Comprehension and production of referential expressions in German Sign Language and Turkish Sign Language: An empirical approach

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To the Deaf Communities of Germany and Turkey

and all sign language researchers…

"You are so young; you stand before beginnings. I would like to beg of you, dear friend, as well as I can, to have patience with everything that remains unsolved in your heart. Try to love the questions themselves, like locked rooms and like books written in a foreign language. Do not now look for the answers. They can not now be given to you because you could not live them. It is a question of experiencing everything. At present you need to live the question. Perhaps you will gradually, without even noticing it, find yourself experiencing the answer, some distant day."

Rainer Maria Rilke

[Translated by Joan M. Burnham, Novato: New World Library, 2000]

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Abstract

Localization, which corresponds to the spatial anchoring of referents to the signing space, functions as a very powerful, yet not necessarily obligatory, device to track referents and maintain coherence in the discourse of sign languages. The question of what happens in the absence of overt localization is the focus of this dissertation; it addresses this question by investigating the potential factors affecting the comprehension of pronominal IX and the production of referential expressions by looking at the comparative data between German Sign Language (DGS) and Turkish Sign Language (TİD) from Referent Selection and Sentence Continuation Tasks.

The results of this work show that the spatial defaults of localization, claimed to be used for the introduction and tracking of referents in signed discourse (Steinbach & Onea 2016; Wienholz et al. 2018), are followed only in restricted contexts (i.e. with reciprocal verbs) for the comprehension of pronominal IX. In production, spatial defaults are applied only scarcely being subject to intra- and inter-language variation. The preferred default pattern for DGS is observed to be ipsi-contra (depending on handedness). On the other hand, in TİD, the pattern appears to be right-left for comprehension and left-right for production (irrespective of handedness).

In addition, a potential influence of the following conventions on the salience of referents is suggested: (i) semantic and morpho-syntactic properties of the verb categories (i.e. plain verbs promoting object preference), (ii) perspective taking strategies (i.e. DGS signers prefer to use signer perspective rotating the signing space 180^0, while TİD signers seem to use addressee perspective mirroring the signing space), (iii) referential value of pronominal IX (i.e. referring to entities of low accessibility status), (iv) structure of the discourse contexts (i.e. a potential difference between maintenance and re-introduction

context with respect to the production of IX signs), (v) type of the coherence relation established between the sentences (i.e. causal relations mainly triggering object preference).

The findings of this dissertation propose a differential contribution of modality specific (i.e. signing space) and modality independent (i.e. verb semantics) as well as participant related (i.e. handedness) and language specific (i.e. interaction with the gestural system of the surrounding spoken language) conventions for resolving anaphora and producing referential expressions. They also highlight a need for an integrated theory of anaphora resolution that includes the above-mentioned aspects; furthermore, a multidimensional approach to salience is suggested.

Zusammenfassung

Verortung entspricht der räumlichen Verankerung von Diskursreferenten im Gebärdenraum und fungiert als ein mächtiges, aber nicht notwendigerweise obligatorisches Mittel, um Referenten zu verfolgen und Kohärenz im Diskurs von Gebärdensprachen aufrechtzuerhalten. Dabei stellt sich die Frage was in der Abwesenheit overter Verortung passiert. Die vorliegende Dissertation thematisiert diese Frage mit Hilfe der Untersuchung potentieller Faktoren, die das Verstehen des pronominalen IX und die Produktion referentieller Ausdrücke beeinflussen. Dabei werden Daten in Deutscher Gebärdensprache (DGS) und Türkischer Gebärdensprache (TİD), erhoben in einem Referentenauswahlaufgabe und einer Satzweiterführungsaufgabe, vergleichend betrachtet.

Die Ergebnisse der vorliegenden Arbeit zeigen das räumliche Standards bei der Verortung, deren Verwendung bei der Einführung und der Verfolgung von Referenten in gebärdensprachlichen Diskursen gezeigt wurde (Steinbach & Onea 2016; Wienholz, Nuhbalaoglu, Mani, Herrmann & Steinbach 2018), nur in begrenzten Kontexten (d.h. mit reziproken Verben) zum Verstehen eines pronominalen IX angewandt werden. Bei der Produktion werden räumliche Standards nur selten verwendet und zeigen deutliche intra- und intersprachliche Variation. Während das bevorzugte Standardmuster für DGS ipsi–contra (unabhängig von Händigkeit) ist, zeigt TİD hauptsächlich ein rechts–links Muster für Sprachverstehen und ein links–rechts Muster für Sprachproduktion (unabhängig von Händigkeit).

Darüber hinaus wird ein möglicher Einfluss der folgenden Konventionen auf die Salienz von Referenten beobachtet: (i) semantische und morpho-syntaktische Eigenschaften der Verbklassen (z.B. einfache Verben unterstützen Objektpräferenz), (ii) Strategien der Perspektive (DGS Signer bevorzugten die Perspektive des Sprechers und rotieren den

Gebärdenraum um 180^0 während TİD Signer die Adressatenperspektive einzunehmen scheinen und den Gebärdenraum spiegeln), (iii) der referentielle Wert des pronominal IX an sich (z.B. Referenz zu Entitäten mit niedrigem Zugangsstatus), (iv) die Struktur des Diskurskontexts (z.B. potentieller Unterschied zwischen Aufrechterhaltungs- und Wiedereinführungskontext im Hinblick auf die Produktion von IX Gebärden), (v) die Art der Kohärenzbeziehung zwischen den Sätzen (z.B. kausale Beziehung rufen mehrheitlich Objektpräferenz hervor).

Die Erkenntnisse der vorliegenden Dissertation unterstreichen den Einfluss verschiedener modalitätsspezifischer (z.B. Gebärdenraum) und modalitätsunabhängiger (z.B. Verbsemantik) und sowohl Probanden-bezogener (z.B. Händigkeit) als auch sprachspezifischer (z.B. Interaktion mit dem Gestensystem der umgebenen Lautsprache) Konventionen bei der Auflösung anaphorischer und der Produktion referentieller Ausdrücke. In Anbetracht dessen wird die Notwendigkeit einer integrierten Theorie der Anaphernresolution, die die der oben genannten Aspekte berücksichtigt, und eines multidimensionalen Ansatzes zur Salienz verdeutlicht.

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1 Introduction

Signers just as speakers of a language make use of referential expressions to communicate in various situations. The main difference between definite/indefinite noun phrases, pronouns and demonstratives is to be found in the channel of articulation (i.e. modality), hence aural-oral in spoken languages and visual-gestural in sign languages. Therefore, from the very beginning of sign language research (van Tervoort 1953; Stokoe 1960) the focus was to determine differences and similarities between two language modalities at different levels of the grammar, i.e. phonology, morphology and syntax (Brentari 1998; Aronoff, Meir & Sandler 2005; Neidle et al. 2000). However, the utterance level phenomena such as 'reference tracking', which include semantic and pragmatic aspects, have been only scarcely investigated in the last two decades. The reason is mainly because the analyses of small scale- and large-scale corpora (i.e. production-based studies) as well as the experimental methods in sign linguistics research (i.e. comprehension-based studies) have started to be applied only recently.

Up to now, production-based studies have mainly focused on identifying constraints affecting the choice of the referential items (i.e. cohesive devices) of the signer. These studies typically use conventional picture stories (e.g. *Balloon stories*) or short video clips to elicit comparable production data from signers and hearing participants including child and adult subjects (e.g. Sümer 2015), speech, sign and co-speech gesture data (i.e. Perniss & Özyürek 2015) as well as data from signers from different populations (i.e. bimodal bilinguals (Morgan 2000) or signers with different levels of sign language acquisition (i.e. L1 and L2 learners)(Frederiksen & Mayberry 2015; Bel, Ortells & Morgan 2015)).

Comprehension-based studies are interested in how an addressee perceives or identifies the referents of the referential expressions. Compared to the production studies,

these use more controlled settings mainly focusing on one type of referential expressions (i.e. pronouns) and testing one element which is hypothesized to be an interpretive preference for that type of referential expression (i.e. subject preference for pronouns) at the level of the local discourse (Emmorey & Lillo-Martin 1995; Emmorey 1997; Frederiksen & Mayberry 2017; Wienholz et al. 2018a; Wienholz et al. 2018b).

As communication typically takes place between two parties, two interlocutors, it is important to have studies with integrated comprehension and production tasks. However, so far there have only been a few studies that have included both of these aspects (i.e. Perniss 2007; Frederiksen & Mayberry 2017). This dissertation aims to contribute to this research field by investigating to what extent modality dependent (visual modality specific devices (i.e. signing space)) and modality independent factors (i.e. first/second mention preference) have an influence on comprehension and production of referential expressions (i.e. pronominal INDEX (IX)) in a comparable data from German Sign Language (DGS) and Turkish Sign Language (TİD).

This chapter aims to provide a highly selective background for understanding the data and the discussions in the following chapters (Chapter 3-6). Setting a literature background for a topic connected to the signing space can be challenging and, if not strictly limited by the focus of the study, can be easily overdone. Therefore, the focus here is on pronominal IX signs referring to non-present individuals and modality (in)dependent conventions that influence comprehension as well as production in ambiguous local contexts.

Thus, Section 1.1 presents the definition of reference, types of anaphoric dependencies, discourse referents as well as types of referential expressions in spoken and sign languages. Next, the signing space is introduced including its structure, referential uses and notions related to the expression of reference. These are: localization, Referential loci, association and distribution of Referential loci in the signing space as well as different

manual and non-manual mechanisms of realizing Referential loci, including pronominal IX (Section 1.1.1-1.1.5). Then, general information on investigated languages is provided (Section 1.2). Following that, a brief overview of the methodology and collected data is presented (Section 1.3). Finally, research aims and contributions (Section 1.4) and the structure of the dissertation are outlined (Section 1.5).

1.1 Reference related notions

Reference (to people or objects, concrete or abstract entities) or talking 'about' the things that are external to ourselves (Carlson 2006) is observed to be one of the unique characteristics of the human languages (Hockett and Altmann 1968: 63–64 as cited in Carlson, 2006). Reference itself is a vast concept and has been a topic of interest for many different research areas, including philosophy and linguistics. In this dissertation, I will use *reference* only in a restricted sense, following the definition by Lyons (1995) given below:

> "Reference, (…), is a context-dependent aspect of utterance-meaning: it is a relation that holds between speakers (more generally, locutionary agents) and what they are talking about on particular occasions. The referential range of referring expressions is fixed by their meaning in the language (i.e. by their sense and denotation). But their actual reference depends upon a variety of contextual factors." (Lyons 1995: 294).

A relationship between a *referentially dependent* expression (i.e. the anaphoric expression, or anaphor[1]) and a *referentially independent* expression, that serves as its antecedent and from which the anaphoric expression gets its reference or other semantic value, is named as an *anaphoric relation* (Partee 2015). If the antecedent of an anaphor is in the written/spoken/signed context of an utterance, this type of relation is called an *endophoric relation*. Endophoric relations can be of two types: *anaphora*, and *cataphora* (i.e. backward anaphora)(Levinson 2006). The former relation comprises precedence of the antecedent (i.e. 'Peter' in (1a)) with respect to the anaphoric element (i.e. 'he' in (1a)). On the other hand, in the latter relation the anaphoric element (i.e. 'he' in (1b)) precedes its antecedent (i.e. Thomas in (1b)). There are also cases in which antecedents can be retrieved from the context beyond the utterance (i.e. physical contexts, world knowledge) referred to as *exophoric relation* or *deictic relation* (Levinson 2006). Consider the example in (1c) where the reference of 'she' can only be understood from the physical context of the utterance (e.g. the two females referred as 'she' are present in the same room as the speaker).

(1) a. Peter$_1$ kissed Ben$_2$. Then he$_{1/2}$ started to cry[2].

b. After he$_1$left Elena$_2$, Thomas$_1$ travelled to Siberia.

c. She$_1$ did not travel with me last year. She$_2$ did.

[1] Note that this usage is different from the restricted sense of anaphora including only reflexive and reciprocal pronouns at the level of syntax (Chomsky 1980; Chomsky 1982).

[2] The underscored numbers (i.e. referential indices) indicate co-referential items by convention.

This dissertation will focus on anaphoric relations of the (1a) type, which include reference resolution (i.e. the process of identifying antecedents of anaphoric expressions) as well as production of referential items in sign languages.

The referred entities, whether real or conceptual, are typically named as *referents* and specifically when they occur in discourse context, as *discourse referents* (Karttunen 1976). These are abstract semantic concepts which are realized via linguistic forms (i.e. referring expressions) whose range varies depending on a language[3]. Canonically, the items conveying reference are: proper names, definite/indefinite noun phases, bare nouns, demonstratives, overt (strong/weak), pronouns, classifiers, and clitics. An inventory of referring expressions may get larger or smaller depending on the type of a language. For instance, Italian being a pro-drop language makes use of the null pronouns while German as a non-pro drop language allows only for the usage of overt pronouns (Bhat 2004). On the other hand, in Bantu languages (i.e. Xhosa) different types of classifiers are typically used for expressing reference (Aikhenvald 2003).

Looking at the cross-modal differences and similarities, signers like speakers of a language use a large inventory of referential expressions to introduce and track discourse referents in local and global discourses[4]. Those are linguistic devices typically realized by the means of visual modality (i.e. signing space, see Section 1.1.1) including nouns (i.e. bare

[3] Note that referring expressions or R-expressions are used in a specific sense in syntactic literature corresponding to one of the three categories of noun phrases (i.e. R-expressions, pronouns and anaphors). In the theory of Binding and Government, those are subject to Principle C of binding (i.e. they must remain free in their binding domain) (Chomsky 1980).

[4] There is a mounting literature on analyses and distribution of referential expressions at the sentence level (Petronio 1995; Lillo-Martin 1986; Koulidobrova 2017), but this dissertation focuses mainly on the utterance level.

nouns, finger spelled nouns and name signs), pronominal IX, demonstratives and zero pronouns as well as classifiers, classifier predicates and constructed action[5]. In terms of realization in the signing space, these referential expressions differ from spoken language expressions. However, they have been shown to resemble their spoken language counterparts in their referential properties, their contribution to the discourse structure and acquisition patterns (Morgan 2000; Sümer 2015; Perniss & Özyürek 2015).

1.1.1 Signing space and its referential uses

The signing space is a three-dimensional area in front of the body of a signer which encompasses the head as well as the area in the shoulder wide (Klima & Bellugi 1979). It is described to have a shape of a 'bubble'(Kegl 2004) and is considered to be an extension of the body (Fekete 2010), being the most important component of signing communication. The size of the signing space varies and thus it might get bigger or smaller depending on pragmatic factors such as the register or the context of usage. For instance, the whispering space in Sign Language of the Netherlands (NGT) is used for conversations of private situations in public (Twilhaar & van den Bogaerde 2016). The (default) size of the signing space differs between urban and rural sign languages[6]. While in urban sign languages (i.e.

[5] Constructed action, also known as role/referential shift is defined as a frequent discourse strategy used in sign languages, in which signers use their manual and non-manual articulators including body, hands, and facial expressions, to report actions, thoughts, feelings and attitudes of the referents (Metzger 1995).

[6] Bauer (2014: 10-31) differentiates between four different types of sign languages: (i) Deaf community sign languages used by large sign language communities in urban contexts (i.e. ASL); (ii) Emerging sign languages, which have a relatively younger age (i.e. Nicaraguan Sign Language); (iii) Village sign languages, distinguished from deaf community sign languages by four parameters, including socio- economic and demographic settings, social homogeneity, (socio)linguistic context and degree of endangerment (i.e.

American Sign Language (ASL)) the signing space does not extend beyond the waist of the signer and only the area in front and to the sides of the body is used, in rural sign languages the signing space can be extended to include the whole body, even the back side of it (i.e. Adamorabe Sign Language, Kata Kolok, Yolngu Sign Language) (for examples and further details on the usage of signing space in rural sign languages see (Nyst 2007; Marsaja 2008; de Vos 2012; Bauer 2014)). The differences in the size of signing space in urban and rural sign languages can be seen in Figure 1.1 below[7].

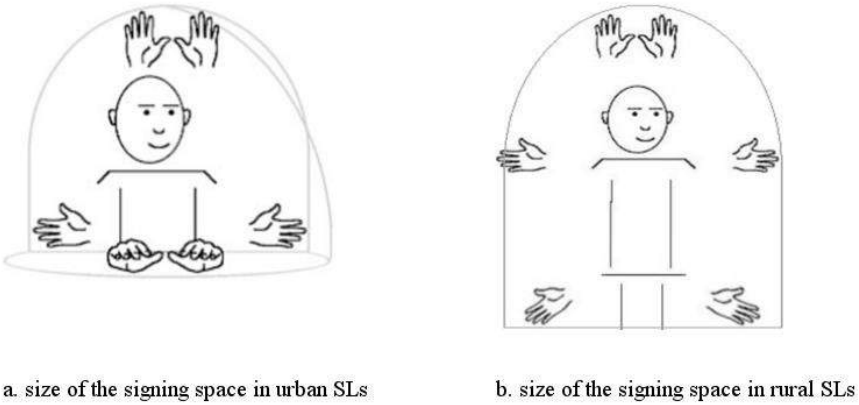


Figure 1.1: Size of the signing space

The signing space is the core of the visual-spatial grammar and expresses a multitude of different functions such as phonological, morphological, morpho-syntactic, semantic and pragmatic. Among those, the primarily function of the signing space is articulatory. That is, this area including body of the signer is used for production of the signs (Poizner, Klima & Bellugi 1987; Brentari 1998). Another function serves to express morphological structures

Adamorabe Sign Language), and (iv) Alternate sign languages, being a heterogeneous group often shared by hearing and deaf members of the community (i.e. Australian Aboriginal Sign Languages). In this dissertation only the general distinction between urban and rural sign languages is followed.

[7] The figures are taken from Bauer (2014).

such as compounds (Aronoff, Meir & Sandler 2005) as well as morpho-syntactic features (i.e. arguments of the verbs via verb agreement (Padden 1990)) or plurality (Pfau & Steinbach 2006)).

The signing space can also be used to convey linguistic meaning at the sentence and utterance level (Perniss 2012; Barberà 2012; Engberg-Pedersen 1993), especially to express and track reference in signed contexts including pronominal reference, which is among the most debatable and intriguing topics in sign linguistics literature. This dissertation aims to further explore the referential usage of space and contribute to the ongoing debate.

In expressing reference, the signing space has been considered to have two different usages: topographic and syntactic (Poizner, Klima & Bellugi 1987). It needs to be emphasized that these two usages are not considered to be discrete by all researchers, in fact it has been observed that a single locus can be used to realize both syntactic and topographic aspects of the signing space. A typical example of those overlapping functions is the introduction of a referent via classifier predicate depicting a particular topographic location (e.g. a sick/tired woman lying on a couch) followed by an agreement verb aASKb using abstract space[8]. Then, the verb can be directed from the same locus (e.g. a woman asking for a coffee from her husband) to an earlier specified location so that it's start and end points indicate the verbal arguments (see Perniss 2012: 416 and references thereof, for parallel examples).

Other studies suggest a so-called integrated or motivated view of the signing space, which eliminates the abstract dimension and advocates only topographic usage both for classifier predicates and verbal agreement as well as anaphoric reference (Liddell 1990;

[8] Note that by convention, the subscripts (a,b) indicate initial and final loci marked via agreement verb ASK in the signing space. In the following chapters R(right)-L(eft) and ipsi (lateral) and contra (lateral) will be used to indicate loci in the signing space.

Liddell 2003; van Hoek 1992; Cormier, Fenlon & Schembri 2015; Fenlon, Schembri & Cormier 2018). These spatial functions are tested in a few experimental studies (Emmorey, Corina & Bellugi 1995; MacSweeney et al. 2002), however they present conflicting evidence for and against differential usages of the signing space (the reader is referred to Barberà (2012: 44–45) for a critical overview). To emphasize my position with respect to the referential functions of the signing space in this dissertation, I will distinguish between syntactic and topographic space but I will also acknowledge that the distinction can be rather flued and I leave it to the data to speak for itself (see discussion on perspective taking in Chapter 3).

Topographic space is used primarily to express spatial relations between people or other animate/inanimate entities (i.e. objects) relative to each other mapped from real or imagined spatial setting (Emmorey 2002; Perniss 2007; Perniss 2012). The exact placement of entities in this type of space is of great importance as any change can cause differences in meaning. This function of space is conventionally associated with iconic usage of the visual modality, flexible utilization of all three dimensions of the signing space, noun phrases followed by classifier constructions, complex predicates which encode semantic (i.e. animacy) or iconic (i.e. shape) properties of the referents (Emmorey, Corina & Bellugi 1995; Perniss 2012). Descriptions of the spatial settings, such as various landmarks, city or country maps, plans of buildings or convention centers, static and motion events are the most typical areas where topographic space is used. Most of the research concerning expression of reference is conducted in relation to topographic space (Emmorey 1996; Perniss 2007; Perniss & Özyürek 2008; Arık 2009; Pyers, Perniss & Emmorey 2015; Sümer, Perniss & Özyürek 2016). This is mainly due to the observation that signers make use of this spatial function quite frequently (Bahan & Petitto 1980; Geraci 2014).

Syntactic space is used to express syntactic (i.e. verb agreement) or discourse related aspects (i.e. reference tracking). Referents are arbitrarily associated with the locations in the signing space, called Referential loci (R-loci) and changes in the placement of these loci do not have any effect on their truth-conditional meaning (Barberà 2012).

As opposed to a more flexible usage of the three dimensional areas in topographic space, the usage of the syntactic space is constrained to three specific planes and their trajectories which are the frontal/ventral/sagittal plane, the midsagittal plane and the horizontal/transverse plane defined by taking the signer's body as the origin (Brentari 1998: 120). Thus, the frontal plane is the dimension parallel to the body (y-axis), the midsagittal plane lies perpendicular to the body (z-axis) and the horizontal plane is positioned diagonally extending on the lateral sides of the body (x-axis), see Figure 1.2 below.

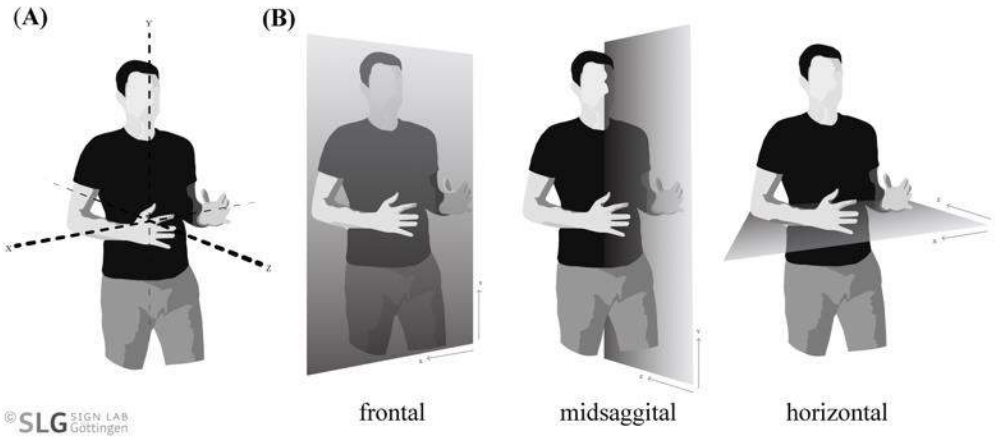


Figure 1.2: Depiction of signing space: all three planes combined (A), each plane shown separately from left to right: frontal plane, midsagittal plane and horizontal plane (B)

Grammatical functions of the frontal and midsagittal planes of the signing space have been investigated relatively recently, but only for a number of sign languages (Barberà 2012). For instance, in Catalan Sign Language (LSC) the upper and lower dimensions or

areas of the frontal plane were documented being used to express different levels of specificity, hierarchical relations, locatives, and the items absent from physical context (Barberà 2012: 114). Moreover, recent analyses of agreement verbs have indicated combined usages of the planes (i.e. horizontal midsagittal or x+z axis) based on the direction of the path movement of the verbs (Padden et al. 2010; Cormier, Fenlon & Schembri 2015). Among the three spatial planes mentioned above, the horizontal plane has been investigated the most in sign languages and is used to express a number of various grammatical functions such as plurality (Pfau & Steinbach 2006), reciprocity (Pfau & Steinbach 2003), contrast (Wilbur & Patschke 1998; Winston 1991), comparison (Aristodemo & Geraci 2017), aspect (Rathmann 2005), verb agreement (Padden 1990) as well as the expression of timelines (Engberg-Pedersen 1993) and tracking of discourse referents (Friedman 1975; Barberà 2012). This dissertation focuses on the latter function and aims to further explore the horizontal dimension of the signing space with a specific focus on discourse-semantics.

In their formal account of reference tracking in DGS, Steinbach and Onea (2016) differentiate between the horizontal space (*H-space*) as being an actual or physical space and the analytical space (*A-space*), which semantically represents the *H-space*. I adapt the authors' terminology in line with their proposal which suggests that the A-space can be decomposed into two major (potentially recursive) areas: R(ight) and L(eft)[9]. Hence, discourse referents' distribution is licensed by spatial defaults based on particular ordering of these two spatial divisions (details of this approach are further elaborated in Chapter 2). I will provide further data to show that these spatial defaults can be used for the interpretation

[9] Note that Right and Left are abstractions from the physical space and depending on the handedness of a signer can be realized differently (i.e. Left as contralateral for right-handed but ipsilateral side for left-handed signers). See Chapter 5, for the revised terms suggested for these areas.

of pronominal IX (Chapter 3) as well as for introduction and maintenance of various referential expressions (Chapter 4).

1.1.2 Perspective taking strategies

In the comprehension and production of the referential expressions, the role of perspective is inevitable for both topographic and syntactic usage of the signing space. In production, real or imagined space is mapped onto the signing space (i.e. topographic space) while spatial arrangement does not take place in a unified manner, but rather depends on the perspective or vantage point (a term coined by Perniss & Özyürek, 2008) from which the signers prefer to view or imagine spatial settings or events. Perspective taking strategies come in two forms: observer perspective and character perspective. In the observer perspective, spatial settings are mapped from the bird's view or globally and the narrator remains fully external to the reported setting. Typically, a restricted area in front of the signer and specifically the lateral/horizontal axis is used to locate referents. In this perspective, the signers by default are observed to use entity classifiers (i.e. B – handshape as a person classifier). On the other hand, in the character's perspective, the signers undertake the role of one of the characters and report the setting/event as an insider. Usage of the signing space is enlarged, mainly the sagittal axis and handling classifiers are utilized[10].

In comprehension, addressees as well might interpret the entities signed in the topographic space or abstract space (i.e. especially in the dialogue situations) either from the signer's perspective (rotating the spatial realization of the scene 180^0) or from their own

[10] Sign languages can as well use marked or non-aligned perspective classifier pairings with varying frequency. That is, *observer perspective* may occur with handling classifiers and *character perspective* may occur with entity classifiers (for a comparative analysis of aligned and non-aligned structures in DGS and TİD, see Perniss & Özyürek (2008)).

perspective, the former named *mental rotation* (Emmorey, Klima & Hickok 1998) and the latter *mental translation* (Perniss 2007). The studies addressing the differences in perspective taking in comprehension and production show that signers prefer to mentally rotate topographically but not abstractly localized entities, perceiving them from the signer's view (Emmorey, Klima & Hickok 1998). Perniss (2012: 153–157) shows that DGS signers do not conventionalize a single viewpoint for both comprehension and production of topographic locations. Hence, they tend to adapt *mental rotation (*i.e. *reverse space)* while producing descriptions of simplex and complex static events but the same signers tend to use *mental translation* (i.e. *mirrored space)* while comprehending complex and simplex spatial scenes. For comprehension of abstractly localized referents in DGS, Fehrmann (2014) reports the results of a pilot study in which DGS signers were more likely to use mirrored space, but the author acknowledges the comments of deaf colleagues who argue that the reverse space is used for the production and the comprehension of referents in both the topographic and the syntactic functions of space in DGS.

1.1.3 Localization

The localization of the referents to the signing 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. It is crucial to note that referent localization is not preferred in single sentences but is rather common in connected discourse (Barberà 2012: 28). Therefore, the localization mechanism, irrespective of its modality specific realization (Brunelli 2011: 48), serves a function of anaphoric disambiguation in a similar manner as gender in spoken languages (Engberg-Pedersen 1993; Kegl 2003; Nuhbalaoglu et al. 2016). In her analysis of Danish Sign Language, Engberg-Pedersen (1993: 143) claims that loci are demonstrative like elements

in spoken languages in serving reference-tracking function[11] 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, having meaning comparable to the natural gender in spoken languages.[12] In a recent experimental study, using the eye tracking methodology and a modified version of the Visual World Paradigm we have shown that localization, apart from disambiguating referents can also accentuate first mentioned/subject referents increasing their accessibility in a way comparable to sentential focus (Wienholz et al. 2018c).

Localization of referents can be of two types: descriptive localization, and non-descriptive localization (Barberà 2012; Twilhaar & van den Bogaerde 2016). The former is used to anchor the referents in the topographic usage of the signing space by isomorphic mapping from the real space to signing space, typically via usage of classifier predicates. In non-descriptive localization, the referents are assigned to the regions in the syntactic space, named R-loci (Lillo-Martin & Klima 1990), in an arbitrary manner. In those cases, the usage

[11] The nature of the association between a spatial point and a referent has been subject of various theoretical approaches. Among the most popular ones are: (i) R-loci as clitic pronouns (Fischer 1975; Padden 1990; Wilbur 2008; Nevins 2011; Barberà 2012), (ii) R-loci as semantic variables (Lillo-Martin & Klima 1990), (iii) R-loci as morphosyntactic features (Kuhn 2016). Given that the domain of these investigations is limited to the syntactic level, and here the focus is on the level of the utterance, the premises of those accounts will not be discussed further in this dissertation.

[12] Engberg-Pedersen (1993) considers loci as a reference tracking mechanism which belongs to the gender group in Foley and Van Valin's (1984, Chapter 7) categorization of reference-tracking systems of spoken languages. According to this categorization reference tracking mechanisms are divided into four major classes: (i) pragmatic pivots in combination with voice oppositions, (ii) switch reference, (iii) assignment of co-reference on the basis of sociolinguistic variables (i.e. honorific speech levels) and (iv) gender.

of pronominal expressions and agreement verbs is typical (see Section 1.1.4, for details of the means used for referent localization and the creation of visual referential links).

Since the very first research on the R-loci, it has been posited that the association of referents with loci in the signing space takes place in a visually transparent way (Lillo-Martin & Klima 1990). That is, each referent is assumed to be linked to a distinct spatial point/area and can be unambiguously retrieved via direct or indirect reference (e.g. pointing) to this spatial area. It has also been claimed that, in cases where referent-locus association is not clear, the structure is considered ungrammatical. This implies that ambiguity should be strictly avoided as emphasized by Poizner, Klima & Bellugi (1987: 17) in the following:

> "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."

More recent analyses focusing on larger discourse contexts have indeed shown that there is not always one-to-one mapping between a referent and its respective locus, but that one-to-many and many-to-one mappings are also quite common (Barberà 2012). Moreover, especially in unplanned narratives the association between a referent and a spatial area might not be clear (i.e. implicit spatial anchoring). Spatial areas might be indicated by unstressed forms (i.e. unstressed pronominal IX) in cases where a referent is highly accessible or due to various discourse related factors the referential expression might be directed to a different

area than initially associated with (Quer & Steinbach 2015; Barberà 2012; Steinbach & Onea 2016). In those environments, anaphora resolution mechanisms active in spoken languages are also proposed to function in sign languages (Quer & Steinbach 2015: 159). The scope of investigation in this dissertation centers on the environments where referent-locus association is not done overtly, and thereby creates ambiguous contexts.

1.1.4 Distribution of R-loci in the signing space

In order to understand pronominal reference and its resolution in sign languages, it is important to understand the motivations or conventions determining the distribution of R-loci in the signing space. Arrangement of R-loci in the signing space is often quoted as *frame of reference*[13] (or *discourse frame* coined by Padden (1988), as cited in Engberg-Pedersen (1993:69)) and is proposed to be dynamic across utterances (Klima and Lillo-Martin, 1990: 193, Engberg-Pedersen 1992: 69). Factors or conventions determining the frame of reference are closely related with the way researchers understand functions of the signing space. In particular, these factors can be categorized either as conceptual (in those cases signing space is considered to be motivated) (van Hoek 1992; Winston 1991; Engberg-Pedersen 1993; Janzen, Leeson & Schaffer 2012; Janzen 2004), semantic and pragmatic (Barberà 2012), or purely semantic (Steinbach & Onea 2016; Schlenker 2012; Kuhn 2013).

[13] Note that the term *frame of reference* should not be with confused with its homonym also used in the sign linguistics literature dealing with topographic space (i.e. spatial and locative relations). In this sense the notion is closely connected with the perspective taking strategies, referring to a specific direction according to which a figure object is positioned in relation to the ground object. Frames of reference come in three types: (i) intrinsic frame of reference (in character perspective), extrinsic frame of reference (in observer perspective) and absolute (irrespective of the used perspective) frame of reference (see Perniss (2007: 148) for further details).

To be more precise, among the proponents of topographic (i.e. non-arbitrary) usage of space, van Hoek (1992) claims that conceptualization of spatial or temporal setting of a referent determines the assignment of its loci. In particular, two general principles are proposed to license the distribution of loci, namely specificity and accessibility where the former is influenced by perceptual salience as well as by the current locus of a referent and the latter by focus in the discourse. Using corpus data from American Sign Language (ASL) and Irish Sign Language, Janzen et al. (2012) show that the arbitrary choice (i.e. syntactic usage of space) of loci for pronouns appears only in a limited amount, while the majority of the chosen loci are conceptually motivated. The authors found three main factors and the combination of those as well as the type of discourse genre to determine the distribution of loci used for pronominal reference for 3rd person non-present referents: (i) conceptual mapping during recall (i.e. spatial relations between entities, relative geographic space, other metaphoric extensions); (ii) perspective of an enacted discourse character; (iii) metaphorical mapping.

When looking at the research concerned with purely semantic constraints determining the distribution of loci, it is mainly concerned with the syntactic usage of space. A more elaborate discussion of the approaches focusing on the utterance level anaphora (e.g. Barberà 2012) are given in Chapter 2.

1.1.5 Realization of R-loci in the signing space

The referents which are concrete, with high thematic value and high relevance to the discourse are typically associated with a spatial locus (Engberg-Pedersen 1993:99). Referent-locus association can be realized by various manual (e.g. IX signs, spatial modification of signs, agreement verbs) and non-manual mechanisms (e.g. eye gaze, head, torso directed towards specific regions in the signing space) or different combinations of

those. It has been reported for ASL that typically at least two-of those mechanisms co-occur and some of them (i.e. eye gaze or rotation of the torso) might be used with varying degrees (Winston 1991: 399). For LSC, all mechanisms listed above as well as their combinations have been identified (manual: IX signs, spatial modification of signs, verb agreement; non-manual: eye gaze, body lean and head tilt) in a small-scale corpus (Barberà 2012: 90–99). For DGS and TİD, the two languages under investigation, mainly manual mechanisms of localization have been documented in the literature (DGS: IX signs and verb agreement (Happ & Vorköper 2006), spatial modification of signs and non-manual markers such as eye gaze or body leans towards R-locus (Steinbach & Onea 2016: 416–417)[14]; TİD: IX signs, noun modification, agreement verbs (Dikyuva, Makaroğlu & Arık in press)[15], see Chapter 4 for (overt) localization mechanisms used in the production data of DGS and TİD). However, to what extend these localization mechanisms are used for each sign language, their obligatoriness and possible combinations are not fully documented up to date.

Association of a spatial area with a referent does not have to be explicitly made because implicit/covert association is possible as well. In such cases, even though there is no previous overt localization of a referent, reference back to one or the other area signals this implicit association. Steinbach & Onea (2016: 417) delineate two conditions of use for this implicit strategy: "(i) the discourse is limited to one or two discourse referents and (ii) the sentence contains an agreement verb or another agreeing sign that indirectly locates the two discourse referents by spatially agreeing with the corresponding R-loci." Consider example (2) (taken from Steinbach & Onea 2016: 447) showing covert referent association

[14] Note that localization mechanisms documented for DGS are not based on naturalistic corpus data, but rather on either constructed or single sentences.

[15] Participant observation reveals that non-manuals such as eye gaze, body and head directed to the area associated with a referent seem to be present in TİD as well.

in DGS, in which neither the first mentioned (subject) nor the second mentioned referent (object) are overtly localized in the signing space, and only initial and final loci of the agreement verb 3aGIVE3b indicate R-loci associated with these referents, 3a with subject (i.e. M-A-R-I-A) and 3b with object (i.e. P-E-T-E-R) respectively.

(2) M-A-R-I-A P-E-T-E-R BOOK 3aGIVE3b

'Maria gives the book to Peter.'

Referents introduced overtly or covertly into the discourse are referred back via different manual and non-manual referential expressions (see Section 1.1), among those the most obvious but not necessarily the most frequent means are IX signs, including pronominal IX, the details of which are given below.

1.1.6 IX signs

Pointing signs, which share their spatial and form related similarities with co-speech gestures, have been at the focus of attention since the beginning of sign language research (Stokoe 1960). Of particular importance here are the pointing signs articulated with an extended index finger H – handshape (henceforth IX signs) directed to a particular point/area in the signing space and articulated with an (optional) path movement (see Engberg-Pedersen 1993 for cases of pronominal IX signs called *undirected forms* which contain either no movement or are integrated inside the transition movement of the neighboring signs). IX signs have a multitude of differing functions including being determiner, demonstrative, pronominal, locative and adverbial. These functions can either be differentiated based on the distribution of an IX sign (e.g. preceding or following nominals), certain phonological properties (e.g. direction of the pointing, type of and intensity of the path movement) or

simply can be retrieved from the context of occurrence (see Pfau (2011) for an elaborated overview of various functions of IX).

The focus here will particularly be on IX signs which have pronominal function[16] and refer to non-present individuals[17] (i.e. personal pronouns), however their referents are not lexically determined but can change depending on a number of *linguistic* and *non-linguistic* elements in the discourse. Given the fact that these referential expressions were shown to possess both gestural and linguistic properties (Cormier et al. 2007; Cormier, Schembri & Woll 2013; Cormier 2014), I will refrain from naming these signs as pronouns (which might imply purely linguistic nature) but rather use the term pronominal IX signs.

In spoken languages, personal pronouns, depending on the type of a language, include some information concerning their referents through a set of phi-features (e.g. person (speaker/addressee), number (plural/singular), and gender (male/female) features) which typically are morphologically realized (Bhat 2004: 9–11). On the other hand, in sign languages pronominal IX signs, come into two classes or types: fully referentially specified and referentially underspecified (Frederiksen & Mayberry 2017). The former type refers to

[16] Note that signs used to utilize pronominal reference in sign languages are not only limited to IX signs, other manual signs (i.e.] – handshape to express possession in many sign languages including ASL, DGS and TİD (Zeshan & Perniss 2008), classifier handshapes as well as non-manual markers (e.g. eye gaze and body shift as in Kata Kolok (Marsaja 2008)) are typically used in various contexts. Moreover, pronominal reference does not have to be overtly realized (Lillo-Martin 1986; Emmorey & Lillo-Martin 1995).

[17] Pronominal signs referring to present entities and individuals (i.e. deictic reference) are quite common, 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, 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 only used to refer to locations of places (Marsaja 2008).

spatially anchored IX signs (3a-b), while the latter includes the cases where IX signs are not spatially linked to their antecedents (3c).

The literature on interpretation of pronominal reference in sign languages has been typically concerned with the cases like (3a-b), in which pronominal IX signs are directed to the areas overtly associated with their antecedents, hence providing transparent interpretation for pronominal reference (Poizner, Klima & Bellugi 1987; Lillo-Martin & Klima 1990; Kegl 2003; Lacy 2003). Note that for those accounts rather than the type of the region/point assigned to the referents, the assignment (i.e. localization) itself was considered to be crucial, i.e. whether the first mentioned (i.e. subject) referent is assigned to the ipsilateral or contralateral area was not of interest. On the other hand, the presence of spatially unanchored pronouns in sign languages as in (3c) and the conventions/constraints guiding their interpretation have been discussed only recently (Geraci 2014; Steinbach & Onea 2016; Frederiksen & Mayberry 2017; Wienholz et al. 2018a, 2018b).

(3) Setting: There is a regular work meeting tomorrow, the boss and the coworker both are female.

a. TOMORROW BOSS IX_R COWORKER IX_L MEET. IX_R TALK WANT.

'Tomorrow the boss meets the coworker. She (boss) wants to talk.'

b. TOMORROW BOSS IX_R COWORKER IX_L MEET. IX_L TALK WANT.

'Tomorrow the boss meets the coworker. **She**[18] (coworker) wants to talk.'

c. TOMORROW BOSS COWORKER MEET. $IX_{R/L}$ TALK WANT.

'Tomorrow the boss meets the coworker. She (boss/coworker) wants to talk.'

Both types of IX signs will be discussed in this dissertation, the former ones with regard to the way they receive spatial anchoring and the latter ones in terms of the (grammatical) factor(s) suggested to identify their referents in global/local contexts. In

[18] The item in boldface indicates accentuation (i.e. stress).

Chapter 2, I will provide a critical overview of the three approaches addressing resolution of referentially unanchored pronominal IX signs in local and global discourse (Barberà 2012; Geraci 2014; Steinbach & Onea 2016) with the aim to evaluate their premises and test their application against empirical data. In addition, further modality (in)dependent conventions influencing salience of the antecedents and pronominal interpretation such as first mention/subject preference (Wienholz et al. 2018b) will be discussed in connection with the the data.

1.2 Languages under investigation

In this dissertation comparative response and production data from two geographically and historically unrelated sign languages[19], namely German Sign Language (*Deutsche Gebärdensprache, DGS*) and Turkish Sign Language (*Türk İşaret Dili, TİD*) will be focused on.

DGS is an officially recognized sign language of d/Deaf[20] population in Germany (2002, Disability Equality Act, Section 6, paragraph 1). The number of signers ranges between 80,000 and 310,000 depending on the reports of different institutions (i.e. German Federal Association of the Deaf, German Federal Association of Hard of Hearing and German Federal Statistical Office). DGS is documented to have regional and deaf school related variations, especially at the level of lexicon (Langer 2012; Eichmann & Rosenstock 2014). This language primarily follows head final (i.e. SOV) word order (Happ & Vorköper

[19] Especially after 1970's some contact between two languages was established either due to interaction of deaf Turkish immigrants with German deaf society (Karar 2008) or via Turkish deaf students/academics who came to Germany for educational purposes.

[20] Both Deaf as a cultural status vs. deaf as a medical condition, the terms initially introduced to the field by Padden & Humphries (1988), are used in this text to characterize deaf society.

2006) and allows subject or object arguments to be dropped (Papaspyrou et al. 2008; Mehling 2010).

Research on DGS was done in different areas including the following topics: sociolinguistics aspects such as language variation (Hillenmeyer & Tilmann 2012) and deaf history (Vogel 2001; Söderfeldt 2013); various aspects of phonology such as phonemes, word accent and prosody (Becker 1998; Prillwitz 2005; Herrmann 2012, 2016); general morphological descriptions as well as analysis of specific structures like classifiers and plural formation (Leuninger 2005; Oviedo 2001; Pfau & Steinbach 2005a; Schwager 2012) and syntactic topics such as negation, relative clauses and questions (Pfau 2008; Pfau & Steinbach 2005b; Grin 2014). Moreover, studies on bilingualism (Plaza-Pust & Weinmeister 2008), education research (Fries & Geißler 2012; Leonhardt 2010; Plaza-Pust 2016), psycho- and neurolinguistics (Leuninger 2005; Hosemann et al. 2013; Hänel-Faulhaber et al. 2014) as well as language contact (Keller 1998; Ebbinghaus et al. 2012) have been conducted. However semantic and pragmatic aspects of the language, besides a few recent studies (e.g. Steinbach & Onea 2016), remain unexplored [21] .

TİD is an officially recognized primary language of communication of the d/Deaf community of Turkey (2005, Disability Law, under the Disability Act subsection no. 5378). Signer population appears with conflicting numbers ranging from 250.000 to 2,5 million depending on the type and categorization of the institution (i.e. National Federation of Deaf, Disability Survey, Turkish Ministry of Education), which prepared the report. The history of TİD goes back to the 14th century being the oldest documented sign language to date, which typologically has not been related to any other sign language (Miles 2000). Regional differences were identified mainly at the lexical, and with some variations at the grammatical

[21] For a comprehensive bibliography of the works published on DGS in *das Zeichen* see: https://www.idgs.uni-hamburg.de/images/daszeichen/dz-bibliografie9.pdf

level (Dikyuva, Makaroğlu & Arık 2017). TİD is shown to be a predominantly SOV language (Açan 2007) which is flexible only in case of different animacy status of the arguments in transitive sentences (Sevinç 2006). It is as well reported to be a pro-drop language, hence allowing for null pronouns (Açan 2007).

