsi-contra default). In contrast, for TİD the characterization should rather be done based on the actual physical areas (i.e., right-left default). Language-specific usage of default patterns across the two sign languages might occur due to different perspective taking strategies applied in DGS and TİD (PERNISS & ÖZYÜREK, 2008). In particular, DGS has been suggested to prefer the use of rotated space (i.e., signer's perspective) for both topographic and grammatical locations (FEHRMANN, 2014), which might explain the left-right (or ipsi-contra) pattern applied by left-handed signers when they perceive a stimulus a right-handed signer. Even though the current data does not provide a clear picture of the right-handed signers' usage of defaults, given the data from the literature (STEINBACH & ONEA, 2016), it can be assumed that rotated space, or signer's perspective, as well as hand dominance determine the usage of defaults in DGS. However, to confirm such a proposal, more data from right-handed signers for a similar task, as well as stimuli videos

recorded with left-handed sign models, are required.

TİD signers tend to apply signer's perspective in their descriptions of static scenes (ARIK, 2013). Given the default pattern they use in production (i.e., left-right) (NUHBALAOGLU, 2018, p. 142) for interpreting pronominal IX, the signers might be using mirrored space (addressee perspective), explaining the right-left pattern. Hence, it might be the case that TİD signers apply different perspective taking strategies for topographical and grammatical locations, i.e., rotated space for topographically motivated locations but mirrored space for grammatical locations. As described in Section 2.1, the Turkish deaf participants were comprised of signers from diverse backgrounds: an early learner and late learners, only one of which had deaf parents. Therefore, it might be possible that age of sign language acquisition as well has an influence on their usage of mirrored space instead of rotated space. To be more specific, it has been shown that hearing participants experience difficulties in mental rotation when compared to their deaf peers, who tend to use mirrored space much more frequently (EMMOREY, KLIMA & HICKOK, 1998). Therefore, it might be the case that, having learned the language later, TİD signers use the pattern of their hearing peers rather than the native deaf pattern. However, to test this assumption we need to conduct a comparative follow up study looking at the spatial patterns of hearing and deaf participants (i.e., both early and late learners of a sign language).

The usage of differing perspective taking strategies in the two languages might as well have been affected by the structure of the stimulus materials used. The agreement verbs used in the stimuli (9 verbs in TİD, 8 verbs in DGS) were produced in the neutral area of the signing space (i.e., sagittal axis). The previous studies on ASL (EMMOREY, 1996) and TİD (SÜMER, PERNISS & ÖZYÜREK, 2016) have shown that, at least for the descriptions of topographic relations, the signers prefer to use addressee perspective or mirrored space with a sagittal axis. Given this background, it is not unlikely that participants (at least for TİD) might have been primed by usage of the sagittal axis and hence preferred to use mirrored space, even in the environments of the reciprocal verbs which were produced on the lateral axis.

The results of the current study also confirm the nature of the spatial defaults to be overridable (GERACI, 2014; STEINBACH & ONEA, 2016) providing evidence for an influence of verb type which can trigger one referent (i.e., R2) to be more salient/prominent than the other (i.e., R1). In such cases, the resolution of pronominal IX signs depends on the factors increasing the salience of a referent. This is in line with the claim of Barberà (2012), who suggested prominence to be the most important determinant for the interpretation of spatial pronouns in the connected discourse of Catalan

Sign Language. However, in contrast to Barberà, who assumes that spatial direction of a pronominal IX does not play a role in its interpretation, the results of the present study indicate that prominent referents might be associated with a particular area in the signing space (see Section 3.2), and hence the IX directed to that particular area will be interpreted as referring to that referent. Moreover, such areas might differ between two unrelated sign languages. While the right area of the signing space in DGS and the left area in TİD seem to be the preferred location for the more prominent referents, i.e. R2, this preference is more visible in the left-handed than in the right-handed signers for both languages. However, this claim must be approached with caution until further testing for the different types of referents, e.g., topicalized arguments, has been done to determine whether these areas are indeed associated with salient or prominent referents.