Since the 2000's, research on TİD has been done mainly in the following areas[22]: sociolinguistic topics like communicative practices or history of deaf in Turkey (Zeshan 2002; Kemaloğlu & Kemaloğlu 2012; İlkbaşaran 2013); phonological aspects such as phonemic inventory and various phonological processes (Kubus 2008; Kubus & Hohenberger 2011); morphological properties of fingerspelling and compounds (Taşçı 2012; Taşçı & Göksel 2018); syntax related topics like word order, negation, complex structures (Sevinç 2006; Gökgöz 2009; Makaroğlu 2013; Göksel & Kelepir 2013) as well as bilingualism (İşsever, Makaroğlu & Ergenç 2018) and language acquisition (Sümer et al. 2013; Sümer, Perniss & Özyürek 2016). However, topics related to semantic and pragmatic aspects of the language, besides a few recent publications (e.g. Perniss & Özyürek 2008) are under-investigated.

As was indicated above, both DGS and TİD are under-investigated in the domain of pragmatics specifically with respect to the expression of reference at the utterance level. An overview of the topics and the methods used in the investigation thus far are summarized in Table 1.1.

[22] http://turkishsignlanguage.enginarik.com/bibliography provides a comprehensive bibliography of TİD by Engin Arık.

Table 1.1: An overview of the studies on DGS and TİD in the domain of reference

Language	**Topic**	**Type of research**	**Author(s)**
DGS	Iconicity and spatial relations	empirical	Perniss (2007)
	Reference tracking	empirical	Perniss & Özyürek (2015)
	Discourse referents and anaphora resolution	theoretical	Steinbach & Onea (2016)
	Spatial defaults	experimental	Wienholz et al. (2018a)
	Interpretational preferences of pronominal IX	experimental	Wienholz et al. (2018b)
	Influence of localization on interpretation of bare nouns	experimental	Wienholz et al. (2018c)
TİD	Referent introduction	empirical	Sümer (2015)
	Viewpoint preferences	empirical	Sümer et al. (2016)
DGS & TİD	Expression of referents in spatial events	empirical	Perniss & Özyürek (2008)

The main motivation for the comparison between DGS and TİD in reference tracking for the present research was: (i) ease of the access and fluency of the author in both sign languages, (ii) the observed differences in patterns of referent establishment in signing space, (iii) lack of research on the comprehension and production of pronominal and other referential expressions, and (iv) inspiration to contribute to already existing literature which has shown similarities and interesting differences between the two languages in the domain of the location, motion, and action of referents involved in complex spatial events (Perniss & Özyürek 2008).

1.3 Methodology and data collection

The tasks used to collect data for this dissertation are of two types: comprehension task (i.e. referent selection) and production task (i.e. sentence continuation)[23]. In a controlled comprehension (addressee oriented) task, the signers selected referents of pronominal IX (see Chapter 3 for the details). In a semi-controlled production task (signer oriented), prompted by sentences containing two referents, the signers freely produced mini-narratives containing referring expressions with various degree of spatial distribution/localization (see Chapter 4 and 5 for the details). To elicit signer responses, videos of native sign models were used which contained no spatial modification (i.e. localization of neither the referent signs nor the verbs). It is considered crucial to use two different methods of data collection for testing as they might tackle different aspects of anaphora resolution mechanisms.

The data for this dissertation were collected from 10 deaf signers of DGS and 10 deaf signers of TİD, all using sign language as their primary communication on the daily basis (for the further details on participants' background see Chapter 3, and Appendix A). For each language, the participants were controlled for their handedness status (5 right-handed and 5 left- handed signers per language). The grounding for this is the following: Especially in production of spatial relations the difference between right-handed and left-handed signers was hardly articulated so far. A few existing studies on the issue have shown that

[23] During the period of sign language data collection (March-April 2016) a comparable written data set was as well collected for spoken Turkish and German as a part of another study. Moreover, during the period of this dissertation I have been involved in a collaborative research (with my colleagues: Anne Wienholz, Annika Herrmann, Nivedita Mani, Edgar Onea and Markus Steinbach) investigating anaphora resolution from an experimental perspective. This research will be mentioned in Chapter 2, in connection to the theoretical aspects and investigated data.

left-handers follow the exact opposite pattern as their right-handed peers in production (Friedman 1975; Geraci 2014). However, it has been shown as well that left-handed signers, the population of which is much larger in deaf communities (Bonvillian, Orlansky & Garland Blanton 1982; Dane & Gümüştekin 2002; Papadatou-Pastou & Sáfár 2016), might significantly diverge from right-handed signers especially in comprehension of the signs at the phonological level (Watkins & Thompson 2017).

1.4 Research aims and contributions

This dissertation aims to contribute to the literature by providing empirical and comparable data from two unrelated sign languages on the usage of spatial defaults for comprehension of pronominal IX at the level of utterance. In addition, it is the first attempt to analyze distribution and spatial realization of R-loci in a semi-controlled production data in order to determine the strength and frequency of the spatial defaults proposed for DGS in comparison with TİD. Moreover, the factors guiding the choice of referential expressions in local contexts prompted by simple sentences with varying verb types are investigated to provide a ground for comparison of local and more natural global discourses with regard to reference tracking.

The general research questions guiding this work can be seen below, note that the more detailed questions are presented and addressed in the relevant parts of each chapter (i.e. Chapter 3, 4 and 5).

$Q_{general}$: To what extend does signing space determine the comprehension of pronominal IX and production of referential expressions when prompted by local contexts containing no spatial cues (i.e. ambiguous settings)?

Q1 (study 1): In case of no previous overt localization of the referents, how do signers interpret referentially unanchored pronominal IX signs? (Chapter 3)

Q2: (study 2 - part 1): Do signers follow a default pattern while overtly localizing referents in the signing space? (Chapter 4)

Q3: (study 2 - part 2): What is the type and form of the referent that signers prefer to continue local contexts prompted by sentences with no or reduced localization cues? (Chapter 5)

1.5 Structure of the dissertation

Chapter 2 outlines the theoretical background including a critical discussion of discourse representation theories (DRT) and attention-based theories (i.e. Accessibility Theory, Givenness Hierarchy) of anaphora resolution and production and their application to sign language data in local and global discourse. In addition, this chapter includes discussion of single factors (i.e. first mention preference) that affect comprehension and production of referential expressions. Chapter 3 presents a Referent Selection Task investigating the comprehension of pronominal IX in ambiguous local contexts using a forced choice paradigm. The data tests the hypothesis whether signers of different handedness status rely on localization defaults (i.e. assigning first mentioned referents to their ipsilateral and the second mentioned referents to their contralateral sides as suggested by Steinbach & Onea (2016)) while identifying referents of referentially unanchored IX. Chapter 4 examines the use of overt referent localization defaults in production data using a Sentence Continuation Task of the same population of participants as in Chapter 3. This chapter, presents frequency analysis of two-referent and one-referent localizations via manual and non-manual devices and discusses the consequences of the obtained patterns both within and across sign languages. Chapter 5 looks at the data analyzed in Chapter 4 from the salience perspective, this time analyzing the type of referents (i.e. first mentioned) and the form of referential expressions preferred in the topic/subject position of

continuations and suggesting potential factors affecting such distribution. Chapter 6 provides the summary of the chapters, highlights of the results, discusses the theoretical and methodological implications of those and concludes the dissertation with suggestions for future studies.

2 Theoretical Background

This chapter aims to provide a background on the theories of anaphora resolution and production at the level of utterance applied to sign language data. The specific focus is on pronominal IX, but not limited to it. In the following, the literature on anaphora resolution will be discussed based on the following three-way classification: (i) syntax-based approach, (ii) discourse semantics-based approach and, (iii) salience-based approach. In Section 2.1, a syntax oriented theoretical claim by Geraci (2014), relevant for the spatial defaults of localization and their usage in anaphora resolution, is outlined and critically evaluated. In Section 2.2, applications of discourse representation theory (DRT) by Steinbach & Onea (2016) and Barberà (2012) are presented and discussed with the relevance to the current work. Further, in Section 2.3, salience-based theories of anaphora production and comprehension are presented with a specific focus on their application to sign languages. This section ends with a summary of psycholinguistic studies testing single factors affecting anaphora resolution.

2.1 Syntax-based approach

The account by Geraci (2014) is not primarily concerned with the resolution of pronominal reference but rather focuses on the spatial anchoring of sentential arguments which has implications for pronominal resolution at least at the level of local contexts, and hence is of crucial importance for the present discussion. According to this view the distribution of R-loci in Italian Sign Language (LIS), which is predominantly an SOV language, is determined by sentential arguments (i.e. subject, object) through a process called spatialization which operates parallel to linearization in spoken languages. While

linearization determines the linear order of the arguments, spatialization maps the arguments onto the signing space. These two processes are considered to be algorithms which work hand in hand at the domain between syntax and phonological form (PF).

In particular, syntactic arguments are systematically mapped to specific locations in the signing space. That is, subjects are realized on the ipsilateral side (closer to the dominant hand) and objects on the contralateral side (distant from the dominant hand) of the horizontal dimension (X-axis) of the signing space depending on the handedness of a signer[24]. This mapping is observed to take place in a consistent manner in non-canonical word orders (e.g. topicalization) and this happens irrespective of the phonological properties of the signs (i.e. both with body-anchored and non-body anchored signs). As mentioned before, Geraci focuses on the sentential level and only briefly mentions the cases where pronominal IX signs were directed to areas, overtly or covertly associated with sentential arguments. Consider the example in (4) adapted from Geraci (2014: 129) where in (a) only the object (i.e. MARIA) is overtly assigned to the contralateral side of the signing space, and (b) where IX sign directed to ipsilateral area is associated with the subject of the previous sentence (i.e. PAOLO) even though previously it was not overtly assigned to the space.

[24] Such assignment is considered to be a default in the usage of the abstract space and is claimed to be overridable via interaction with topographic usage of space. Moreover, the pattern of spatializations is shown to be applied not only to the Determiner Phrase (DP) arguments but also to the sentential complements in LIS (Geraci 2014: 130).

(4) a. PAOLO $\text{MARIA}_{\text{contra}}$ LOVE[25]

'Paolo loves Maria.'

b. EVERYDAY $\text{IX-3}_{\text{ipsi}}$ $\text{IX-3}_{\text{contra}}$ $_{\text{ipsi}}\text{CALL}_{\text{contra}}$

'He (Paolo) calls her every day.'

The process of R-loci assignment in LIS is considered to be recursive and required by the visual-gestural modality in the usage of abstract space. However, the universality and conceptual necessity of this assignment remain unclear and it is potentially subject to parametric variation in different dialects of LIS (e.g. signers from Turin area of Italy were observed to use regions on Z-axis rather that X-axis) as well as different sign languages[26]. Moreover, the type/level of the structure to be spatialized (e.g. vP or CP: sentential arguments, or topics) is suggested to be subject to variation as well. Especially the typological variation regarding the usage of the spatial axes and spatial areas assigned to them is of interest here, as it is closely related to the interpretation of pronominal IX in local contexts. Table 2.1 below illustrates typological variation in the usage of spatial areas suggested by Geraci.[27]

[25] Note that the conventions used to indicate lateral areas of the signing space in the examples from Geraci (2014) are adapted to the conventions of this dissertation. In general oppositions in the spatial areas are shown interchangeably as left (L)-right(L) or ipsi(lateral)-contra(lateral).

[26] Even though details of the judgments and scenarios used to elicit data are not provided by Geraci, the author acknowledges inconsistency of the participants' judgments for the spatial pattern.

[27] Ipsilateral side (ipsi) is the area close to the dominant hand of the signer, contralateral side (contra) denotes the area close to the non-dominant hand of a signer on X-axis. Proximate and distant are areas on the Z-axis (proximate: close to the body, distant: further away from the body). ABSL: Al-Sayyid Bedouin Sign Language, ISL: Israeli Sign Language, LSC: Catalan Sign Language.

Table 2.1: (Potential) parametric variation in the usage of spatial areas for spatial mapping of sentential arguments

Spatial axes	**subject**	**object**	**language**
X-axis	ipsi	contra	LIS
	contra	ipsi	--
	ipsi/contra	ipsi/contra	LSC
Z-axis	proximate	distant	ISL & ABSL, Turin dialect of LIS
	distant	proximate	--
	distant/proximate	distant/proximate	--
X-axis and Z axis	ipsi/proximate	contra/distant	--

To recapitulate, Geraci's account suggests that the lateral axis (i.e. X-axis) in LIS is grammatically structured in such a way that subjects are assigned to the ipsilateral and objects to the contralateral area of the signers depending on their handedness. This way, at least for the sentential level, pronominal IX signs directed to one or the other lateral area should be interpreted as subject or object exclusively. Hence in LIS, it is predicted that in hypothetical contexts such as (5a-b) IX_{ipsi} will be identified as subject of the previous sentence, irrespective of its position in the sentence and whether its coreferential referent is overtly localized or not.

(5) a. TOMORROW BOSS COWORKER MEET. IX_{ipsi} TALK WANT.

'Tomorrow the boss meets the coworker. She wants to talk.'

topic

b. TOMORROW COWORKER BOSS MEET. IX_{ipsi} TALK WANT.

'It is the coworker who meets the boss tomorrow. She wants to talk.'

Unfortunately, a formal implementation of the localization pattern in LIS is not developed further and the strength and identifiability of the suggested pattern is admitted to

be subject to variation and overridable by default. This, in a way makes one question its grammatical viability of the observed pattern also given that the details of methodology (the type of materials, participant profile etc.) used to elicit data from the signers are not provided.

To underline the relevance of Geraci's approach once again, it is the resemblance of default pattern observed in LIS to the one proposed for DGS (i.e. subject/first-mentioned referent assigned to the ipsilateral and object/second-mentioned referent assigned to the contralateral side of the signing space) with the difference that for LIS, this pattern was suggested to be primarily determined by syntax.

2.2 Discourse semantics-based approach

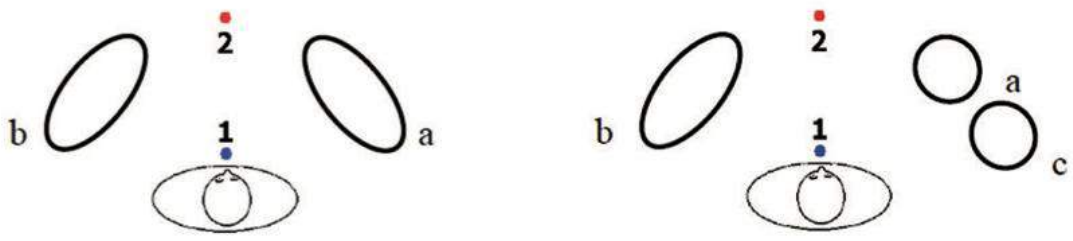
2.2.1 Signing space-oriented view

Steinbach & Onea (2016), henceforth S&O, propose that introduction of discourse referents (DR) in space and resolution of anaphora (i.e. pronominal reference) depend on morphosyntactic principles[28] which govern subdivisions in the horizontal plane of the signing space (H-space). In particular, S&O looking at a small-scale corpus of elicited DGS data (i.e. narrations, interviews, picture descriptions) have observed that the first two DRs 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." (S&O 2016: 421). Hence a pronominal IX directed to the ipsilateral side identifies first-introduced referents and a pronominal IX directed to the contralateral side identifies second-introduced referents. The choice of the default region for the first referent is noted to be

[28] The authors acknowledge the importance of prominence for anaphora resolution but neither elaborate on it nor implement this notion into their theoretical model.

subject to individual differences such as handedness of the signers, place of articulation of the previous sign or register (e.g. in the course of narration, a typical usage of the anaphoric timeline which proceeds from left-to-right might interact with the default assignment of the first referent). Note that, as opposed to Geraci 2014, S&O do not mention the details of the spatialized referents (i.e. grammatical type), but rather only refer to the temporal order of their introduction.

Given these data driven initial observations, S&O suggest that discourse referents are assigned to contrastive regions in the signing space, which can be dynamically and recursively sub-divided into further contrastive areas following the *Principle of Maximal Contrast* with addition of more referents. This is exemplified in Figure 2.1 below from S&O (2016: 517-518). In Figure 2.1 (a), two DRs (i.e. 'a' and 'b') are assigned to maximally contrastive areas while in (b) the third referent is added to the region of the first referent creating further subdivisions (RR and LR). Note that the area assigned to the first referent 'a' is slightly moved to the left with introduction of the third DR 'c' (The numbers in the figure indicate first person (1) and second person (2) interlocutors). According to such spatial structuring, interpretation of pronominal IX signs can be done unambiguously given that each referent is assigned to a unique and distinctive area as the discourse unfolds.



a. Two-way subdivision for two DRs b. Three-way subdivision for three DRs

Figure 2.1: Subdivisions in H-space

In this account, the main claim is that the structuring of the H-space is determined by the abovementioned binary oppositions. This is in contrast to the approaches which assume no further structuring of the H-space, or rather that any region/point in this space can be used for assignment and retrieval of the referents (e.g. Lillo-Martin & Klima 1990; Wilbur 2008). Therefore, R-loci occupy uniquely identifiable spatial regions which can be used for unambiguous identification of the referents (i.e. via pronominal signs) associated with those regions. Assignment of DRs to contrastive R-loci is proposed to be realized via various overt manual and non-manual devices as well as what the authors call *default operations* (i.e. implicit assignment of DRs to R-loci). In the latter, DRs are not overtly assigned to R-loci but can be identified via (non)manual spatial devices (i.e. pronominal IX) (see Chapter 1, Section 1.1.5 for the details). In DGS example (6) below from S & O (2016: 441), FARMER is localized on the ipsilateral (i.e. right side) of the signing space via body lean and slight movement of the head to the same area. However, DONKEY is not initially linked to the spatial area, but it is realized on the contralateral (left) side only via final location of the spatial verb BEAT.

(6) COND FARMER$_{ipsi}$ OWN$_{ipsi}$ DONKEY - IX$_{ipsi}$ BEAT$_{contra}$
'If a farmer owns a donkey, he beats it.'

We tested the psychological reality of the abovementioned default pattern in an event-related potential study using a semantic mismatch design (Wienholz et al. 2018a). In this study, we used constructed sentence sets where the first sentence contained DRs with no localization and the second sentence was either consistent or inconsistent with the sentence initial pronominal IX. Semantic mismatch conditions evoked an N400, which provides supporting evidence for DGS signers to be sensitive to the mismatch and that they make use of a default pattern to assign distinct and contrastive referential locations to DRs. Moreover,

in mismatch conditions contralateral IX sign engendered a Phonological Mismatch Negativity, which was interpreted as participants' sensitivity to violations of semantic or phonological expectations.

To recap, the difference in the treatment of defaults by S&O and by Geraci (2014) distinguishes between the two approaches. The former approach is concerned with capturing the resolution of pronominal IX at the level beyond sentence and the premises of the approach are experimentally confirmed. On the other hand, the latter approach is concerned with the sentence level only and does not provide clear methodological details of the collected data. In terms of the nature of the suggested pattern of referent distribution, S&O propose that it has a discourse-semantic function comparable but not exactly the same with gender in spoken languages. While they do not elaborate on the grammatical or cognitive nature of this pattern, this is currently being addressed by other researchers (Nuhbalaoglu et al. 2016). In the following, I will give a brief summary of the formal analysis developed by S&O as its implications for the data presented in this dissertation will be discussed in Chapter 6.

In order to correctly read the theoretical implementation of S&O, it is important to understand how they model signing space. In particular, the horizontal dimension (H-space) of the signing space is considered as a physical dimension where the signs are realized. Anaphoric space (A-space) is proposed to be an analytical/grammatical dimension which corresponds to underspecified semantic representation of H-space. Crucially, being an abstract dimension, individual differences such as physical right and left as well as handedness and the preferences of signers are ignored at this level of representation. A-space reflects the right-left oppositions created either by (non)manual devices like IX signs or default mechanisms via sequences of binary and potentially recursive distinctive features (i.e. R(ight) and (L)eft). Therefore, each DR is assumed to have its own distinct locus

assigned either overtly or covertly and defined by features R or L. Otherwise the locus can remain non-distinctive for DRs with low level of prominence.

S&O also consider possible the cases where a group of referents can be assigned to one and the same locus. In this approach, R-loci are proposed to be regions in H-space, which constitute linguistic entities (i.e. features), assigned to DRs by Determiner Phrases at the level of syntax and serve the function to disambiguate DRs by assigning them to respective structured divisions in Discourse Representation Structures (DRS). Consider Figure 2.2 below (from S&O 2016: 525) which represents the placement of DRs *x* and *y* in the A-space. In particular, introduction of the first two DRs creates the first default sub-division (i.e. L-R). In Figure 2.2 the regions are partially separated by a vertical line and the scope of this separation is identified by the length of this line. Further, when an additional DR is introduced to the discourse it is assigned to the R region which is now sub-divided as well into two regions (i.e. RL and RR). Moreover, when the RL region is chosen for introduction of more DRs, in this case *x* and *y*, each of those are assigned to contrastive divisions within this area: *x* to the left side (RLL) and *y* to right side (RLR). The crucial aspect here is that the spatial subdivisions are always defined in terms of opposition with the previously assigned referents. The degree of granularity of the spatial subdivisions is suggested to be determined by interaction of grammar and context.

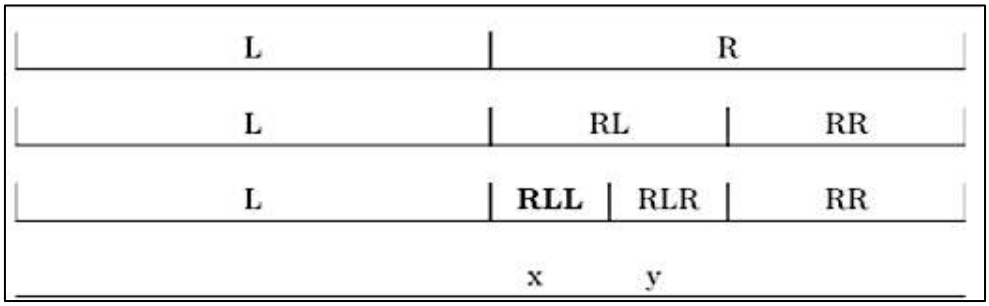


Figure 2.2: Contrastive subdivision of spatial areas used for DR disambiguation

The discourse-semantic theory developed by S&O is a conservative extension of the classical Discourse Representation Theory (DRT, or *dynamic semantics*) developed by Kamp (1981) and Kamp & Reyle (1993). It is proposed with the aim to account for the geometrical properties of the visual modality specific concept – the signing space – used in introduction and tracking of DRs. This account incorporates direct mapping of spatial oppositions in the A-space into DRS. In this section, I will only briefly mention the basic concepts of the theory focusing on the representation of it via graphical *box* notations and not going into the details of its formal semantic language. This is mainly due to the reason that in this dissertation, the aim is to provide empirical evidence for the premises of the theory and suggest some extensions to be implemented in DRS rather than developing a formal implementation to the current version of the theory.

Each of the *box* notations in Figure 2.3 (from S&O 2016: 435) correspond to the mental representations of each sentence received by an addressee, and named as DRS. The upper part of these boxes corresponds to DRs (i.e. *t* and *m*) and the lower part contains the conditions imposed on DRs (i.e. *likes (m, t)*). Crucially, the upper portion of the DRSs, is structured (i.e. Referent Structures: RS) in such a way that it reflects the oppositions created via sequences of R and L features in A-space for respective DRs.[29] This can be seen in the DRS structure formed for the sentence *Maria likes the new teacher,* where the first-mentioned referent M-A-R-I-A being assigned to the ipsilateral (right) area in the signing space is mapped to the subdivision created by feature R. Likewise, the second-mentioned

[29] Note that the structuring of DRs is the most important extension of the theory, however it as well allows for flat/unstructured upper box for the referents, with the implication that a group of referents can be assigned to one locus and crucially that there are no essential differences in terms of truth conditional values they convey.

referent NEW TEACHER being associated with the contralateral (left) area in A-space, is assigned to the leftmost subdivision of the DRS by feature L.[30]

M–A–R–I–A INDEX_R NEW TEACHER INDEX_L LIKE
'Mary likes the new teacher'

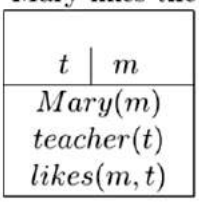


Figure 2.3: The representation of two DRs in DRS

Figure 2.4 (from S&O 2016: 436) shows additional steps of derivation when a following sentence containing IX directed to the contralateral or left side is introduced into the discourse. This phase of the context update contains three stages: *merge, resolution and disambiguation*. The sentence containing pronominal IX (i.e. *She is smart.)* comes with a presupposition (indicated via a dashed box), which includes a variable in the leftmost side of the structure to be resolved. First, the former and the latter DRSs are merged in one. Second, the presupposition containing the pronominal *x* is resolved (both *t* and *x* assigned to the left subdivision of the DRS). Third, DRs of the former and latter sentences (*t* and *x*) are assigned to the same referent, hence reference disambiguation took place. The theory is proposed to be capable of handling an infinite number of sub-divisions of RSs. In addition, this mechanism is suggested to capture cases for overtly as well as covertly localized DRs.

[30] Note that the conventions of representing pronominal IX are used as in the original publication by S&O (i.e. INDEX).

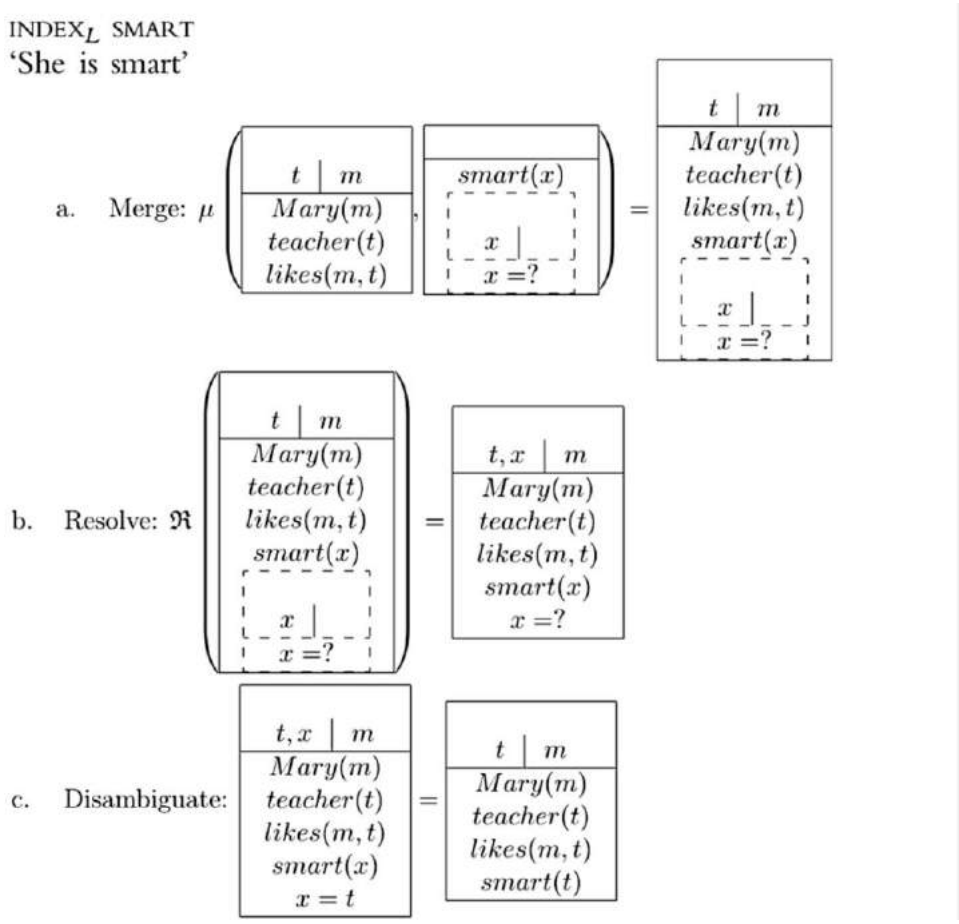


Figure 2.4: Merge, resolution and disambiguation stages of derivation in DRS

The underdeveloped aspects of the theory, which will be relevant for further theoretical discussion and for the course of the dissertation, can be listed as the following:

i. There is no explicit way the theory deals with referential ambiguities. The space is considered to be a basic but weak device (i.e. easily overridable), applying only in default cases. However, the cases where there is no one-to-one mapping between a DR and pronominal IX especially in larger contexts, are not approached at all.

ii. The prominence of DRs is pre-supposed but is not integrated into the model however, this is expected as the main aim of the theory is to come up with the logical possibilities rather than implement those.

iii. The authors talk about context as a crucial factor to determine the subdivisions in space, however they do not provide relevant data from larger contexts to support their theoretical premises. Hence the empirical power of the theory seems to be weak as it only provides either intuitive examples or very basic sentences without a context.

iv. The authors acknowledge the potential of other factors, such as topographic relations or semantic/iconic principles, to govern the distribution of R-loci in the signing space, but they do not discuss how these can interact with contrastive R-loci.

v. The R-L features are proposed to be assigned at the level of syntax, however integration of their recursive nature at the syntax level is not clearly stated.

In the current work I will mainly investigate the proposed default pattern of referent localization (i.e. first-mentioned DR assigned to the ipsilateral and second-mentioned DR to the contralateral spatial area) and the usage of this default in the resolution of pronominal anaphora. The main focus is to examine how the default pattern is used in comprehension and production of pronominal IX, and whether it interacts with or can be overridden by other prominence related factors in minimally controlled local contexts.

The frequency of usage of the spatial opposition in overt localization of DRs will be discussed with support of the data from two sign languages (i.e. DGS and TİD). Hence, the two aspects listed above (ii and iii), which were not elaborated in theoretical the

implementation by S&O, will be addressed in this dissertation, and implications of those on two further aspects (iii, iv) will be discussed in Chapter 6.

2.2.2 Prominence-oriented view

Another account concerning the interpretation of pronominal IX is the one proposed by Barberà (2012). It differs from the abovementioned approaches in analyzing corpus data (i.e. a small-scale corpus) from Catalan Sign language (LSC) and providing empirical data on a global discourse. In this data-driven approach, Barberà proposes that LSC does not make grammatical distinctions on the lateral plane of the signing space. Thus, the association of a referent with the ipsilateral or contralateral side of the signing space does not contribute to its propositional meaning. Therefore, the spatial direction of pronominal IX is suggested not to have any importance for the identification of its referent. The referent is rather associated with an abstract point (p) or a spatial morpheme which is realized via (non)manual markers and discourse related properties, such as discourse topicality, are considered crucial for its identification by pronominal IX. A referent is considered to be the discourse topic when it is in the focus of a current discourse and has the most potentiality to be referred back to and is therefore the most noteworthy and prominent entity (Barberá 2012: 323). Importantly, discourse topicality is suggested to be determined by the interaction of the previous and current context of an utterance.

The implementation of prominence and its assignment in discourse is done via a hybrid model merging Discourse Representation Theory (DRT) (Heim 1982; Kamp & Reyle 1993) and Centering Theory (CT) (Grosz, Weinstein & Joshi 1995; Walker, Joshi & Prince 1998). To understand the following discussion, a brief overview of CT is crucial; This theory offers rules and constraints which are claimed to predict both the most salient/prominent entity in a particular utterance and the form of the referring expression to which the most

salient entity should refer in a coherent discourse segment. In particular, a speaker plans an utterance (U_n) in such a way that this utterance forms a continuity with the previous utterance (U_{n-1}) as well as signaling the likelihood of each entity, i.e. center in (U_n), to be the source of continuity in the following utterance (U_{n+1}).

The main claims of the CT are the following: (i) the entities realized in an utterance (forward looking centers: C_f) are partially ranked according to their salience potential to be referred in the subsequent utterance, (ii) the most highly ranked element in the set of forward looking centers is the preferred center (C_p), (iii) the most salient entity (C_p) is usually the backward-looking center (C_b) of the following utterance and determines the form of C_b as a pronoun or a zero form depending on the language type. According to the CT, discourse entities (C_f) are ranked based on their salience which is determined by a number of universal and language specific factors such as surface order position/order of mention in the sentences, grammatical configuration of the constituents, information structure (i.e. topichood) and thematic roles.

The technicalities of Barberà's hybrid approach will be spelled out only briefly in comparison with S&O's analysis, but will not be developed further as the current work does not focus on connected discourse. The two main differences between the approaches are listed below:

i. DRs or variables are not structured as opposed to S&O's representations which are structured reflecting the divisions in the signing space (see Figure 2.5).
ii. The notion of prominence is integrated into the DRS via topical variables, determined by the assignment of the superindex (see explanation below) to the variables which satisfy the prominence condition spelled with the support of CT. Pronominal IX, irrespective of its spatial direction, is interpreted towards the DR

satisfying a set of pronominal construction rules as well as discourse topicality condition presented in (7). In S&O's account, the notion of prominence is not integrated to the DRT at all.

Given the premises of the CT, Barberá proposed a DR to be linked to a discourse topic of a particular discourse fragment in cases when it verifies the formula (from Barberá 2012:336) in (7) irrespective of the DR's scope. According to this formula, it is the intersection between the backward looking center $DR_b(U_k)$ of the previous discourse and the preferred center of the current utterance $DR_p(U_k)$, that is proposed to characterize DR_p for that specific fragment of the discourse. As prominence is considered to be a dynamic concept the given formula should be satisfied in each of the new fragments of a discourse.

(7) Discourse topicality condition for LSC

$DR_b(U_n)=DR_b(U_{n-1}) \wedge DR_b(U_n)=DR_p(U_n)$

The stretch of discourse (from Barberá 2012: 337) given in (9) is modeled in Figure 2.5 in two steps. First, the initial sentence (i.e. *I will offer the pen-drive to someone, since he/she/his person always works with computers.)* is formed and unstructured DRs (i.e. x, y, z) are represented in the upper part of the DRS. The second step includes integration of pronominal IX occurring in the second and third sentences of (9) (i.e. *I find it very adequate to offer the pen-drive to him/her. And he will be happy and enjoy it a lot.*) into DRS. At this stage, the assignment of the prominence status to these sentences is verified by the formula in (7). Construction rules for pronouns[31] are used and their identity relation with the DRs is

[31] For the details of application and a whole list of these rules the reader is referred to Barberà (2012)

determined. Then the prominence formula in (8), is verified and the variables are assigned some sort of diacritics referred as *superindex* satisfying this condition, (i.e. z and w). As can be seen the most prominent DRs are indicated via little p in the structure of DRS (i.e. Step 2 in Figure 2.5).

(8) Discourse topicality conditions for a stretch of discourse in (9)

a. $[DR_b(U_n)=DR_b(U_{n-1}) \wedge DR_b(U_n)=DR_p(U_n)] \equiv z$

b. $[DR_b(U_n)=DR_b(U_{n-1}) \wedge DR_b(U_n)=DR_p(U_n)] \equiv w$

Importantly the identity relation between variables and DRs is proposed to take place as a coincidence relation in spatial location. But this relation was not found to be sufficient to capture cases where pronominal IX and the respective DR[32] do not have a one-to-one mapping in terms of location. So as opposed to S&O, Barberá's model captures the cases where there is no direct mapping with a DR and pronominal IX.

[32] The cases where pronominal IX is not overtly linked to the spatially anchored antecedent, it is directed to the neutral are in the space or is unaccentuated.

(9) A stretch of discourse containing pronominal expressions in LSC

____eg:ip-l
IX1 1-OFFER-3_{ip-l} ONE PERSON-3_{ip-l} PEN-DRIVE COMPUTER PEN-DRIVE

_____eg:ip-l ____eg:ip-l
1-OFFER-3_{ip-l}, BECAUSE PERSON-3_{ip-l} ALWAYS++ WORK THEME

IS/SAME COMPUTER.

_____eg:ip-l
PEN-DRIVE ADEQUATE IX1 1-OFFER-3_{ip-l} $IX3_{ip-l}$ PEN-DRIVE.

$IX3_{ip-l}$ HAPPY, ENJOY.

'I will offer the pen-drive to someone, since he/she/this person always works with computers. I find it very adequate to offer the pen-drive to him/her. And he will be very happy and enjoy it a lot.'

(P_Obj 00:01)

x, y, z
pen-drive (x)
person (y)
offer (1, x, y)
work-computer (y)

Step 1: Representation of the first sentence in (9)

x, y, z
pen-drive (x)
person (y)
offer (1, x, y)
work-computer (y)
he $(z)^p$
happy (z)
z=y
he $(w)^p$
enjoy (w)
w=y

Step 2: Representation of the second and third sentences in (9)

Figure 2.5: Steps of derivation applied to the discourse in (9)

Coming back to the local contexts with referentially unanchored pronominal IX and given the importance attributed to the prominence by Barberà's view, it can be assumed that in hypothetical cases like (10) the interpretation of IX will depend on the prominence (or salience), (i.e. topicality) of the potential referents irrespective of their overt/covert spatial association. Thus, in case COWORKER is because a topic of the sentences pronominal IX will be identified as this referent.

(10) TOMORROW BOSS COWORKER MEET. $IX_{R/L}$ TALK WANT.

'Tomorrow the boss meets the coworker. She wants to talk.'

However, the question whether topicality is the only determinant of the relative salience of a referent in global and local contexts remains. This issue is approached in Section 2.3. Before ending this section, Table 2.2 provides a comparative overview of the three approaches discussed as their premises will be relevant in the following chapters (Chapter 3-5). These approaches differ with respect to the domain and language of focus, as well as the type and nature of the data examined. Moreover, they diverge in terms of whether the spatial default is attested and relevant for the interpretation of pronominal IX. In the case of its relevance, it is mainly agreed on that the default is easily overridable and subject to variation. Given the different types of analyzed data, the models either take into consideration only the signing space or they consider pragmatics (i.e. prominence) as a necessary condition for production and interpretation of pronominal IX.

Table 2.2: An overview of the syntax- and discourse-semantics-based approaches on resolution of the pronominal IX

	Geraci	**Steinbach & Onea**	**Barberà**
Domain	sentence (local)	utterance (local/global)	utterance (global)
Language of focus	LIS	DGS	LSC
Data analyzed	simplex & complex sentences	narrative data & intuitive examples	corpus data
Relevance of defaults for Interpretation of IX	crucial	crucial	not relevant
Grammatical assignment of ipsi-contra default	syntax	grammar-context interaction	--
Robustness of defaults	subject to variation	subject to variation	--
Relevance of prominence for interpretation of IX	not discussed	mentioned but not integrated	crucial
Theoretical implementation	not developed	(extended) DRT	DRT+CT

The overall picture includes several aspects (listed below). Some of these will be discussed in the following chapters by focusing on local utterance contexts.

i. Comparable data for local and global contexts are needed.
ii. The strength of the spatial defaults is necessary to be tested for comprehension and production (Chapter 3,4).
iii. The factors affecting salience/prominence of referents and hence guiding production of pronominal IX should be identified (Chapter 5).
iv. It is important to determine the interaction of space-related and prominence-related factors governing the interpretation and production of IX.
v. A similar methodology is needed to be used in cross-linguistic studies to allow for a better understanding of the defaults and their interaction with other factors affecting the interpretation of pronominal IX (Chapter 3).
vi. It is crucial to develop a (computational) model which combines all relevant aspects for interpretation of pronominal IX for sign languages.

2.3 Salience-based approach

As shown in the previous section, prominence or salience of the referents, defined in terms of discourse topicality, can be a convention affecting interpretation of pronominal IX in LSC (Barberà 2012). In this section, further factors influencing salience and the theoretical accounts modeling those, with the focus on interpretation and comprehension of referential expressions in sign language data, will be presented.

Salience of an entity is a complex notion and might be influenced by a multitude of linguistic and non-linguistic factors, therefore it is extremely difficult to come up with a single definition describing this concept. In this dissertation I will follow the definition

discussed by Chiarcos, Claus & Grabski (2011:2): "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." It is important to note that the focus here will be specifically on the linguistic salience, and particularly on relative salience of entities in discourse (i.e. DRs) and its relevance for resolving pronominal reference and distribution of referential expressions in discourse (i.e. local contexts)[33].

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 towards the most salient referents in comprehension. However, theories slightly differ with respect to the notions considered to determine salience of the entities. For instance, some accounts consider familiarity/given-new information of a referent (Prince 1981), topicality of a referent (Givón 1984) while others put importance on activation of a referent (Chafe 1994), accessibility of a referent (Ariel 1985; 2001), and givenness of a referent (Gundel, Hedberg & Zacharski 1993) in the memory of the interlocutor as a determinant of the salience and propose hierarchies of degrees of salience.

These accounts are considered as unidimensional as they take only one factor (i.e. familiarity) to characterize salience (Chiarcos, Claus & Grabski 2011). The existing studies on sign languages mainly apply this unidimensional view of salience to account for production (Bel, Ortells & Morgan 2015; Frederiksen & Mayberry 2015; Perniss & Özyürek 2015; Frederiksen & Mayberry 2016) and comprehension of referring expressions (Frederiksen & Mayberry 2016; Wienholz et al. 2018a; Wienholz et al. 2018b; Wienholz et al. 2018b). However, the recent research on spoken language anaphora emphasizes the importance of multidimensional approaches which include a number of factors to play a role

[33] Salience might be determined by discourse relations as well as non-linguistic means, both of which remain beyond the scope of the current discussion.

on anaphora resolution, including forward as well as backward anaphora (i.e. Centering Theory). This finds a considerable amount of support from psycholinguistic research as well (Arnold 1998; Kaiser 2010; Kaiser 2011a). Nevertheless, in sign languages there are only a few studies (e.g. Wulf et al. 2002; McKee et al. 2011) that consider the inclusion of multiple factors effecting the production of anaphora in global discourse.

2.3.1 Accessibility-based approach

Accessibility theory (Ariel 1985; Ariel 1990; Ariel 2001), which includes a procedural analysis of referential expressions, proposes that the form of those expressions indicates various degrees of activation or accessibility in the memory. Hence, the referents are suggested to have unequal activation which is reflected in the use of full or reduced forms of a particular referential expression. That is, fuller forms are observed to be associated with a lower accessibility status in the memory of a perceiver and more reduced forms relate to a higher status. Consider the accessibility hierarchy in Figure 2.6 proposed by Ariel (2001: 31), which shows low accessibility markers on the top and high accessibility markers on the bottom.

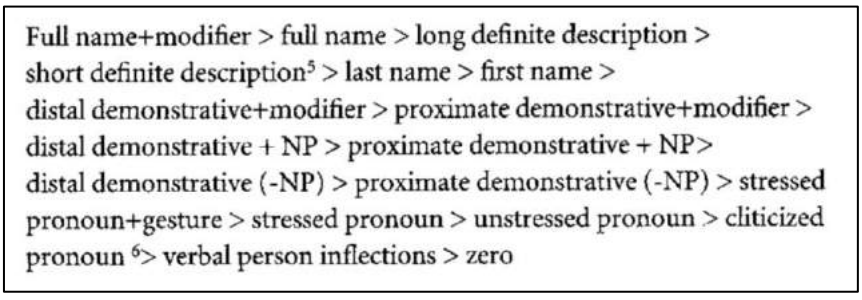


Figure 2.6: Accessibility hierarchy

The existing studies on sign languages on global discourse mainly focus on testing whether Ariel's accessibility hierarchy is applicable to sign language referential expressions.

They propose tentative accessibility hierarchies for particular sets of referential expressions given their occurrence in different referential contexts (i.e. introduction, maintenance and re-introduction). The idea is that certain portions of the discourse contain less accessible information (i.e. introduction) and others (i.e. maintenance) more accessible information regarding the referents in the mind of the addressee (Gullberg 2006). The most relevant aspect of these studies for the current work is their differential results regarding the distribution of overt pronouns (i.e. pronominal IX signs).

Among those studies, Perniss & Özyürek (2015), in their analysis of video vignette retellings, observed higher occurrence of pronominal forms in maintenance contexts than in re-introduction contexts of DGS. For Catalan Sign Language (LSC), Bel et al. (2015) report that L1 signers produced overt pronouns only in 31% of the cases in the maintenance contexts for the stories prompted by silent videos. In general, signers are observed to produce less overt pronouns than the hearing peers or L2 learners of LSC, and the amount of production also varies depending on the type of the elicitation task. In American Sign Language (ASL) data containing retellings of simple picture stories (i.e. only introduction and re-introduction contexts by 8 native signers), Frederiksen & Mayberry (2016) observed only a few cases of pronominal IX (in the maintenance contexts). On the other hand, Czubek (2017), investigated more complex stories in ASL confirming and extending Frederiksen & Mayberry's proposed hierarchy of referential expressions with more deaf native signers (i.e. 19 participants). In addition, Czubek observed more occurrences of pronominal IX signs in personal narratives compared to the retellings of picture stories, which underlines the importance of the genre as well as larger contexts on the distribution of those signs. Given those distributional differences, some of the accessibility hierarchies do include IX in their scale while others do not. Table 2.3 illustrates three different hierarchies suggested for ASL

and LSC for accessibility of referential expressions in discourse. Note that the referential expressions in Table 2.3 are presented as they are given in the original publications.

Table 2.3: Accessibility scales proposed for LSC and ASL

Barberá & Massó (2009): LSC	**Frederiksen & Mayberry (2016): ASL**	**Czubek 2017: ASL (extended)**	**Accessibility**
Full NPs	Nouns	Definite Descriptions	Low ↕ High
Entity and Limb CL	SASSes	Descriptive Classifiers (SASSes)	
Pronouns /verb agreement	Zero anaphora from agreement verbs and constructed action	Indexing (IX)	
Role shift	Zero anaphora from plain verbs	Constructed Action (CA)	
Null arguments	Semantic Classifiers	Null	
--	--	Semantic Classifiers (SCL)	
--	--	Agreement (AGR)	

2.3.2 Givenness-based approach

Givenness Hierarchy (Gundel, Hedberg & Zacharski 1993) is another attention based approach, which finds its application in sign language discourse. It is proposed that a form of a referential expression depends on the cognitive status of a referent assumed by the signer/speaker. In other words, cooperative signers/speakers make predictions about the knowledge and attentional states of their addressees with regard to the discussed entities at a particular moment of discourse. Therefore, a hierarchy of six cognitive statuses is proposed with the claim that each status can be reflected by particular forms of referring expressions (see Figure 2.7 proposed by Gundel, Hedberg & Zacharski (1993: 275) with examples from

English). Crucially, each status is considered a necessary and sufficient condition indicating an appropriate use of referential expressions.

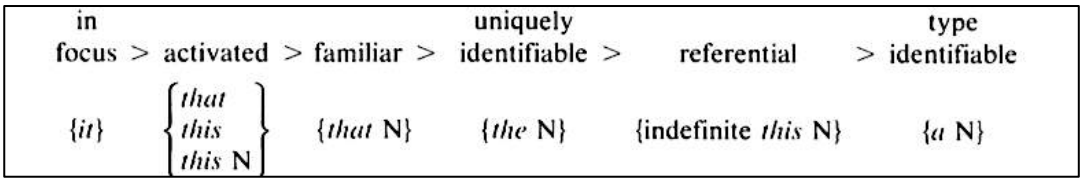


Figure 2.7: Givenness Hierarchy

Swabey (2002; 2011) applied the Givenness Hierarchy to English and ASL narrations of the Frog Stories (Frog Where Are You? (Mayer, 1969 as cited in Swabey 2011)) in a cooperative context, where 8 signers of ASL and 8 speakers of English were telling the stories to a passive interlocutor. Of particular interest here is the cognitive status 'in focus' as it is the center of attention and considered typical for the use of reduced forms such as null and overt pronouns. In fact, a considerable difference was observed between ASL and English for the production of overt pronouns. In ASL only 1% (7/756) of the referents were expressed via overt pronouns (i.e. pronominal IX) while in English 59% (257/435) of the referents in the 'in focus' status were expressed via overt pronouns. These findings provide support for the difference between a spoken and a sign language in terms of the usage of overt pronouns to refer to the highly salient referents.

2.3.3 Multifactorial approach

Multifactorial approach to anaphora production concentrates on global discourse, including different genres and signers from various age, gender and region groups. It is only application was done with the focus to identify whether subject arguments take the form of full or null pronouns while accompanying plain verbs in ASL (Wulf et al. 2002) and both plain and agreement verbs in Australian Sign Language (Auslan) and New Zealand Sign

language (NZSL) (McKee et al. 2011). Both studies found that null pronouns are preferred over overt pronouns, and overt pronouns typically occur in contexts of switch reference or topic change. Moreover, in addition to the pragmatic conditioning a multivariate of factors such as influence of English, person/number, constructed action, age, and gender as well were identified to influence licensing of overt pronouns in the ASL data.

2.3.4 Psycholinguistic studies

Since 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 (Crawley & Stevenson 1990); first mention preference (Carreiras, Gernsbacher & Villa 1995; Gernsbacher & Hargreaves 1988; Järvikivi et al. 2005); thematic role or semantic focusing of the verbs (Miltsakaki 2007; Stevenson, Crawley & Kleinman 1994); implicit causality of the verbs (Hartshorne 2014; Caramazza et al. 1977; Garvey, Caramazza & Yates 1974); type of connective words (Stevenson, Crawley & Kleinman 1994; Stevenson et al. 2000); information structural units such as topic and focus (Arnold 1998; Kaiser 2010; Colonna, Schimke & Hemforth 2012) as well as the interaction of multiple factors (i.e. semantic and syntactic) (Rose 2005).

Investigations of the factors influencing salience of the referents in the context of an anaphora resolution have only been done recently for sign languages by looking at the local utterances. Some of those studies focused on determining the influence of modality independent factors (i.e. first mention effect, verb causality) (Frederiksen & Mayberry 2017; Frederiksen 2018; Wienholz et al. 2018b) while others examined how modality dependent factors (i.e. localization) affect comprehension of pronominal IX and other types of referential items (i.e. bare nouns) (Wienholz et al. 2018a; Wienholz et al. 2018c). The results of these studies which are relevant for the current work are presented below.

Studies on spoken languages revealed that the subject arguments occupy more prominent positions that other sentential arguments, therefore reduced referential expressions are usually observed to refer to the subject of a sentence (Givón 1984; Gordon, Grosz & Gillom 1993; Lambrecht 2000). Other studies showed that it is not only the subjecthood but indeed the initial order of mention which increases the prominence of referential expressions (Gernsbacher & Hargreaves 1988; Carreiras, Gernsbacher & Villa 1995). The effect of the order of mention and/or subjecthood on the production and comprehension of referential expressions was tested for two sign languages (i.e. ASL and DGS), and revealed differing results.

Local contexts were examined in a pilot study on ASL via sentence continuation task focusing on production and comprehension of pronominal IX (Frederiksen & Mayberry 2017). Given the relevance of the local contexts and the design for the current study (Chapter 5), some details of this task are provided already here to set the ground for the further discussion. Frederiksen & Mayberry (2017) investigated whether referentially anchored and unanchored pronominal IX follow structural constraints (i.e. subject preference) in identification of their referents. Therefore, they conducted two tasks: (i) free, and (ii) controlled sentence continuation. The first task contained 96 prompt sentences presented in two conditions either localization or neutral localization (i.e. no localization or localization in the neutral area of the signing space in front of the torso of the signer) of sentential arguments. The second task contained 16 prompt sentences with neutral localization of the arguments followed by sentences starting with referentially unanchored pronominal IX. Four signers of ASL were instructed to watch the videotaped sentences and continue them without any restrictions in the free continuation task while in the controlled setting they were supposed to continue sentences already starting with pronominal IX. The findings for free continuations indicate that when pronominal IX was chosen to continue the prompt sentences

in localization condition it was co-referential with the subjects in slightly more cases (35,27%) when compared to the objects (30,72%)[34]. However, in neutral condition IX was identified to refer to objects more frequently (45,46%) than to subjects (22,55%). In controlled continuations, signers had a slight preference to identify and continue IX initial sentences with the objects (52,12%) than with the subjects (47,88%). Overall, the findings suggest that referentially unanchored pronominal IX signs are more frequently identified to refer to objects than to subjects.

We conducted an event-related potential study examining the presence of a first mention effect during pronoun resolution in DGS in ambiguous contexts (Wienholz et al. 2018b). Therefore, 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. Results show an N400 in the contralateral compared to the ipsilateral condition suggesting increased processing costs for the contralateral IX sign, which refers to the second-mentioned referent. Thus, it was interpreted as supporting evidence for a first mention effect in DGS. Given that DGS signers were shown to follow a right-left default pattern while assigning referents such that the first referent is overtly or covertly associated with the ipsilateral and the second referent with the contralateral area in the signing space (Steinbach & Onea 2016; Wienholz et al. 2018a). Hence, directing a pronoun to one of those sides would identify its referent either as the first or second-mentioned one.

In yet another study, we examined whether overt manual localization increases the prominence and hence the accessibility of a discourse referent and how this interacts with its grammatical role in DGS (Wienholz et al. 2018c). Using eye tracking and a modified

[34] Note that in the free continuation task referential expressions other than pronominal IX (e.g. bare nouns) were produced as well. Those findings will be discussed further in Chapter 5, Section 5.4.

version of the Visual World Paradigm, participants were presented with two pictures representing the discourse referents contained in the stimulus sentence appearing in a video. Each video included short discourses that introduced two discourse referents with varying their overt localization in a first sentence while a subsequent second sentence started with one of the referents, i.e. as a bare noun. Analyzing proportions of target looking using mixed-effects models revealed increased looks to the target referent for conditions containing overt localization of both referents or only localizing the subject. This suggests that overtly localizing a referent indeed enhances its accessibility, but only if the referent occurs in the subject position. Moreover, localization seems to accentuate a referent in a similar way as prosodic focus in spoken languages. Thus, the combined factors of localization and subject preference lead to facilitatory processing of referential expressions co-referential with the focused referent.

To wrap up, the sign language studies that have investigated the factors that influence salience in the production and the comprehension of referential expressions were mainly conducted on well investigated sign languages such as ASL, and were primarily focused on the production of these expressions in different genres of discourse. As mentioned earlier, the effect of one particular convention/factor (i.e. accessibility) on the salience of referential expressions was investigated. In production, the highly accessible referents were observed to be referred to via pronominal IX with varying number depending on the type of a genre and the complexity of the discourse. In comprehension, object preference for ASL while subject/first mention preference for DGS were identified to be the factors influencing interpretation of pronominal IX in controlled local contexts (for an overview, see Table 2.4 below).

Table 2.4: An overview of the factors determining salience of referential expressions proposed in sign language literature

	Single factor			**Multiple factors**
	Accessibility	Givenness	Subject/first mention	Pragmatics, gender etc.
Authors	Barberà & Massó (2009); Bel et al. (2015); Frederiksen & Mayberry (2015, 2016) Czubek (2017)	Swabey (2002; 2011)	Frederiksen & Mayberry (2017); Wienholz et al. (2018a, b, c)	Wulf et al. (2002); McKee et al. (2011)
Domain	global discourse	global discourse	local discourse	global discourse
Language	ASL, BSL, DGS, LSC	ASL	ASL, DGS	Auslan, NZSL
Data	simple & complex narratives	simple narratives	controlled two-sentence utterances	corpus data
Method	elicited production	elicited production	elicited production, EEG, eye tracking	corpus analysis
Influence on production of pronominal IX	varying	--	--	mainly pragmatics
Influence on comprehension of pronominal IX	--	--	object mention in ASL, first mention in DGS	--

3 Resolving Pronominal Reference: A Referent Selection Task

Reference to non-present entities in sign languages can be realized through overt or covert referent-location associations (i.e. localization) in the horizontal plane of the signing space (Lillo-Martin & Klima 1990; Barberà 2012; Perniss 2012). Such associations take place in an arbitrary manner and are used for pronominal reference and they remain constant until restructured in context. Recent analyses have shown that the initial placement of referential locations (R-loci) in space follows a potentially overridable pattern (i.e. spatial default), realization of which may vary 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).

It has been observed in the elicited narrative data that signers of German Sign Language (DGS) prefer the following realization of the spatial default pattern: The first-mentioned referent is overtly or covertly associated with the ipsilateral (right of a signer) side and the second-mentioned one with the contralateral side (left of a signer) of the signing space in case of two discourse referents (Steinbach & Onea 2016). This pattern was tested and confirmed to be used in interpreting reference of referentially unanchored pronominal INDEX (IX) signs in local contexts and only for right-handed DGS signers in an ERP study (Wienholz et al. 2018a). The same pattern was observed for left-handed signers as well in a production task (see Chapter 4, Section 4.3.1 & 4.3.2).

Signers of Turkish Sign Language (TİD) have been observed to differ from signers of DGS in their productions. That is, in cases of two discourse referents, irrespective of their handedness the first-mentioned referent is associated with the left side of signers and the second-mentioned one with the right side of signers (see Chapter 4, Section 4.3.3 & 4.3.4). This raises the question whether signers from diverse backgrounds (e.g. different periods of

sign language acquisition, handedness, region and register styles) within the same language as well as across different sign languages use the same pattern (i.e. spatial default pattern observed in production) robustly for interpreting pronominal IX (see Chapter 2, Section 2.1. for typological suggestion on usage of different axes by Geraci (2014)).

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

The forced choice referent, or the picture selection task, has been frequently used in offline studies on pronoun comprehension in spoken languages (Kaiser 2011b; Hartshorne 2014; Schumacher, Dangl & Uzun 2016). In sign languages, the forced choice design has been applied in studies focusing on sign perception (Emmorey, McCullough & Brentari 2003) or sign recognition (Campbell, Martin & White 1992). To my knowledge, this design was not used before to investigate the comprehension of pronominal IX signs. Therefore, another aim of the present study is to determine whether this offline method is suitable for investigating the interpretation of pronominal IX in sign languages as well as indicating potential advantages and disadvantages of it.

The research questions aimed to be addressed in this chapter are the following:

i. Do the signers exclusively rely on the spatial defaults while interpreting unanchored pronominal IX?

ii. Is there a typological variation in usage of the spatial defaults in comprehension of pronominal IX?

iii. Does handedness of the signers make a difference in comprehension of pronominal IX?

iv. What are the other factors (i.e. covariates) influencing comprehension of pronominal IX?

This chapter is organized as following: Section 1 presents methodology of the study including information on participants, materials, procedure and stages of evaluation. Section 2 includes variable and co-variable based results of the response data. Section 3 summarizes and discusses the results of the current chapter.

3.1 Methodology

3.1.1 Participants

The participants were recruited either through social media or through the contact information given for previous experiments on DGS and TİD. 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 Deaf Community of the respective language and usage of sign language on daily basis, and (iii) being either right-or left-handed (i.e. 5 right-handed and 5 left-handed participants per language).

Even though the age of sign language acquisition is a very important factor influencing comprehension of various structures (Boudreault & Mayberry 2006), it was not possible to achieve this criteria equally for all signers of DGS and TİD[35] (for details of participants' metadata information see Appendix A).

[35] Mainly because the priority aim was getting an equal number of right- and left-handed signers.

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. Among those, nine participants reported to be deaf since birth and one participant from 2 years of age. The age of acquisition varied slightly as well with eight participants having 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 education system of Germany) and some experience with the video camera setting before.

Ten signers of TİD (4 male, 6 female, age range: 18 - 46 years, mean: 29,7 years), all located in Istanbul, took part in this study. Three participants were deaf from birth, three lost their hearing before the age of 3 and four lost their hearing between the ages of 3 and 7 years. All subjects were fluent signers of TİD, however age of acquisition varied. One participant was early learner and acquired TİD at the age of 2 years. The remaining nine signers were late learners, eight of which having learned TİD before the age of 10 and one participant started learning TİD after 10 years old. Only one of the participants had deaf family members whereas the remaining nine were born to hearing families. The participants had secondary school (*Ortaokul* in education system of Turkey) or high school (*Lise* in education system of Turkey) level of education and all have experienced video recordings for various purposes before.

3.1.2 Materials

The stimulus material is composed of eighty pre-recorded mini-narratives (forty items per language) without any additional fillers.[36] Each mini-narrative is composed of two

[36] The actual videos of the stimuli used in this dissertation are stored on the server of the University of Goettingen and can be accessed at any time upon request.

sentences both having SOV word order[37]. The first (i.e. introduction) sentence contains a sentence initial adverb, a subject referent (first-mentioned referent = R1), an object referent (second-mentioned referent=R2) and a verb[38]. The second (i.e. continuation) sentence starts with an IX oriented either towards right (IX_R) or left (IX_L) area of the signing space and is followed by a semantically neutral predicate which equally refers to each of the referents (i.e. TALK WANT in (11a-b)). By using semantically neutral predicate, it is ensured that IX is not interpreted relying on the properties of a predicate (i.e. context pragmatic biases). An example of a mini-narrative from DGS differing only in the direction of IX, can be seen below in (11) and Figure 3.1 (for the complete lists of stimuli see Appendix B[39]).

(11) a. LATER ANNIKA MARKUS MEET. IX_R TALK WANT.

b. LATER ANNIKA MARKUS MEET. IX_L TALK WANT.

'Later Annika meets Markus. S/he wants to talk.'

[37] Note that both DGS and TİD have SOV as their default word order (see Chapter 1, Section 1.2 for details).

[38] The introduction sentences were used as prompt sentences for sentence completion task as well (see Chapter 4, Section 4.1).

[39] By convention in the sign linguistics literature, examples of the stimuli sentences are given in small caps, English glosses and with English translations for both DGS and TİD. When required, the stills extracted from the videos are provided as well (see Appendix A for informants' consents of visual use).

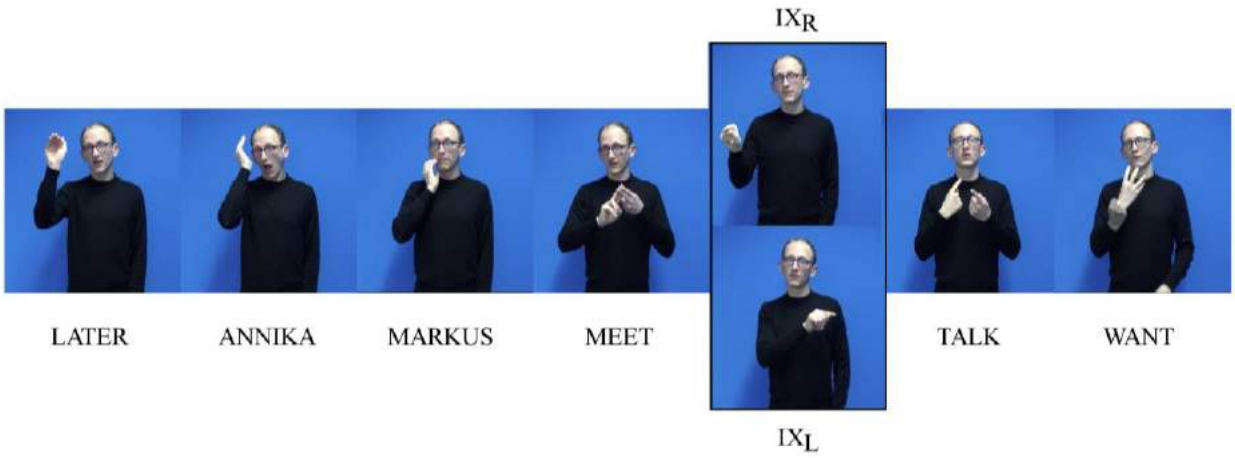


Figure 3.1: Stills of the DGS stimulus sentences

When introduction sentences use time adverbials (e.g. YESTERDAY), in order to situate the sentences in a temporal context, these were judged by DGS and TİD consultants in the pre-testing of stimuli[40] to be more natural than the sentences without time specifications. Each sentence contained one female and one male character, ten characters (5 female and 5 male) in total. These were assigned a proper name (frequent names in German and Turkish societies) and a sign name (same for both sign languages)[41]. A pair of referent signs in each

[40] In two cases, i.e. the sentences connected with the verb know and like, the temporal/manner adverbs were used between the two referents since in the stimuli preparation stage consultants of DGS and TİD agreed on the sentence-medial position to be more natural than the sentence-initial one (see the stimuli list in Appendix B for these examples).

[41] Note that instead of sign names finger spelling of the proper names could be used as well. However, the aim of the task was to investigate the default pattern in the absence of overt localization and as finger spelling of the names typically localize these referents, it was not preferred. Moreover, usage of the bare nouns was avoided as bare nouns can mark both definite and indefinite nouns in DGS and TİD (Özkul 2014; Perniss & Özyürek 2015).

item is combined in such a way that one sign is repeated maximally four times and occurred only once in combination with another one. Each sign name is produced either on the upper or lower part of the head, in one or two-handed manner and accompanied by mouthing of German (for DGS) or Turkish (for TİD) version of the proper name. When signed with one hand all sign names were produced on the ipsilateral (right) side of the informants (see Appendix C for a full list of the proper names and visuals of sign names assigned to the characters).

A set of the sentence final verbs in the introduction contexts comprised twelve verbs used in the previous EEG 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. In addition to those, eight other common verbs were used[42]: INVITE, PICK-UP, WARN, CONGRATULATE, CRITICIZE, HELP, THANK, LOOK-AFTER. Since the main concern of the design was to minimize localization cues, only localization but not semantic properties of the verbs were controlled for. The selected verbs comprise a heterogeneous group, which contain either no spatial marking of the referents (i.e. plain verbs) or citation forms of the verbs (i.e. signed in the neutral area of signing space and on the Z-axis) typically marking their arguments in space (i.e. agreement verbs) [43]. The set of agreement verbs selected for the

[42] By common use, it is meant that these verbs can be found in examples of descriptive grammars of DGS (Happ & Vorkörper, 2006) and TİD (Dikyuva et al. 2017) as well as lecture notes (Bogazici University 2011/12-Winter Semester TİD I- Lecture Notes - Korkmaz; University of Goettingen DGS II - lecture notes - Winter Semester 2014/15-Grin) for teaching these languages at different levels.

[43] Here I follow Carol Padden's (1988) verb categorization according to which the verbs in sign languages come into three classes given their morphosyntactic realization of arguments. In particular, verbs that mark subject and object or only object arguments are named as *agreement verbs*, verbs that mark the locative arguments are referred to as *spatial verbs* and verbs the form of which does not change according to the arguments are *plain verbs*.

stimuli include both forward (e.g. THANK) and backward agreement verbs (e.g. PICK-UP). Additionally, semantically reciprocal verbs (e.g. MEET), which are lexicalized in such a way that localization of one or the other referents is not transparent, were used. See Figure 3.2 representing visuals of each group of the verbs and Table 6 below for a full list of verbs used in the stimuli.

Figure 3.2: An example of verb types used in the stimuli videos of DGS

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[44]. 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. The sentences were recorded in pairs as in (11) and informants were instructed to sign them as natural as possible but reducing non-manuals. They had to take particular care that neither the referents nor the verbs of the introduction sentence are localized in signing space, manually or non-manually.

[44] The aim was to preserve the contexts of the mini-narratives as much as possible. The same verbs were used in TİD, but their spatial category could not be equally preserved given the typological differences between the two sign languages. Hence, HELP (plain verb), GET-to-KNOW (plain verb) and CONGRATULATE (agreement verb) have different spatial category than their DGS counter parts (see Table 3.1).

Table 3.1: Verb types according to their spatial agreement properties in DGS and TİD

spatial verb type	**DGS**	**TİD**
plain	SEARCH, KNOW, WARN, LIKE, GREET, CONGRATULATE	SEARCH, KNOW, WARN, LIKE, HELP, GET-TO-KNOW
reciprocal[45]	KISS, MEET, PLAY, FLIRT, MARRY, GET-TO-KNOW	KISS, MEET, PLAY, FLIRT, MARRY
agreement (forward/single)	SEE, LOOK-AFTER, THANK, CHEEK-KISS	SEE, LOOK-AFTER, THANK, CHEEK-KISS, CONGRATULATE, GREET
agreement (forward/double)	HELP, CRITICIZE	CRITICIZE
(backward/double) agreement	INVITE, PICK-UP	INVITE, PICK-UP

In DGS, all IX signs were produced with a head nod and without any mouthing or mouth gesture that can possibly identify one or the other referent. In TİD, all IX signs were accompanied by mouthing of 3rd person pronoun in spoken Turkish /o/, which is a gender-neutral pronoun (see Section 3.3.5 for further co-variable analysis of non-manuals)[46].

Each stimulus sentence was recorded with one Camcorder Sony HDR-CX550VE, which focused on the informants from frontal view. Video stimuli were digitized with Adobe

[45] Reciprocal verbs are not considered to be plain verbs in a strict sense (e.g. LIKE is a typical plain verb being a body-anchored verb and not localized in space in both TİD and DGS). Nevertheless, in this study these verbs are considered as a sub-group of the plain verbs as they include simultaneous movement of both hands from two lateral sides, and due to such symmetry, it is not clear which referent is localized in which spatial area or whether it is localized at all.

[46] Given that little is known on influence of other potential factors (e.g. coherence relations between the sentences or verb biases), on pronoun resolution in sign languages, the stimuli were not controlled further for those factors.

Premiere Pro (CS36) in the Experimental Sign Language Laboratory at the University of Goettingen.

3.1.3 Procedure

All participants took part in the sentence completion task before doing the current task with a break of around 15 minutes between the tasks and were paid for their participation. For DGS, testing took place in the Experimental Sign Language Laboratory at the University of Goettingen. For TİD, testing took place in different locations: three participants were tested in the Sign Language Laboratory at Bogazici University in Istanbul, 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 participants have filled in metadata and consent forms in written German (for DGS participants) or Turkish (for TİD participants). In addition, all instructions and explanations were provided in the sign language of the participant.

The videos of the stimuli sentences were presented on PowerPoint (Version 16.13.1) slides to DGS participants via a laptop computer connected to a Projector and to TİD participants only on a laptop computer. DGS participants were seated facing the projection surface and TİD participants facing the laptop screen. The stages of stimuli presentation are exemplified below: (1) pre-stimuli: sign name familiarization; (2) stimulus presentation: presentation of video stimulus, and (3) post-stimulus: question regarding identification of IX. As can be seen in Figure 3.3 below, each pre-stimuli slide contained a cartoon picture of a male and a female referent positioned vertically with a video of the corresponding sign name next to each picture. Order of the visuals was manually randomized across trials. The

visuals were positioned on the left side and the videos on the right side of the slide[47]. The reason for positioning the visuals vertically instead of horizontally was to prevent any kind of influence of horizontal positioning of the referents on the way the referents might be interpreted in signing space[48]. Each stimulus slide contained a video number as a title, which was assigned for the ease of further coding and to show participants the progress during the task[49]. Additionally, each post-stimulus slide included a question mark as a title, prompting that a question will be asked in that part of the task.

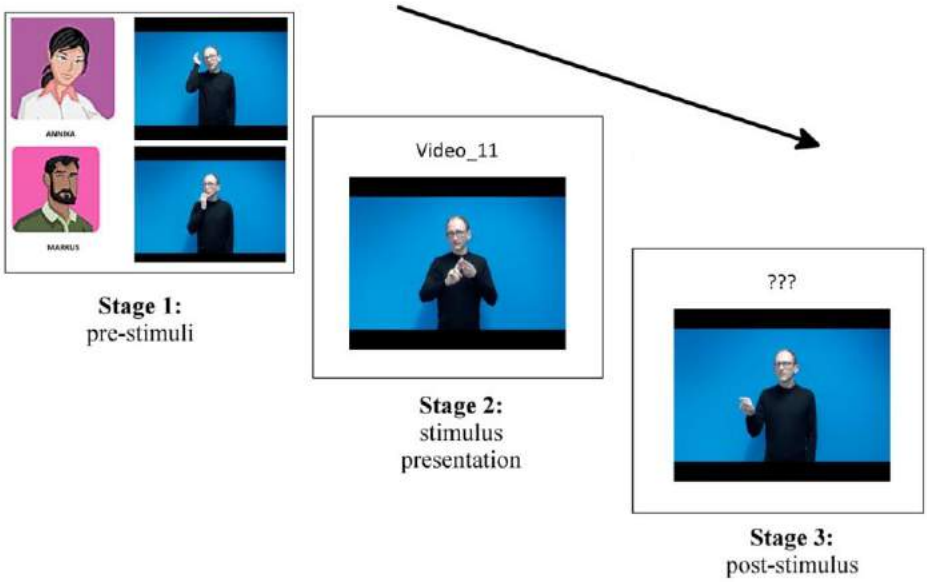


Figure 3.3: The structure of a single trial in Referent Selection Task

[47] Note that the character visuals were drawings (concrete but not familiar from the outer environment), to maximally ensure that signers do not associate them conceptually with some familiar individuals which in turn might influence projection of these referents into the signing space.

[48] I do not exclude the fact that the current positioning of the pictures, can affect their spatial mapping in a different way (i.e. mapping on the Z-axis), however this option must be tested separately.

[49] In the beginning the participants were told that there will be twenty videos and that they will see the number of each video as they progress in the task.

Each trial, as exemplified in Figure 3.3, started with the sign name familiarization where 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, which could be repeated if required, followed by a post-stimulus question. These questions contained an IX pointing either to the right or left area of the signing space followed by an interrogative pronoun WHO (i.e. IX$_{R/L}$ WHO? 'Who is the one on the right/left?'). Thus, at this point participants had to indicate, whom IX is referring to by naming one or the other character. Following each trial, participants were asked about the potential reasons why they chose a specific referent. All answers and explanations were entered on 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 possible suggestions to enhance it.

Stimuli were distributed into two lists each containing twenty mini-narratives, such that the items differing only in the direction of IX, do not occur in the same list. A total duration of DGS videos was 6 min (List 1 mean duration= 9 sec, List 2 mean duration=9 sec), a total duration of TİD videos was 6 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 spatial group and IX signs having the same spatial direction did not 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.

3.2 Data collection and analysis

Responses of all participants (200 per language, total number: 400) were manually entered into the checklists during the task by the experimenter. Afterwards, the responses were transferred to a coding form (see an excerpt from it in Figure 3.4 where '1' corresponds to the choice and '0' to no choice of a particular referent) containing the following categories:

i. individual characteristics of the participants such as participant number (given to participants based on the order of their participation in the task and to anonymize the data), handedness and gender

ii. stimuli item number

iii. (spatial) type of the sentence final verb

iv. direction of pronominal IX

v. type of the referent (selected for the IX in each item)

	participant	handedness	gender	language	item_name	verb	spatial_verb_type	IX_direction	R1	R2	R1R2
2	G01	LH	w	DGS	IXR_marry_DGS	marry	spatial-rec	R	0	1	0
3	G01	LH	w	DGS	IXR_kiss_DGS	kiss	spatial-rec	R	0	1	0
4	G01	LH	w	DGS	IXR_play_DGS	play	spatial-rec	R	0	1	0
5	G01	LH	w	DGS	IXR_meet_DGS	meet	spatial-rec	R	0	1	0
6	G01	LH	w	DGS	IXR_flirt_DGS	flirt	spatial-rec	R	0	1	0
7	G01	LH	w	DGS	IXR_gettoknow_DGS	gettoknow	spatial-rec	R	0	1	0
8	G01	LH	w	DGS	IXR_warn_DGS	warn	plain	R	1	0	0
9	G01	LH	w	DGS	IXL_lookafter_DGS	lookafter	agreement	L	0	1	0
10	G01	LH	w	DGS	IXL_search_DGS	search	plain	L	0	1	0
11	G01	LH	w	DGS	IXR_know_DGS	know	plain	R	0	1	0
12	G01	LH	w	DGS	IXL_congratulate_DGS	congratulate	plain	L	0	1	0
13	G01	LH	w	DGS	IXL_like_DGS	like	plain	L	0	1	0
14	G01	LH	w	DGS	IXL_cheekkiss_DGS	cheekkiss	agreement	L	1	0	0

Figure 3.4: An excerpt from a coding form of participant responses

Out of initially coded 400 responses, one response from DGS and three from TİD were excluded as they contained referent interpretations corresponding to a referent, which was not presented before 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 were instructed to identify IX as one of the previously

introduced two referents; however, in some cases they selected both referents as a group and in these cases this grouping which will be referred to as the plural referents[50]. 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 of the referents (R1R2, i.e. subject and object).

For the analyses, mean percentages as well as frequencies 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, to determine the independence between the variables and participants' responses for each language, descriptive statistics using either Pearson's Chi-Square test (Pearson 1900; Agresti 2007) or, for the cases including occurrences of less than '5' data points, the Fischer's exact test was performed on the actual numbers 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 visually seemed to have importance for the interpretation of the IX.

Further analyses based on covariates (i.e. verb type and non-manual markers) were applied as well. For non-manual based analysis, each stimulus sentence set was annotated by the researcher via ELAN (Version 4.8.1–beta) to determine non-manual markers such as

[50] Note that in the plural choice of referents, participants often had difficulties deciding between the two referents, and had reported that both referents could equally be identified by IX in those contexts. The reports contained answers such as: BOTH or TWO-OF-THEM.

eyebrow raise, mouthing and the mouth gestures freely occurring on R1, R2 and IX[51]. The aim was to check the type of uncontrolled non-manual markers as well as to determine whether these could have any influence on interpretation of IX (see Section 3.3.5).

3.3 Results

The response data were analyzed being grouped according to: (i) language (Section 3.3.1); (ii) spatial direction of IX (Section 3.3.2), and (iii) handedness of the participants (Section 3.3.3). In addition, item analyses based on the spatial type of the verbs (Section 3.3.4) and non-manual markers (Section 3.3.5) of the stimuli were performed. Given that the referents were selected in the closest amount in the contexts of reciprocal verbs, further analyses were performed for this sub-group of verbs according to: (i) spatial direction of IX (Section 3.3.4.1), and (ii) spatial direction of IX and handedness of the participants (Section 3.3.4.2). Non-manual-based analyses focuses on the non-manuals (i.e. eyebrow raise and squint) occurring on the referent and IX signs of the stimuli items.

Analyses examined the frequency of the occurrences of three types of referent selections (i.e. R1, R2 and R1R2) for each language according to the sub-groupings given above and thereby the frequencies of the covariate non-manuals per sign name and per IX were determined respectively.

[51]ELAN is a computer software used for multiple layer annotation of spoken and sign language data, developed by Max Planck Institute for Psycholinguistics, The Language Archive, Nijmegen, The Netherlands: https://tla.mpi.nl/tools/tla-tools/elan/ (Crasborn & Sloetjes 2018)

3.3.1 Results based on language

For a first general overview of selected referents, frequency (with actual numbers and percentages) of referent choices per language were calculated. The data show that referents of IX were not chosen equally often (see Figure 3.5), but rather the second-mentioned referent (R2) was preferred over other referents in both languages (DGS= (67%), TİD= (60%)). Additionally, signers of DGS identified IX as plural (R1R2) referents in higher amount (21%) compared to TİD signers (8%). On the other hand, signers of TİD selected first-mentioned referents (R1) slightly more (32%) than DGS signers (21%).

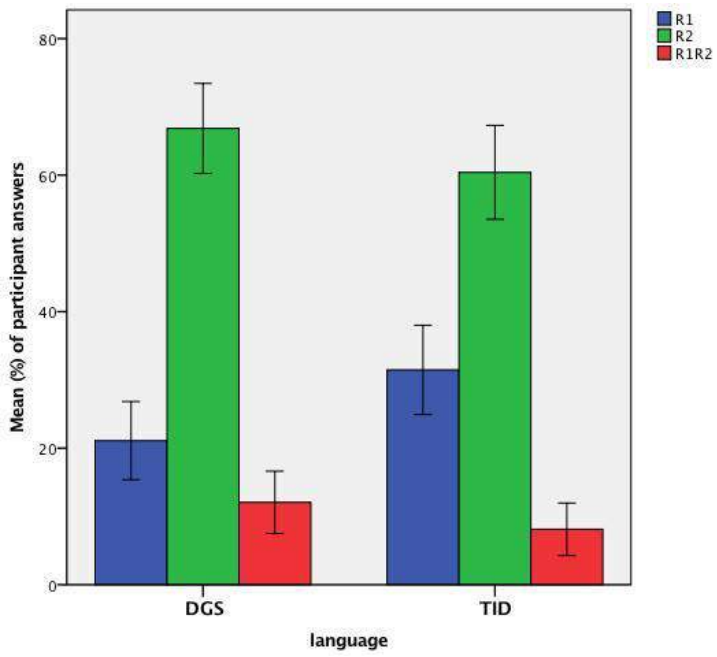


Figure 3.5: Overall proportions of participant responses for DGS and TİD

A Chi-Square test of independence comparing the frequency of referent choices (see Table 3.2) with respect to the two languages, DGS and TİD, revealed the factor language to have a significant influence on the referent choice. X^2 (2, N=396) = 6.21 $p < .05$). Thus, signers of DGS and TİD 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.

Table 3.2: Frequency and percentage of participant responses by referent selections for DGS and TİD

language	R1		R2		R1R2		total #
DGS	42	(21%)	133	(67%)	24	(12%)	199
TİD	62	(32%)	119	(60%)	16	(8%)	197

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 R2 was selected in considerably higher amounts in both languages. 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.

3.3.2 Results based on IX direction

In order to determine whether signers' selection of referents differed according to the spatial direction of IX (i.e. default pattern of covert localization), the response data were split by the direction of IX for each language separately. The frequency of participants' referent choices was calculated for both IX directed to the right (IX_R) and the left (IX_L) side of the informant. R2 was chosen almost equally high for IX_R and IX_L in both languages (see Figure 3.6).

DGS signers tended to identify IX_R (72%) as R2 in slightly higher amounts than IX_L (62%). On the other hand, TİD signers show a reverse pattern with IX_L (67%) being interpreted more as R2 compared to IX_R (54%). As for R1, in DGS IX_L (24%) is identified as R1 in higher amount than IX_R (18%), while in TİD again the reverse pattern is observed with

IX_R (37%) interpreted as R1 more than IX_L (26%). Plural referents are selected the least, irrespective of IX direction in both languages (DGS: IX_R = (10%), IX_L = (14%), TİD: IX_R = (9%), IX_L = (7%)).

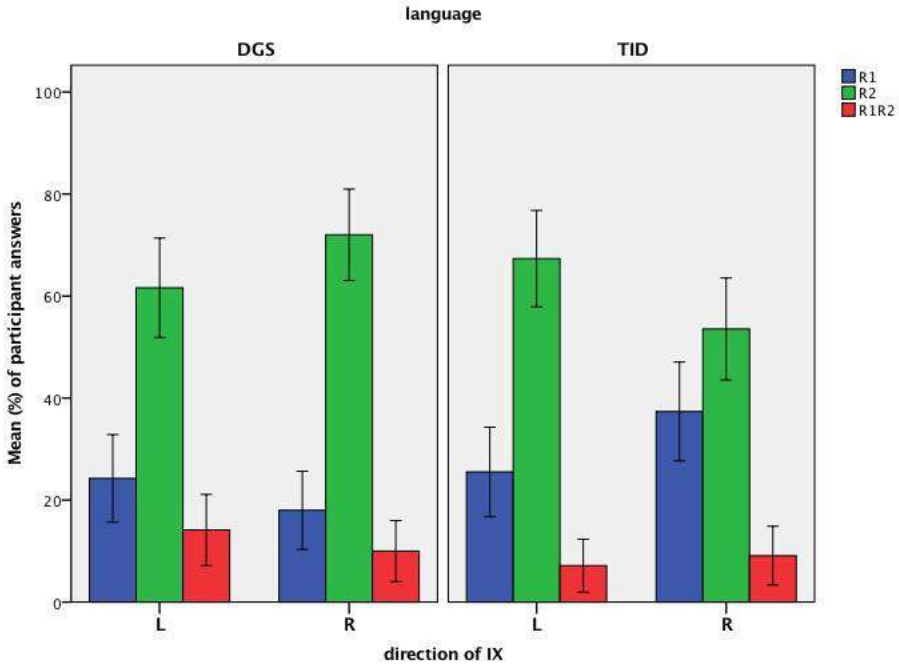


Figure 3.6: Overall proportions of participant responses for DGS (left panel) and TİD (right panel) separated by spatial direction of IX

A Chi-Square test of independence was applied comparing the frequency of referent choices (see Table 3.3) grouped by dependent variable IX direction for DGS and TİD, to determine whether there was a statistical difference between the participant responses[52]. 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

[52] It has to be noted that as the signer population recruited for two languages under investigation is very diverse, the calculations were done separately for each language, instead of collapsing the whole data and looking at the factors and interactions of these factors within a larger sample of responses.

that signers did not interpret pronominal IX signs based on their spatial direction; the spatial default did not seem to play a role in the interpretation of the IX signs.

Table 3.3: Frequency and percentage of participant responses by referent selections and by spatial direction of IX for DGS and TİD

language	**IX direction**	**R1**		**R2**		**R1R2**		**total #**
DGS	IX_R	18	(18%)	72	(72%)	10	(10%)	100
	IX_L	24	(24%)	61	(62%)	14	(14%)	99
TİD	IX_R	37	(7%)	53	(54%)	9	(9%)	99
	IX_L	25	(26%)	66	(67%)	7	(7%)	98

In sum, even though spatial direction was not found to be a statistically significant factor in interpreting IX, visual inspection of Figure 3.6 suggests a slight difference between IX_R and IX_L, which is more visible in TİD compared to DGS. In particular, IX signs directed to the right side in DGS but left side in TİD seem to be identified as the most selected referent (R2). On the contrary, IX signs directed to the left side in DGS but right side in TİD are preferred to be identified as the least selected referents (R1 and R1R2). That is, R2 appears to be the prominent/preferred referent and is associated with a particular spatial region in both languages[53]. Accordingly, there seems to be an asymmetry between DGS and TİD in terms of signers' preferences to identify certain areas in space with prominent referents (i.e. right area vs. left area).

[53] At this point it is difficult to say whether it is the grammatical status or sentential position/recency of R2, which plays a role in its association with a particular spatial area.

3.3.3 Results based on handedness

Response data were further grouped by handedness of the participants for each language, to see whether this factor affects referential choice (see Figure 3.7). In DGS, overall selection of R1 and R2 is higher in left-handers (R1= (23%), R2= (73%)) than in right-handers (R1 = (19%), R2 = (61%)) while the proportion of plural referent selections is higher in right-handers (20%) than in left-handers (4%).

On the other hand, in TİD the proportion of R2 selections is higher in right-handers (65%) than in left-handers (56%), while the selection of both R1 and plural referents is higher in left-handers (R1 = (35%), R1R2 = (9%)) compared to right-handers (R1 = (28%), R1R2 = (7%)) [54].

[54] The abbreviations RH (right-handed) and LH (left-handed) are used to refer to handedness of the signers in this dissertation. RH and LH are conventionally used in neurolinguistics to refer to right and left hemispheres of the brain respectively. The reader familiar with these concepts should keep in mind that in this chapter, the two terms are used to refer exclusively to the handedness of the participants.

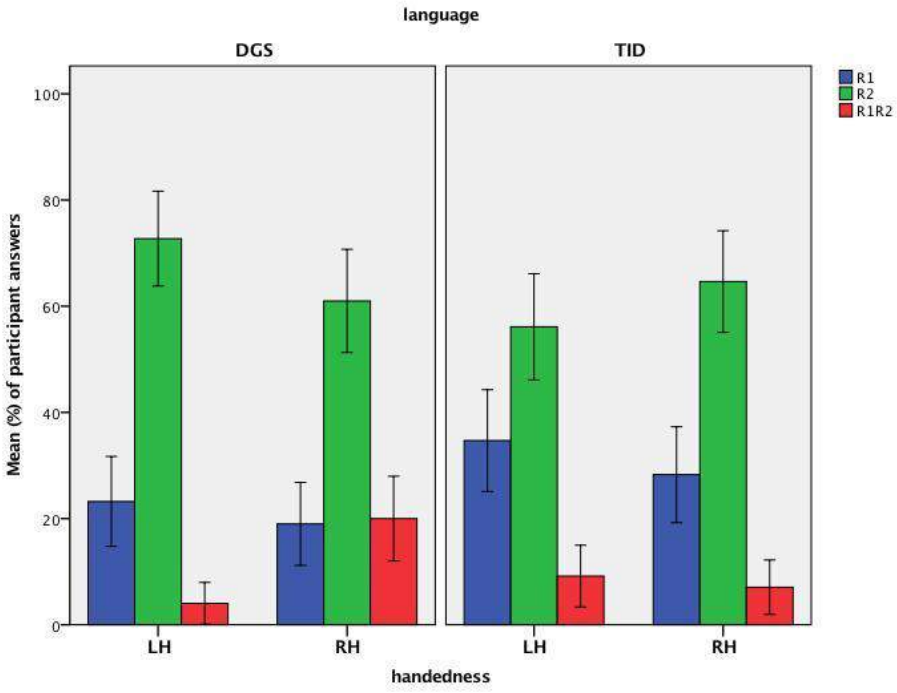


Figure 3.7: Overall proportions of participant responses for DGS (left panel) and TİD (right panel) separated by handedness of the participants presented on the x-axis

To determine whether there was a statistical difference among participant responses, a Fisher's exact test[55] was applied comparing frequency of the referent choices (see Table 3.4) grouped by the independent variable handedness, separately for DGS and TİD. Handedness was found to be a significant factor for selection of the referents in DGS (p= 0.002), but not in TİD (p= 0.46).