The influence of the verb type (i.e., semantic focusing of the verbs which renders one or the other argument to be more salient) on the interpretation of pronouns has been extensively investigated for spoken languages (HARTSHORNE, 2014; STEVENSON, CRAWLEY & KLEINMAN, 1994). As for the influence of the verb types on interpretation of the pronominal IX, only one recent study, based on a total of 120 responses from fifteen ASL signers (FREDERIKSEN, 2018), has shown that both neutrally and laterally localized pronouns are interpreted depending on the next-mention bias of the verbs (i.e., NP2 or object biased verbs like ‘admire’ impose object interpretation of the IX, irrespective of the fact whether its referent was previously localized or neutrally signed in the signing space). In the present study, it was detected that for both DGS and TİD a subgroup of verbs, i.e. reciprocal verbs, differs from plain verbs and agreement verbs. While R2 selections are preferred mostly in the context of plain verbs, followed by agreement verbs, R1 and R2 choices appeared in similar amount with reciprocal verbs.

Thus far, elements contained in the introduction sentences of the stimuli were discussed in terms of their influence on the interpretation of IX (i.e., implicit assignment of the referents and sentence final verbs). In addition to this, and given that the properties of pronominal forms have been reported to influence their interpretation in spoken languages (BOSCH, KATZ & UMBACH, 2007), it is necessary to mention a potential role of the IX itself. In particular, both DGS and TİD allow for the dropping of arguments. Even though, little is known about the behavior of null arguments in these languages, and assuming general principles of accessibility (ARIEL, 1985), it can be expected that subjects/R1 being the most salient arguments should be more likely to be referred to via reduced forms (e.g., null pronouns, unaccentuated IX), while less reduced forms (e.g., overt pronouns) would be selected to refer to less accessible referents, such as objects/R2. Therefore, it might be the case that only in the environment of topic change, as in ASL, (WULF ET AL., 2002) overt pronominal signs



are preferred. This view receives support from the studies looking at the distribution of referential items in larger contexts, which show that in fact pronominal IX signs occur in the lower parts of the accessibility hierarchy (CZUBEK, 2017).

In fact, ASL signers as well showed a preference to interpret referentially unanchored pronominal IX signs as object rather than subject of the previous sentences in a sentence continuation task (FREDERIKSEN & MAYBERRY, 2017; FREDERIKSEN, 2018). Additionally, pronominal IX in the current stimuli is signed in a very clear (i.e., pronounced) way and in particular in DGS stimuli it appears with an additional head nod. Those might indicate that pronominal IX gets extra accentuation (i.e., is produced in a visually prominent way). Therefore, it might be the case that we are actually dealing with a focus effect requiring interpretation of R2, in the very same way as accentuated pronouns in English are interpreted as object referents (KAMEYAMA, 1999). However, to make more solid claims we first need to determine the influence of non-manuals on the interpretation of different pronominal forms in sign languages, which is yet to be done as a follow-up.

In addition to the verb based and the IX based explanations given above, the results of this study can be explained from a methodological point of view as well. Given that no fillers were used in the materials, and participants were asked to explain what motivated their referent selections after each stimulus, it might be the case that the participants were primed in their referent selections (mainly choosing R2 referents). Thus, the signers might have adapted one particular technique of resolving the anaphora (i.e., IX as R2) that they used for all their responses. At least for spoken languages, there is some evidence from English that such type of priming operates at the level of anaphoric relations (KAISER, 2009).

Finally, concerning the methodological advantages and disadvantages of the applied procedure, and because it's a short and easily understandable task, it can be of benefit to investigate referential expressions in general. However, given that the participants had time for their decisions it might not be the best way to compile immediate reactions, and hence the tools used to identify referents of the pronominal expressions might differ from those used in naturalistic settings and online tasks.

## 5. Conclusion

In sum, this study provides further evidence for the usage of spatial defaults as a modality-specific device of anaphora resolution identifying restricted environments of their usage (i.e., with reciprocal verbs). Further, this modality-specific means is shown to be subject to variation across two unrelated

sign languages. In addition, second-mention or object preference was observed for pronominal IX. This is in line with the previous production study on ASL (FREDERIKSEN, 2018) but counter to the comprehension study on DGS (WIENHOLZ ET AL., 2018b), which suggests first-mention/subject preference. The conventions licensing this preference are suggested to be modality-independent (e.g., semantic focusing of the verbs and/or inherent referential preferences of accentuated pronouns). Taken together, the findings point towards a need for more research on factors influencing pronoun resolution in sign languages and a potential theoretical model which integrates both modality dependent and independent factors of differential weight to influence interpretation of pronominal IX in ambiguous contexts.

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