[55] The minimum requirement for the Chi-Square test of independence was not met, due to occurrences which had the frequency less than 5 in the data. Therefore, Fisher's exact test, a comparable test which can be performed on the data less than 5 occurrence was applied.

Table 3.4: Frequency and percentage of participant responses by referent selections and by handedness for DGS and TİD

language	handedness	R1		R2		R1R2		total #
DGS	RH	19	(19%)	61	(61%)	20	(20%)	100
	LH	23	(23%)	72	(73%)	4	(4%)	99
TİD	RH	28	(28%)	64	(65%)	7	(7%)	99
	LH	34	(35%)	55	(56%)	9	(9%)	98

These results suggest that handedness of the participants might affect their referent selections differently in two sign languages under investigation. The source of this difference was not possible to identify statistically; however, a visual inspection of Figure 3.7 suggests a reverse pattern for the two languages where right-handers in DGS and left-handers in TİD both select R1 and R2 in closer proportions than their respective left-handed (DGS) and right-handed (TİD) counterparts[56].

To recap the findings so far, signers of both DGS and TİD seem to differ in their selection of referents. Both groups of signers, preferred to select R2 in majority of the cases. The visual inspection suggests that in DGS IX$_R$ and in TİD IX$_L$ identify as the most selected referent (i.e. R2); whereas, in DGS IX$_L$ and in TİD IX$_R$ select R1 and R1R2; therefore the handedness of a signer does appear to play a role in referent selection in DGS, but not in TİD.

As mentioned in Section 3.1.2, the stimuli were not controlled for the type of the final verb as well as for non-manuals in the introduction sentences. However, given an increased amount of R2 choices, it was considered necessary to have a closer look at these two co-

[56] The referent choices were calculated for each handedness group and by the direction of IX for each language as well. None of the groups showed significant or near significant differences in their selections based on the IX direction, the visual inspection of the generated graphs suggested no interesting differences as well.

variables, which potentially might have affected interpretation of IX. Therefore, additional analyses based on the spatial verb type and non-manuals co-occurring with the referent signs as well as IX were performed and are presented in Section 3.3.4 and 3.3.5, respectively.

3.3.4 Results based on verb type

Response data were further grouped according to three types of the verbs occurring in the introduction sentences (see Section 3.1.2). The first group consists of plain verbs, the second group includes a sub-group of plain verbs, i.e. reciprocal verbs. The third group contains agreement verbs of both single and double agreement (forward and backward agreement) type and no further distinctions were done in this group since all sub-groupings show a similar pattern in response data with a high amount of R2 selections (see Table 3.5 for details).

Frequency of participants' referent choices was calculated for each verb type and each language (see Figure 3.8). The findings show that referent choice differed between verb types. Specifically, agreement verbs (DGS: R1 = (24%), R2 = (67%), R1R2= (9%); TİD: R1 = (30%), R2 = (61%), R1R2=8/90 (9%)), plain verbs (DGS: R1= (8%), R2 = (85%), R1R2 = (7%); TİD: R1= (24%), R2 = (74%), R1R2 = (2%), and reciprocal verbs (DGS: R1 = (30%), R2= (48%), R1R2 = (22%); TİD: R1 = (44%), R2 = (42%), R1R2 = (15%)).

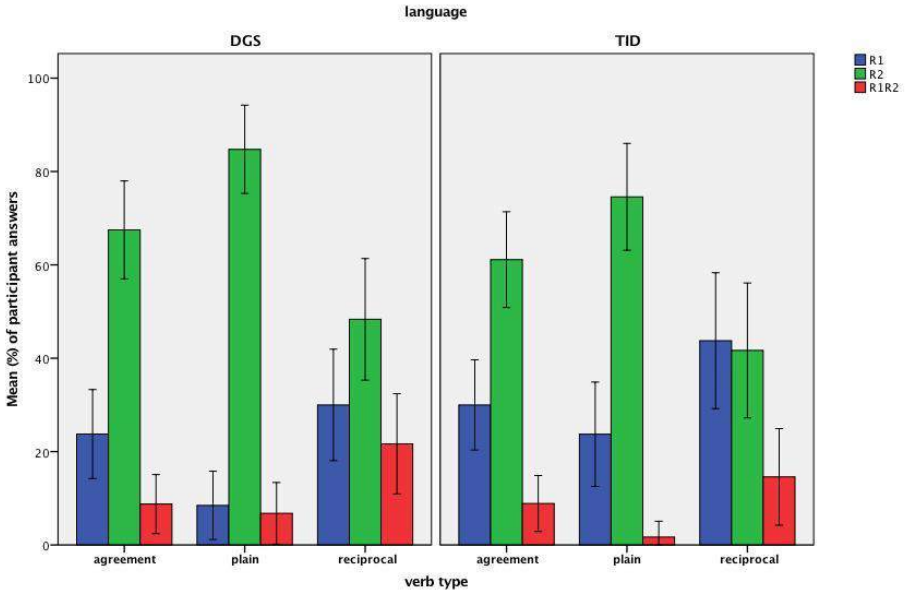


Figure 3.8: Overall proportions of participant responses of referent selections for DGS (left panel) and TİD (right panel) separated by verb type

The significance of the verb type as a factor influencing the referent choice was determined via Chi-Square test of independence applied to the data comparing referent choice frequencies (see Table 3.5) grouped by verb type. Verb type was found to be a significant factor in the choice of referents in both languages (DGS: X^2 (4, N = 199) = 19.5, $p < .05$; TİD: 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.

Table 3.5: Frequency and percentage of participant responses by referent selections and by verb type for DGS and TİD

language	**verb type**	**R1**		**R2**		**R1R2**		**total #**
DGS	agreement	19	(24%)	54	(67%)	7	(9%)	80
	plain	5	(8%)	50	(85%)	4	(7%)	59
	reciprocal	18	(30%)	29	(48%)	13	(22%)	60
TİD	agreement	27	(30%)	55	(61%)	8	(9%)	90
	plain	14	(24%)	44	(74%)	1	(2%)	59
	reciprocal	21	(44%)	20	(42%)	7	(15%)	48

The findings show that the choice of the referents differs depending on the verb type. In particular, R2 was selected the most with plain verbs and secondly with agreement verbs and lastly with reciprocal verbs where the amount of R1 and R2 selections were the closest. Given the picture provided by the verb types, it seems that plain verbs and agreement verbs behave differently than reciprocal verbs in that R2 has been selected more with the former two groups than the latter. Given that R1 and R2 were chosen equally often with reciprocal verbs in both DGS and TİD, a more detailed analysis of this grouping based on the direction of IX and handedness was performed and is presented in the following sections.

3.3.4.1 Results based on reciprocal verbs: IX direction

In order to determine whether signers' selection of referents differed according to the spatial direction of IX occurring in the context of reciprocal verbs, the response data were split by the direction of IX for each language separately. The frequency of referent selections was calculated for both right and left directions of IX per language (see Figure 3.9). Comparing referent selections for IX_R and IX_L in DGS, participants tended to identify IX_R as R2 (R1 = (20%), R2 = (63%), R1R2 = (17%)) and for IX_L they preferred to select R1 and R1R2 (R1 = (40%), R2 = (33%), R1R2 = (27%)). However, the reverse pattern is observed in TİD. Thus, participants preferred to identify IX_R as R1 and R1R2 (R1= (60%), R2 = (20%), R1R2 = (20%)), while they were likely to select R2 for IX_L (R1= (27%), R2 = (65%), R1R2 = (9%)). To recap, in both languages an asymmetry between IX_R and IX_L was observed such that, in DGS IX_R was interpreted as R2 (and R1R2) while IX_L as R1, the reverse pattern has been observed for TİD, IX_R being interpreted as R1 (and R1R2) and IX_L as R2.

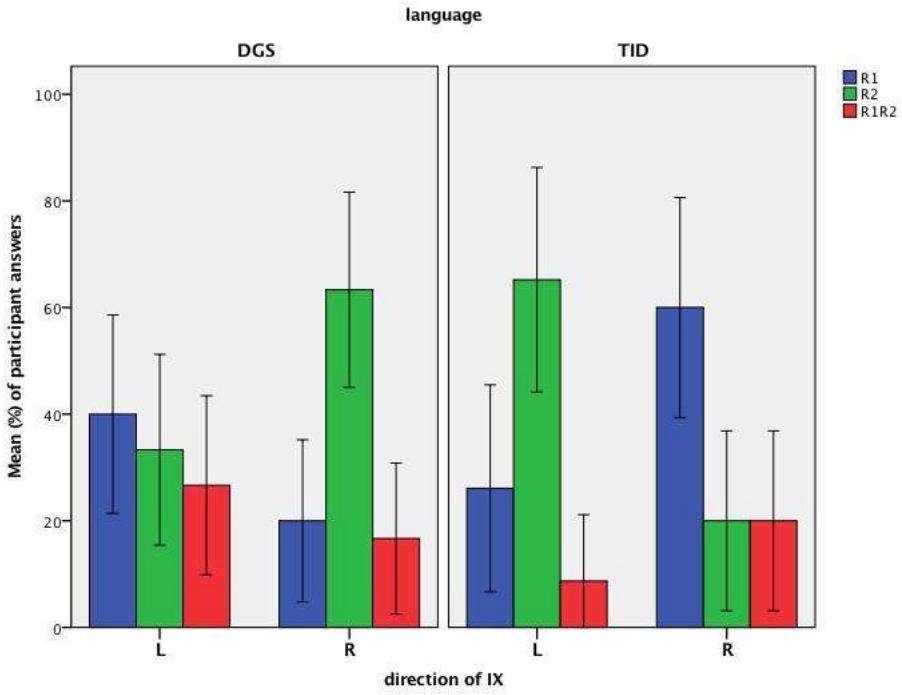


Figure 3.9: Overall proportions of the referent selections for DGS (left panel) and TİD (right panel) separated by spatial direction of IX in the context of reciprocal verbs

A Chi-Square test of independence comparing the frequency of referent choices (see Table 3.6) for IX grouped by the dependent variable IX direction for DGS and TİD, confirmed that frequencies of the referent selections differ by direction of the IX in TİD and differ only marginally for DGS (DGS: X^2 (2, N=60) = 5.48, p > .05; TİD: X^2 (2, N= 48) =10.077, p < .05) in the context of the reciprocal verbs.

Table 3.6: Frequency and percentage of participant responses by referent selections and by spatial direction of IX in the context of reciprocal verbs in DGS and TİD

language	**IX direction**	**R1**		**R2**		**R1R2**		**total #**
DGS	IX_R	6	(20%)	19	(63%)	5	(17%)	30
	IX_L	12	(40%)	10	(33%)	8	(27%)	30
TİD	IX_R	15	(60%)	5	(20%)	5	(20%)	25
	IX_L	6	(27%)	15	(65%)	2	(9%)	23

In sum, looking at the data for a subset of the verbs, i.e. reciprocal verbs, referent selections seem to differ based on the direction of IX. For TİD, there seems to be a preference of selecting R1 for IX_R and R2 for IX_L. On the other hand, DGS shows such an asymmetry as well, but in a less strong manner especially for IX_L where R1 is selected only in a slightly higher amount than other referents.

3.3.4.2 Results based on reciprocal verbs: handedness and IX direction

Selection of referents in the context of reciprocal verbs seem to differ based on the direction of IX and show opposing patterns in DGS and TİD. In this section, the factor handedness is added to the analysis and the data are split according to the handedness of participants. Frequency of participants' referent choices were calculated for both IX_R and IX_L as well as right- and left-handed participants per language (Table 3.7).

In DGS, right-handed signers selected R2 and R1R2 equally often and more 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 TİD, 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 TİD signers showed a similar pattern such that IX_R was identified most as R1 (R1 = (67%), R2 = (8%), R1R2 = (25%)) while IX_L was mainly identified as R2 (R1 = (36%), R2 = (65%), R1R2 = (0%)).

To sum up, TİD signers interpreted IX_R as R1 and IX_L as R2 irrespective of their handedness. On the other hand, left-handed DGS signers showed 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 directions, but only for IX_L. R2 appeared to be selected more than R1R2 while for IX_R the referents other than R1 were selected equally often.

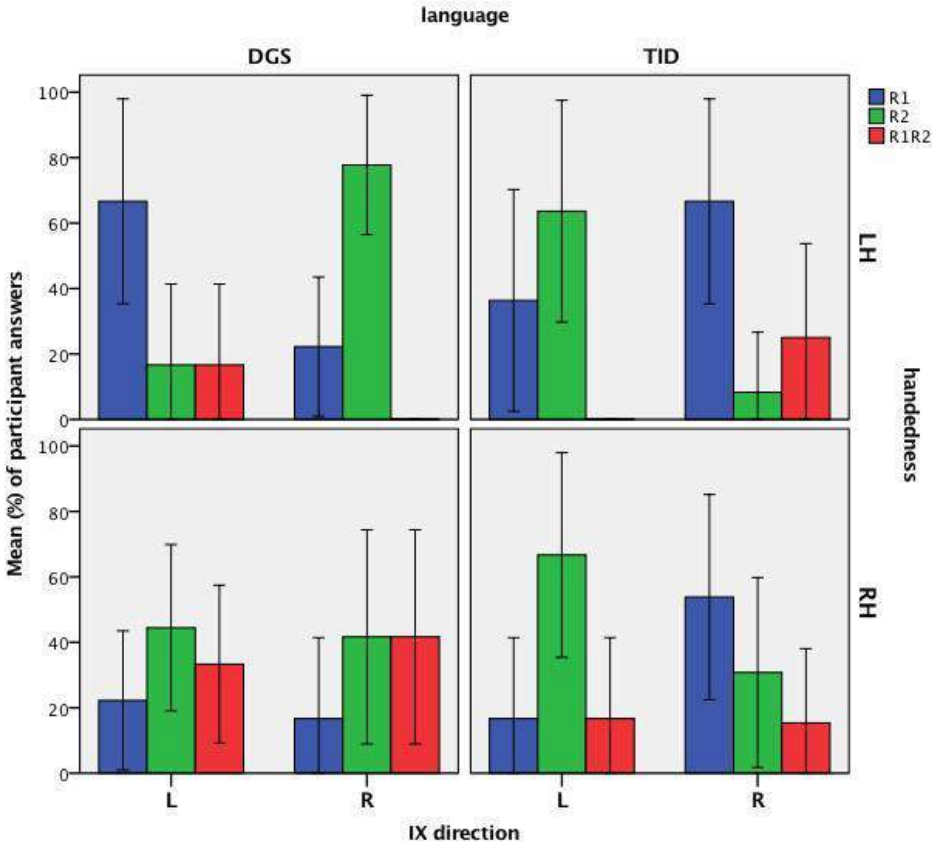


Figure 3.10: Overall proportions of participant responses by referent selections and by spatial direction of IX occurring in the context of reciprocal verbs in DGS and TİD

In order to determine whether spatial direction of IX is a significant factor in the choice of the referents in each sub-group of the data based on handedness, a two-tailored Fisher's Exact test was calculated for frequencies of responses (see Table 3.7). For left-

handed signers, IX was found to be significant factor in referent selection in DGS (p=0.002) and TİD (p=0.007). On the other hand, for right-handed signers, IX was not found to be significant in DGS (p=0.99) or in TİD (p=0.16). Nevertheless, the visual inspection of Figure 3.10 suggests that for right-handed signers of DGS and TİD, there might be a preference for IX_L to be interpreted as R2, and at least for TİD, IX_R seems to be preferred to be selected as R1.

Table 3.7: Frequency and percentage of participant responses by referent selections, IX, spatial direction of IX and by handedness of the participants in the context of reciprocal verbs in DGS and TİD

language	**handedness**	**IX direction**	**R1**		**R2**		**R1R2**		**total #**
DGS	RH	IX_R	2	(17%)	5	(42%)	5	(42%)	12
		IX_L	4	(22%)	8	(44%)	6	(33%)	18
	LH	IX_R	4	(22%)	14	(78%)	0	(0%)	18
		IX_L	8	(67%)	2	(17%)	2	(17%)	12
TİD	RH	IX_R	7	(54%)	4	(31%)	2	(15%)	13
		IX_L	2	(17%)	8	(67%)	2	(12%)	12
	LH	IX_R	8	(67%)	1	(8%)	3	(25%)	12
		IX_L	4	(36%)	7	(64%)	0	(0%)	11

3.3.5 Results based on non-manuals

The examined data turned out to be favoring R2 interpretations and one of the factors triggering this tendency seems to be a covariate verb type (see Section 3.3.4). Another co-variate in the stimuli is the non-manuals co-occurring with referents and IX signs of the same stimulus item. As was mentioned in Section 3.1.2, the aim was to create as natural as possible contexts, hence non-manuals were controlled only minimally (i.e. eye gaze, head and body movements directed towards the signing space). The question then arose whether, and to what extent, the freely occurring non-manuals might have contributed to participants'

tendency to select R2. Therefore, in this part a closer look is taken at the non-manuals in the stimuli sentences with a particular focus on the eyebrow raise and the squint because an eyebrow raise is shown to mark more accessible referents, such as topics (Janzen 1997), while a squint is observed to mark less accessible referents in sign languages (Dachkovsky & Sandler 2009).

It should be noted that this section presents a quantitative analysis that includes a small number of uncontrolled occurrences; I will discuss these in the context of my current analysis. This section also contains some speculative comments which, as they have yet to be tested with a more controlled dataset focusing on the interaction of manual and non-manual markers in the contexts of reference resolution of pronominal IX, must be regarded as conjecture.

The analyses in this section are built on the assumption that co-occurrence of a particular non-manual on one of the referents and IX might create some kind of non-manual co-referential link between the two items leading to a particular interpretation[57]. Item analysis was based on the frequency of occurrences of the non-manuals accompanying the referential expressions (i.e. referent signs and IX) in each of the stimulus sets in addition to the referent selections made for IX and all of these occurrences were calculated for DGS and TİD separately.

For both DGS and TİD, three groupings of interest were determined: (i) co-occurrence of a non-manual on one of the referents and IX; (ii) appearance of a non-manual only on one of the referents; and (iii) appearance of a non-manual only on IX. After

[57] So far literature on sign languages, does not contain explicit information about such kind of visual links and their importance for reference resolution, hence one of the aims of the current section is to open up such aspect for the follow up research.

determining these co-occurrences, the frequency of the referents selected for the IX of each of these items were calculated. This was done in order to see whether any referent in particular was chosen due to the presence of a non-manual marking. For instance, whether R1 or R2 was selected in the cases where eyebrow raise occurred on both a referent and IX of the same items (A full list of non-manual distribution accompanying referential items for each stimuli item per language as well as the frequency of referent selections for each stimuli item are given in the Appendix C). Note that single occurrences of non-manuals, as well as the non-manuals not relevant for the reference resolution (e.g. furrowed brows which occurred due to phonological spreading) but observed in the stimuli, were also included in the list.

For DGS, Table 3.8 shows referent selections for each of the items containing (co)-occurrence of non-manuals shared between one of the referents and IX as well as on either one of the referents and IX, with the frequency and percentage of the most selected referent for IX occurring within that particular item. Eyebrow raise was observed to co-occur with one of referents (i.e. R1) and IX in two of stimuli items (2/40). In six cases, (6/40) eyebrow raise occurred only on R1. There was only one case where IX appeared with eyebrow raise and one case where IX occurred with squint.

To sum up the findings for DGS: (i) it is not clear whether an occurrence of an eyebrow raise on both R1 and IX promotes the interpretation of R2; (ii) an eyebrow raise on R1 does not seem to affect IX to be interpreted as R1 even though it is marked with this non-manual, a typical topic marker; and (iii) a few instances of eyebrow raise and squint on IX do not show evidence for preference of one or the other referent. Additionally, given the unsystematic occurrence of non-manuals, it is not possible to see a clear identification of IX as one or the other referent.

Table 3.8: Frequency of the items containing non-manuals on R1 and IX, R1 only and IX only, in DGS

domain of NMM	**stimuli item name**	**mostly selected referent**	**# of selections**
R1 and IX (ebr)	IXR_warn_dgs	R2	5/3
	IXL_warn_dgs	R1	2/4
R1 only (ebr)	IXR_search_dgs	R2	5/5
	IXL_warn_dgs	R2	5/5
	IXR_congratulate_dgs	R2	5/5
	IXL_congratulate_dgs	R2	5/5
	IXR_like_dgs	R2	5/5
	IXL_like_dgs	R2	5/5
IX only (ebr)	IXR_greet_dgs	R2	4/5
IX only (sq)	IXR_play_dgs	R2	3/5

[a]Each item name corresponds to the video name of the stimuli items, coding the final verb of the first sentence and direction of the IX sign in this item (eyebrow raise = ebr, squint = sq).

In TİD data (see Table 3.9), eyebrow raise was observed to co-occur with R2 and IX in three cases (3/40) of the stimuli items. In a single case (1/40), eyebrow raise occurred only on R2. There were seven cases (7/40) where only IX appeared with eyebrow raise**.** The facts for TİD can be listed as following: (i) it might be the case that occurrence of eyebrow raise on both R2 and IX promotes interpretation of R2; (ii) eyebrow raise on R2 only, might influence IX to be interpreted as R2 but one occurrence does not provide clear evidence; and (iii) in majority of the cases eyebrow raise on IX seems to go hand in hand with this pronoun to be interpreted as R2, but consider items occurring with the verb KISS, in which R1 was preferred. A general speculation might be that in TİD given the class of agreement verbs, an occurrence of an eyebrow raise on R2 and IX, R2 only or IX only might increase the prominence of R2. However, whether this is due to the sole presence of agreement verb or its co-occurrence with eyebrow raise, is yet to be further examined.

Table 3.9: Frequency of the items containing non-manuals on R1 and IX, R1 only and IX only, in TİD

domain of NMM	**stimuli item name**	**mostly selected referent**	**# of selections**
R2 and IX (ebr)	IXR_thank_tid	R2	3/5
	IXR_warn_tid	R2	4/4
	IXL_warn_tid	R2	3/5
R2 only (ebr)	IXL_see_tid	R2	3/5
IX only (ebr)	IXL_criticize_tid	R2	5/5
	IXL_criticize_tid	R2	4/5
	IXL_help_tid	R2	5/5
	IXL_invite_tid	R2	3/5
	IXR_kiss_tid	R1	4/5
	IXL_kiss_tid	R1	5/5
	IXL_lookafter_tid	R2	3/5

[b] Each item name corresponds to the video name of the stimuli items, coding the final verb of the first sentence and direction of the IX sign in this item (eyebrow raise = ebr).

To recap, it is not clear whether non-manual cues occurring on referential items in the stimuli, i.e. eyebrow raise, were used to increase the prominence of the referential items on their own or together with the presence of certain types of verbs. Being used inconsistently and in the context of plain (DGS) and agreement (TİD) verbs, which appeared to promote R2 interpretation, it is not easy to say whether non-manuals fulfilled one or the other purpose or whether they have had an effect on pronominal interpretation in general.

3.4 Discussion

This study examined the impact of the default localization pattern on the interpretation of pronominal IX sign occurring in the local discourse with two potentially competing antecedents using data obtained from right- and left-handed signers of DGS and TİD. When given two newly introduced discourse referents, the right-left default assigns

linearly first one to the right (ipsilateral) and second one to the left (contralateral) area of the signing space (Steinbach & Onea 2016). This pattern was confirmed to be followed in covert localization of the referents and used for comprehension of pronominal IX by the results of the ERP study for right-handed signers of DGS (Wienholz et al. 2018a). Participants' responses (i.e. referent selections) were analyzed for pronominal IX directed to the right or left area in the signing space for the current offline study. Those IX signs were preceded by introduction sentences containing no localization cues.

The response data revealed that: (i) in general, signers of DGS and TİD preferred to identify pronominal IX as second-mentioned referent (R2), (ii) R2 as the most prominent referent was not selected equally for right and left IX direction, but rather there seems to be an asymmetry between the two languages: IX_R in DGS, but IX_L in TİD, was identified mainly as R2, (iii) the preference of R2 to resolve pronominal IX in both languages seems to be influenced by a spatial type of the verb (see Table 3.1) immediately preceding pronominal IX (whereas plain and agreement verbs seem to have caused R2 interpretations), (iv) in the context of reciprocal verbs (e.g. MEET), 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, and (vi) naturally occurring non-manuals on nominal (i.e. sign names) and IX signs in the stimulus material were not observed to contribute to referent identification in both languages.

In the current study, contrary to the findings of previous studies on DGS (Steinbach & Onea 2016; Wienholz et al. 2018a), an influence of spatial defaults on comprehension of IX appeared only in the context of reciprocal verbs and only for left-handed signers. The right-left default was not observed in the right-handed signers of DGS but the reverse of this

pattern was observed in the left-handed signers. That is, R1 was interpreted as assigned to the left (ipsilateral) and R2 as assigned to right (contralateral) side of the signing space. Additionally, a similar pattern was observed for left-handed signers of LIS and was described as an opposing pattern compared to right-handed signers of the same language (Geraci 2014). As for TİD signers the right-left default was observed to be used in referent selection for pronominal IX, irrespective of the handedness status, and again only with reciprocal verbs.

Given these observations, it seems reasonable to describe the default pattern in DGS in terms of the dominant hand used by the signers (i.e. ipsilateral and contralateral or ipsi-contra default). On the other hand, for TİD the characterization should rather be done based on the actual physical areas (i.e. right-left default). Evidence from production data confirms this labeling (see Chapter 4, Section 4.3.5 for realization of overt localization patterns in production of both languages).

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 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 stimulus from the 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 determines 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 (Arık 2013). Given the default pattern they use in production (i.e. left-right) (see Chapter 4, Section 4.3.5) it seems that 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). It must be noted that the Turkish deaf signers are comprised of participants from diverse backgrounds: early learners, and late learners and only one of them had deaf parents (see Appendix A, for the details). 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.[58] To test whether this is the case, a similar task has to be conducted with native deaf signers of TİD as well as deaf late learners and hearing learners of the sign language (i.e. L2 learners of sign language).

The usage of differing perspective taking strategies in the two languages might have been affected by the structure of the stimulus materials used. As was presented in Section 3.1.1, 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

[58] This point was brought to my attention by Caterina Donati (p.c.).

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[59] 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 the 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 certain referents (i.e. prominent) might be associated with a particular area in the signing space (see Section 2.2) and hence the IX directed to that particular area will be interpreted as 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.

[59] Note that the definition of prominence adapted in this texts is that of Chiarcos, Claus & Grabski (2011:2): "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." (see Chapter 2, Section 2.3 for the details).

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 was extensively investigated for spoken languages (Hartshorne 2014; Miltsakaki 2007; Stevenson, Crawley & Kleinman 1994). As for the influence of the verb types on interpretation of the pronominal IX, only one recent study based on 120 responses of each of the 15 ASL signers (Frederiksen 2018), has shown that both neutrally and laterally localized pronouns seem to be interpreted based 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 and then agreement verbs, R1 and R2 choices appeared in similar amount with reciprocal verbs. Analyzing corpus data, McKee, Schembri, McKee, & Johnston (2011) observed that signers of Australian Sign language (Auslan) and New Zeland Sign Language (NZSL) prefer to use overt rather than null subjects with plain and agreement verbs (i.e. single/object agreement verbs). Even though the authors do not articulate it explicitly, these findings might imply that subjects are less salient and potentially that non-subjects (i.e. objects) are more salient in those contexts [60]. This is compatible with the results of the present study, where R2 (i.e. object) selections were preferred with plain and agreement

[60] Object preference for intransitive verbs may indicate ergative morphology of a language, at least for TİD it has been proposed that this language shows both agentive and ergative morphology in its intransitive verbs (Sevinç 2007: 49). However syntactic ergativity does is not necessarily have to occur at the level of discourse even in the typically ergative languages like Dyirbal (Cooreman 1988). Therefore, such claim has to be tested separately for both sentence and utterance levels.

verbs. But this claim must be verified both in local and connected discourse of sign languages.

A possible explanation for the reciprocal verbs rendering no preference for one or the other referent might be that the referents occur on the same accessibility level. However, I do not exclude the possibility that a closer look at the semantics of different reciprocal verbs might reveal differences with respect to the salience of the verbal arguments as well in this class of verbs.

Thus far, the influence of the elements contained in the introduction sentences on the interpretation of IX, (i.e. implicit assignment of the referents and sentence final verb type), was discussed. In addition to this and given that the properties of referential forms have been reported to influence referents' interpretation in spoken languages (Kaiser 2005; Bosch, Katz & Umbach 2007), it is necessary to mention a potential role of the IX itself to contribute to this interpretation. In particular, both DGS and TİD allow for the dropping of their arguments (Happ & Vorköper 2006; Açan 2007). Even though, little is known about the behavior of null arguments in these languages and assuming general principles of accessibility (Ariel 1985; Ariel 2001) it can be said that subjects/R1 being the most salient arguments would be referred via reduced forms (i.e. null pronouns, unaccentuated IX) and less reduced forms (i.e. 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 stand has a 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 (Barberà & Massó 2009; Czubek 2017).

In fact, ASL signers as well showed a slight trend to interpret referentially unanchored pronominal IX signs as object rather than subject of the previous sentences in a

sentence continuation task (Frederiksen & Mayberry 2017). Additionally, pronominal IX in the current stimuli appears very accentuated (i.e. with a head nod and clear pointing to the spatial direction, see Figure 3.1). Therefore, it might be the case that we are confronted 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 to 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 might 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 the reasons of their referent selections after each stimulus, it might be the case that the participants were primed in their referent selections (mainly choosing R2 referents) even though the material was randomized so that verbs from one spatial class did not follow each other [61]. Thus, the signers might have adapted one 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 the disadvantages of the applied study, and because it's a short and easily understandable task, it can be of benefit to investigate referential expressions. 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 (see Chapter 6, Section 6.2 for a general methodological discussion and further suggestions).

[61] It must be noted that even though the participants were asked to indicate reasons to select the antecedents of pronominal IX, most of the time they couldn't provide an answer.

To sum up, this chapter discussed the results of a referent selection task where either the verb type or the default localization pattern (i.e. ipsi-contra for DGS and right-left for TİD) has had an influence on the interpretation of pronominal IX. The next chapter presents a sentence continuation task conducted for DGS and TİD that examines the production of default overt spatial localization patterns of referents in local contexts while looking at the various manual and non-manual localization devices and their connection with the production of referentially anchored and unanchored pronominal IX.

4 Localization in Local Contexts: A Sentence Continuation Task

Reference tracking in sign languages is done by associating a referent to an area in the abstract dimension of the signing space and thus when referring to this area a signer is identifying the previously assigned referent. The question of whether any area in the signing space can be freely assigned to a referent or whether there is a structuring of the signing space that imposes constraints on the spatial distribution of one or more referents is considered in this dissertation. Recent studies on sign languages (DGS, LIS) focusing on the spatial placement of two discourse referents propose that space is used in a particular manner for localizing referents by defaults. Studies on DGS (Steinbach & Onea 2016; Wienholz et al. 2018a) have shown that signers follow a right-left default pattern to overtly or covertly assign referents to the signing space. That is, in the case of two referents, right-handed signers tend to assign the first to the ipsilateral (right) and the second to the contralateral (left) side of the signing space. Chapter 3 has shown that the spatial default of covert localization used for the interpretation of pronominal IX in the context of reciprocal verbs, should be considered as ipsi-contra for DGS and as right-left for TİD signers.

So far, there are no studies that have looked at the default pattern of localization in the production data; these data are the closest we can get to natural language production. Hence, this chapter aims to fill this gap by examining the production of overt localization defaults by investigating whether signers systematically follow a pattern (i.e. right-left or ipsi-contra) for spatial distribution of discourse referents in the signing space. The present task is a qualitative study investigating distribution of overt localization defaults for discourse referents in signing space in elicited production data of DGS and TİD using a sentence continuation (or sentence completion) paradigm. For sentence continuations, participants are typically given prompt sentences which they are asked to complete or

continue. It is a commonly used task to study pronominal reference resolution, especially in psycholinguistic studies on spoken languages (Crawley & Stevenson 1990; Miltsakaki 2007; Kaiser 2010). In sign language research this task was used only recently to investigate anaphora resolution in American Sign Language (ASL) (Frederiksen & Mayberry 2017).

The current study is a semi-controlled task comprised of two consecutive parts; namely, sentence repetition and sentence continuation. The sentence repetition part of the task can be considered as a simple form of a sentence reproduction task (SRT) that is used to investigate the production and processing strategies of signers at the sentence level (Cormier et al. 2012; Hauser et al. 2008; Marshall et al. 2015; Supalla, Hauser & Bavelier 2014; Winston 2013). Typically, the SRT contains sentences of different length and complexity; however, in the present study the sentences are of the same complexity and almost the same length (either 4 or 5 signs each)[62]. The repetition data are comprised of implicit reactions to a stimulus that does not contain any localization. Thus, the null hypothesis is that the signers repeat the stimuli adding spatial modification (i.e. localization) of nominal and/or verbal signs.

In the sentence continuation part of the task, the signers watched the video stimuli and were instructed to sign coherent continuations for these sentences. The aim of this task was to collect free production data containing one or/and two referents localized in the signing space in order to determine the form and spatial preferences of these localizations. The hypothesis is that, in their sentence continuations, participants will produce spatial localization of the referents via different (non)manual means of localization and potentially with varying frequency in comparison to repeated sentences.

[62] A limited number of signs was preferred in order to reduce memory load.

With respect to the realization of the default localization pattern and relying on the findings of the comprehension task (Chapter 3) as well as previous studies on DGS (Steinbach & Onea 2016; Wienholz et al. 2018a), it was expected that signers of DGS will follow an ipsilateral-contralateral pattern depending on their handedness when localizing first- and second-mentioned referents respectively. On the other hand, TİD signers were expected to follow a right-left pattern irrespective of their handedness.[63]

The research questions that underpin the present sentence continuation task are as follows:

i. Do signers assign referents in a particular manner (i.e. following a default pattern) or randomly to referential locations in the signing space?
ii. Is the signing space used in the same way for localization of single referents as well as when two referents are localized?
iii. Does handedness of participants have an influence on the way they use spatial areas for localizing referential expressions?
iv. What are the manual and non-manual localization mechanisms preferred by signers to initially localize referents? Is there a signer variation in these usages?
v. Do the signers of DGS and TİD differ with respect to the aspects listed above (i-iv)?

[63] Note that free observations of TİD data (natural signing or monologues/dialogues on social media) showed that signers frequently use left-right pattern while (non)manually localizing referents in space. Therefore, this option was also among the expected patterns in the production.

4.1 Methodology

4.1.1 Participants

Ten deaf signers of DGS (4 male, 6 female, age range: 26-48 years, mean: 34,4 years) and ten deaf signers of TİD (4 male, 6 female, age range: 18 - 46 years, mean: 29,7 years) took part in this study. Five right-handers and five-left handers for each language. These are the same participants who took part in the referent selection task (see Chapter 3, Section 3.1 for further details).

4.1.2 Materials

The single sentences (i.e. introduction sentences) that were used in the referent selection task (see Chapter 3, Section 3.1.2 for the details) were also used as prompt stimuli for the current task but were presented in a different order. Note that the video stimuli were not cut from the ones created for the referent selection task, but were recorded separately for the current task (see Appendix B for the full list of the stimuli). An example of a prompt sentence extracted from the original video in DGS can be seen in Figure 4.1 below.

'Later Annika meets Markus.'

Figure 4.1: An example of a prompt sentence in DGS

In parallel to the stimuli for the comprehension task (Chapter 3, Section 3.1.2), the stimuli sentences used for this task were first created for DGS before being translated into TİD and finally then checked with a native deaf signer of TİD who is also fluent in DGS. In total, forty stimuli sentences (twenty items per language) were recorded for DGS and TİD with the support of two male deaf native right-handed informants (one for each language), both having professional experience with video recordings for sign language research. DGS stimuli have a total duration of 2,5 minutes (range: 6-9 seconds, mean duration: 8 seconds) while TİD stimuli have a total duration of 2 minutes (range: 5-7 seconds, mean duration: 6 seconds). The role models (i.e. informants) remained motionless for approximately 1,5 seconds at the beginning and at the end of each video to ensure that participants do not miss any important information.

The informants were instructed to sign the sentences as natural as possible but reducing non-manuals. In particular, they had to take care that neither the referents nor the verbs of the introduction (i.e. prompt) sentences were manually or non-manually localized in the signing space. In case of agreement verbs, informants were asked to sign them in the neutral part of the signing space (the area in front of the signer, Z-axis). As with the stimuli material designed for the comprehension task in Chapter 3, each stimulus sentence was recorded with a Camcorder (Sony HDR-CX550VE) that focused on the informants from the frontal view. Video stimuli were digitized with Adobe Premiere Pro (CS36) in the Experimental Sign Language Lab at the University of Goettingen.

4.1.3 Procedure

Procedure and setting of the task were nearly the same as with the referent selection task. In contrast to the referent selection task where participants saw one of the two stimuli lists, all participants saw only one and the same list of the stimulus items in the current task.

The testing session began with an introduction video explaining the procedure of the task with two relevant examples containing sample sentence continuations (i.e. one began with the sign names accompanied by IX sign and the other began with pronominal IX). In addition, participants were asked to watch and tryout two practice items. After the participants completed watching the explanation videos and were confident with the upcoming procedure, the actual task began.

Each trial (Figure 4.2), which had structure exactly the same structure as with the Referent Selection Task (for details see Chapter 3, Section 3.1.3), began with the sign name familiarization where participants saw videos of the sign names with the corresponding pictures of the cartoon characters used in the following prompt sentences to ensure their understanding of the sign names. Then the prompt was presented, which could be repeated multiple times if required, followed by a post-stimulus question. These questions contained a question phrase (i.e. CONTINUE HOW?) reminding the participants to sign continuations of the sentences they had just seen. Thus, the participants had to repeat the prompt sentences precisely and come up with self-created continuations (mini stories) prompted by these sentences. The continuations were supposed to be about one of the characters in the immediately preceding prompt sentence.

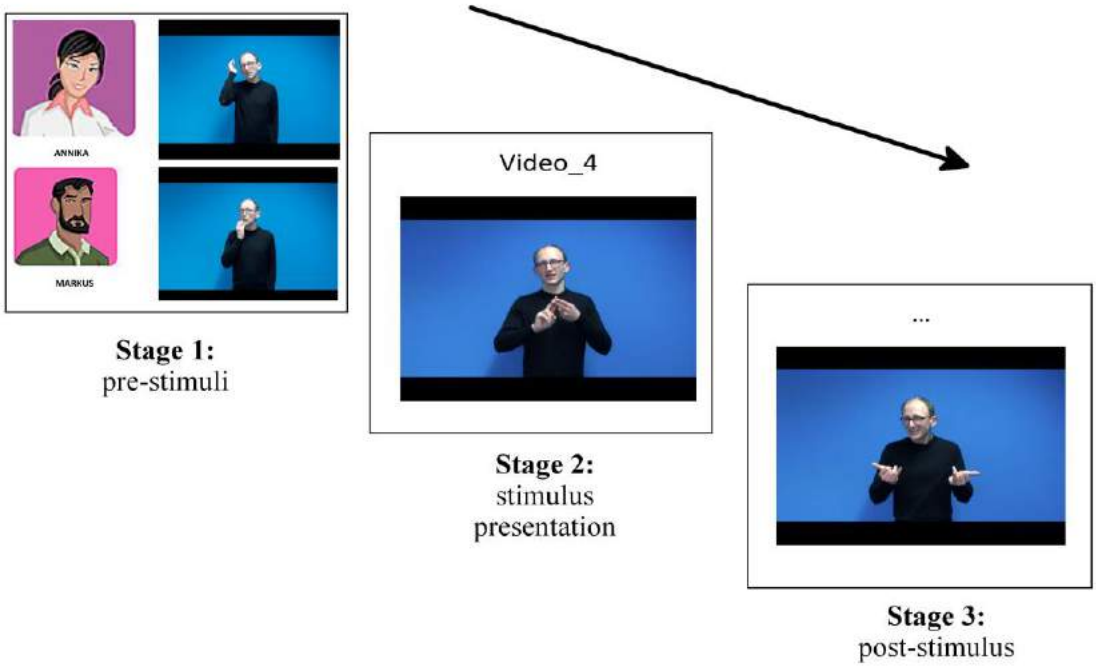


Figure 4.2: The structure of a single trial with the stages of the stimuli presentation

The signers were given 1-2 minutes time to come up with their continuations and were not restricted in their choice of referring expressions or setting the frame of their mini-stories. In case they had difficulties in finding continuations, neutral key words (i.e. not connected to one or the other character) were provided as a cue by the researcher. Then the next prompt sentence was presented and after each five stimuli participants were given an opportunity to have a short break of 1-2 minutes. The participants were seated and signed their productions to the camera, capturing them from the frontal side. They were informed that the data will be analyzed by hearing and deaf researchers. The whole session was video recorded and had an approximate duration of 20-30 minutes depending on the time participants took for watching the videos, breaks, thinking and signing the continuations. At the end of the recording session participants were asked for their feedback on the task and their comments were entered manually into a checklist by the researcher.

4.2 Evaluation

For analysis, production data were first manually annotated using ELAN. Each mini-narrative was annotated on a separate ELAN file (eaf. file). In total, 398 ELAN files were used (20 files per participant) for 20 participants. One mini-narrative was excluded from the analysis of each language due to bad recording quality (199 mini-narratives per language, total number: 398). DGS narrations contain 37 minutes of video data (range: 7-21 seconds, mean duration: 11 seconds) including a total amount of 2281 glosses and 454 sentences. TİD videos have a total duration of 32 minutes (range: 6-20 seconds, mean duration: 10 seconds) with identified 1885 glosses and 491 sentences. A hearing professional interpreter annotated DGS production data, while the TİD data were annotated by the researcher, i.e. myself. Annotated sentences were double checked with native signers of DGS and TİD at various stages of annotation and coding. Afterwards, these annotations were transferred to excel files and further coded according to the determined categories. Further coding of the data was performed separately for repeated prompt sentences (i.e. introduction contexts) and for continuation contexts (i.e. free productions of the narrations).

In particular, each production of an introduction sentence was compared to each of the prompt sentence[64] gloss-by-gloss. Any manual or non-manual deviation from the stimulus was identified as a mismatch. Matches were coded with 1, and mismatches with 0. The utterances, which included a mismatch, were further categorized according to the type of this mismatch. Among those deviations, only manual and non-manual localizations that

[64] As was already mentioned in Section 4.1.2, the prompt sentences were controlled only for the non-manuals which might potentially localize the referents.

were not present in the stimuli were considered for the analysis.[65] Eventually, the categories given below were coded for each of first-mentioned referent (subject, R1), second-mentioned referent (object, R2) and the sentence final verb to evaluate the current task.

R1 coding

- spatial side of R1 localization (e.g. ipsi, contra or neutral)[66]
- manual localization devices of R1 (e.g. IX sign)
- non-manual localization devices of R1[67] (e.g. body leans)

R2 coding

- spatial side of R2 localization
- manual localization devices of R2
- non-manual localization devices of R2

Sentence final verb cording

- spatial side of localization of sentence final verb (e.g. ipsi)
- type of the referent(s) marked via verb localization (e.g. R1, R2 or both).
- localizing non-manuals accompanying final verb (e.g. eye gaze)

[65] It is a common practice to do such coding with multiple coders/raters and then compared those using interrater reliability tests. However, given the time limitations for the current study and unavailability of coders competent in both sign languages, such comparison was not done for the current task.

[66] Initially right and left were used for coding the spatial areas but for the ease of analysis and presentation of the data ipsilateral (ipsi) and contralateral (contra) were chosen.

[67] Note that initially all of the non-manuals were coded but only the localizing ones (i.e. directional body leans) will be focused on here.

As for the continuation contexts, they contained either one or more sentences (DGS: range: 1-4 sentences, mean: 2 sentences; TİD: range: 2-7 sentences, mean: 2 sentences). For the current evaluation, the focus was only on determining the first localization of the referents in these contexts[68]. More specifically, the spatial area and localization mechanism (i.e. manual and non-manual) were identified for referents introduced in the prompt sentences.

For analysis, two types of referent localizations were investigated in order to identify their default spatial distribution: (i) one referent localization, and (ii) two-referent localization (i.e. occurrences where both of the referents were localized). These were identified looking at two domains: (i) only introduction sentences, and (ii) each of the mini-narratives (i.e. introduction and continuation). Frequency distribution for these contexts were calculated using the statistical software SPSS.

Stimuli prompt sentences as well as elicited production data were digitized and annotated using ELAN (version 5.1). In total, seven linguistic (i.e. three parent and four daughter) tiers and one non-linguistic tier were used for annotations of the data (see dependency relations in Figure 4.5).

For the annotation of the prompt sentences, the same tiers used for the production data (see Figure 4.3) were used except for the linguistic tier CR that indicates the type of coherence relation because it was deemed irrelevant for single sentences (see Figure 4.4). The localization tier was used for the ease of transforming and comparing the stimulus with the production data, even though localization was controlled for in the prompt sentences.

[68] Continuation contexts (especially the first sentences following the repeated prompts) were coded for further aspects such as forms of referring expressions, connectives, and discourse relations among other categories. These are further discussed in Chapter 5.

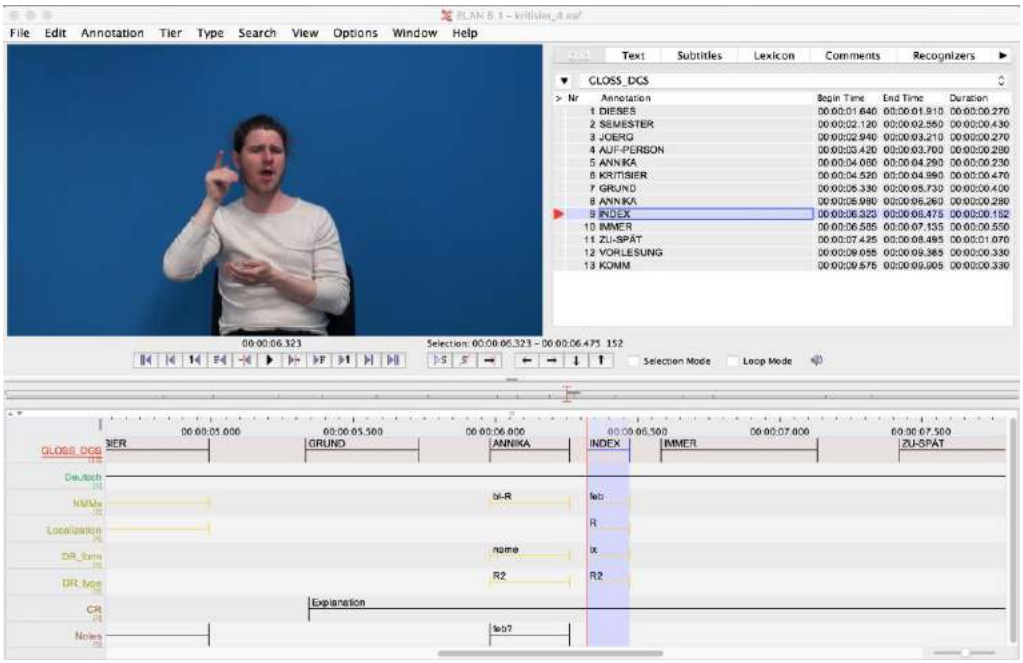


Figure 4.3: A screenshot of an ELAN annotated mini-narrative (DGS)

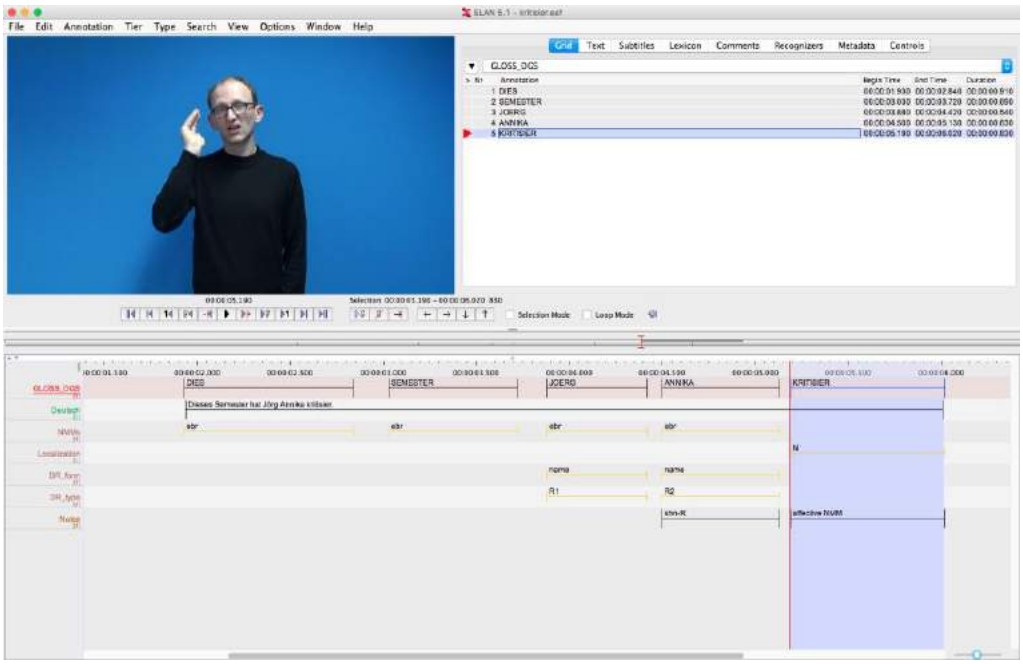


Figure 4.4: A screenshot of an ELAN annotated prompt sentence (DGS)

The properties of the tiers used in ELAN annotations and represented in the screenshots in Figures 4.3 and 4.4 can be listed as following:

1. **GLOSS_DGS/TİD:** a parent tier used to indicate approximate translations of the signs for DGS in German and for TİD in Turkish glosses. Note that these are different from ID-glosses, which are consistent labels used to tag the signs irrespective of their contextual meaning (Johnston 2008) typically used for annotation of corpus data in sign languages (i.e. Auslan Corpus: http://new.auslan.org.au/about/archive/)
2. **Deutsch/Türkçe:** a parent tier used for German translations of DGS (Deutsch), and Turkish translations of TİD (Türkçe). Translations were done utterance by utterance and were not meant to be exact. This tier was considered necessary especially for the researcher (who is a non-native signer of both sign languages) to help understanding the signed sentences, specifically in terms of the referential relations they contain.
3. **NMMs**: a daughter tier used to identify non-manuals accompanying the referents and verbs in introduction and continuation sentences. The primary aim to use this tier was to identify the localizing non-manuals (e.g. directional eye gaze) accompanying referents and verbs. However, given that little is known about the role of non-manuals in referential chain formations, non-localizing non-manuals (e.g. eyebrow raise) were also annotated on referents and verb signs.
4. **Localization:** a daughter tier used to mark spatial location of the referents and verbal elements as well as other items (e.g. adjectives), which included spatial localization. Three main spatial divisions: Right (R), Left (L) and Neutral (N) as

well as proximate (p) and distant (d) within each main sub-division, all from the signers' perspective, were coded[69].

5. **DR_form:** a daughter tier created to determine linguistic form (e.g. noun, pronominal IX, zero form) of the each referring items both in introduction and continuation sentences. Note that, given the nature of free production data, these categories were not pre-defined but rather determined in the course of annotation.
6. **DR_type:** a daughter tier formed to determine the type of the referent based on the order of its introduction to the mini-discourse. Namely, the first- mentioned referent (R1 or subject), the second-mentioned referent (R2 or object), plural referents (R1 and R2 (R1R2)), and another referent (R3) which is different than the ones mentioned in the introduction sentences.
7. **CR:** a parent tier used to identify the type of coherence relation between an introduction and the first sentence of continuation. In particular, a three-way categorization proposed by Kehler (2002) was used to identify these relations Resemblance (Parallel, Contrast, Exemplification, Generalization, Exception, Elaboration) Cause-Effect (Result, Explanation, Violated Expectation, Denial of Preventer) and Contiguity (Occasion). This tier was used in order to determine the type of the coherence relation mostly preferred in the local contexts with the aim to determine an effect of the discourse relation on the salience of the referents[70].

[69] Note that for the ease of evaluation and presentation the spatial areas were eventually recoded as ipsilateral (right for right-handed and left for left-handed signers) and contralateral (left for right-handed and right for left-handed signers), and proximate-distant distinctions are not considered relevant for the current analysis.

[70] This tier will be relevant for the analysis in Chapter 5.

8. **Notes:** a non-linguistic parent tier used to include additional remarks and questions (e.g. comments on the functions of non-manuals on referential items) regarding the annotations. It was considered useful for the further analysis of the data, especially for the production because it needed to be discussed further with native signers in terms of form and meaning.

The four daughter tiers mentioned above were assigned a particular dependency relation with respect to the parent tier GLOSS (i.e. symbolic association of NMMs, Localization, DR_form and DR_type tiers to the parent GLOSS tier, see Figure 4.5). In other words, the four daughter tiers were synchronized dependent on the GLOSS tier. Such relation was mainly preferred for a strict alignment of these tiers and for the ease of gloss-by-gloss comparison of the produced sentences with prompt sentences in the excel files.

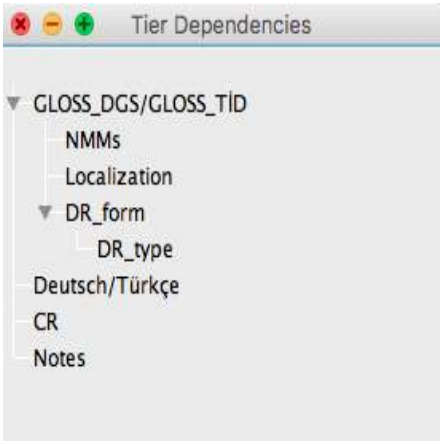


Figure 4.5: Dependency relations of the tiers used for ELAN annotations

4.3 Results

Elicited production data are examined looking at the first association (i.e. localization) of the referents to the signing space based on the side of the active hand. That is, ipsilateral or ipsi (right for right-handed and left for the left-handed signers) and

contralateral or contra (left for right-handed and right for the left-handed signers). These associations are determined for repetition contexts (i.e. repetitions of the prompt sentences) and each of the local contexts (i.e. repetition/introduction and continuation sentences). Results for DGS and TİD are presented and discussed separately for each of these contexts.

Sentence repetition data are analyzed according to the absence or presence of manual and non-manual localization of the referents to the signing space[71]. Specifically, in the cases of referent localization frequency of occurrence (i.e. with actual numbers) of these localizations by spatial area (i.e. ipsilateral, contralateral) is determined and further split according to: (i) handedness, and (ii) participants.

Local contexts (i.e. mini-narratives) are analyzed according to: (i) localization of both referents (i.e. two-referent localization) based on the order of their initial localization, and (ii) localization of single referents (i.e. one-referent localization). These are further grouped by:

- context of localization,
- (non)manual localization mechanisms,
- spatial area of localization,
- spatial area of localization by handedness, and
- spatial area of localization by participants

[71] This is different from a typical analysis of repetition data which is done either for accuracy or error rate (Hauser et al. 2008; Supalla, Hauser & Bavelier 2014; Marshall et al. 2015).

4.3.1 Sentence Repetition Results for DGS

In order to show whether the signers diverged in localization of the nominal signs from the prompt sentences which they repeated, manual and non-manual localization of these signs are determined according to the spatial area referents were associated with. The participants are grouped according to their handedness status because they use the side of their dominant hand, i.e. right side for right-handers and left side for left-handers, as the dominant spatial area during sign production. Moreover, in order to detect whether the patterns were produced equally often, localizations are analysed separately for each of the participants.

In repetition data containing a total of 199 sentences, 70 instances of manual localization of the referents were detected. In the remaining cases participants' localizations matched the prompt sentences. Among produced localizations, 14 include localization via manual particle (i.e. IX, PAM (person agreement marker)) and IX-DUAL (3rd person plural exclusive pronoun) and 56 cases contain localization via verbs (i.e. spatial modification of the agreement verbs).

As is illustrated in Table 4.1, 5 out of 10 participants (i.e. G01, G02, G04, G07 and G10) produced manual localization via particles. Among those, PAM appeared in the most (8/14) and in IX the least of the cases (2/14)[72]. R2 was localized via IX and PAM, both referents as a group (R1R2) were localized via IX-DUAL while R1 localizations were not produced at all.

The ipsilateral area was preferred for R2 localizations in general, but G07 and G10 both right-handed, mainly assigned R2 to their contralateral side. In these contexts,

[72] Note that G01 is an ambidextrous signer who always shifted dominant hands during signing. In the data given in Table 4.1, this participant is categorized as right-handed because right hand was used predominantly in those productions.

ipsilateral area was either used by another element (i.e. demonstrative) or possibly R1 was covertly assigned to the ipsilateral area hence contralateral area seemed to be reserved for R2 (see the examples in Figure 4.6 and 4.7).

'Last week Andreas warned Annette.'

Figure 4.6: Contralateral localization of R2 via PAM

'This semester Jörg criticized Annika.'

Figure 4.7: Ipsilateral localization of demonstrative IX and contralateral localization of R2 via PAM and the verb CRITICIZE

Table 4.1: Frequency of localized referents, manual localization mechanisms and spatial areas of localization for each of the DGS participants

handedness	participant	localization mechanism	spatial area	LoC ref	total #
RH	G01	IX	ipsi	R2	1
	G01	PAM	ipsi	R2	1
	G04	IX-DUAL	ipsi	R1R2	2
	G04	PAM	ipsi	R2	2
	G07	PAM	ipsi	R2	2
	G07	PAM	contra	R2	2
	G07	IX-DUAL	ipsi	R1R2	2
	G08	--	--	--	0
	G09	--	--	--	0
	G10	IX	contra	R2	1
LH	G02	PAM	contra	--	1
	G03	--	--	--	0
	G05	--	--	--	0
	G06	--	--	--	0

[a]RH: right-handers, LH: left-handers, LoC ref: localized referent, G01-10: the signers of German Sign Language with the numbers indicating the order of their participation in the task

In case of IX-DUAL, it was signed with the oscillating movement between ipsilateral and neutral regions in all occurrences, and the assumption is that both referents as a group are localized on the ipsilateral area. Moreover, in some occurrences IX and PAM were accompanied with an eye gaze in the direction of the localization. For all cases but one (i.e. production by G07) where R2 was localized, continuation sentences appeared to begin with the R2 referent. Likewise, in all occurrences where IX-DUAL appeared in the introduction sentences, the following sentence continued with plural referents (More detailed information on the types of continuations is presented in Chapter 5).

To recap, it seems that only half of the participants produced additional manual signs to localize referents for repetition contexts with G07 and G04 signing the most of the

occurrences. Localized referents were mainly assigned to the ipsilateral side of the signers, which corresponds to the area close to their dominant hand (see the examples of ipsilateral assignment below in Figure 4.8 and 4.9).

'Today Markus congratulated Annette.'

Figure 4.8: Ipsilateral localization of R2 via IX

'Markus and Nina both know (each other) for a long time.'

Figure 4.9: Ipsilateral localization of R1R2 via IX-DUAL

DGS participants in some cases (56/199) diverged from the stimuli sentences (i.e. neutral localizations) in that the sentence final verbs (i.e. mainly single agreement verbs) were spatially modified being directed either to their ipsilateral or contralateral sides of the signing space (see Appendix C for a complete list of verbs as well as other manual and non-manual localization devices analyzed in the repetition data). An illustrative example of neutrally localized

verb THANK in the stimuli and its modifications by right- and left-handed signers of DGS in repetition sentences is given in Figure 4.10.

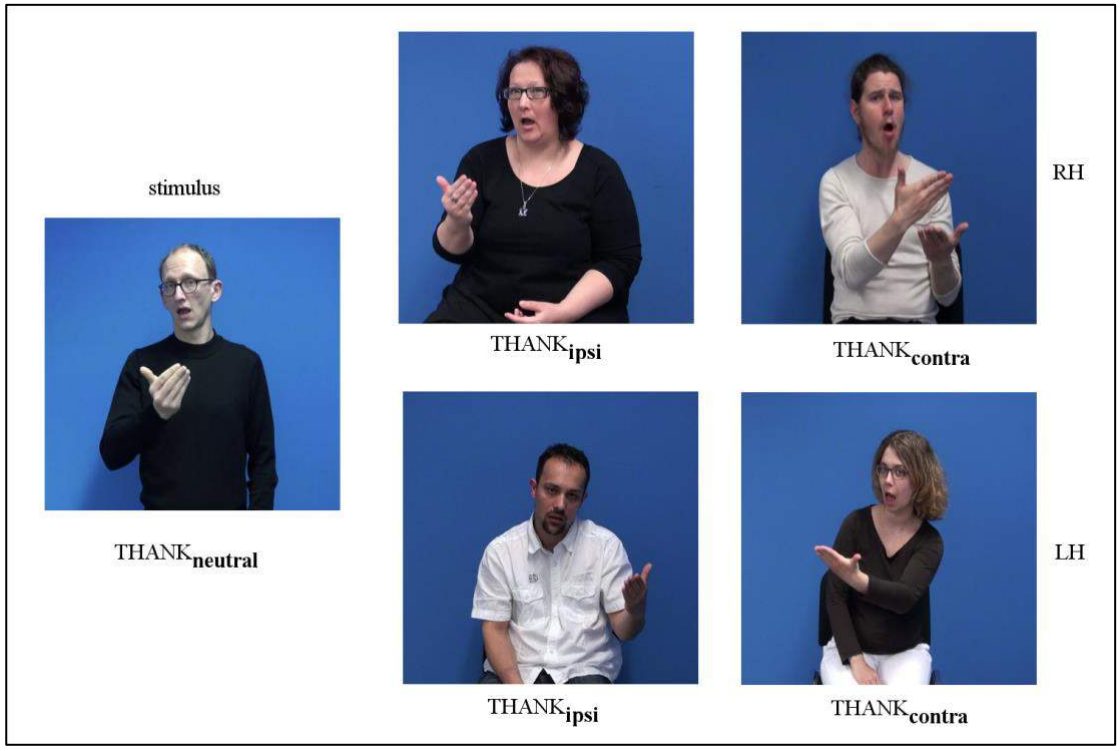


Figure 4.10: Spatial modification of the verb THANK by right-handed (RH) and left-handed (LH) signers in DGS data, represented is the final hold of the verb

The spatial modifications (i.e. non-neutral localizations) produced with verbs were determined and grouped according to the spatial side and by handedness of the participants (Table 4.2). The counts indicate that R2 can be localized either on ipsilateral and contralateral areas of the signing space, but contralateral area is slightly preferred both by right and left-handed signers (boldfaced in Table 4.2).

Table 4.2: Frequency of R2 localizations by spatial area of localization grouped according to the handedness of DGS participants

handedness	localization mechanism	spatial area	LoC ref	total #
RH	verb	ipsi	R2	13
	verb	contra	R2	16
LH	verb	ipsi	R2	11
	verb	contra	R2	16

To determine whether the above illustrated pattern is a general preference for all signers or whether it can be attributed only to certain participants who produced more localizations than others, the same data were further split according to the participants (Table 4.3). In general, a more or less similar amount of verb localizations was produced by all participants, with G05 having the highest number of occurrences (i.e. 7 cases). Some participants showed a stronger preference to localize R2 on their contralateral side (left-handers: G01, G03, G05; right-handers: G08, G10). On the other hand, others seemed to have either prefer the ipsilateral side (i.e. G01, G06) or did not to have a spatial preference for R2 (i.e. G07).

Table 4.3: Frequency of R2 localizations by spatial area of localization grouped by handedness and participants in DGS

	participant	**spatial area**	**LoC ref**	**total #**
RH	G01	ipsi	R2	3
	G01	contra	R2	0
	G04	ipsi	R2	4
	G04	contra	R2	2
	G07	ipsi	R2	2
	G07	contra	R2	2
	G08	ipsi	R2	0
	G08	contra	R2	6
	G09	ipsi	R2	4
	G09	contra	R2	1
	G10	ipsi	R2	0
	G10	contra	R2	5
LH	G01	ipsi	R2	1
	G01	contra	R2	2
	G02	ipsi	R2	3
	G02	contra	R2	3
	G03	ipsi	R2	2
	G03	contra	R2	4
	G05	ipsi	R2	1
	G05	contra	R2	6
	G06	ipsi	R2	4
	G06	contra	R2	1

Careful inspection of the data revealed some occurrences of non-manual localization of the referents as well. In these environments, both R1 and R2 were localized via sideward body leans in the repeated prompt sentences (see Figure 4.11).

Figure 4.11: Non-manual localization of nominal signs via body lean directed to the ipsilateral (left) and contralateral (right) sides

Interestingly only three participants were observed to produce referent localizations via body leans. Below, the frequency of non-manual localizations of R1 and R2 are shown for two right-handed and one left-handed participants (see Table 4.4). First of all, it can be observed that there is an unequal distribution. Secondly, two right-handed signers with a relatively high amount of non-manual localizations showed reverse patterns in their default localizations. That is, G04 links R1 to the contralateral and R2 to the ipsilateral side, while G10 did the opposite. Finally, one left-handed signer (i.e. G02) produced only a single sentence with non-manual localizations where R1 was associated with the ipsilateral (left) and R2 with the contralateral side (right).

Table 4.4: Frequency of non-manual localizations via sideward body leans by spatial area of the localization according to handedness and participants

handedness	participant	LoC R1	LoC R2	total #
RH	G04	contra	ipsi	7
	G10	ipsi	contra	5
LH	G02	ipsi	contra	1

Given manual and non-manual localization of the signs in the repetition sentences, a general overview of the spatial areas preferred in first/default localization of R1 and R2 for each participant according to the handedness status can be seen in Table 4.5.

Table 4.5: An overview of spatial distribution of the referents by spatial area of localization, handedness and participants in repetition sentences of DGS

handedness	participant	LoC R1	LoC R2
RH	G01	--	ipsi
	G04	contra	ipsi
	G07	--	ipsi & contra
	G08	--	contra
	G09	--	ipsi
	G10	ipsi	contra
LH	G01	--	contra
	G02	ipsi	contra
	G03	--	contra
	G05	--	contra
	G06	--	ipsi

[b]G01 showed an ambidextrous behaviour. In the overview above this participant is included under both handedness groups and the preference for spatial sides is given based on the active hand at the relevant part of the context.

To summarize the results so far, an unequal distribution of the referent localizations in repetition data reveal the following observations:

i. Some participants produce more referent localizations than the others (i.e. G10 vs. G03).

ii. In the contexts where two referents are localized, signers sharing the same handedness status may follow reverse pattern (ipsi-contra vs. contra-ipsi) for localizing these referents via body lean (i.e. G10 vs. G04).

iii. In contexts where only R2 is overtly localized, there is a slight preference to assign this referent to the ipsilateral side by right-handed signers and to the

contralateral side by left-handed signers. In fact, if there is a covert assignment of R1 in those cases (i.e. R1 assigned to the contralateral side), it may resemble the pattern of G04 for right-handers and the pattern of G02 for left-handers (i.e. R1 assigned to the ipsilateral side).

iv. R1 is not observed to be overtly localized on its own but only when followed by R2 localization. R2 signs are localized both manually and non-manually.

v. The observed patterns of one- and two-referent localizations can be characterised as relative rather than absolute showing inter-subject variation.

Repetition data contained only a few cases of R1 localizations, hence the decision was made to explore larger contexts including both repetition and continuation sentences (henceforth local contexts) with the aim to observe further default localizations. Additionally, given that repetition data revealed a considerable amount of R2 localizations, single referent localizations were determined and analysed as well in continuation data, in order to determine whether the spatial distribution observed in repetition contexts exits in other contexts (i.e. continuation) as well.

4.3.2 Sentence Continuation Results for DGS

Frequency of two-referent and one-referent localizations in production data of DGS were determined according to: (i) context of referent localizations, (ii) manual and non-manual localization mechanisms used to assign referents to the signing space, (iii) spatial regions split by handedness of the participants and, (iv) spatial regions split by participants. Note that in two-referent localizations, the referents were grouped according to the linear order of overt localization, this was done assuming three different hypotheses:

i. Irrespective of its type (e.g. R1 or R2), the referent localized first, is assigned to the ipsilateral and the referent localized second is assigned to the contralateral side (ipsi-contra pattern),

ii. Irrespective of the order of overt localization, R1 is assigned to ipsilateral and R2 to the contralateral side (ipsi-contra pattern),

iii. R1 and R2 are freely assigned to the signing space (no pattern).

4.3.2.1 Spatial distribution of two-referent localizations

The data revealed a total of 34 instances of local discourses containing overt localization of two referents in the following contexts: (i) both referents were localized in the repeated introduction sentences (i.e. intro) (also see Section 4.3.1 above), (ii) both referents were localized in the continuation sentences (i.e. cont) and, (iii) one of the referents was localized in the introduction and the other in the continuation sentences (intro & cont). Localization of both referents was mainly observed in the latter contexts (15/34). The referents are grouped according to the order of their initial localization (i.e. R1 localized first and R2 in the second place ($R1_{loc}$>$R2_{loc}$) or R2 localized first and R1 second ($R2_{loc}$>$R1_{loc}$)). The distribution of two-referent localizations in the mini-narratives is given in Table 4.6.

Table 4.6: Frequency of occurrence of two-referent localizations grouped by the context of their occurrence in the production data of DGS

Order of LoC	**intro**	**cont**	**intro &cont**	**total #**
$R1_{loc}$ >$R2_{loc}$	10	3	3	16
$R2_{loc}$ >$R1_{loc}$	3	--	15	18

Two-referent localizations were produced via different manual (i.e. IX signs, classifiers (CL), person agreement marker (PAM), possessive pronouns (POSS), FOR particle and verb agreement (VERB)) as well as non-manual (i.e. body leans (bl)) mechanisms (Table 4.7). Among those, localization via verb and via IX sign were preferred the most as manual strategies while localization via body leans was used as the only non-manual strategy[73]

Table 4.7: Frequency of occurrence of localization mechanisms for each of the referents in two-referent localizations with grouping based on the order of localization in production data of DGS

Order of LoC	**LoC Ref**	**bl**	**IX**	**CL**	**PAM**	**POSS**	**FOR**	**VERB**	**total #**
$R1_{loc}$ >$R2_{loc}$	R1	13	3	--	--	--	--	--	16
	R2	13	1	--	--	--	--	2	16
$R2_{loc}$ >$R1_{loc}$	R1	--	4	--	2	3	1	8	18
	R2	--	1	1	1	--	--	15	18

In two-referent localizations, the cases where R2 was localized first and R1 second ($R2_{loc}$>$R1_{loc}$) were produced in slightly higher amount (18/35) than the cases where R1 was localized first and R2 in the second place ($R1_{loc}$>$R2_{loc}$) (16/35)[74]. Table 4.8 contains distribution of these localizations. Note that not only contrastive sides (i.e. ipsilateral and

[73] Note that by non-manual mechanism here it is meant that these are not accompanied by any other manual strategy. Manual mechanisms in the data were accompanied by non-manuals as well, however the details and alignment of those two will not be discussed further here.

[74] There was one occurrence of two-referent localization where the first localized referent was not one of the referents introduced before (i.e. R3). Both referents ($R3_{loc}$ >$R2_{loc}$) were localized in the continuation sentence by a left-handed signer (i.e. G01), where R3 was localized on the ipsilateral and R2 on the contralateral side of the signing space.

contralateral) but also the same lateral side (i.e. ipsilateral) as well as the neutral area in the signing space are included in the counts to show the other possibilities.

A general observation is that contrastive assignment of the referents is preferred overall. In cases where R1 was localized before R2, each of the referents equally occurred on ipsilateral and contralateral side (14/16). However, in cases where R2 was localized first (13/18), it was mainly linked to the contralateral side while R1 was assigned to the ipsilateral side. Overall, the cases where R1 is linked to the ipsilateral and R2 to the contralateral side (20) exceed the cases where R2 was linked to the ipsilateral and R1 to the contralateral (9) side, if not considering their order of localization.

Table 4.8: Frequency of two-referent localizations according to the order of initial localization and by spatial area in production data of DGS

Order of LoC	**ipsi> contra**	**contra> ipsi**	**ipsi> ipsi**	**neutr> ipsi**	**total #**
$R1_{loc}$ >$R2_{loc}$	7	7	1	1	16
$R2_{loc}$ >$R1_{loc}$	3	13	2	--	18

The abovementioned counts summarize overall occurrences of two-referent localizations. In order to understand whether handedness makes a difference for the spatial distribution of two-referents, a handedness-based splitting of the same data is done as well (Table 4.9). Note that the patterns followed by signers to assign referents to the signing space are rather relative than they are absolute. The occurrences of two-referent localizations were produced in unequal amount by right-handers (23/33) and left-handers (10/33)[75].

[75] As noted before, G01 shows ambidextrous behavior in the productions. The active hand of this participant is determined against the hand dominance observed in the analyzed contexts.

It can be generalized that, right-handed signers slightly prefer to localize R1 on the contralateral and R2 on the ipsilateral side, when R1 localization precedes R2 localization. On the other hand, when R2 is localized first, there is a preference to localize this referent on the contralateral and R1 on the ipsilateral side. Overall, there are more productions of the cases where R1 is on the ipsilateral and R2 on the contralateral side (14) than vice versa (9) irrespective of their order of overt localization.

Looking at the productions of left-handed signers, when R1 is localized before R2 they assigned R1 to their ipsilateral and R2 to their contralateral side. For the cases where R2 localization was first, we see a slight preference for R2 being localized on the contralateral while R1 on the ipsilateral area, in the same way as in right-handed signers. Taken together, R1 seems to be slightly preferred on the ipsilateral and R2 on the contralateral side (6) while there are less occurrences for the reverse placement (2) if the order of their overt realization is ignored.

Table 4.9: Frequency of occurrence of contrastive localizations grouped by spatial area and handedness of the participants in production data of DGS

handedness	**Order of LoC**	**ipsi> contra**	**contra> ipsi**	**ipsi> ipsi**	**neutr> ipsi**	**total #**
RH	$R1_{loc}$ >$R2_{loc}$	5	7	--	--	12
	$R2_{loc}$ >$R1_{loc}$	1	9	1	--	11
LH	$R1_{loc}$ >$R2_{loc}$	2	--	--	1	3
	$R2_{loc}$ >$R1_{lo}$	2	4	1	--	7

Given unequal distribution of the localizations, it is difficult to say whether these patterns are due to the fact that certain individuals produced more occurrences than the others or whether it is a general pattern of localization. Therefore, the data was grouped further by each of the participants (see Table 4.10). This grouping shows that the signers indeed localized R1 and R2 in different amount, hence some signers were observed to produce more

localizations than the others (e.g. G04 vs. G09). To give more details, two participants did not produce any two-referent localizations at all (i.e. G08 and G09). Three participants, all left-handed, (i.e. G02, G03 and G06) produced only a few occurrences of two-referent localizations each, in which they preferred to sign the first localization (of either R1 or R2) on their ipsilateral and second localization (either R1 or R2) on their contralateral side.

One of the participants has shown an ambidextrous behavior by constantly switching the hands (even in the same local context), this participant's localizations were grouped according to the active hand used at a particular portion of the discourse (i.e. G01). In right-hand dominant productions, this signer assigned R1 to the ipsilateral and R2 to the contralateral side irrespective of their order of localization. In the left-hand-dominant production (only one case), this signer preferred to assign R2 to the ipsilateral and R1 to the contralateral side.

Among three right-handed-signer productions, G07 showed a slight preference to localize R2 on the contralateral and R1 on the ipsilateral area. The remaining two signers, both right-handed, indeed showed a clear pattern of localizing R1 and R2. The initial localization of G04, irrespective of the referent, was always on the contralateral side while the referent localized second was assigned to the ipsilateral side. Participant G10 showed a clear pattern of localizing R1 to the ipsilateral (right) and R2 to the contralateral (left) side of the signing space, irrespective of the order of these localizations.

To wrap up, even though some participants produced more localizations than the others, it is possible to generalize that both right-handed and left-handed signers prefer to localize R2 on their contralateral and R1 on their ipsilateral side, and such a pattern is produced more when R2 is localized first. However, this pattern does not seem to be absolute if we look at the individual productions. That is, participants of the same handedness status

might consistently use reverse strategies to localize referents irrespective of the order of overt localization (i.e. ipsi-contra as with G10 or G07 or contra-ipsi as with G04).

Table 4.10: Frequency and spatial distribution of two-referent localizations grouped by spatial area and each of the participants in production data of DGS

participant	**Order of LoC**	**ipsi> contra**	**contra> ipsi**	**ipsi> ipsi**	**neutr> ipsi**	**total #**
G01_LH	$R1_{loc}$>$R2_{loc}$	1	--	--	--	1
	$R2_{loc}$ >$R1_{loc}$	--	1	--	--	1
G01_RH	$R1_{loc}$>$R2_{loc}$	--	--	--	--	0
	$R2_{loc}$ >$R1_{loc}$	1	--	--	--	1
G01_LH/RH	$R1_{loc}$>$R2_{loc}$	--	--	1	--	1
	$R2_{loc}$ >$R1_{loc}$	--	--	--	--	0
G02_LH	$R1_{loc}$>$R2_{loc}$	1	--	--	1	2
	$R2_{loc}$ >$R1_{loc}$	--	--	--	--	0
G03_LH	$R1_{loc}$>$R2_{loc}$	--	--	--	--	0
	$R2_{loc}$ >$R1_{loc}$	1	--	1	--	2
G04_RH	$R1_{loc}$>$R2_{loc}$	--	7	--	--	7
	$R2_{loc}$ >$R1_{loc}$	--	2	--	--	2
G05_LH	$R1_{loc}$>$R2_{loc}$	--	--	--	--	0
	$R2_{loc}$ >$R1_{loc}$	1	2	--	--	3
G06_LH	$R1_{loc}$>$R2_{loc}$	--	--	--	--	0
	$R2_{loc}$ >$R1_{loc}$	1	--	--	--	1
G07_RH	$R1_{loc}$>$R2_{loc}$	--	--	--	--	0
	$R2_{loc}$ >$R1_{loc}$	--	2	1	--	3
G08_RH	$R1_{loc}$>$R2_{loc}$	--	--	--	--	0
	$R2_{loc}$ >$R1_{loc}$	--	--	--	--	0
G09_RH	$R1_{loc}$>$R2_{loc}$	--	--	--	--	0
	$R2_{loc}$ >$R1_{loc}$	--	--	--	--	0
G10_RH	$R1_{loc}$>$R2_{loc}$	5	--	--	--	5
	$R2_{loc}$ >$R1_{loc}$	--	5	--	--	5

4.3.2.2 Spatial distribution of one-referent localizations

The rationale behind analyzing the one-referent localizations is that in the initial analysis of repeated introduction sentences the single localizations of the referents were produced quite frequently and to some extent a pattern was observed for overt localization of the two-referents. That is, (as mentioned in Section 4.3.1) the signers might be covertly localizing both referents in their introductions and when continuing with one-referent localizations they used the ipsi-contra default. Otherwise, they might be assigning an initially localized referent to the ipsilateral side irrespective of its type, or single referents might be assigned randomly to the space. This section aims to determine which of those three options was preferred in the collected data containing single localizations.

In order to determine whether localization of single referents follows a particular pattern of spatial distribution and whether this pattern is similar among participants from different handedness groups, a total of 82 one-referent (i.e. R1 and R2) localizations were examined[76]. Among those, only a few R1 localizations (6/6) were observed in continuation sentences. R2 localizations occurred in introduction as well as continuation contexts with a higher amount in the former (49/76), than in the latter (27/76). This is illustrated in Table 4.11 below.

[76] Note that there were three occurrences of the localizations which were identified as neither R1 nor R2. Two of those (R1R2) were localized via IX and one (R3: a single referent other than R1 and R2) was localized via an agreement verb. These cases were analyzed in the data but are not included in the discussion above.

Table 4.11: Frequency of occurrence of single-referent localizations grouped by the context in production data of DGS

LoC ref	intro	cont	total #
R1	--	6	6
R2	49	27	76

As with the two-referent localizations, DGS signers mainly used manual localization mechanisms to assign single referents to the space. Both R1 and R2 were mostly localized via verbs. A detailed distribution of manual localization mechanisms used to localize each of the single referents is given in Table 4.12.

Table 4.12: Manual and non-manual localization devices used to assign each of R1 and R2 in the production data of DGS

LoC ref	bl	IX	CL	PAM	POSS	FOR	THERE	VERB	total #
R1	--	1	--	--	1	1	1	2	6
R2	1	12	1	12	2	1	1	46	76

[c]bl: body leans, IX: pronoun/demonstrative and localizing IX, CL: classifiers, PAM: person agreement marker, POSS: possessive pronouns, FOR particle, THERE particle, VERB: verb agreement

The overall view of the spatial distribution of single referent localizations has shown that R2 was localized in higher amount than R1 and that the contralateral side seems to be more available for R2 (35/76) than for R1 (1/6) (see Table 4.13).

Table 4.13: Spatial distribution of single referent localization for each of single R1 and R2 in the production data of DGS

LoC ref	ipsi	contra	total #
R1	5	1	6
R2	41	35	76

The same data are grouped according to the handedness of the participants to identify whether this factor plays a role in the spatial distribution of single referents (Table 4.14). The counts indicate that R1 (in a few occurrences) seems to be localized on the ipsilateral side for signers in both handedness groups while R2 localizations are slightly preferred on the ipsilateral side by right-handers and on the contralateral side by left-handers.

Table 4.14: Frequency of occurrence of the single referent localizations grouped by spatial area and handedness of the DGS participants

handedness	LoC ref	ipsi	contra	total #
RH	R1	3	1	4
	R2	26	16	42
LH	R1	2	--	2
	R2	15	19	34

Given unequal distribution of the referents in the signing space, the data was also split according to the individual productions (Table 4.15). It can be seen that for a few productions of R1 localizations, both right-handed and left-handed signers prefer to assign this referent to their ipsilateral side. On the other hand, individual productions vary with respect to the spatial distribution of R2. In particular, right-handed signers assigned this referent to their ipsilateral (i.e. G04 and G09), to their contralateral (i.e. G08, G10) or equally to both of the lateral sides (i.e. G07). The same can be said for left-handed signers. Some of

them preferred to assign R2 to their ipsilateral side (i.e. G01, G03 and G06) while others used their contralateral side (i.e. G02 and G05). In general, it seems that both ipsilateral and contralateral areas in space are available for R2 localizations.

Table 4.15: Frequency of occurrence and single referent localizations of R1 and R2 grouped by spatial area and each of the of DGS participants

participant	LoC ref	ipsi	contra	total #
G01_LH	R1	1	--	1
	R2	10	1	11
G02_LH	R1	1	--	1
	R2	3	6	9
G03_LH	R1	--	--	0
	R2	5	4	9
G04_RH	R1	--	--	0
	R2	6	--	6
G05_LH	R1	--	--	0
	R2	1	7	8
G06_LH	R1	1	--	1
	R2	5	2	7
G07_RH	R1	1	--	1
	R2	3	3	6
G08_RH	R1	1	1	2
	R2	--	8	8
G09_RH	R1	--	--	0
	R2	8	1	9
G10_RH	R1	--	--	0
	R2	--	3	3

Looking at the production data containing two-referent and one-referent localizations, it is possible to generalize the following:

i. The signers use lateral axis to assign contrastive two-referent localizations quite rarely and with varying degree,

ii. There are individual differences in the usage of lateral side for localization,

iii. Both right- and left-handed signers share a pattern of referent localization where R1 is assigned to the ipsilateral side and R2 to the contralateral side,

iv. Less preferred additional patterns are: (a) for right-handers contralateral-ipsilateral (first overt localization irrespective of the type of the referent is assigned to the contra and second to the ipsi); (b) for left-handers ipsilateral-contralateral (first overt localization irrespective of the type of the referent is assigned to the ipsi and second to the contra) [77],

v. Single referent localizations suggest that both right- and left-handed signers use signing space in a similar way assigning R1 (if at all) to the ipsilateral area and R2 either to ipsilateral or contralateral area in the signing space. Assignment of R2 to the contralateral side might signal that there is an established contrast with covertly localized R1. It is probable that covert localization of R1 is optional, and conditions of that should be determined separately.

4.3.3 Sentence Repetition Results for TİD

As with DGS repetitions, in TİD data deviations from the prompt sentences are determined looking at manual localization of the nominal and verb signs. Note that, TİD participants were not observed to localize referents only via non-manual localization mechanisms. Repetition data of TİD contain 199 sentences (one sentence had to be excluded

[77] It still has to be determined whether these patterns are specific idiolects (sociolects) or they reflect general patterns and how the competition between these patterns can be resolved. As has already been shown the neutral area can as well be used in contrastive localizations (i.e. neutral-ipsilateral contrast). However, given very few occurrences in the data, at this point it is not possible to generalize it to a pattern.

from the analysis due to technical issues), which include 61 cases of manual localization. There are two instances of manual particle (i.e. IX) and 59 occurrences of verb localizations. The data are grouped according to the handedness status, and the participants.

Productions of TİD participants mainly matched the stimuli[78], except one sentence including two localizations (see also Table 4.16 for cases which do not include any manual localizations of the referents). The added manual localization devices are two IX signs. T06 (right-handed) produced them in the same sentence to localize each of R1 and R2 (Figure 4.12). In this single occurrence both referents are localized on the contralateral side (left). In particular, R2 is assigned to the distant (contra-d) and R1 to the proximate (contra-p) contralateral area relative to the body of a signer. Note that, even though the sentence includes localization of both referents, the discourse is further continued with null form of the R1 referent (for further details on the forms of the referents in continuation sentences see Chapter 5).

Figure 4.12: Contralateral proximate localization of R1 and contralateral distant localization of R2

[78] This might be an indication that referents are not necessarily required to be localized at the beginning of a discourse.

Table 4.16: Frequency of localized referents, manual localization mechanisms and spatial areas of localization for each of the TİD participants

handedness	participant	localization mechanism	spatial area	LoC ref	total #
RH	T01	--	--	--	0
	T02	--	--	--	0
	T03	--	--	--	0
	T04	--	--	--	0
	T06	IX	contra-d	R2	1
	T06	IX	contra-p	R1	1
LH	T05	--	--	--	0
	T07	--	--	--	0
	T08	--	--	--	0
	T09	--	--	--	0
	T10	--	--	--	0

In some cases (59/199) TİD participants diverged from localizations of the verbs in the prompt sentences by producing them in the lateral (i.e. ipsilateral or contralateral side) rather than in the neutral area of the signing space. In particular, agreement verbs signed in the neutral space in the stimulus material were signed with their end point (a location typically associated with the object referent, R2) on the ipsilateral or contralateral area, while their starting point were produced proximate to the body of the signer. An illustrative example of neutrally localized verb GREET in the stimuli and its modifications by right- and left-handed signers of TİD in repetition sentences is given in Figure 4.13[79].

The counts grouped according to the handedness and spatial area of the verb localization indicate that the ipsilateral (right) side is preferred by right-handed signers and

[79] As the consent for the visual usage was not obtained from the TİD informant, the production which was found the closest to the stimulus (i.e. for neutral localization of the verb) is used as a representative example.

the contralateral (right) side is preferred by left-handed signers to localize R2 with verbs (see Table 4.17).

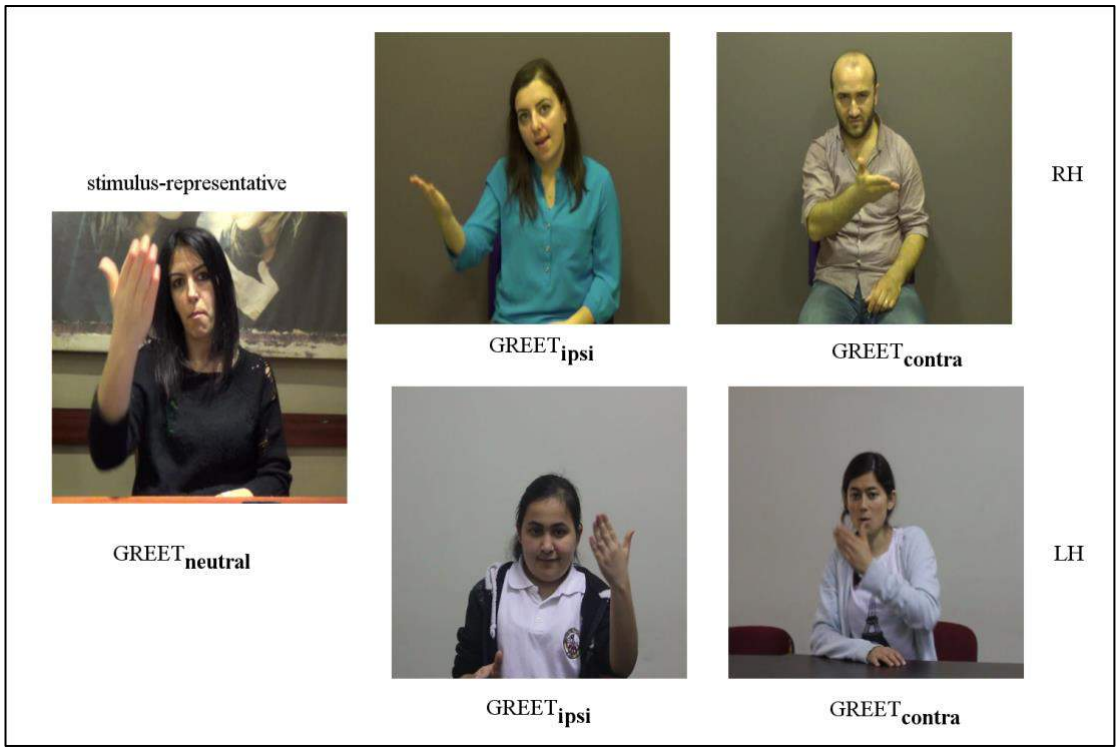


Figure 4.13: Spatial modification of the verb GREET by right-handed (RH) and left-handed (LH) signers in TİD data, represented is the final hold of the verb

Table 4.17: Frequency of R2 localizations by spatial area of localization grouped according to the handedness of TİD participants

handedness	localization mechanism	spatial area	LoC ref	total #
RH	verb	ipsi	R2	30
	verb	contra	R2	9
LH	verb	ipsi	R2	2
	verb	contra	R2	18

In order to determine whether there are individual differences among participants in verb localization (either due to unequal production or intra-subject variation), the data were further split by of each signer (see Table 4.18). The findings show that all participants

produced ipsilateral or contralateral localizations, however in varying amount. That is, the most cases were signed by T10 (i.e. 10 occurrences) and the least by T05 (i.e. 2 occurrences). Some participants preferred the ipsilateral area for R2 localizations (right-handers: T01, T02 and T03), while others mainly favoured the contralateral area (right-handers: T04 and T06; left-handers: T07, T08, T09 and T10). A few localizations by T05 (left-handed) are difficult to generalize to a pattern.

Table 4.18: Frequency of R2 localizations by spatial area of localization grouped by handedness and participants in TİD

handedness	**participant**	**spatial area**	**LoC ref**	**total #**
RH	T01	ipsi	R2	8
	T01	contra	R2	1
	T02	ipsi	R2	10
	T02	contra	R2	0
	T03	ipsi	R2	8
	T03	contra	R2	1
	T04	ipsi	R2	2
	T04	contra	R2	4
	T06	ipsi	R2	2
	T06	contra	R2	3
LH	T05	ipsi	R2	1
	T05	contra	R2	1
	T07	ipsi	R2	1
	T07	contra	R2	5
	T08	ipsi	R2	0
	T08	contra	R2	6
	T09	ipsi	R2	0
	T09	contra	R2	3
	T10	ipsi	R2	0
	T10	contra	R2	3

To recap the findings regarding the spatial distribution of the referents obtained via manual localization, a general overview of the spatial areas preferred in default localization of R1 and R2 for each participant grouped by their handedness status is given in Table 4.19.

Table 4.19: An overview of spatial distribution of the referents by spatial area of localization by handedness and participants in repetition sentences of TİD

handedness	**participant**	**R1 $_{loc}$**	**R2 $_{loc}$**
RH	T01	--	ipsi
	T02	--	ipsi
	T03	--	ipsi
	T04	--	contra
	T06	contra-p	contra-d
LH	T05	--	ipsi & contra
	T07	--	contra
	T08	--	contra
	T09	--	contra
	T10	--	contra

An unequal distribution of the referent localizations in repetition data revealed the following observations for TİD:

i. Some participants produced more localizations than the others (i.e. T10 vs. T05).

ii. Two-referent localizations were only observed for one signer in one occurrence (i.e. T06).

iii. In the contexts where only R2 was localized, this referent was preferred to be assigned to the ipsilateral side (right) by right-handed signers and to the contralateral side (right) by left-handed signers. Given that R1 was first introduced to the context it might be the case that this referent is covertly assigned to the left side (contralateral for right-handers and ipsilateral for right-handers).

iv. R1 was observed to be overtly localized when followed by an R2 localization (i.e. only one occurrence by T06), but not when it was on its own.

Repetition data of TİD included only one case of R1 localization, hence the decision was made to explore larger contexts including both repetition and continuation sentences with the aim to observe further occurrences of two-referent and one-referent overt localizations and to determine how those differ from the ones in DGS productions.

4.3.4 Sentence Continuation Results for TİD

TİD data containing frequency distribution of two-referent and one-referent localizations are analyzed, in the same manner as DGS data, based on: (i) spatial regions of these localizations, (ii) spatial regions split by handedness of the participants, and (iii) spatial regions split by the participants. In addition, specific domains of referent localizations, manual and non-manual localization mechanisms used to assign referents to the signing space are determined and discussed. As with DGS data, the referents are grouped according to the order of their overt localization into the space for two-referent localizations (see Section 4.3.3).

4.3.4.1 Spatial distribution of two-referent localizations

A detailed examination of the mini-narratives shows that TİD signers produced a total of 37 cases of two-referent localizations. Among those, all cases in which initial localizations of R1 preceded initial localizations of R2 ($R1_{loc} > R2_{loc}$) appeared in continuation sentences (8/8). On the other hand, R2 localizations preceding R1 localizations ($R2_{loc} > R1_{loc}$) mainly occurred either in continuation sentences (15/29) or were distributed between the introduction and the continuation contexts (13/29). In those cases, R2 was localized in the introduction and R1 in the continuation sentences. Only one occurrence of both referent localizations was observed in the introduction sentences (see Table 4.20).

Table 4.20: Frequency of occurrence of two-referent localizations grouped by the context in production data of TİD

Order of LoC	**intro**	**cont**	**intro & cont**	**total #**
$R1_{loc}$ >$R2_{loc}$	--	8	--	8
$R2_{loc}$ >$R1_{loc}$	1	15	13	29

Two-referent localizations in TİD mini-narratives were realized mainly via verb or IX and IX_2 (2^{nd} person pronoun) signs, and in a few cases via palm up sign (PU). The distribution and frequency of these occurrences are given in Table 4.2.

Table 4.21: Frequency of occurrence of localization mechanisms for each of the two referents in two-referent grouping based on the order of localization in production data of TİD

Order of LoC	**LoC Ref**	**IX**	**IX_2**	**PU**	**VERB**	**total #**
$R1_{loc}$ >$R2_{loc}$	R1	6	1	--	1	8
	R2	1	1	--	6	8
$R2_{loc}$ >$R1_{loc}$	R1	11	--	2	16	29
	R2	7	--	--	22	29

The contexts given above are further analyzed according to the spatial distribution of the referents grouped by the order of their overt localization. A general observation is that participants tend to use contrastive areas in the signing space (i.e. ipsilateral and contralateral) to localize the referents. But in some cases, they also assigned both referents to one side (i.e. ipsi or contra) or one of these sides and the neutral side (i.e. neutr) (see Table 4.22). Each of the referents in two-referent localizations could be assigned to the ipsilateral and contralateral areas. However, there seems to be a preference to assign R1 to the ipsilateral and R2 to the contralateral side, which is more obvious when the initial localization of R2 precedes the R1 localization (16/29).

Table 4.22: Frequency of two-referent localizations according to the order of initial localization and by spatial area in production data of TİD

Order of LoC	**ipsi > contra**	**contra> ipsi**	**ipsi> ipsi**	**ipsi> neutr**	**contra> contra**	**neutr> contra**	**total #**
$R1_{loc}$ >$R2_{loc}$	4	3	1	--	--	--	8
$R2_{loc}$ >$R1_{loc}$	8	16	1	2	1	1	29

Above it was shown that TİD signers prefer to localize referents via manual localization mechanisms (i.e. IX or verb signs), and that they are likely to assign these referents in a particular way. Specifically, R1 on the ipsilateral and R2 on the contralateral side irrespective of their order of localization. The data were further grouped by the handedness of the signers (Table 4.23), to determine whether the pattern observed above differs according to this factor.

The findings suggest that right-handed signers seem to prefer localizing R2 on the ipsilateral (right) and R1 on the contralateral (left) side, especially when the former referent is overtly localized first (8/15). As for the left-handers, they seem to favor ipsilateral side (left) for R1 and contralateral side for R2 (right), and this preference is most visible when R2 localization precedes R1 localization (12/14).

Table 4.23: Frequency of occurrence of contrastive localizations grouped by spatial area and handedness of the participants in production data of TİD

handedness	**Order of LoC**	**ipsi> contra**	**contra> ipsi**	**ipsi> ipsi**	**ipsi> neutr**	**contra> contra**	**neutr> contra**	**total#**
RH	$R1_{loc}$>$R2_{loc}$	3	3	--	--	--	--	6
	$R2_{loc}$>$R1_{loc}$	8	4	1	2	--	--	15
LH	$R1_{loc}$>$R2_{loc}$	1	--	1	--	--	--	2
	$R2_{loc}$>$R1_{loc}$	--	12	--	--	1	1	14

Given that participants did not produce the same amount of localizations, the question arises as to whether the spatial distribution of localized referents is a property of the one handedness group or whether it is an idiosyncratic pattern. To determine this aspect, localizations of each participant are depicted in Table 4.24. In general, individual productions did not diverge much from the handedness-based group pattern. Specifically, only four among five participants produced two-referent localizations. Among those, T06 and T03 signed the most cases (6 productions per person), and T01 the least (4 productions). These occurrences indicate a slight variation between the participants, namely some of them (i.e. T01, T02 and T03) preferred to assign R1 on their contralateral and R2 on their ipsilateral side irrespective of their order of overt localization. On the other hand, one participant (i.e. T06) favored a reverse pattern assigning R1 to the ipsilateral (right) and R2 to the contralateral side (left), again irrespective of their order of localization[80].When we look at the productions of left-handed signers (maximum 5, minimum 2 occurrences per person), each preferred to localize R2 on their contralateral (right) and R1 on the ipsilateral side (left), especially when the former was localized first.

To recap, it seems that irrespective of their handedness TİD signers (except T06) were likely to use the right side of the signing space (from the signer's perspective) for R2 and left side of the signing space (from the signer's perspective) for R1 localizations by default. This pattern will be referred to as a left-right default in the following discussion.

[80] Metadata of T06 shows that one of the parents of this signer is a hearing teacher of TİD. In addition, the fluent consultants of TİD found signing of this participant somehow 'different', potentially in an idiosyncratic way. Divergence in the pattern of localization might well be attributed to sociolinguistic factors like education or language input. To determine these factors, further investigation of the constructions containing localization should be done in future research.

Table 4.24: Frequency and spatial distribution of two-referent localizations grouped by spatial area and each of the participants in production data of TİD

participant	Order of LoC	ipsi> contra	contra> ipsi	ipsi> ipsi	ipsi> neutr	contra> contra	neutr> contra	total#
T01_RH	$R1_{loc}$>$R2_{loc}$	--	1	--	--	--	--	1
	$R2_{loc}$>$R1_{loc}$	2	1	--	--	--	--	3
T02_RH	$R1_{loc}$>$R2_{loc}$	--	1	--	--	--	--	1
	$R2_{loc}$>$R1_{loc}$	2	--	--	2	--	--	4
T03_RH	$R1_{loc}$>$R2_{loc}$	1	1	--	--	--	--	2
	$R2_{loc}$>$R1_{loc}$	3	--	1	--	--	--	4
T04_RH	$R1_{loc}$>$R2_{loc}$	--	--	--	--	--	--	0
	$R2_{loc}$>$R1_{loc}$	--	--	--	--	--	--	0
T05_LH	$R1_{loc}$>$R2_{loc}$	1	--	--	--	--	--	1
	$R2_{loc}$>$R1_{loc}$	--	--	--	--	--	1	1
T06_RH	$R1_{loc}$>$R2_{loc}$	2	--	--	--	--	--	2
	$R2_{loc}$>$R1_{loc}$	1	3	--	--	--	--	4
T07_LH	$R1_{loc}$>$R2_{loc}$	--	--	--	--	--	--	0
	$R2_{loc}$>$R1_{loc}$	--	4	--	--	--	--	4
T08_LH	$R1_{loc}$>$R2_{loc}$	--	--	1	--	--	--	1
	$R2_{loc}$>$R1_{loc}$	--	2	--	--	--	--	2
T09_LH	$R1_{loc}$>$R2_{loc}$	--	--	--	--	--	--	0
	$R2_{loc}$>$R1_{loc}$	--	3	--	--	--	--	3
T10_LH	$R1_{loc}$>$R2_{loc}$	--	--	--	--	--	--	0
	$R2_{loc}$>$R1_{loc}$	--	3	--	--	1	--	4

4.3.4.2 Spatial distribution of one-referent localizations

To identify whether the spatial localization of the referents follows a left-right default pattern (i.e. R1 assigned to the left side and R2 to the right side of the signing space) only in the contrastive localization or whether it can also be seen in single referent localizations, 98 instances of single-referent localizations were determined (see Table 4.25). The single localizations of R1 occurred only in continuation sentences while R2 localizations appeared in the introduction (39/78) as well as in the continuation contexts (47/78).

Table 4.25: Frequency of occurrence of single-referent localizations grouped by the context in production data of TİD

Ref LoC	intro	cont	total #
R1	--	20	20
R2	39	47	78

Single referents in TİD were realized with manual localization mechanisms, mainly verb and IX signs. R1 was localized with IX sign in majority of the cases (19/20), while R2 was localized either with IX (36/86) or verb signs (49/86) (see Table 4.26).

Table 4.26: Manual localization devices used to assign each of R1 and R2 in the production data of TİD

LoC Ref	IX	PU	VERB	total #
R1	19	--	1	20
R2	36	1	49	86

The contexts described above are further examined according to the spatial distribution of the single referents (see Table 4.27). This grouping indicates that R1 was localized equally often on the ipsilateral (10/20) and contralateral side (10/20), while R2 was localized slightly more on the contralateral side (41/86) than on the ipsilateral side (37/86) of the signing space.

Table 4.27: Spatial distribution of single-referent localization for each of R1 and R2 in the production data of TİD

LoC ref	ipsi	contra	total #
R1	10	10	20
R2	37	41	78

Another grouping of the data based on the handedness indicates that right-handed signers localized R1 on their contralateral side (left) and R2 on their ipsilateral side (right) while left-handed signers localized R1 on their ipsilateral side (left) and R2 on their contralateral side (right) (Table 4.28 shows the frequency distribution). It seems that signers of TİD both in their two-referent and one-referent localizations follow left-right default. That is, they prefer to assign R1 to the left area and R2 to the right area of the signing space, and their handedness does not seem to play a role in this assignment.

Table 4.28: Frequency of occurrence and type of single-referent localizations grouped by spatial area and handedness of participants in TİD

handedness	**LoC ref**	**ipsi**	**contra**	**total #**
RH	R1	--	3	3
	R2	26	9	35
LH	R1	10	7	17
	R2	11	36	43

As could be seen in the distribution above, the counts indicate that localization of R1 and R2 were not produced with the same frequency in the data. Given the possibility that not all participants produced the same amount of localizations, the same data set is further split according to the individual productions of the participants (see Table 4.29). The analysis of this data shows that, among five right-handed participants only two produced R1 localizations (i.e. T01 and T03). Both of those signers assigned R1 to their contralateral areas (left). As for R2, right-handed signers mainly localized it on their ipsilateral side (right), except T06 who preferred to localize this referent on the contralateral side (left). Left-handed signers showed a variation in the spatial side they prefer to localize single referents in general. That is, some are more likely to assign single referents on their contralateral side (i.e. T05, T09, T10) while others seem favor their ipsilateral side (i.e. T07, T08).

Table 4.29: Frequency of occurrence of single-referent localizations grouped by spatial area and production of each of the participants of TİD

participant	LoC ref	ipsi	contra	total #
T01_RH	R1	--	1	1
	R2	8	1	9
T02_RH	R1	--	--	0
	R2	8	--	8
T03_RH	R1	--	2	2
	R2	4	3	7
T04_RH	R1	--	--	0
	R2	2	4	6
T05_LH	R1	1	2	3
	R2	1	3	4
T06_RH	R1	--	--	0
	R2	4	1	5
T07_LH	R1	2	--	2
	R2	4	2	7
T08_LH	R1	6	--	6
	R2	6	4	11
T09_LH	R1	1	3	4
	R2	--	11	11
T10_LH	R1	--	2	2
	R2	--	11	11

The analysis of local contexts in TİD presented above revealed the following generalizations:

(i) Signers rarely use lateral areas in space to localize referents, but when they do there seems to be a preference for contrastive usage of those in the cases of two-referent localizations.

(ii) The most obvious pattern of localizing referents is the left-right pattern where R1 is associated with the left area and R2 with the right area irrespective of the order of overt localization, and handedness.

(iii) There is a signer variation within right-handers in terms of the usage of localization pattern (i.e. T06's usage of right-left pattern).

(iv) For single-referent localizations right-handers use similar pattern as for two-referent localizations. That is, they assign R1 on the left and R2 on the right side of the signing space. However, there is a signer variation among left-handers, such that some signers prefer the contralateral (right) side as their primary side of assigning each of R1 and R2 referents while others favor the ipsilateral side (left) to localize single referents.

4.3.5 A comparative summary of localization defaults in DGS and TİD

The patterns of overt localization defaults of two-referent and one-referent localizations for DGS and TİD are summarized in Table 4.30. The more frequent patterns are given as 'Pattern 1' (boldfaced) and the less frequent ones as 'Pattern 2'. When we look at Pattern 1 for two-referent localizations, it can be seen that the two languages differ in realization of this pattern, especially in the productions of right-handed signers. That is, in DGS this pattern seems to be hand dominance dependent, namely R1 is assigned to the ipsilateral area and R2 to the contralateral area. On the other hand, in TİD the pattern can be interpreted as being dependent on the physical sides of the signing space. Thus, it is the left side (contralateral for right-handers, ipsilateral for left-handers) which is preferred for R1, and it is the right side (ipsilateral for right-handers and contralateral for left-handers) which is preferred for R2. However, Pattern 2 used for two-referent localizations by right-handers, deviates from Pattern 1 within each language indicating intra-language variation.

As for single referent localizations, in DGS the ipsilateral side is primarily used to localize R1 and R2 by both handedness groups. As a secondary pattern, contralateral side is used to localize single occurrences of R2. For TİD signers, single localizations follow a less unified pattern. Pattern 1 is consistent with the one used with two-referent localizations in

the same language, namely R1 is assigned to the contralateral side (left side for right-handers and right side for left-handers) while R2 is either assigned either to the ipsilateral or contralateral sides. Pattern 2 shows the opposite picture, where R2 is assigned to the contralateral (left) side by right-handers and each of R1 and R2 are assigned to the ipsilateral (left) side by left-handers.

Table 4.30: A general overview of the patterns used for two-referent and one-referent localizations by right- and left-handed signers of DGS and TİD

language	**handedness**		**R1 $_{loc}$> R2 $_{loc}$**	**R2 $_{loc}$> R1 $_{loc}$**	**R1 $_{loc}$**	**R2 $_{loc}$**
DGS	RH	**Pattern 1**	ipsi>contra	contra>ipsi	ipsi	ipsi
		Pattern 2	contra>ipsi	contra>ipsi	--	contra
	LH	**Pattern 1**	ipsi>contra	contra>ipsi	ipsi	ipsi
		Pattern 2	ipsi>contra	ipsi>contra	--	contra
TİD	RH	**Pattern 1**	contra>ipsi	ipsi>contra	contra	ipsi
		Pattern 2	ipsi>contra	contra>ipsi	--	contra
	LH	**Pattern 1**	ipsi>contra	contra>ipsi	contra	contra
		Pattern 2	--	--	ipsi	ipsi

4.4 Discussion

Previous research on DGS (Steinbach & Onea 2016; Wienholz et al. 2018a) has shown that signers follow right-left (or ipsi-contra) default pattern to overtly or covertly assign discourse referents to the signing space. That is, in case of two discourse referents the first-mentioned one is assigned to the right (ipsilateral) and the second-mentioned one to the left (contralateral) side of the signing space, for right-handed signers. Chapter 3 has shown that spatial defaults of covert localization used for interpretation of pronominal IX in the context of reciprocal verbs, is ipsi-contra (for left-handed) DGS signers and right-left for TİD signers, irrespective of their handedness.

The current qualitative study investigated spatial distribution of default overt localization in elicited production data of DGS and TİD using a free sentence continuation

task. Right- and left-handed participants (i.e. the same signers as in Chapter 3) were presented with sentence prompts containing no localization cues and were instructed to repeat and continue them with the themes about one of the referents introduced in the prompt sentences. Their productions were analyzed according to the contrastive localization of both referents (i.e. R1 and R2) and the localization of single referents (i.e. R1 or R2).

Production data suggest two types of variation with respect to the two-referent overt localization default: inter-language variation and intra-language variation. The latter type includes inter-signer as well as intra-signer variation. In particular, DGS and TİD seem to differ in realization of the pattern, such that the former can be defined according to the hand dominance (i.e. ipsi-contra), in line with the previous studies and comprehension results in Chapter 3. On the other hand, the latter can rather be defined according to the physical sides in the signing space (i.e. left-right) irrespective of the handedness, which is a mirror image of the pattern (i.e. right-left) used in comprehension of pronominal IX.

Another logical possibility to describe the pattern in TİD, might be to assume that right-handed signers follow a contra-ipsi pattern and left-handed signers follow an ipsi-contra pattern. Thus, in terms of hand-dominance, right- and left-handed signers could be described to use reverse patterns. In any case, it seems that at least right-handed signers of DGS and TİD make use of the same spatial areas to assign referents; however, they do so in a different order, i.e. DGS signers start to assign their referents on their ipsilateral side, while TİD signers start on the left side of the signing space.

Such variation in usage of the lateral spatial axis might be attributed to the typological difference between the two languages. In fact, that languages might show variation in their usage of spatial axes for default localization, has already been suggested by Geraci (2014). Table 4.31 (initially presented in Chapter 2, Section 2.1 and here repeated with inclusion of

DGS and TİD) provides an overview of the realization of spatial axes across various sign languages.

Table 4.31: (Potential) parametric variation observed in the usage of spatial axes

Spatial axes	subject/R1	object/R2	language
X-axis	ipsi	contra	LIS
	contra	ipsi	--
	ipsi/contra	ipsi/contra	LSC
Z-axis	proximate	distant	ISL & ABSL, Turin dialect of LIS
	distant	proximate	--
	distant/proximate	distant/proximate	--
X-axis and Z axis	ipsi/proximate	contra/distant	--

[d] This table is formed on the basis of suggestions by Geraci (2014).

Another scenario regarding differential realization of the defaults, might be contact of DGS and TİD with the gestural pattern of the spoken languages (i.e. German and Turkish). It has been observed that not only sign languages, but also spoken languages make use of the visual modality (i.e. gestural space) for expression of gestures co-occurring with the speech (i.e. referential expressions). The studies have shown that, speakers make use of contrastive areas in gestural space to express meaning as well (So et al. 2005; Calbris 2008; Smith & Kam 2012; Smith & Kam 2015; Herrmann 2018). Calbris (2008) discusses that hearing individuals (i.e. a case of the French prime minister) as well follow left-right pattern in enumeration of the entities while they prefer right-left pattern when contrasting two entities in gesturing. Herrmann (2018) in a behavioral task, has observed that German speakers make use of right-left default placement of gestures (i.e. palm up) to identify referents of ambiguous pronouns.

In the light of those, DGS signers might share the same spatial pattern as speakers of German in gesturing. On the other hand, TİD signers either might have diverged from that

because the left-right pattern became grammaticalized in this sign language or they might as well be adapting the gestural default pattern of speakers of Turkish. However, we need to look at comparative data on spatial modification including gesture of Turkish/German speakers and sign of DGS/TİD signers to verify these assumptions.

The default patterns of localization are not absolute but rather relative (Table 4.30: Pattern 2), and can differ even in the productions of the same signers (i.e. intra-signer variation). This might as well be another evidence for the spatial defaults, by nature being overridable and gradient as suggested by Geraci (2014).

Inter-signer variation with respect to two-referent localizations, within the same language as well as the same handedness group was observed for both sign languages as well. For instance, in DGS participants G10 and G04, while in TİD participants T06 and T01, all right-handed, used opposing patterns of localization in their productions. This difference can be attributed to the sociolinguistic factors such as the region of the participants, register they tend to use in daily life (i.e. formal vs. informal) as well as sign language input (i.e. sign language history of the family).

In the light of those, if we look at two DGS signers with varying localization patterns, we can see that both have high level of education, but G04 has a deaf family and comes from Berlin (east of Germany) while G10 has a hearing family and comes from Frankfurt area (south of Germany) (see Appendix A for the metadata information). As both of the signers teach DGS, it might be the case that they are using a clear localization pattern (manual and non-manual). However, variation in realization of the pattern might as well be due to either regional differences (a comparable variation was observed for Turin region signers of LIS by Geraci (2014)), or the sign language input the signers were exposed from the very beginning. As these are the only signers coming from the two regions, there was no chance to compare regional variation, and needless to say it has to be investigated further.

As for the TİD signers of the same handedness group, T01 followed a contra-ipsi pattern typical of his right-handed peers while T06 consistently used the reverse-pattern. Both signers were raised by hearing families and are currently certified instructors of TİD. While T01 was raised in the western part of Turkey, T06 was raised in the eastern part of Turkey. Moreover, one of the parents of T06 was a hearing teacher of TİD and might potentially be using a localization pattern which is particular to the education context or affected by the gestural system of Turkish. Therefore, T06's deviation from the expected contra-ipsi (left-right) pattern used by right-handed signers might be attributed to the influence of the gestural pattern of the Turkish speakers (i.e. potentially right-left/ipsi-contra).

In terms of the one-referent localizations, both right and left-handed DGS signers, primarily started from the ipsilateral side, irrespective of the referent type. In some cases, localizations of R2 were on the contralateral side, for those occurrences we can assume that R1 is covertly localized on the ipsilateral side, even though there is no visible contrast in overt localization. These occurrences confirm the pattern observed for two-referent localizations.

When we look at the patterns observed for one-referent localizations in TİD, it seems that right-handed signers might be covertly localizing one of the referents hence single localizations of R1 are realized on the contralateral (left) and R2 on the ipsilateral (right) side, following the overt localization pattern of two-referents. They can as well start single R2 localizations from the left, in those cases R2 seem to be treated as first irrespective of R1. As for the left-handed signers, they either start from the contralateral (right) side or from the (ipsilateral) left side to localize R1 and R2. In the first case, they might simply treat these referents as first-mentioned irrespective of their type, in the second case the signers might have already localized covertly one of the referents on the left, hence the right side is used

for the remaining referent irrespective of its type. All in all, the default pattern of overt localization is as well confirmed in the cases of one-referent localizations in TİD.

To recap, it was shown that the signers' production of localization defaults (i.e. usage of lateral spatial axis for initial localization) is quite scarce and subject to variation. In fact a similar picture was observed for the British Sign Language (BSL) Corpus, where only a small frequency (9,4%) of the agreement/indicating verb tokens involved side-to-side spatial modification of the third person referents (Cormier, Fenlon & Schembri 2015). In the current data, the production of relatively small amount of lateral localizations might be caused by the nature of the prompt sentences themselves. That is, the participants might have been primed by sentences without localization cues, and produced as well either no localization at all, or only a few occurrences of it. To verify the frequency of usage of the lateral axis both for localizing verbs and pronominal IX signs, corpus data from DGS and TİD need to be analyzed.

Given that the defaults are easily overridable and occur scarcely in the natural or elicited production data, the question is whether they should be considered as a part of the grammar at all, and, if yes, how to handle, and more importantly how to integrate, all those variation in a model of the grammar. It is also important to note that the current task only looked at free continuation data, but different discourse contexts (e.g. contrast, comparison, coordination) might use divisions in space in different ways, and hence may trigger different patterns of defaults. Therefore, each of those contexts should be investigated separately with signers from different populations to determine the defaults (i.e. marked vs. unmarked structures), the deviations from those defaults, their function in discourse, and the potential factors overriding them.

5 Production of Referential Expressions in Local Contexts

In sign languages a referent associated with a spatial locus (i.e. localized) is observed to have a high thematic value (Engberg-Pedersen 1993: 99) and hence is the preferred candidate for the topic (i.e. most salient entity) of the following discourse. For DGS, it was shown that localization of first-mentioned referents (i.e. subjects) increases their accessibility in a way comparable to sentential focus (Wienholz et al. 2018c). Given that overt localization has a potential to indicate the salient entity[81], the question on marking salience in the contexts where the referents are not overtly localized, appears. In particular, if the signers start their discourses without localizing the referents in the signing space, will they make use of the modality independent conventions (e.g. semantic focusing of the verbs) to indicate salient referents and the form of referential expressions for those?

In Chapter 3, it was already shown that factors like semantic properties of the verbs and referential preferences of the linguistic expressions (i.e. accentuated pronominal IX) might influence the interpretation of referentially unanchored pronominal IX. In the study examined in this chapter, the introduction sentences of the stimuli in Chapter 3 containing no localization cues are used as prompt sentences for the production of short discourses. This is done to test the following hypotheses: (i) in the absence of overt localization, the type of the verb (i.e. semantic properties of the verb) is the main (if not the only) determinant of the salient referent, and (ii) the sentences without localization of the referents will very rarely be continued with pronominal IX (if at all).

[81] As already mentioned in Chapter 2 the definition of salience followed in this dissertation is the one discussed by Chiarcos, Claus & Grabski (2011:2): "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."

Therefore, the focus of the current chapter is to determine strategies the signers apply to produce salient referents in the subject position and referential devices used for their realization. Among those, production of the pronominal IX and its coreference relation with first-mentioned (i.e. R1/subject) and second-mentioned (i.e. R2/object) referent of the preceding prompt sentences are of particular interest as well.

Given the findings in Chapter 3, and by Frederiksen & Mayberry (2017) (see Chapter 2, Section 2.3.4), the sentences ending with plain and agreement verbs were expected to be continued with pronominal IX or other linguistic expressions referring to R2. But given the nature of free-continuations, and that the prompt sentences repeated by the participant slightly diverged from the original stimuli (Chapter 4, Section 4.1.2), the covariates (e.g. type of coherence relation) occurring in those productions were examined looking at their influence on salience and therefore the referential choice, not only for pronominal IX, but also for other types of referential expressions (e.g. bare nouns).

It has to be noted that, for spoken languages factors like coherence relations (e.g. *Cause-Effect*) or the type of connective (e.g. because) were shown to have a differential influence on the production and the comprehension of referential expressions, including pronouns (Stevenson et al. 2000; Kehler 2002; Rohde, Kehler & Elman 2006). However, there is no research on the influence of these factors on the salience of referential expressions in sign languages. The present study aims to determine and exploit the potential correlations between the presence / absence of these factors and the choice of referential expressions coreferential with R1 or R2 (or both of those as a group, R1R2) in the prompt sentences. The analyzed production data contain the introduction sentences and only the first sentence of the free continuations. That is, the data presented in Chapter 4 and analyzed for the distribution and realization of the overt spatial localization is now examined from the perspective of salience. The research questions guiding this chapter are the following:

(i) Do the signers prefer to continue the prompt sentences with R1/subject or R2/object referents in this particular data?

(ii) Do the signers use full forms for less accessible/salient referents (i.e. objects) and reduced forms for more accessible/salient referents (i.e. subjects)?

(iii) How frequently is pronominal IX produced when preceding sentences contained no localization? How natural is it to produce it in local contexts?

(iv) Which factors determine the relative salience of the referents in local contexts prompted by sentences without any localization cues? In particular, whether the type of spatial verb, usage of a specific type of connective word, or a type of coherence relation have an influence on a referent's saliency.

In the following, Section 1 presents the methodology including participants, materials, procedure, coding and evaluation. Section 2 contains results of DGS and TİD, first presented separately and then summarized in comparison with each other. Finally, Section 3 discusses the results and their relevance for the current literature.

5.1 Methodology

5.1.1 Participants

Data from 10 signers of DGS (4 male, 6 female, age range: 26-48 years, mean: 34,4 years) and 10 signers of TİD (4 male, 6 female, age range: 18-46 years, mean: 29,7 years) were analyzed in this chapter (for more details on background of the participants see Chapter 3, Section 3.1.1 and Appendix A).

5.1.2 Materials

The stimuli used to elicit data presented in Chapter 4 are also used to collate data for the current chapter. To recall, twenty prompt videos containing simplex sentences of SOV word order with two-person characters (i.e. male and female) were used for DGS and TİD respectively. These sentences were only controlled for overt localization cues, and were signed with naturally occurring non-manuals at the speed of natural signing (see Chapter 4, Section 4.1.2 for a more detailed description of the stimulus structure).

5.1.3 Procedure

The same procedure as in Chapter 4 (see Section 4.1.3 for details) was followed to elicit data for this chapter. Participants watched the signed prompt sentences on a computer screen and then repeated them to the recording camera and freely continued them forming mini-narrations with self-created thematically related sentences about one of the referents.[82] Crucially, the signers were told that the audience, who will later watch the videos, will include deaf and hearing researchers competent in the respective sign language and familiar with details of the performed task.

As was discussed in Chapter 4, the elicitation method used in this study is a free sentence continuation task inspired by Miltsakaki (2007) and applied by Frederiksen & Mayberry (2017) to ASL. It is a frequently used method in spoken languages to elicit local contexts in which participants are presented with sentence prompts and are instructed to continue them in the most natural way with the referents contained in the previous sentences

[82] Frederiksen & Mayberry (2016) have observed no significant difference between the narrations produced to the deaf interlocutor and to the camera when eliciting narratives signed to the present signer as well as to the camera. But I am aware of the fact that signing to a camera might still influence the productions as compared to ones signed to/with deaf interlocutor.

(Stevenson 2002; Rohde, Kehler & Elman 2006; Kaiser 2011a). That is, what comes next is fully decided by the participants, however the sentence prompts are typically manipulated in such a way that they contain only one of the factors which is tested in terms of its effect on the relative salience of the referents (e.g. if order of mention is tested prompts containing referents in different order of mention are included). In continuations, the entity mentioned first and the expression it is realized with is determined with the intention to predict which of the locally presented referents appears to be more prominent in the mental model of the participant. In such tasks, there is always a risk to get messy data, but when this risk is taken free continuations can tell a lot about the actual referential preferences of the participants.

5.2 Evaluation

For the present study, only the first two sentences (repetition and continuation) of the signed narrations were evaluated (DGS = 191, TİD = 199).[83] As discussed in Chapter 4, Section 4.2, all productions were transcribed manually gloss-by-gloss (the gloss conventions standardized by Experimental Sign Language Laboratory of University of Goettingen were followed) on ELAN software and coded for the following categories:

i. Repeated introduction sentences:
    a. Spatial type of the sentence final verb (e.g. agreement, plain, reciprocal);
    b. Type of the localized referent (e.g. R1, R2, R1R2, R3);

[83]Originally, 200 productions were elicited from two languages, however one narrative from DGS and one from TİD could not be evaluated due to video related technical problems. At least for spoken languages, a difference between main and subordinate clauses was determined with respect to the anaphora production and comprehension (Miltsakaki 2007). Assuming that subordinate clauses might behave differently as well in sign languages, eight further cases were removed from DGS data as they included only one complex sentence, instead of two simplex sentences (i.e. introduction and continuation).

c. Non-manuals freely occurring on each of the referents (e.g. head nod).

ii. Continuation sentences (only for the referents in subject position)[84]:

a. Type of the referents in continuations (e.g. R1, R2, R1R2, R3);

b. Form of the referring expressions in continuations (e.g. IX, noun, etc.);

c. Type of the coherence relation (e.g. *Cause-Effect*).

The sub-categories coded for repetition sentences are evaluated only with respect to their co-occurrence with the type of the referent and the form of referring expression occurring in the subject position of the continuation sentences. As the evaluation was done for the semi-controlled production data and was meant to be of rather an exploratory and qualitative nature, the frequency distribution of the abovementioned categories is presented only with raw numbers.

5.3 Results

Production data are analyzed with the aim to determine which referent the signers prefer to mention first in their continuations, the forms of referential expressions used to realize the chosen referent and potential factors affecting this choice in local contexts. Therefore, the elicited data are grouped based on: (i) the type of a referent (DGS: Section 5.3.1.1 and TİD: Section 5.3.2.1), (ii) the type of a referent by the verb type in the introduction sentences (DGS: Section 5.3.1.2 and TİD: Section 5.3.2.2), (iii) the type of the verb in the introduction sentences by coherence relation (DGS: Section 5.3.1.2.1 and TİD: Section 5.3.2.2.1), (iv) the connective words by the coherence relations (DGS: Section

[84] The type of the referents and form of the referring expressions occurring in the non-subject position were coded as well, but will not be discussed in the scope of the present analysis.

5.3.1.2.2 and TİD: Section 5.3.2.2.1), and (v) the type of a referent by the form of referring expression (DGS: Section 5.3.1.3 and TİD: Section 5.3.2.3). Each of those groupings are explained below.

The analyses examine frequency of occurrence of four types of referent selections: first-mentioned referent/subject of the preceding sentence (R1); second-mentioned referent/object of the preceding sentence (R2); both referents/subject and object of the preceding sentence (R1R2), and the referent not mentioned in the preceding sentence (R3)[85]. The properties of R3 referents will be discussed for each language separately. Given the results in Chapter 3, (i.e. pronominal IX signs occurring in the continuation sentences were mainly interpreted as R2) it is hypothesized that R2 will be the most preferred referent to continue the narrations.

The referent types are further grouped according to the three types of verbs in the introduction sentences (i.e. agreement verbs, plain verbs and reciprocal verbs). This step in the evaluation was performed given the observed influence of these verbs on the interpretation of the reference of pronominal IX (Chapter 3). The expectation is that the signers might produce R2 continuations mainly with plain verbs, then with agreement verbs and the least with reciprocal verbs. Likewise, R1 productions were expected to occur the most with reciprocal verbs.

Another grouping used in the analysis was done by splitting the verb types according to the coherence relations determined between the introduction and continuation sentences. The main reason for this grouping was to identify whether a particular verb type triggers a

[85] Typically, studies using free sentence continuation paradigm tend to eliminate referent productions which are not at the focus of the study of their analysis (i.e. if only subject and object continuations were looked at plural continuations were removed). However, given the exploratory nature of the current study all types of the continuations produced were considered for the analysis to give a general picture of all possibilities.

particular type of coherence relation, which might indeed be a reason for one referent to be preferred over another in the continuations. In some accounts, the type of the coherence relation was considered the most important determinant effecting interpretation of referential expressions (i.e. pronouns) for spoken languages (Kehler 2002; Rohde, Kehler & Elman 2006; Kehler et al. 2007).

A three-way categorization proposed by Kehler (2002) is used to identify the coherence relations in the production data, these are: *Resemblance*, *Cause-Effect* and *Contiguity*. In particular, *Resemblance* relations imply common or contrasting relations among the entities and are further divided into six subgroups (i.e. *Parallel, Contrast, Exemplification, Generalization, Exception* and *Elaboration*). These relations are usually signaled by certain conjunctions (e.g. and, but, however, nevertheless and that is). *Cause-Effect* relations are based on implications caused by the two sentences and can be of five types (i.e. *Result, Explanation, Violated Expectation* and *Denial of Preventer)*. The *Cause-Effect* relations are usually indicated by a separate set of connectives (i.e. and, because, even though, despite). The third type of the coherence relations, *Contiguity,* includes one type of relation (i.e. *Occasion*), and it expresses eventualities centered around some entities. The examples of each type of the coherence relation from Kehler (2002: 16-22) are given in (12).

(12) a. Gephardt supported Gore, but Armey opposed him. *(Resemblance: Contrast)*

b. George is dishonest because he's a politician. *(Cause-Effect: Explanation)*

c. George picked up the speech. He began to read. *(Contiguity: Occasion)*

Furthermore, in order to determine whether a particular coherence relation is signaled by a certain connective as suggested by Kehler (2002), another grouping based on the connectives/conjunctives was done. It is assumed that the examined sign languages might as

well show the same types of co-occurrences. Hence, one of the predictions was to find continuations starting with connectives like 'because' to signal *Cause-Effect* type of coherence relations. As there is no study describing the types and frequency of the connectives in both sign languages first, the form and the frequency of these connectives, and then their co-occurrence within different coherence relations was determined.

Finally, the frequency of referents was analyzed by looking at the linguistic forms they were realized with, including but not limited to pronominal IX (e.g. bare nouns, other types of pronouns, zero forms). For those, more reduced forms are predicted to refer to more accessible or salient referents (i.e. R1) while less reduced forms are predicted to identify less accessible ones (i.e. R2), given the premises of the Accessibility Theory (Ariel 1985; Ariel 2001), (see Chapter 2, Section 2.3.1).

5.3.1 DGS Results

5.3.1.1 Type of the referent

DGS data are first analyzed according to the type of the referent produced at the beginning of the continuations (see Table 5.1). The participants preferred to start their continuations either with R2 (76/191) of the previous sentence or R1R2 (73/191). R1 was picked up penultimately least (27/191), and only in a few cases participants selected R3 (15/191). R3 selections included two groups of referents: (i) indirect reference to R2 (8/15) (e.g. ROOM, an entity which implicitly refers to the property possessed by R2[86]), (ii) referents

[86] These cases can be considered as an example of 'bridging cross-reference anaphora'. A semantic type of anaphoric relation in which the association between anaphor and its antecedent requires some background information not directly retrievable from the sentence or discourse context (e.g. John walked into a concert hall. The chandeliers were magnificent.), see Huang (2000) and the references thereof for the details. These types of R3 references were coded as indirect reference to R2 in the present study.

not mentioned before (7/15) (e.g. STORM which is none of the person referents introduced in the prompt sentences).

Table 5.1: Frequency distribution of the referent types occurring in the subject position of continuation sentences in DGS

referent type	**frequency**
R1	27
R2	76
R1R2	73
R3	15
Total #	191

5.3.1.2 Verb type

DGS continuations are analyzed by splitting the data further by the sentence final verbs of the repeated introduction sentences (see Table 5.2). The results indicate that the sentences preceded by agreement verbs and plain verbs were mainly continued with R2 (agreement verbs: 40/73, plain verbs: 31/60). On the other hand, the sentences with final reciprocal verbs were continued mostly with R1R2 (39/58).

Table 5.2: Frequency distribution of the referent types grouped according to the verb type in introduction sentences in DGS

referent type	**verb types in the introduction sentences**		
	agreement	plain	reciprocal
R1	12	3	12
R2	40	31	5
R1R2	16	18	39
R3	5	8	2
Total #	73	60	58

5.3.1.2.1 Coherence relation

This analysis examined the types of verbs by coherence relations, to investigate whether a particular type of a verb (e.g. plain verbs) triggers the occurrence of a certain coherence relation. First, the overall occurrence of the coherence relations[87] was determined (Table 5.3), then this grouping was further split by the verb type (Table 5.4).

As for the overall frequency of the coherence relations, DGS signers seem to prefer a subgroup of *Cause-Effect* relations, and in particular the *Explanation* relation (130/191). The least preferred was a subgroup of *Resemblance* relations, in particular *Contrast* (5/191) and a subgroup of *Cause-Effect* relations, in particular *Result* (5/191).

Table 5.3: Frequency distribution of coherence relations established between the introduction and continuation sentences in DGS

coherence relation	**frequency**
Contiguity	26
Resemblance (contrast)	5
Resemblance (elaboration)	25
Cause-Effect (explanation)	130
Cause-Effect (result)	5
Total #	191

When we look at the verbs grouped by their co-occurrence with coherence relations, it appears that with agreement and plain verbs *Cause-Effect* (i.e. *Explanation*) relation was preferred (agreement verbs: 50/73; plain verbs: 50/60). Likewise, with reciprocal verbs

[87]As there are no previous studies investigating coherence relations in sign languages, I mainly relied on examples and explanations by Kehler (2002) to determine those relations for the investigated sign languages. In uncertain cases, I consulted the deaf informants to check the meaning of the relations.

Cause-Effect (i.e. *Explanation*) (30/58) as well as *Contiguity* (i.e. *Occasion*) (14/58) relations were established.

Table 5.4: Frequency distribution of the verb types by coherence relations established between the introduction and continuation sentences in DGS

coherence relation	**verb types in the introduction sentences**		
	agreement	plain	reciprocal
Contiguity	8	4	14
Resemblance (contrast)	1	1	3
Resemblance(elaboration)	11	5	9
Cause-Effect (explanation)	50	50	30
Cause-Effect (result)	3	--	2
Total #	73	60	58

5.3.1.2.2 Type of connective

The next evaluation looks at connective words according to the type of the coherence relations. First, the frequency and form of different connective words in the data and then, co-occurrence of those with certain types of coherence relations will be presented. In total 68 occurrences of 8 different connectives were observed, these are: BUT (ABER), AFTERWARDS (DANACH), THEN (DANN), BY-MEANS-OF (DURCH), FOR (FÜR), REASON/BECAUSE (GRUND), AND (UND), WHY/BECAUSE (WARUM). As can be seen in Table 5.5, the most frequently used connective at the beginning of continuation sentences appears to be BECAUSE.

Table 5.5: Frequency distribution of the connectives in the continuation sentences in DGS

connective	**frequency**
BUT	2
AFTERWARDS	1
THEN	4
BY-MEANS-OF	1
FOR	1
BECAUSE	50
AND	2
WHY/BECAUSE	7
Total #	68

Among the observed connectives, THEN might signal the *Contiguity* relations (4/5), while BECAUSE and BECAUSE/WHY appear to exclusively (57/59) indicate *Cause-Effect* (i.e. *Explanation*) type of coherence relations (see Table 5.6). For the remaining connective words, it was not possible to determine whether they co-occur with certain type of coherence relation given their scarce occurrence in the data.

Table 5.6: Frequency distribution of the connectives by coherence relations established between the introduction and continuation sentences in DGS

Connective	**coherence relations**				
	Contiguity	Resemblance (contrast)	Resemblance (elaboration)	Cause-Effect (explanation)	Cause-Effect (result)
BUT	--	2	--	--	--
AFTERWARDS	1	--	--	--	--
THEN	4	--	--	--	--
BY-MEANS-OF	--	--	--	1	--
FOR	--	--	--	1	--
BECAUSE	--	--	--	50	--
AND	--	--	2	--	--
WHY/BECAUSE	--	--	--	7	--
Total #	5	2	2	59	0

5.3.1.3 Form of the referent

Analysis of DGS continuations according to the form of the referents is given in Table 5.7. Before discussing the frequencies, a general overview of the referential expressions determined in the subject position of the continuations is provided. In particular, referential expressions in DGS data come in two forms: overt expressions (152/191) and zero expressions (39/191). Overt expressions can further be divided into two forms: single-sign expressions and multiple-sign expressions. Single-sign expressions (see the parts highlighted in grey in Table 5.7) consist of single pronominal (e.g. IX$_R$) and plural pronominal items (e.g. IX$_{DUAL}$) as well as nominal items (e.g. SIGN NAME). As for the multiple-sign expressions, these were formed by either two or three simplex forms signed one after the other (see the unhighlighted parts in the left most column in the Table 5.7).

In particular, pronominal plural form (i.e. IX$_{DUAL}$) was either preceded or followed by two sign names. IX$_R$ and IX$_N$ were mostly preceded by one or two nominal expressions (e.g. SIGN NAME, NOUN), and in one case IX$_R$ followed a nominal expression. Likewise, IX$_L$ was

mainly followed by one nominal expression, and only once preceded by a nominal. SIGN NAME was followed by a possessive pronoun (i.e. POSS), a NOUN, or a combination of both (i.e. SIGN NAME + POSS + NOUN). NOUN was combined with one or two preceding possessive pronouns.

When looking at the forms for each of the referent type, it appears that continuations with R1 are produced with a pronominal IX, a nominal preceded by IX (i.e. IX+SIGN NAME), a nominal (i.e. SIGN NAME) or zero forms. The most frequent realizations occur with SIGN NAME (14/27). Only in a few cases the pronominal IX signs were produced referring to R1 (3/27).

R2 appears to take more diverse forms of referential expressions compared to other types of referents. These are: a pronominal IX, IX preceded or followed by a nominal, a nominal (e.g. SIGN NAME, NOUN), a possessive pronoun followed by a nominal, PAM, SELF (i.e. reflexive pronoun) and zero forms. As with R1, R2 was most frequently produced with SIGN NAME (41/76), and the pronominal IX signs appeared only in a few cases (7/76), especially with the preference of IX_L (5/7)[88].

R1R2 continuations took the form of dual exclusive pronominal IX, pronominal IX, two sign names preceded or followed by dual pronominal IX and zero forms. Among those the most frequent distribution occurred with dual pronominal IX (45/73).

R3 was expressed via pronominal IX, pronominal IX following or preceding nominals, nominal signs and a combination of two or three nominal signs. Most frequent occurrences are observed with NOUN (6/15). The general picture shows that when IX accompanied a nominal it mainly preceded it. As for the zero forms in the data, this set includes zero pronouns, clitics/loci and in a few cases role shift (R1: zero pronouns (3/8), clitic pronouns

[88] Pronominal IX signs were not produced equally frequently by all participants. That is, only two participants (G1 and G10) produced those more frequently than the others who either signed only one instance or none.

(5/8); R2: zero pronouns (2/7), clitic pronouns (4/7) and role shift (1/7); R1R2: zero pronouns (24/24)).

Besides the analyses of the DGS data presented above, the data were as well analyzed according to the covariable non-manuals freely added by the participants in their repeated prompt sentences with the aim to detect whether there is any co-occurrence between a particular non-manual on R1 or R2 in the introduction and the type of the referent in continuation. In other words, the data were examined to determine whether non-manuals increase the prominence of one or the other referent and trigger it to be the theme of the following discourse. These analyses show that DGS signers prefer to produce R1 and R2 in their repeated sentences with a head nod, however no further co-occurrences between a non-manual on a referent and this referent's occurrence in continuation were observed, therefore these analyses will not be discussed further here.

Table 5.7: Frequency distribution of the referential expressions (R-expressions) for each of the referent type occurring in the subject position of the continuation sentences in DGS

R-expression	R1	R2	R1R2	R3
IX_R	1	2	--	1
IX_N + SIGN NAME	1	--	--	--
IX_R + SIGN NAME	--	8	--	1
IX_R + SIGN NAME + NOUN	--	--	--	1
IX_R + NOUN	--	1	--	--
IX_R + SELF	--	1	--	--
SIGN NAME +IX_R	1	4	--	--
IX_L	2	5	--	--
IX_L+ SIGN NAME	--	1	--	--
IX_L + PAM	--	1	--	--
NOUN + IX_L	--	--	--	1
IX_{PL}	--	--	1	--
IX_{DUAL}	--	--	45	--
IX_{DUAL}+ SIGN NAME + SIGN NAME	--	--	1	--
SIGN NAME + SIGN NAME + IX_{DUAL}	--	--	2	--
SIGN NAME	14	41	--	--
SIGN NAME + NOUN	--	--	--	1
SIGN NAME + POSS	--	--	--	1
SIGN NAME + POSS +NOUN	--	--	--	1
NOUN	--	2	--	6
POSS +NOUN	--	--	--	1
POSS + POSS + NOUN	--	--	--	1
PERSON	--	1	--	--
SELF	--	2	--	--
zero form	8	7	24	--
Total #	27	76	73	15

[a] **IX_R/ IX_L** = pronominal IX signs directed to the right (R) or left (L) of the signer, **IX_N** = pronominal IX signs directed to the neutral spatial area, **IX_{PL} =** plural pronoun referring to a group of referents, **IX_{DUAL} =** plural pronoun encoding exclusive dual persons, **POSS** = possessive pronoun, **NOUN** = nominal signs, **SIGN NAME** = sign names given in the prompt sentences, **PERSON =** pronoun referring to people, **SELF** = reflexive pronoun, '+' indicates that the two signs occur together following a sequential order, without any further implication of forming complex units like compounds).

5.3.2 TİD Results

5.3.2.1 Type of the referent

The analysis of 199 TİD continuations shows that participants were more likely to start them with R2 (96/199) of the previous sentences. In addition, there was also a considerable amount of R1 continuations in the data (67/199). On the other hand, continuations with R1R2 (19/199) and R3 (17/199) in the subject position appeared to be less preferred (see Table 5.8). The group of referents included under the label R3 in TİD contain the following: (i) indirect reference to R1 (e.g. BORA FRIEND 'Bora's friend' with BORA as the R1 of a sentence) (3/17), (ii) indirect reference to R2 (e.g. IX GIRL MOTHER 'That girl's mother' with GIRL as the R2 of a sentence) (10/17), and (iii) referents not mentioned before (i.e. IX DAY 'that day', a referent mentioned for the first time as a theme of the continuation) (4/17).

Table 5.8: Frequency distribution of the referent type occurring in the subject position of continuation sentences in TİD

referent type	**frequency**
R1	67
R2	96
R1R2	19
R3	17
Total #	199

5.3.2.2 Verb type

TİD data grouped according to type of the referent by verb type are presented in Table 5.9. The continuations preceded by agreement verbs were mostly preferred to start with R2 (52/80). On the other hand, the sentences containing plain verbs were continued equally often with R1 (28/69) and R2 (28/69). The continuation sentences preceded by reciprocal verbs were preferred to start with R1 (23/50).

Table 5.9: Frequency distribution of the referent types grouped according to the verb type in introduction sentences in TİD

referent type	**verb types of introduction sentences**		
	agreement verb	plain verbs	reciprocal verbs
R1	16	28	23
R2	52	28	16
R1R2	7	7	5
R3	5	6	6
Total #	80	69	50

5.3.2.2.1 Coherence relation

As in the DGS data, the verb types are further analyzed according to the coherence relations formed between the introduction and the continuation sentences. First, the overall occurrence of the different types of coherence relations was determined (Table 5.10), then the frequency of occurrence of each of those relations was grouped by the type of the verb (Table 5.11). As for the overall frequency of the coherence relations, TİD signers seem to prefer *Cause-Effect* relations (i.e. *Explanation*) (156/199) while the least preferred were *Resemblance* relations (i.e. *Elaboration*) (10/199). In general, signers tend to form coherent narratives, only a few cases were (3/199) identified as incoherent by deaf consultants.

Table 5.10: Frequency distribution of coherence relations established between the introduction and continuation sentences in TİD

coherence relations	**frequency**
Contiguity	28
Resemblance (elaboration)	12
Cause-Effect (explanation)	156
Incoherent cases	3
Total #	199

The data split by verb types indicate that among the observed coherence relations, *Cause-Effect* (i.e. *Explanation*) was established in continuations preceded by all three types of the verbs (agreement verbs: 58/80, plain verbs: 57/69, reciprocal verbs: 41/50), the remaining relations appeared only in a small amount as can be seen in Table 5.11.

Table 5.11: Frequency distribution of the verb types by coherence relations established between the introduction and continuation sentences in TİD

Coherence relation	**verb types in the introduction sentences**		
	agreement	plain	reciprocal
Contiguity	15	5	8
Resemblance (elaboration)	7	5	0
Cause-Effect (explanation)	58	57	41
Incoherent cases	--	2	1
Total #	80	69	50

5.3.2.2.2 Type of connective

The next evaluation focused on grouping the connective words by coherence relation in the same way as for DGS to determine whether a particular connective word might indicate the occurrence of one or the other coherence relation. Before presenting the frequencies of this grouping, the frequency and forms of different connective words are illustrated (Table 5.12). A total of 45 occurrences of 5 different connectives were produced, these are: BUT (AMA), FOR/SO (İÇİN), REASON/BECAUSE (SEBEP), THEN (SONRA), THEREFORE/SO (YÜZÜNDEN)[89]. Among those, the most frequently produced connective is REASON/BECAUSE (21/45) and then THEREFORE/SO (11/45).

[89]Note that the English counterparts of those connectives are only approximate as the semantics and distribution of those has not been investigated up to date.

Table 5.12: Frequency distribution of the connectives in continuation sentences in TİD

connective	**frequency**
BUT	1
FOR/SO	5
REASON/BECAUSE	21
THEN	7
THEREFORE/SO	11
Total #	45

When looking at the co-occurrence of the connectives with the coherence relations, it appears that THEN might be indicating *Contiguity* relations (5/5) while REASON/BECAUSE (21/39) as well as THEREFORE/SO (11/39) seem to signal the *Cause-Effect* (i.e. *Explanation*) relations. As for the remaining connectives their scarce appearance does not provide further evidence for a particular co-occurrence pattern (Table 5.13).

Table 5.13: Frequency distribution of the connectives by coherence relations established between the introduction and continuation sentences in TİD

Connective	**coherence relations**			
	Contiguity	Resemblance (contrast)	Cause-Effect (explanation)	Incoherent cases
BUT	--	1	--	--
FOR/SO	--	--	5	--
REASON/BECAUSE	--	--	21	--
THEN	5	--	2	--
THEREFORE/SO	--	--	11	--
Total #	5	1	39	0

5.3.2.3 Form of the referent

Referential expressions used to express each type of the referent in TİD continuations are illustrated in Table 5.14. Prior to discussing the frequency of each referent's occurrence with a particular form, an overview of the produced referential expressions is given.

Participants used both overt expressions (143/199) and zero forms (56/199). Overt expressions were produced either using one sign or multiple signs as was observed in DGS (i.e. a combination of two, three or four signs). Single-sign expressions (highlighted in the Table 5.14) are pronominal IX signs (i.e. singular (IX_1, IX_R, IX_L) and exclusive dual (IX_{DUAL})) or nominal forms (e.g. NOUN). Multiple-sign expressions comprise IX signs mostly followed by one, two or three nominals (e.g. NOUN and SIGN NAME), SIGN NAME followed by IX, NOUN or both pronominal and NOUN as well as NOUN signs followed by IX signs, other nominals (e.g. NOUN, SIGN NAME) or a combination of both.

As for the the forms each referent type was realized in the data, we observe the following: R1 was realized with bare nominals (i.e. SIGN NAME), nominals followed by IX (i.e. NOUN + IX), pronominal IX and zero forms. More commonly, R1 was expressed via zero forms (27/67) and then via pronominal IX forms (17/67), with a higher preference for IX_L (11/17).

R2 was realized via bare nominals (e.g. SIGN NAME), nominals followed by IX (e.g. NOUN + IX), pronominal IX and zero forms. Among those, the frequent appearance was with SIGN NAME (28/96) and the pronominal IX (17/96) with a trend towards the usage of IX_R (12/17).

R1R2 referents were almost exclusively expressed by zero forms (16/19) while R3 was realized via pronominal IX, nominals or nominals preceded by IX. Interestingly, nominals followed by IX were quite scarce in the data when looking at their occurrence among all nominals accompanied by IX (7/47).

The types of the zero forms in the data were determined as following: R1: zero pronouns (25/27), clitic pronouns/expressed via locus on agreement verbs (2/27); R2: clitic pronouns expressed via locus on verbs (13/13); R1R2: zero pronouns (19/19).

Table 5.14: Frequency distribution of the referential expressions (R-expressions) by each of the referent type occurring in the subject position of the continuation sentences in TİD

R-expression	R1	R2	R1R2	R3
IX_1	--	--	--	3
IX_L	11	5	1	--
IX_L+ SIGN NAME	3	2	--	--
IX_L+ SIGN NAME + NOUN	--	--	--	1
IX_L+ NOUN	2	9	--	--
IX_L+ Q + NOUN	--	--	--	1
IX_R	6	12	--	1
IX_R + SIGN NAME	3	6	--	--
IX_R + SIGN NAME + NOUN + NOUN	--	--	--	1
IX_R + NOUN	3	16	--	2
IX_R + NOUN + NOUN	--	--	--	1
IX_{DUAL}	--	--	1	--
SIGN NAME	10	28	--	1
SIGN NAME + IX_L	1	--	--	--
SIGN NAME + IX_R	--	2	--	--
SIGN NAME + IX_R+PRS	--	1	--	--
SIGN NAME + NOUN	--	1	--	1
SIGN NAME +POSS + NOUN	--	--	--	1
NOUN	--	--	--	2
NOUN + IX_L	--	1	--	--
NOUN + IX_L + SIGN NAME	1	--	--	--
NOUN + NOUN + IX_R	--	--	1	--
NOUN + NOUN +Q	--	--	--	1
Q + NOUN	--	--	--	1
zero form	27	13	16	--
Total #	67	96	19	17

[b] **IX_1 =** first person pronoun, **IX_R/ IX_L** = pronominal IX signs directed to the right (R) or left (L) or the signer, **IX_{DUAL} =** plural pronoun encoding exclusive dual persons, **POSS** = possessive pronoun, **NOUN** = nominal signs, **SIGN NAME** = sign names given in the prompt sentences, **PERSON =** pronoun referring to people**, Q** = quantifier 'all', '+' indicates that the two signs occur together following a sequential order, without any further implication of forming complex units like compounds

Additional analyses looking at the co-occurrence of non-manuals on each of the referents in repeated prompt sentences and the type of the referent used in continuations were performed as well. In general, a head nod was observed to occur with both R1 and R2, however no further findings according to which non-manuals might indicate the salient referent were encountered. Therefore, non-manual based analysis will not be pursued further here.

5.3.3 Interim Summary

To sum up the findings of the present chapter, as can be seen in Table 5.15 below, DGS and TİD appeared to resemble each other in many aspects. In particular, signers of both languages mainly preferred to continue their sentences with R2, additionally R1R2 continuations appeared in a considerably high amount in DGS.

The type of the sentence final verbs in the prompt sentences seems to be the main determinant of the choice of the salient referent. That is, in both languages agreement and plain verbs triggered R2 continuations. In addition, plain verbs as well triggered R1 in the same amount as R2 continuations in TİD. As for the reciprocal verbs, those triggered R1R2 in DGS while only R1 continuations in TİD.

Looking at the type of the preferred coherence relation and whether it appears to co-occur with a particular type of the verb, in other words whether it is a coherence relation rather than semantics of the verb that triggers R2 continuations, no such co-occurrences were observed. In addition, the most preferred coherence relation established between sentences was the *Cause-Effect* (i.e. *Explanation*) followed by *Contiguity* relations in both languages. The former type seems to be signaled by the connective BECAUSE (and also THEREFORE/SO in TİD) while the latter appears to be identified by the connective THEN.

With regard to the referring expressions, in both sign languages R2 which is the most preferred referent took the form of nominals (i.e. single- or multiple-sign expressions). In DGS, R1 was produced mostly via single-signed nominals while in TİD it was preferred to take zero forms. As for the plural referents (i.e. R1R2), they took the form of plural pronoun (IX_{DUAL}) in DGS while zero form was favored in TİD. In general, pronominal IX signs were produced quite rarely. The IX signs accompanying a nominal were mostly preferred in the pre-nominal position, while post-nominal occurrence was very infrequent.

Table 5.15: A summary of the main findings obtained from continuations of DGS and TİD

Findings	**DGS**	**TİD**
Referent type preferred in the continuations	R2 and R1R2	R2
Potential factors influencing salience of the Referents		
Type of the referent triggered by plain verbs	R2	R1 or R2
Type of the referent triggered by agreement verbs	R2	R2
Type of the referent triggered by reciprocal verbs	R1R2	R1
Preferred coherence relation in continuations	Cause-Effect (explanation)	Cause-Effect (explanation)
Verb type coherence relation interaction/co-occurrence	not observed	not observed
Connectives marking certain coherence relations	THEN: Contiguity BECAUSE: Cause-Effect	THEN: Contiguity REASON/BECAUSE & THEREFORE/SO: Cause-Effect
Referential expressions used		
Form of R1	single-sign nominal expression	zero
Form of R2	single- or multiple-sign nominal expression	single- or multiple-sign nominal expression
Form of R1R2	IX_{DUAL}	zero
Usage of pronominal	scarce	scarce
Preferred order of IX when combined with nominal	pre-nominal	pre-nominal

5.4 Discussion

Production data elicited from DGS and TİD signers show a general preference to continue introduction sentences with the second-mentioned referent (i.e. R2/object). This is in line with the results obtained from a forced-choice Referent Selection Task in Chapter 3, where the same introduction sentences were used and pronominal IX in the continuations was mainly identified as R2 when preceded by agreement and plain verbs. Therefore, one plausible explanation for a general preference of R2 might be that the type of the referent participants prefer to select as a theme of their continuations (i.e. salient referent) is determined by the (semantic) properties of the verbs appearing in the repeated introduction sentences. However, the verb types do not behave exactly in the same manner in both languages. In particular, plain verbs and agreement verbs in DGS trigger continuations with R2. On the other hand, in TİD R1 and R2 appear equally often with plain verbs while agreement verbs trigger R2 continuations. Moreover, reciprocal verbs promote R1R2 continuations in DGS but R1 continuations in TİD. If it was (only) semantic properties of the verbs, we would expect the same verb types to (semantically) focus on similar referent types, which is not the case.

Another possibility is that, it might be the morpho-syntactic properties of the verbs which differ between the two languages causing the above-mentioned difference in focusing one or the other referent (see Table 5.16, earlier given in Chapter 3, Section 3.1.2, showing that there is a slight difference between the two languages in categorizing the verbs according to their agreement properties in the signing space). Recall that all verbs were controlled for their spatial modification in the current data, nevertheless the signers might be relying on the default morpho-syntactic properties (e.g. side-to-side spatial modification of the arguments in agreement verb HELP in DGS and CRITICIZE in TİD) to identify the salient referents.

To give some details, in TİD equal preference for R1 and R2 with plain verbs might be due to the differential agentive and ergative morphology observed for this type of verbs (Sevinç 2006). In other words, it might be the case that plain verbs like KNOW and CONGRATULATE, besides having different semantics in terms of the affected patient, also have differential ergative patters. On the other hand, in DGS plain verbs might behave in a more unified manner, all promoting R2 (i.e. ergative morphology) given that those verbs typically appear with PAM (person agreement marker) (Rathmann 2000; Murmann 2012), morphologically marking the object arguments (i.e. R2) in the signing space. In fact, this explanation seems more plausible than the semantic one, as body anchored plain verbs in DGS were shown to be grouped into different semantic categories according to the affectedness of the patient, including 'decreased agentivity of Agent like argument' (i.e. KNOW), or 'increased affectedness of Patient like argument' (Oomen 2018). Therefore, plain verbs are actually expected to behave in a non-unified manner.

In addition to modality dependent and independent factors which might have affected the preference of R2, the results have shown that the participants tended to use *Cause-Effect* (i.e. *Explanation*) coherence relations with their continuations. At least for spoken languages, causal relations have been shown to promote object continuations (Stevenson et al. 2000). Thus, in addition to the factors listed above the type of the naturally preferred coherence relations might have directed the signers to choose continuations having R2 as a theme.

Table 5.16: Verbs grouped according to their spatial agreement properties in DGS and TİD

spatial verb type	DGS	TİD
plain	SEARCH, KNOW, WARN, LIKE, GREET, CONGRATULATE	SEARCH, KNOW, WARN, LIKE, HELP, GET-TO-KNOW
reciprocal	KISS, MEET, PLAY, FLIRT, MARRY, GET-TO-KNOW	KISS, MEET, PLAY, FLIRT, MARRY
agreement (forward/single)	SEE, LOOK-AFTER, THANK, CHEEK-KISS	SEE, LOOK-AFTER, THANK, CHEEK-KISS, CONGRATULATE, GREET
agreement (forward/double)	HELP, CRITICIZE	CRITICIZE
agreement (backward/double)	INVITE, PICK-UP	INVITE, PICK-UP
agreement		

Besides the influence of the semantic or morpho-syntactic properties of the verbs (i.e. a modality independent factor), another potential explanation for the R2 preference in the data might be due the modality specific devices. In this respect, I consider two notions: the body as a subject and the usage of the role shift. In the 'body as a subject' hypothesis proposed by Meir et al. (2007), the subjects are considered to be lexically encoded on the body (of the signers) in plain and single agreement verbs. When connecting this to the current data, and keeping in mind that all agreement verbs were produced in the neutral space, it might be the case that the subjects being associated with the body are backgrounded (appear as a part of the common ground i.e. less salient). On the other hand, objects (i.e. R2) by means of being located in the neutral space appear to be (visually) more salient.

Role shift (Padden 1986; Metzger 1995; Engberg-Pedersen 1993) in combination with classifiers (i.e. limb classifiers) is shown to be a frequent reference tracking strategy marking prominent, and highly accessible, discourse referents especially in the maintenance contexts of sign languages (Barberà & Quer 2018). Moreover, it is observed to be associated with a first-person point of view acting as a subject clitic (Kegl 1986 as cited in Barberà &

Quer 2018). Therefore, using role shift might be a non-classical but more natural way to continue sentences with topics (i.e. first-mentioned referents/subjects/R1) in sign languages, hence more pronounced strategies (e.g. full names, IX) might be reserved for more marked continuations (i.e. R2/objects). In a way, the referential value of the role shift strategy itself is likely to be a determinant of the usage of the R1 continuations, and the lack of it in the current data can be considered to boost the R2 continuations. However, to verify this hypothesis, a comparative data containing prompts triggering role shift continuations has to be elicited and compared to the results of the data analyzed in this chapter.

The current data were analyzed according to the referential forms the participants selected for the themes of their continuations. To remind, the produced continuations can be considered as maintenance contexts (or somewhere between introduction and maintenance contexts) for the two referents, being introduced quite recently and thus are active in the mental representation of the signers. Given these, the expectation was to see reduced forms for continuations of both referents, but continuations with subjects of the preceding sentences were expected to be realized with more reduced forms than the objects. When looking at the continuations with R1, this referent was produced via zero form in both languages, but other forms like full nominals and pronominal IX were observed as well. For R2, a high number of full nominals were produced in both sign languages, which is in line with the expectation.

One way to explain the frequent nominal productions for R1 is to consider the continuations as introduction contexts as well. In particular, it might be the case that some participants just repeated the prompt sentences but actually started to introduce the referents in the continuations via nominals or nominals accompanied by localizing IX. In fact, this is supported by earlier research on larger discourse in sign languages, which has shown a preference for full nominal forms in introduction contexts (Perniss & Özyürek 2015;

Frederiksen & Mayberry 2016). Another way to explain the frequent occurrence of nominals both for R1 (especially in DGS) and R2 might be connected to the signed modality or sign language typology. In particular, it has been observed that full nominals including bare nouns have a wide distribution and are very common referential forms in sign languages, for they can express definite, indefinite and generic forms in different contexts (Tang & Sze 2002; Sandler & Lillo-Martin 2006). In the current contexts, the bare nouns might be expressing definite descriptions as well.

Yet another explanation for extensive usage of the full nominals in the data might be the nature of the elicitation procedure itself (where the signers were signing their utterances to the camera). It is likely that without a clear knowledge of the background of the audience that is going to watch the videos, the participants used the strategy of 'extreme clarity' and avoided usage of reduced forms. To confirm these claims referential value of bare nouns has to be determined for various contexts as well as for different audience types (e.g. deaf interlocutors, hearing researchers).

One aim of the present study was to examine the production of the pronominal IX signs referring to 3rd persons. It was expected that the prompts containing no localization cues will not be continued (and if, only scarcely) with the pronominal IX, which is usually spatially anchored to the previously localized referents. This expectation was indeed confirmed by the data which revealed that in both languages the occurrences of the pronominal IX in the continuations were quite scarce (DGS=10/191, TİD=35/199). Pronominal IX signs appeared co-referentially either with R1 or R2, hence not preferring one or the other referent. Moreover, in TİD the spatial direction of the pronominal IX seems to follow the default pattern of localization presented in Chapter 4 (i.e. IX_R = R2, IX_L = R1) while for DGS no such pattern was observed given the scarcity of the productions.

Crucially, IX signs were produced with different frequencies by the participants and appeared mainly in continuations preceded by introduction sentences where the referent of IX was spatially anchored[90]. This latter aspect indicates that spatially anchored and unanchored pronominal IX does not seem to occur naturally in the local (i.e. maintenance) contexts. The studies on larger discourse support this claim as well (Bel, Ortells & Morgan 2015; Frederiksen & Mayberry 2015; Frederiksen & Mayberry 2016). An implication for future controlled experimental settings, including designs as in Chapter 3, is that short contexts might not be suitable to test referential preferences of IX signs; however, to confirm this we need to look at the contexts prompted by overtly localized referents / arguments and examine whether the production of IX signs is determined by the length of the signed contexts or rather by the spatial anchoring of the referents that are coreferential with IX.

Another implication is that IX signs might be used to refer to less accessible referents, thus behaving like demonstratives. This is in line with the findings of Chapter 3 where pronominal IX signs were mainly selected for R2 (i.e. objects). The current data further show that the distribution of the IX in isolation and in combination with nouns (i.e. prenominal position) can also provide support for its demonstrative rather than (i.e. personal) pronominal properties. In fact, earlier studies on IX signs in Swedish Sign Language (Ahlgren 1990) and recent research on American Sign Language propose that IX signs show characteristics of demonstrative pronouns (Koulidobrova & Lillo-Martin 2016).

Furthermore, the *Avoid Pronoun Principle* (see Ariel (2001) and the references therein) might be operative in both languages suggesting low accessibility markers to be avoided while referring to highly accessible antecedents. However, when looking at the dual exclusive pronouns in the data (i.e. IX$_{DUAL}$) they seem to behave differently than singular ones

[90] As was shown in Chapter 4, some signers localized their referents even if they were exposed to the prompt sentences without localization.

(i.e. pronominal IX) occurring frequently in both languages especially in the context of reciprocal verbs. In fact, the differential behavior of single and plural pronominal IX was already investigated with the focus on indexicality, the former being more indexical than the latter (Cormier et al. 2007). I suggest that the present data indicate different referential values of singular and plural pronouns while the former might refer to less accessible referents and occur in reintroduction contexts, the latter might refer to more accessible referents and occur predominantly in maintenance contexts. However, these claims need to be verified in larger contexts and with different genres of discourse.

Lastly, it seems that in the investigated contexts, especially for R1 and R1R2, TİD signers prefer to use zero forms while DGS signers favor the usage of full forms such as bare nominals or plural pronouns respectively. It seems to be the case that both languages differ in the distribution of their zero forms, and this potential difference is an interesting topic for further investigation.

6 General discussion and Conclusion

This dissertation has an empirical focus and explores an influence of modality specific (spatial defaults of localization) as well as potential modality-independent conventions (semantic properties of the verbs) on the comprehension and the production of referential expressions in local contexts of two unrelated sign languages (i.e. DGS and TİD). The findings suggest a participant dependent (i.e. handedness) and language specific (i.e. gestural system of the surrounding spoken language) differential contribution of signing space and verb semantics for resolving pronominal anaphora and producing referential expressions.

In this chapter, firstly: the main results presented in the previous chapters are summarized (Section 6.1); secondly: the methodological (Section 6.2) and theoretical implications (Section 6.3) of the analyzed data are discussed before the key questions suggested for future research are listed (Section 6.4), and lastly, the dissertation is concluded outlining its main contributions (Section 6.5).

6.1 Summary and main results

(Study 1): Chapter 3 examined the impact of default localization pattern on the interpretation of referentially unanchored pronominal IX sign occurring in the local discourse with two competing antecedents. The comparative response data was collected using a two-alternative forced choice referent selection task from right- and left-handed signers of DGS and TİD. It was hypothesized that signers of both languages will follow an ipsi-contra default pattern of localization as suggested by Steinbach & Onea (2016) to identify referents of pronominal IX. That is, IX directed to the right (ipsilateral) side was expected to be identified

as a first-mentioned referent/R1 (i.e. subject) and IX directed to the left (contralateral) side as a second- mentioned referent/R2 (i.e. object) in the absence of any previous localization cues.

The findings of Chapter 3 have shown that the spatial default is indeed attested but only in the context of reciprocal verbs (e.g. MEET) and its usage for pronominal interpretation differs across the two languages. That is, in TİD the default pattern is identified as right-left (more clearly seen in left-handers) irrespective of handedness, and in DGS as ipsi-contra depending on handedness of the signers (observed only with left-handers). The differences in the usage of defaults were discussed in connection to the default patterns observed in production data of the overt localization in Chapter 4 (i.e. left-right in TİD; ipsi-contra in DGS) and were attributed to a typological variation in perspective taking strategies used in these languages. DGS signers seem to prefer the signer's perspective rotating the signing space 180^0, while TİD signers seem to use addressee perspective mirroring the signing space.

Another main finding of this chapter is the preference of pronominal IX to be identified as R2 or object of the previous sentence, which implies existence of the following potential factors overriding spatial defaults: (i) semantic focusing of plain and agreement verbs which might increase the prominence of R2, (ii) referential value of accentuated IX (i.e. reference to the entities of low accessibility), (iii) anaphoric priming of the stimuli (i.e. the usage of a particular strategy to resolve anaphora) which might have imposed R2 to be a repetitive anaphoric choice. All of these contribute to the set of other potential factors (e.g. place of articulation of the previous sign, usage of anaphoric timeline, individual characteristics of the signers) that are claimed in the literature to override spatial defaults (Geraci 2014; Steinbach & Onea 2016).

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 visual modality specific means is shown to be subject to parametric 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 & Mayberry 2017) 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 a theoretical model which integrates both modality dependent and independent factors of differential ranking/weight to influence interpretation of pronominal IX in ambiguous contexts.

(Study 2-part 1): Chapter 4 investigated the distribution of default overt localization in the signing space in elicited production data of DGS and TİD using a free sentence continuation task. Right- and left-handed participants (i.e. the same signers as in Chapter 3) were presented with sentence prompts containing no localization cues and were instructed to repeat and continue them with the themes about one of the referents from the prompt sentences. Their productions were analyzed according to two-referent (R1 and R2) and one-referent (R1 or R2) overt localizations.

The findings suggest two types of variation with respect to two-referent (i.e. contrastive) overt localization default: inter-language variation and intra-language variation. The latter type includes inter-signer as well as intra-signer variation. In particular, DGS and TİD differed in realization of the pattern, such that for DGS it can be defined according to the hand dominance (i.e. ipsi-contra), in line with the previous studies (Steinbach & Onea 2016; Wienholz et al. 2018a) and comprehension results in Chapter 3. On the other hand, for TİD it is rather defined according to the physical sides in the signing space (i.e. left-right) irrespective of the handedness, which is a mirror image of the pattern (i.e. right-left) used in

comprehension. Moreover, these patterns have been observed to vary in the productions of the same signers and across the signers of the same handedness status. The former variation is suggested to be due to the relative / overridable nature of defaults and the latter due to sociolinguistic differences (i.e. region, register, age of acquisition) between the signers.

This chapter provides evidence for the vague nature of the spatial defaults of localization and underlines the importance of handedness in realization of this pattern. Moreover, language internal and typological variation in terms of the structuring of spatial axes is observed and hence the way of handling all these variation in a single model of anaphora resolution / production is questioned. It is suggested that the spatial defaults might resemble characteristics of gestural defaults and a more optimal way of approaching them might be to consider them as a part of more general cognitive preferences rather than being a sign language specific grammatical device used to produce and resolve anaphoric relations.

(Study 2-Part 2): Chapter 5 examined the production of the type of referents / entities the participants preferred to mention next (e.g. R1/R2 continuations) and their choice of referential expressions (e.g. pronominal IX) for those. For analysis, the first sentences of short passages (i.e. two-sentence contexts), prompted by the stimuli without localization (as with the data in Chapter 4), were evaluated. Given the findings in Chapter 3, as well as those by Frederiksen & Mayberry (2017), the sentences ending with plain and agreement verbs were expected to be continued with pronominal IX (or another linguistic expression) referring to R2. Moreover, the production of pronominal IX was expected to be scarce.

The results focusing on the type of continuation show an overall preference of R2 in the continuations where a number of potential explanations were provided: (i) semantic focusing of the verbs; (ii) morpho-syntactic properties of the verbs; (iii) body as a subject hypothesis; (iv) lack of the role shift; and (v) preference of causal coherence relations established between the sentences.

The main findings concerning the form of the referential expressions have indicated a scarce usage of pronominal IX in both languages, which is explained by the lack of previous localization and the properties of the context (i.e. maintenance). Moreover, the data suggested preference for full nominals to express R2 in both languages. As for reduced forms, TİD signers produced them with a higher frequency than DGS signers to refer to both R1 and R2.

This study implies different referential values for pronominal IX referring to single referents and for pronominal IX_{DUAL} referring to plural referents. In particular, the former seems to signal less accessible referents, hence showing characteristics of demonstratives, while the latter seems to signal the more accessible ones, and is therefore showing pronominal properties. Moreover, the significance of the spatial type of the verb has been shown to be an important convention affecting the salience of referents (i.e. a preference for R2 continuations with the sentences containing agreement verbs) in line with the results of the comprehension study (Chapter 3).

6.2 Methodological implications

In this dissertation an offline data collection methodology (i.e. Referent Selection Task and Sentence Continuation Task) was used to elicit response and production data from a diverse population of signers (i.e. early and late learners). Below I will discuss the advantages and disadvantages of using this method (comparing it with an online technique).

The Referent Selection Task (as already mentioned in Chapter 3) adapted the structure of the stimuli of an ERP study investigating processing of pronominal IX in DGS (Wienholz et al. 2018a, 2018b). While in the ERP study the non-manuals (except mouthing) were controlled, in the current study the sentences were produced with naturally occurring non-manuals and were only controlled for localization. Moreover, while only right-handed

native DGS signers (12 female, 9 male, age range: 20–51 years, mean: 33 years) took part in the ERP study, both right- and left-handed signers, as well as early and late learners of sign language (DGS: 4 male, 6 female, age range: 26-48 years, mean: 34,4 years, TİD: 4 male, 6 female, age range: 18 - 46 years, mean: 29,7 years), participated in the Referent Selection Task. The crucial aspect here is that the findings of these two comparable studies differ. In particular, while the ERP study shows that the spatial defaults as well as the first-mention preference guide interpretation of pronominal IX, the Referent Selection Task suggests the usage of spatial defaults only in restricted contexts and shows the second-mention preference.

The difference in results obtained through these two methods investigating IX in comparable contexts suggests that signers might have applied different strategies for interpreting pronouns in different settings. In particular, the pragmatic reasoning used for online conditions might be different (i.e. immediate reactions) than in offline conditions (i.e. conscious reactions). In fact, this is supported by the results of a judgment task applied as a part of the abovementioned ERP study, which indicated no significant difference between the conditions as opposed to the online data. Additionally, research on spoken language anaphora, especially in the field of language acquisition, also reports many cases of task effects, where the results of online methods (e.g. eye tracking) do not match those of offline methods (Conroy et al. 2009; Bergmann, Paulus & Fikkert 2011; Chamorro 2018).

Another important factor which might have influenced the difference between the results of the online and the offline studies, mentioned above, is the type of the signer population and the number of signers the data were collected from (see also Quer and Steinbach (2019), for an influence of the differential signer population on the signed data source). For instance, twenty-one DGS signers who participated in the ERP study learned DGS before 3 years of age while ten DGS signers who participated in the Referent Selection

Task, included eight signers who learned the DGS before the age of 3 and two signers who learned this language before the age of 6. If we only focus on the right-handed signers, all of the participants in the ERP task but only five of the participants (two of whom were late learners, see Appendix A) in the Referent Selection Task, it will become clear that both the difference in the statistical power of the collected data as well as the homogeneity/heterogeneity of the signers might have influenced the difference in signers' preference to interpret pronominal IX (i.e. first-mention vs. second-mention preference).

The Referent Selection Task was slightly flexible than classical force-choice paradigms as referents not present in the data, but selected by the signers were also coded and included into the analysis. Even though this task does not provide online measurements of comprehension (i.e. how easy / difficult it was to interpret referents of pronominal IX), it has its own advantages. For instance, it is relatively easy to construct, instruct and apply. This task can provide initial tendencies of the signers regarding anaphora resolution and should be considered as a crucial complement for the online studies having similar structure. Some take home messages from the current task which could improve the follow-ups of the same type in the future, are the following: (i) DGS and TİD participants have difficulties and take a considerably long time to identify referents of pronominal IX signs when those are not preceded by spatially anchored referents; therefore, a time limit should be defined for choices in similar tasks, (ii) it is important to include fillers containing similar structure as the stimuli items but without further controlled elements to prevent the signers from developing data driven strategies for making their choices.

The Sentence Continuation Task is typically used to investigate factors influencing interpretation and comprehension of referential expressions in spoken languages. The current study is the first one examining production of overt localization defaults as well as referential expressions in comparative data of two unrelated sign languages (see also

Frederiksen & Mayberry 2017 for ASL). The biggest advantage of such a task is that it can be used to collect (semi-controlled / naturalistic) production data, but it comes with the risk of obtaining messy data, which can, nevertheless, offer interesting insights into the patterns (e.g. referential links) signers tend to use in natural signing.

More challenges follow with the annotation of the data, which might take an extremely long time, especially with the free-production data. Ideally, annotations should be done by multiple deaf coders who are trained to work with pre-defined categories (e.g. coding of ipsi-contra spatial default). The reliability of the annotated categories should then be compared between those coders as well. For the current task, I developed annotation and coding categories for the spatial directions as well as for frequently occurring referential items. Those can be adapted and further developed in the follow-up usages of the task.

6.3 Theoretical implications

This dissertation mainly focused on filtering the regularities in the data, and it includes some theoretical ideas for implementation in the existing theories, but it does not primarily aim to extend these theories. The comprehension and production data indicate a need for a theoretical model which integrates both signing space (i.e. localization defaults) and salience related factors (i.e. verb related properties) to account for pronominal anaphora resolution in local contexts. As discussed in Chapter 2, the existing discourse-semantic theories model either spatial defaults acknowledging but not elaborating on salience/prominence related factors (Steinbach & Onea 2016) or pragmatics per se (i.e. prominence defined as discourse topicality) (Barberà 2012) to account for pronoun resolution.

Salience-based accounts applied to sign languages mainly accept a one-dimensional view of salience attributing it to a particular factor (i.e. being activated in the memory of the

signer) therefore pronominal expressions are assumed to be resolved towards the salient entities which are either most accessible by their occurrence in particular discourse contexts (Perniss & Özyürek 2015; Bel, Ortells & Morgan 2015; Frederiksen & Mayberry 2016) or in a certain order of mention (i.e. first / second mention) (Wienholz et al. 2018b). However, the current data points towards the influence of multiple factors (i.e. spatial default, semantic properties of the verbs, coherence relations, and referential values of the linguistic items) on anaphora resolution.

Taken together, the existing discourse-semantic theories of sign language anaphora seem to require integration of a model that includes a multidimensional approach to salience as well as the use of modality specific conventions (i.e. signing space). I provide my suggestions for the further development of existing discourse-semantic theory (DRT), as extended by Steinbach & Onea (2016), to capture and include the above-mentioned aspects as follows.

The DRT implementation outlined by Steinbach & Onea (2016) can be developed further by extending the signing-space-determined structuring of the referents in DRS (i.e. a more complex structure is needed). Given the influence of the verb types on the salience of the referents observed in the current data, this property in particular can be integrated into the structure. However, the model should also be able to capture the fact that in different settings certain factors might be more important that the others in effecting salience, hence a dynamic hierarchy of those factors should be developed and integrated into the model (potentially using a hybrid model integrating Optimality Theory (McCarthy 2002)).

Moreover, given that signers prefer to use contrastive areas, and with variable realization mainly being affected by their handedness status, it might be necessary to redefine the type of features governing spatial oppositions from R(ight) & L(eft) to

C(ontrastive) proximate and distant ones. Proximate areas being realized close to the body or ipsilateral side, and distant the ones away from the body and closer to contralateral side.

In addition, the heuristics guiding the mapping from syntax to DRSs should be developed taking into consideration that IX signs behave as demonstratives and might have a differential structure and semantics in the pre-nominal (e.g. attributive & definite) and the post-nominal (e.g. predicative) positions.

To recap, the empirical outcomes of this dissertation can be considered as first claims that need to be verified against a larger dataset and only then can a general model of the anaphora resolution for sign languages be further developed.

6.4 Implications for the future research

As typical in any empirical (and theoretical) research this dissertation provides answers to some questions but also puts forward even more questions for further research. I believe that the following questions, grounded by the findings from each of the foregoing chapters, will guide future empirical and experimental studies on referentiality in sign languages:

i. How do different perspective taking strategies influence the interpretation and the production of referential expressions (e.g. IX signs)? (Chapter 3 suggested that DGS signers seem to apply a signer's perspective while TİD signers prefer the addressee's perspective when interpreting pronominal IX. It is important to verify this finding with more signers with different backgrounds (e.g. native, near-native, later-learners).)

ii. Does the handedness of a sign model influence the comprehension of referential expressions in ambiguous contexts? (The sign models used in this dissertation

were all right-handed. For the stimuli material produced by those informants the handedness of the participants was observed to have an influence on their comprehension. It is as also interesting to examine whether left-handed or ambidextrous sign models can affect comprehension of referential expressions in the same way.)

iii. How does their referential value differ when the referential expressions are accompanied with non-manual markers? (In Chapter 3, it is suggested that the accentuated pronominal IX (i.e. clearly pronounced and accompanied with a head nod) might serve the function of accentuated pronouns in English in retrieving less accessible referents (i.e. objects). It is crucial to determine whether different types of non-manual markers influence retrieval of the referents in a different way (e.g. eyebrow raise on IX might retrieve topicalized referents.))

iv. Can anaphoric priming effect observed in spoken languages (e.g. English) be observed in sign languages as well? (In the stimuli used in this dissertation no filler items were used and it was suspected that the signers might have adapted a particular anaphora resolution strategy (Chapter 3) to identify referents of pronominal IX (object preference). However, without knowing whether anaphoric priming observed in languages like English is also possible in sign languages it is difficult to identify the exact source of the preferences, hence this aspect needs to be investigated in the future research.)

v. Does the order of mention or the grammatical role determine preferences for interpreting and producing referential expressions? (The literature includes differential results on the preference of order of mention in interpretation and production of pronominal anaphora in sign languages. The current dissertation contributes to this debate by indicating second-mention (i.e. object) preference.

By manipulating the order of the arguments in the sentences, it has yet to be seen whether it is indeed, the order of mention or the grammatical role which determines the preference to identify the reference of pronominal expressions.)

vi. Are spatial localization defaults realized differently in different contexts (e.g. relative clauses, coordination, comparatives)? (Chapter 4 examined the production of spatial localization defaults in free-continuations, which appeared to be established mainly using causal relations. However, whether different senses of contexts require usage of the same or differently realized defaults should be checked separately to fully understand the grammatical status of those mechanisms.)

vii. How does realization of spatial defaults used in sign languages differ (if at all) from the gestural defaults used in co-speech gestures? (Chapter 4 suggested that spatial defaults used in sign languages might resemble the gestural patterns used in the expression of co-speech gestures. Psycholinguistic studies need to be conducted to compare those patterns for different discourse contexts.)

viii. What are the semantic properties and distribution of bare nouns and do they differ across unrelated sign languages (i.e. DGS and TİD)? (Chapter 5 indicated a general preference to use bare nouns for salient referents, while in those contexts the usage of more reduced forms is expected. The reasons for such a preference must be determined to understand whether sign languages mark salient referents differently than spoken languages.)

ix. What is the distribution of the zero forms (e.g. role shift) in DGS and TİD and how is it licensed at the levels of sentence and utterance? (Chapter 5 has shown that DGS and TİD differ in their usage of zero forms to refer to salient referents (i.e. R1/subjects), whether this difference is due to the differential referential

value of those expressions or is rooted in a typological difference between the two languages has to be further explored.)

x. What is the distribution of connective words and how do they contribute to the discourse coherence of sign languages? (Chapter 5 provides evidence for the usage of different types of connective words in local contexts suggesting that *Cause-Effect* type coherence relations might be signaled by 'because' and *Contiguity* type relations might be signaled by 'then' in DGS and TİD. The functions and distribution of other connectives found in the data need to be further investigated to gain a full understanding of their influence on discourse coherence in sign languages.)

6.5 Conclusion

The data presented in this dissertation have limited statistical power, but should be considered as a first step to broaden our understanding of anaphora production and resolution in sign languages in a comparative data. The findings of this exploratory work open a whole range of new avenues for follow-up research. Chief among which are the influence of perspective taking strategies, grammatical and information structural factors as well as the form of referential expressions, non-manuals and verb semantics on the interpretation of anaphoric expressions and the production of spatial referential expressions including IX signs. These aspects should be examined with various populations of signers. To get a clearer understanding of the constraints governing anaphora resolution in sign languages, it is crucial to determine the ranking and interaction of those factors not only using offline methods, i.e. behavioral tasks, but also online methods, i.e. measurement of reaction times, as well as corpus analyses.

The outcomes of this dissertation can be listed as following: (i) IX behaves like a demonstrative (pronoun), (ii) spatial defaults seem to show a more general (i.e. cognitively grounded) rather than grammatical pattern of contrast and their realization is suggested to vary in different contexts, (iii) the horizontal dimension of the signing space does have a structure however its usage in the comprehension and the production of anaphora does not seem to be compulsory, (iv) plain and agreement verbs seem to promote objects in interpretation and production of referential expressions due to their semantics and / or morphosyntax and this constraint seems to be very strong at the level of utterance. Thus, there is a need to have a more tightly defined categorization of these verb types in order to examine their interaction with modality dependent and independent conventions affecting anaphora resolution. All in all, the signing space appears to be an important but not a sufficient device to resolve and produce anaphoric dependencies in sign languages.

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Appendix A - Metadata

Metadata information of DGS and TİD participants and informants (Chapter 3-5)

Participant	Age	Gender	Region	HS	AoA	HS_parent	Education	Handedness	Consent
G01	28	F	Essen	deaf	2	deaf	General qualification for university entrance	LH	approved
G02	26	F	Worms	deaf	2	deaf	Advanced vocational certificate	LH	approved
G03	28	F	Nürnberg	deaf	1	hearing	High-School	LH	approved
G04	29	M	Berlin	deaf	0	deaf	University	RH	approved
G05	29	F	Nürnberg	deaf	1	deaf	High-School	LH	approved
G06	35	M	Erfurt	deaf	1	deaf	Advanced vocational certificate	LH	approved
G07	46	M	St.Ingbert	deaf	3	hearing	Technical College	RH	approved
G08	48	M	Hildesheim	deaf	6	hearing	Technical College	RH	approved
G09	43	F	N. -Hardenberg	deaf	6	hearing	Technical College	RH	approved
GInf	34	M	Münster	deaf	0	deaf	University	RH	approved
G10	32	F	Frankfurt	deaf	3	hearing	University	RH	not approved
T01	35	M	Bursa	deaf	7	hearing	University	RH	approved
T02	38	F	Istanbul	deaf	9	hearing	University	RH	approved

T03	26	F	Istanbul	hoh	2	deaf	College	RH	approved
T04	32	M	Istanbul	hoh	8	hearing	High-School	RH	approved
T05	46	M	Istanbul	deaf	16	hearing	Secondary-School	LH	approved
T06	44	F	Istanbul	deaf	8	hearing	High-School	LH	approved
T07	18	F	Istanbul	deaf	7	hearing	High-School	RH	approved
T08	20	F	Istanbul	deaf	7	hearing	High-School	LH	approved
T09	18	F	Istanbul	hoh	10	hearing	High-School	LH	approved
T10	20	M	Istanbul	deaf	8	hearing	High-School	LH	approved
TInf	34	M	Hamburg	deaf	0	deaf	University	RH	not approved

[a]**Participant (0-10)**: an anonymous number given to the participants according to the order of their participation in the tasks. **G**=signers of DGS (G: for German Sign Language), **T** =signers of TİD (T: for Turkish Sign Language), **Inf**=informant/sign models used for creating the stimuli; **Age**: age at the time of recordings, Hearing Status: (HS), hoh = hard of hearing; **AoA:** age of acquisition; **HS_parents**: hearing status of the parents; **Education:** level of education at the time of the recordings. The equivalents of the education level in Germany are: General qualification for university entrance (Abitur), Advance vocational certificate (*Fachabitur*), High School (*Mittlere Reife*), Technical College (*Berufsschulabschluss*). The equivalents of the education level in Turkey: College (*Yüksekokul*), High School (*Lise*), Secondary School (*Ortaokul)*; **Handedness**: handedness status of the participants, self-reported. (RH = right handed, LH = left handed); **Region**: primary place of residence at the time of recordings; **Consent**: written consent given for the usage of videos and stills in the dissertation and in future publications.

Appendix B - Materials

Chapter 3-5: Complete list of stimulus materials

Two-sentence utterances given below were used in the Referent Selection Task (Chapter 3) and only first sentences of those utterances were used as prompt sentences in Sentence Continuation task (Chapter 4-5). The subscripts **R**, **L** and **N** refer to right, left and neutral areas of the signing space from the signer's view. **D** and **P** correspond to distant and proximate part of the neutral space with respect to the body of the signer. All sentences are given in English glosses, an approximate translation from German and Turkish glosses.

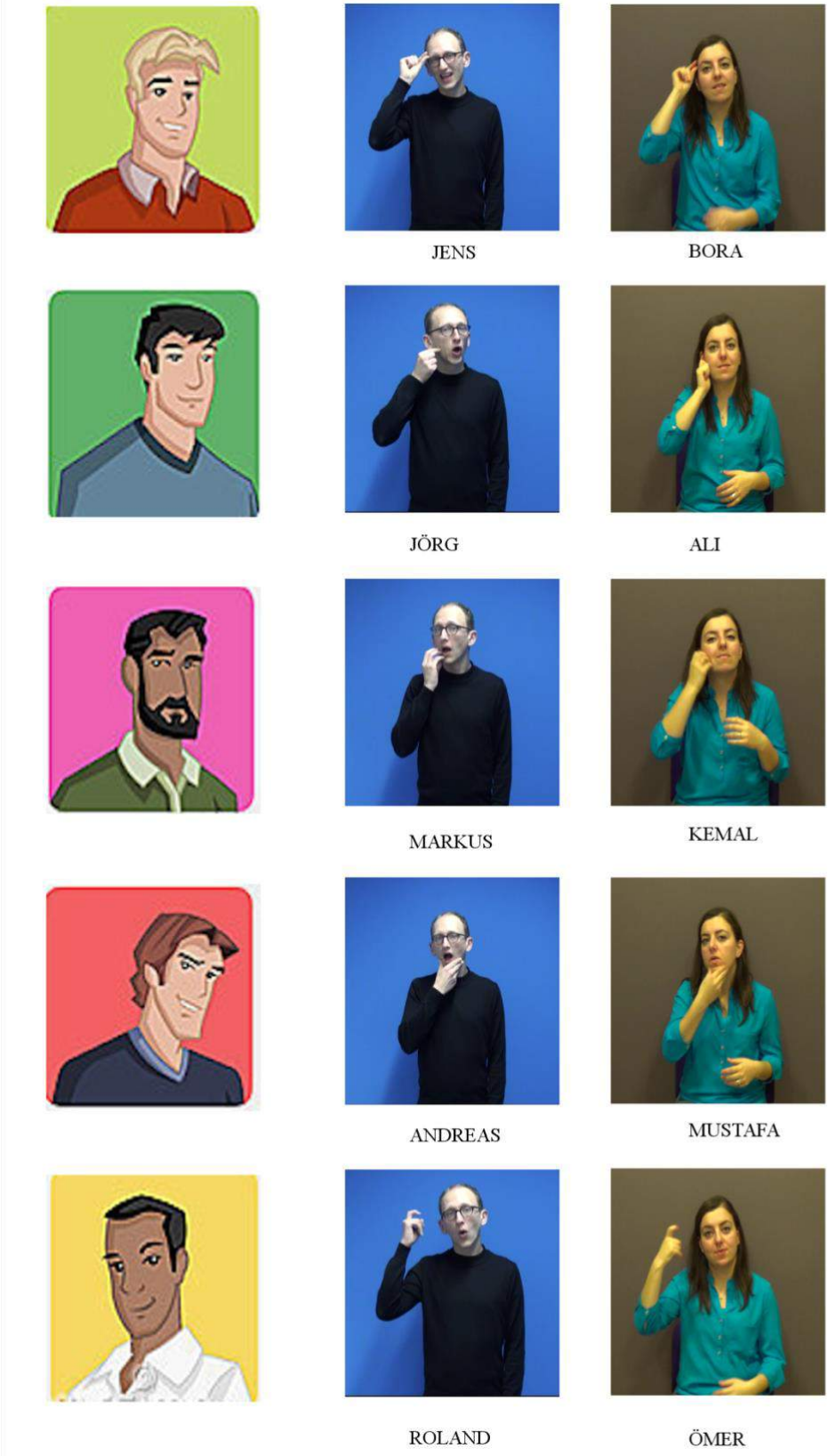
condition	language	Stimulus material for DGS and TİD
IXR	DGS	TODAY AFTERNOON JENS ANNETTE MARRY. **IX$_R$** NOW DANCE.
IXL		TODAY AFTERNOON JENS ANNETTE MARRY. **IX$_L$** NOW DANCE.
IXR	DGS	TODAY ANNIKA ANDREAS CHEEK-KISS. **IX$_R$** VERY HAPPY.
IXL		TODAY ANNIKA ANDREAS CHEEK-KISS. **IX$_L$** VERY HAPPY.
IXR	DGS	LAST WEEK ANDREAS ANNETTE WARN. **IX$_R$** POSS$_1$ FRIEND.
IXL		LAST WEEK ANDREAS ANNETTE WARN. **IX$_L$** POSS$_1$ FRIEND.
IXR	DGS	THE-DAY-BEFORE-YESTERDAY MIKA ROLAND PARTY $_D$INVITE$_P$.
IXL		**IX$_R$** VERY DRUNK.
		THE-DAY-BEFORE-YESTERDAY MIKA ROLAND PARTY $_D$INVITE$_P$.
		IX$_L$ VERY DRUNK.
IXR	DGS	TODAY NIGHT MIKA JÖRG $_P$HELP$_D$. **IX$_R$** VERY TIRED.
IXL		TODAY NIGHT MIKA JÖRG $_P$HELP$_D$. **IX$_L$** VERY TIRED.
IXR	DGS	LAST YEAR LIONA ANDREAS LOOK-AFTER. **IX$_R$** NOW RESTAURANT
IXL		WORK.
		LAST YEAR LIONA ANDREAS LOOK-AFTER. **IX$_L$** NOW RESTAURANT
		WORK.
IXR	DGS	YESTERDAY JENS MIKA KISS. **IX$_R$** HOME-RUN.
IXL		YESTERDAY JENS MIKA KISS. **IX$_L$** HOME-RUN.

IXR	DGS	TODAY MORNING MIKA MARKUS GREET. **IX$_L$** EXHIBITION VISIT.
IXL		TODAY MORNING MIKA MARKUS GREET. **IX$_R$** EXHIBITION VISIT.
IXR	DGS	ALWAYS JÖRG ANNETTE TOGETHER PLAY. **IX$_R$** WITHOUT BOREDOM.
IXL		ALWAYS JÖRG ANNETTE TOGETHER PLAY. **IX$_L$** WITHOUT BOREDOM.
IXR	DGS	TOMORROW JENS LIONA $_D$PICK-UP$_P$ **IX$_R$** THERE IMPORTANT
IXL		MEETING. TOMORROW JENS LIONA $_D$PICK-UP$_P$ **IX$_L$** THERE IMPORTANT MEETING.
IXR	DGS	LATER ANNIKA MARKUS MEET. **IX$_R$** TALK WANT.
IXL		LATER ANNIKA MARKUS MEET. **IX$_L$** TALK WANT.
IXR	DGS	NOW JÖRG NINA SEARCH. **IX$_R$** BERLIN LIVE.
IXL		NOW JÖRG NINA SEARCH. **IX$_L$** BERLIN LIVE.
IXR	DGS	YESTERDAY NINA JENS THANK$_N$. **IX$_R$** HARD LAUGH.
IXL		YESTERDAY NINA JENS THANK$_N$. **IX$_L$** HARD LAUGH.
IXR	DGS	THIS SEMESTER JÖRG ANNIKA $_P$CRITICIZE$_D$. **IX$_R$** HOLIDAY DRIVE.
IXL		THIS SEMESTER JÖRG ANNIKA $_P$CRITICIZE$_D$. **IX$_L$**HOLIDAY DRIVE.
IXR	DGS	NINA MARKUS LONG KNOW. **IX$_R$** HEAVY SICK.
IXL		NINA MARKUS LONG KNOW. **IX$_L$** HEAVY SICK.
IXR	TİD	TODAY AFTERNOON BORA ELIF MARRY. **IX$_R$** WEDDING DANCE.
IXL		TODAY AFTERNOON BORA ELIF MARRY. **IX$_L$** WEDDING DANCE.
IXR	TİD	TODAY OYA MUSTAFA CHEEK-KISS. **IX$_R$**VERY HAPPY.
IXL		TODAY OYA MUSTAFA CHEEK-KISS. **IX$_L$** VERY HAPPY.
IXR	TİD	LAST WEEK MUSTAFA ELIF WARN. **IX$_R$** POSS$_1$ FRIEND.
IXL		LAST WEEK MUSTAFA ELIF WARN. **IX$_L$** POSS$_1$ FRIEND.
IXR	TİD	THE-DAY-BEFORE-YESTERDAY EMEL ÖMER PARTY $_D$INVITE$_P$.
IXL		**IX$_R$** VERY DRUNK. THE-DAY-BEFORE-YESTERDAY EMEL ÖMER PARTY $_D$INVITE$_P$. **IX$_L$** VERY DRUNK.
IXR	TİD	TODAY NIGHT EMEL ALI $_P$HELP$_D$. **IX$_R$** VERY TIRED.
IXL		TODAY NIGHT EMEL ALI $_P$HELP$_D$. **IX$_L$** VERY TIRED.
IXR	TİD	LAST YEAR BURCU MUSTAFA LOOK-AFTER. **IX$_R$** NOW RESTAURANT
IXL		WORK. LAST YEAR BURCU MUSTAFA LOOK-AFTER. **IX$_L$** NOW RESTAURANT WORK.

IXR	TİD	YESTERDAY BORA EMEL KISS. **IX$_{R}$** RUN AWAY.
IXL		YESTERDAY BORA EMEL KISS. **IX$_{L}$** RUN AWAY.
IXR	TİD	TODAY MORNING EMEL KEMAL GREET. **IX$_{R}$** WALK GO.
IXL		TODAY MORNING EMEL KEMAL GREET. **IX$_{L}$** WALK GO.
IXR	TİD	ALWAYS ALI ELIF TOGETHER PLAY. **IX$_{R}$** WITHOUT BOREDOM.
IXL		ALWAYS ALI ELIF TOGETHER PLAY. **IX$_{L}$** WITHOUT BOREDOM.
IXR	TİD	TOMORROW BORA BURCU AIRPORT $_{D}$PICK-UP$_{P}$. **IX$_{R}$** TOMORROW
IXL		MEETING GO. TOMORROW BORA BURCU AIRPORT $_{D}$PICK-UP$_{P}$. **IX$_{L}$** TOMORROW MEETING GO.
IXR	TİD	OYA KEMAL NOW-NOT TOMORROW MEET. **IX$_{R}$** TALK WANT.
IXL		OYA KEMAL NOW-NOT TOMORROW MEET. **IX$_{L}$** TALK WANT.
IXR	TİD	ALI NOW MÜGE SEARCH. **IX$_{R}$** ANKARA LIVE.
IXL		ALI NOW MÜGE SEARCH. **IX$_{L}$** ANKARA LIVE.
IXR	TİD	YESTERDAY MÜGE BORA THANK$_{N}$. **IX$_{R}$** A LOT LAUGH.
IXL		YESTERDAY MÜGE BORA THANK$_{N}$. **IX$_{L}$** A LOT LAUGH.
IXR	TİD	THIS SUMMER ALI OYA $_{P}$CRITICIZE$_{D}$. **IX$_{R}$** HOLIDAY GO.
IXL		THIS SUMMER ALI OYA $_{P}$CRITICIZE$_{D}$. **IX$_{L}$** HOLIDAY GO.
IXR	TİD	MÜGE KEMAL LONG TIME KNOW. **IX$_{R}$** HEAVY SICK.
IXL		MÜGE KEMAL LONG TIME KNOW. **IX$_{L}$** HEAVY SICK.
IXR	TİD	YESTERDAY EVENING MÜGE MUSTAFA SEE$_{N}$. **IX$_{R}$** SHOP DO.
IXL		YESTERDAY EVENING MÜGE MUSTAFA SEE$_{N}$. **IX$_{L}$** SHOP DO.
IXR	TİD	PREVIOUSLY ÖMER MÜGE FLIRT. **IX$_{R}$** NOW SINGLE.
IXL		PREVIOUSLY ÖMER MÜGE FLIRT. **IX$_{L}$** NOW SINGLE.
IXR	TİD	ÖMER ALWAYS OYA LIKE. **IX$_{R}$** HEART GOOD.
IXL		ÖMER ALWAYS OYA LIKE. **IX$_{L}$** HEART GOOD.
IXR	TİD	THESE-DAYS BURCU ÖMER BETTER GET-TO-KNOW. **IX$_{R}$** TWENTY-
IXL		TWO YEARS OLD. THESE-DAYS BURCU ÖMER BETTER GET-TO-KNOW. **IX$_{L}$** TWENTY-TWO YEARS OLD.
IXR	TİD	TODAY KEMAL ELIF CONGRATULATE. **IX$_{R}$** VERY RICH.
IXL		TODAY KEMAL ELIF CONGRATULATE. **IX$_{L}$** VERY RICH.

Chapter 3-5: Visuals of the female characters (first column) with proper names (under the visuals) and sign names (second column DGS, third column TİD) assigned to them

Chapter 3-5: Visuals of the male characters (first column) with proper names (under the visuals) and sign names (second column DGS, third column TİD) assigned to them



Appendix C - Data supplements

Chapter 3 - Section 3.3.5

Distribution of freely occurring non-manuals on first-mentioned referent, second-mentioned referent and pronominal IX sign in the stimuli material used for Referent Selection Task.

Item name	**NMMs IX**	**Mouthing/ Mouth Gesture IX**	**R1 NMMs**	**R2 NMMs**
IXR_marry_dgs	shnR	--	shnR	shnR
IXL_marry_dgs	shnL	--	shnR	shnR
IXR_cheekkiss_dgs	shnR+egR	--	shnR	--
IXL_cheekkiss_dgs	shn-L+feb	--	shnR	--
IXR_warn_dgs	hn+ebr	--	hn+ebr	hn+ebr
IXL_warn_dgs	shnL	--	ebr	hn
IXR_invite_dgs	shn-R+feb	--	shnR	shnR
IXL_invite_dgs	shnL+feb	--	shnR	shnR
IXR_help_dgs	hn+feb	--	shnL+ebr	hn+ebr
IXL_help_dgs	shn-L+feb	--	shnL	hn
IXR_lookafter_dgs	shnR	--	hn	--
IXL_lookafter_dgs	shnL	--	hn	--

IXR_kiss_dgs	shnR+ebr	--	ebr	ebr
IXL_kiss_dgs	shnL+ebr	--	ebr	ebr
IXR_greet_dgs	hn+ebr	--	shnL+ebr	ebr
IXL_greet_dgs	shnL	--	shnL+ebr	ebr
IXR_play_dgs	shnR+sq	--	--	hn
IXL_play_dgs	shnR+feb	--	--	hn
IXR_pickup_dgs	shnR	--	shnR	hn
IXL_pickup_dgs	hn	--	shnR	shnR
IXR_meet_dgs	shnR	--	shnR+ebr	ebr
IXL_meet_dgs	shnL	--	shnR	--
IXR_search_dgs	hn	--	ebr	hn
IXL_search_dgs	shnL	--	ebr	hn
IXR_thank_dgs	shnR+feb	--	hn	shnR
IXL_thank_dgs	shnL+feb	--	hn	shnR
IXR_criticize_dgs	shnR	--	hn	shnR
IXL_criticize_dgs	shnL	--	hn	shnR
IXR_know_dgs	hn+feb	--	hn+ebr	ebr
IXL_know_dgs	shnL+feb	--	hn+ebr	hn
IXR_see_dgs	shnR	--	hn	-
IXL_see_dgs	shnL+feb	--	hn	-
IXR_flirt_dgs	hn	--	shnR+ebr	hn
IXL_flirt_dgs	shnL	--	shnR+ebr	hn
IXR_like_dgs	shnR+feb	--	shnR +ebr	shnR+feb

IXL_like_dgs	shnL+feb	--	shnR +ebr	shnR+feb
IXR_gettoknow_dgs	shnR	--	hn	shnR
IXL_gettoknow_dgs	shnL	--	hn	shnR
IXR_congratulate_dgs	shnR	--	ebr	shnR
IXL_congratulate_dgs	hn, feb	--	ebr	shnR
IXR_marry_tid	ebr	'O'	ebr	ebr
IXL_marry_tid	egL	'O'	ebr	ebr
IXR_cheekkiss_tid	ebr	'O'	-	-
IXL_cheekkiss_tid	ebr	'O'	-	-
IXR_warn_tid	ebr	'O'	-	ebr
IXL_warn_tid	ebr	'O'	-	ebr
IXR_invite_tid	ebr	'O'	ebr	ebr
IXL_invite_tid	ebr+egL	'O'	-	-
IXR_help_tid	ebr	'O'	ebr	ebr
IXL_help_tid	ebr	'O'	-	-
IXR_lookafter_tid	ebr	'O'	-	-
IXL_lookafter_tid	headL	'O'	-	-
IXR_kiss_tid	--	'pursed lips'	headR	headL
IXL_kiss_tid	egL	'pursed lips'	-	-
IXR_greet_tid	--	'O'	ebr	ebr
IXL_greet_tid	ebr	'O'	ebr	ebr
IXR_play_tid	--	'O'	-	-
IXL_play_tid	ebr+egL	'O'	-	-

IXR_pickup_tid	ebr	‘O’	ebr	ebr
IXL_pickup_tid	ebr	‘O’	ebr	ebr
IXR_meet_tid	--	‘pursed lips’	ebr	ebr
IXL_meet_tid	ebr	‘pursed lips’	ebr	ebr
IXR_search_tid	ebr	‘O’	ebr	ebr
IXL_search_tid	ebr	‘O’	ebr	ebr
IXR_thank_tid	--	‘O’	-	-
IXL_thank_tid	ebr	‘O’	-	ebr
IXR_criticize_tid	ebr	‘O’	-	-
IXL_criticize_tid	ebr+egL	‘O’	-	-
IXR_know_tid	feb	‘O’	-	-
IXL_know_tid	feb	‘O’	-	-
IXR_see_tid	--	‘O’	-	-
IXL_see_tid	egL	‘O’	-	ebr
IXR_flirt_tid	ebr	‘O’	ebr	ebr
IXL_flirt_tid	ebr	“O”	ebr	ebr
IXR_like_tid	--	‘O’	ebr	ebr
IXL_like_tid	--	‘O’	ebr	ebr
IXR_gettoknow_tid	ebr	‘pursed lips’	ebr	ebr
IXL_gettoknow_tid	ebr	‘pursed lips’	ebr	ebr

[b]NMMs (non-manuals), eg (eye gaze), ebr: (eye brow raise), hn (head nod), feb (furrowed eyebrow), shn (sideward head nod), ‘O’ corresponds to mouthing of 3rd person singular pronoun in Turkish, R(right) side of the signing space, L(eft)side of the signing space, (+) indicates co-occurrence of two multiple non-manuals (not necessarily simultaneous occurrence), item names include verbs of the first sentences, direction of IX and language

Chapter 4 - Section 4.3.1 (DGS Results) and Section 4.3.3 (TİD Results)

Distribution of manual and nonmanual localization mechanisms in repeated prompt sentences of Sentence Continuation Task. **Participant** (G= signers of German Sign Language (DGS), T: signers of Turkish Sign Language (TİD)); **handedness** (LH: left-handers, RH: right-handers); **verb** (sentence final verb of the prompt sentence); **LocR_R** (the type of the referent localized on the right side from the signer's perspective); **LocR_L** (the type of the referent localized on the left side from the signer's perspective); **LocD_R** (Localization device/mechanism used to localize referents on the right side); **LocD_L** (Localization device/mechanims used to localize referents on the left side); **bl** (body lean); **PAM** (Person Agreement Marker); **verb** (verb localization the form of which is indicated under the column verb)

participant	handedness	verb	LocRef_R	LocD_R	Loc Ref _L	LocD_L
G01	LH	lookafter	R2	verb		
G01	RH	congratulate	R2	IX		
G01	RH	thank	R2	verb		
G01	RH	see	R2	verb		
G01	LH	help			R2	verb
G01	RH	criticize	R2	PAM		
G01	LH	invite	R2	verb		
G01	RH	pickup	R2	verb		

G02	LH	flirt	R2	bl	R1	bl
G02	LH	lookafter	R2	verb		
G02	LH	like	R2	PAM		
G02	LH	thank	R2	verb		
G02	LH	help			R2	verb
G02	LH	criticize	R2	verb		
G02	LH	invite			R2	verb
G02	LH	pickup			R2	verb
G03	LH	lookafter	R2	verb		
G03	LH	thank	R2	verb		
G03	LH	help	R2	verb		
G03	LH	criticize	R2	verb		
G03	LH	invite			R2	verb
G03	LH	pickup			R2	verb
G04	RH	flirt	R2	bl	R1	bl
G04	RH	gettoknow	R2	bl	R1	bl
G04	RH	warn	R2	bl	R1	bl
G04	RH	lookafter	R2	bl	R1	bl

G04	RH	search	R2	bl	R1	bl
G04	RH	congratulate	R2	bl	R1	bl
G04	RH	like	R2	PAM		
G04	RH	cheekkiss	R2	bl	R1	bl
G04	RH	greet	R2	verb		
G04	RH	thank			R2	verb
G04	RH	see	R2	verb		
G04	RH	help	R2	verb		
G04	RH	criticize	R2	PAM		
G04	RH	invite	R2	verb		
G04	RH	pickup			R2	verb
G05	LH	congratulate	R2	verb		
G05	LH	thank	R2	verb		
G05	LH	help	R2	verb		
G05	LH	criticize	R2	verb		
G05	LH	invite			R2	verb
G05	LH	pickup	R2	verb		
G06	LH	thank			R2	verb

G06	LH	see	R2	verb		
G06	LH	help			R2	verb
G06	LH	criticize	R3	verb		
G06	LH	invite			R2	verb
G06	LH	pickup			R2	verb
G07	RH	warn			R2	PAM
G07	RH	lookafter			R2	verb
G07	RH	search	R2	PAM		
G07	RH	greet			R2	verb
G07	RH	thank	R2	PAM		
G07	RH	criticize			R2	PAM
G07	RH	invite	R2	verb		
G07	RH	pickup	R2	verb		
G08	RH	flirt			R2	verb
G08	RH	greet			R2	verb
G08	RH	see			R2	verb
G08	RH	help			R2	verb
G08	RH	criticize			R2	verb

G08	RH	invite			R2	verb
G09	RH	thank	R2	verb		
G09	RH	help	R2	verb		
G09	RH	criticize	R2	verb		
G09	RH	invite			R2	verb
G09	RH	pickup	R2	verb		
G10	RH	kiss	R1	bl	R2	bl
G10	RH	flirt	R1	bl	R2	bl
G10	RH	gettoknow	R1	bl	R2	bl
G10	RH	warn			R2	verb
G10	RH	lookafter			R2	IX
G10	RH	thank			R2	verb
G10	RH	see	R1	bl	R2	bl
G10	RH	help	R1	bl	R2	bl
G10	RH	criticize			R2	verb
G10	RH	invite			R2	verb
G10	RH	pickup			R2	verb
T01	RH	warn	R2	verb		

T01	RH	lookafter			R2	verb
T01	RH	congratulate	R2	verb		
T01	RH	greet	R2	verb		
T01	RH	criticize	R2	verb		
T01	RH	invite	R2	verb		
T01	RH	pickup	R2	verb		
T02	RH	flirt	R2	verb		
T02	RH	lookafter	R2	verb		
T02	RH	search	R2	verb		
T02	RH	congratulate	R2	verb		
T02	RH	greet	R2	verb		
T02	RH	thank	R2	verb		
T02	RH	see	R2	verb		
T02	RH	invite	R2	verb		
T02	RH	pickup	R2	verb		
T03	RH	warn	R2	verb		
T03	RH	lookafter	R2	verb		
T03	RH	congratulate	R2	verb		

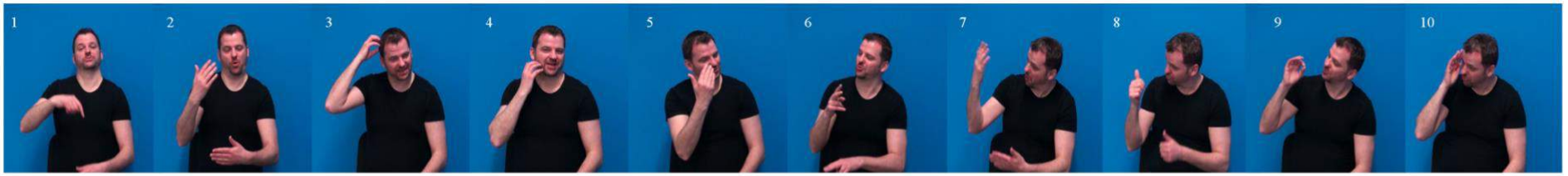
T03	RH	greet	R2	verb		
T03	RH	thank			R2	verb
T03	RH	see	R2	verb		
T03	RH	invite	R2	verb		
T03	RH	pickup	R2	verb		
T04	RH	flirt			R2	verb
T04	RH	warn			R2	verb
T04	RH	congratulate			R2	verb
T04	RH	greet			R2	verb
T04	RH	invite	R2	verb		
T04	RH	pickup	R2	verb		
T05	LH	warn				
T05	LH	lookafter				
T05	LH	congratulate				
T05	LH	thank				
T05	LH	invite			R2	verb
T05	LH	pickup	R2	verb		
T06	RH	help	R1	IX	R2	IX

T07	LH	flirt	R2	verb			
T07	LH	warn	R2	verb			
T07	LH	greet	R2	verb			
T07	LH	criticize	R2	verb			
T07	LH	invite	R2	verb			
T07	LH	pickup			R2	verb	
T08	LH	flirt	R2	verb			
T08	LH	warn	R2	verb			
T08	LH	lookafter	R2	verb			
T08	LH	congratulate	R2	verb			
T08	LH	greet	R2	verb			
T08	LH	see	R2	verb			
T09	LH	lookafter	R2	verb			
T09	LH	congratulate	R2	verb			
T10	LH	flirt	R2	verb			
T10	LH	lookafter	R2	verb			
T10	LH	see	R2	verb			

Chapter 4 - Section 4.3.5 examples of default patterns of localization observed in DGS and TİD

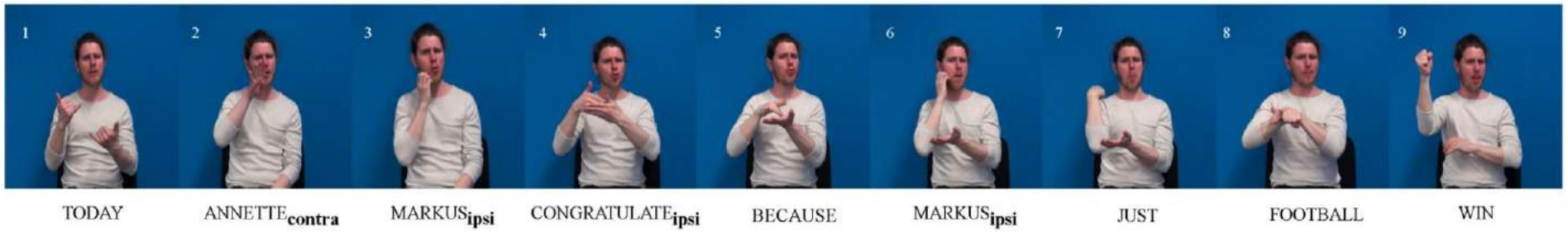
Two-referent localization default patterns in DGS

Pattern 1 (RH signers): $R1_{\textbf{ipsi}}$-$R2_{\textbf{contra}}$



'This morning Mika greeed Markus. (He) greeted her back asking whether she is feeling fine and slept well.'

Pattern 2 (RH signers): $R1_{\textbf{contra}}$-$R2_{\textbf{ipsi}}$



'Today Annette congratulated Markus. Because Markus just won the football (game).'

Pattern 1 (LH signers): $R1_{ipsi}$-$R2_{contra}$

'Previously Roland flirted with Nina. Later Roland lost interest (in her).'

Pattern 2 (LH signers): $R1_{ipsi}$-$R2_{contra}$

'Yesterday Nina thanked Jens. Jens built a house for her.'

Two-referent localization default patterns in TİD

Pattern 1 (RH signers): R1$_{\textbf{contra}}$-R2$_{\textbf{ipsi}}$

YESTERDAY BORA OYA KISS THEN IX$_{\textbf{contra}}$ BORA SEE$_{\textbf{ipsi}}$ LOVE BECOME

'Yesterday Bora kissed Oya. Then (he) looked at (her) and fell in love.'

Pattern 2 (RH signers): R1$_{\textbf{ipsi}}$-R2$_{\textbf{contra}}$

NOW EVENING OYA ALI HELP BECAUSE ALI FRIEND VISIT IX$_{\textbf{ipsi}}$ OYA HELP$_{\textbf{contra}}$

'This evening Emel helped Ali. Ali's friends visited (him), therefore Emel helped (him).'

Pattern 1 (LH signers): $R1_{ipsi}$-$R2_{contra}$

'Previously Ömer flirted with Müge. (He) proposed to her but she didn't want.'

Curriculum Vitae

1. PERSONAL DATA

Name	Derya Nuhbalaoglu
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2. EDUCATION

2010-2014	Boğaziçi University, Istanbul PhD Program in Linguistics (qualificational exams completed) Grade: 3.92/4.00
2007-2010	Boğaziçi University, Istanbul Master of Arts in Linguistics Thesis Title: On the Role of Empty Onsets in Turkish: A Government Phonology Approach (Supervised by Assist. Prof. Dr. Markus A. Pöchtrager) Grade: 3.60/4.00
2007-2008	Boğaziçi University, Istanbul Certificate in Teaching English as a Foreign Language (Internship at Şişli Terakki Foundation High School, Istanbul)
2003-2007	Boğaziçi University, Istanbul Bachelor of Arts: Turkish Language and Literature, Minor: Linguistics Grade: 3.86/4.00 (High Honors Degree)

3. WORK EXPERIENCE

since 01.2018	Research Associate at The Sign Hub Project: Preserving, Researching and Fostering the Linguistic, Historical, and Cultural Heritage of European Deaf Signing Communities with an Integral Resource (Horizon 2020)
05-08.2018	Coordinator of Courant Research Center "Text Structures", Georg-August-Universität Göttingen (temporal replacement)
2014-2017	Research Assistant at a DFG funded project (SPP 1727): Discourse Referents in Space: Anaphora Resolution in German Sign Language, Georg-August-Universität Göttingen
2012-2014	Research Assistant at TÜBİTAK funded Project (111K314): Model for a Reference Grammar of Sign Languages: Methods of Description and Analysis of Sign Patterns in light of Turkish Sign Language (TİDBİL), Boğaziçi University, Istanbul
2008- 2011	Research Assistant, Department of Turkish Language and Literature, Boğaziçi University, Istanbul
06-08.2008	Teaching Assistant, Turkish Language and Culture Program, Language Center, Boğaziçi University, Istanbul

4. TEACHING EXPERIENCE

Vertiefungsseminar [Advanced Seminar]: Anaphora resolution in spoken and sign languages, [Department of English Philology, Georg-August-Universität Göttingen, Summer 2017]

Turkish Language and Grammar, [TKL 103]: tutorials [taught by Dr. Ceyda Arslan Kechriotis, Department of Turkish Language and Literature, Boğaziçi University, Istanbul, Winter 2010]

Turkish for Foreigners [Upper Intermediate, TK S21] listening and speaking, [Turkish Language and Culture Program, Language Center, Boğaziçi University, Istanbul, Summer 2008]

5. PUBLICATIONS

A. Wienholz, **D. Nuhbalaoglu**, M. Steinbach & N. Mani (submitted): Phonological priming in German Sign Language: An eye tracking study using the Visual World Paradigm.

O. Kubus & **D. Nuhbalaoglu** (2018): The Challenge of Marking Relative Clauses in Turkish Sign Language. In: A. Sumru Özsoy (ed.), Turkish Sign Language (TİD) - Special Issue of Journal of Linguistics Research 29, 139-160.

A. S. Özsoy, M. Kelepir, **D. Nuhbalaoglu** & E. Hakgüder (2018): Properties of Command Constructions in TİD. In: A. Sumru Özsoy (ed.), Turkish Sign Language (TİD) - Special Issue of Journal of Linguistics Research 29, 161-178.

A. Wienholz, **D. Nuhbalaoglu**, N. Mani, A. Herrmann, E. Onea & M. Steinbach (2018): Pointing to the Right Side? An ERP Study on Anaphora Resolution in German Sign Language. PLoS One, doi: 10.1371/journal.pone.0204223.

D. Nuhbalaoglu (2013): Determining the Paradigm of Personal Pronouns in Turkish Sign Language. In: B. Ç. Başaran, B. C. Yıldız, F. Gümüşok, & D. F. Şafak (eds.), Proceedings of the 9th International Postgraduate Conference on Linguistics and Language Teaching: Selected Papers Ankara, Turkey: Gazi Kitabevi, 207–221.

S. Özsoy, E. Arık, A. Göksel, M. Kelepir & **D. Nuhbalaoglu** (2013): Documenting Turkish Sign Language. In: E. Arık (ed.), Current directions in Turkish Sign Language research, Newcastle upon Tyne, UK: Cambridge Scholars Publishing, 55-70.

S. Özsoy, M. Kelepir, E. Hakgüder & **D. Nuhbalaoglu** (2013): Commands in Turkish Sign Language. In: Journal of Japanese Linguistic Society 146, Tokyo: Gengo Kenkyu,13-30.

6. SELECTED PRESENTATIONS

D. Nuhbalaoglu (2018): "To localize or not to localize: Investigating spatial defaults in sign languages." Invited talk presented at Sign languages: Structure, Processing and Language Modality Workshop, University of Pompeu Fabra, Barcelona, 14.11.2018.

O. Kubus & **D. Nuhbalaoglu** (2018): "Position of the head noun makes a difference: (Varying) marking of relative clauses in Turkish Sign Language". Talk presented at the first international workshop on Cognitive and Functional Explorations in Sign Language Linguistics (Sign CAFÉ 1), University of Birmingham, Birmingham, 30-31.07.2018.

D. Nuhbalaoglu (2018): "Investigating spatial defaults in local contexts? Sentence continuation task in German Sign Language and Turkish Sign Language." Poster presented at Sign language Grammars Through the Formal and Experimental Glass Workshop, University of Crete, Crete, 25.07.2018.

D. Nuhbalaoglu (2018): "Does INDEX Matter? Selecting Referents in German Sign Language and Turkish Sign Language." Talk presented at the conference on Formal and Experimental Advances in Sign Language Theory (FEAST), University of Venice, Venice, 18-20.06.2018.

A. Wienholz, **D. Nuhbalaoglu**, M. Steinbach, A. Herrmann and N. Mani (2018): "Phonological Priming in the Visual World: An Eye Tracking Study on German Sign Language." Talk presented at the conference on Formal and Experimental Advances in Sign Language Theory (FEAST), University of Venice, Venice 18-20.06.2018.

Wienholz, A., & **Nuhbalaoglu, D**. (2018): "Ich sehe was, was du nicht siehst! Eye Tracking Studien zur DGS." Talk presented at Institute of German Sign Language and Communication of the Deaf, University of Hamburg, Hamburg, 22.01.2018.

D. Nuhbalaoglu (2017): "Interpreting Spatial Pronouns in German and Turkish Sign Languages: An Empirical Study." Talk presented at Workshop on Anaphora Resolution on Sign and Spoken Languages (ARISAS), University of Göttingen, Göttingen, 20-21.02.2017.

A. Wienholz, **D. Nuhbalaoglu**, A. Herrmann, E. Onea, M. Steinbach & N. Mani (2016): "Pointing to the Right Side? An ERP Study on Anaphora Resolution in German Sign Language." Talk presented at the conference on Formal and Experimental Advances in Sign Language Theory (FEAST), University of Venice, Venice, 01-02.09.2016.

D. Nuhbalaoglu, A. Wienholz, M. Steinbach & E. Onea (2016): "Distinguishing Discourse Referents: What R-Loci and Gender Features Have in Common." Talk presented at the international conference Theoretical Issues in Sign Language Research (TISLR) 12, La Trobe University, Melbourne, 04-07.01.2016.

D. Nuhbalaoglu, A. Wienholz, M. Steinbach & E. Onea (2015): "Distinguishing Discourse Referents: A Unified Analysis of R-Loci in Sign Language and Gender in Spoken Language." Talk presented at the conference on Formal and Experimental Advances in Sign Language Theory (FEAST), Pompeu Fabra University, Barcelona, 04-06.05.2015.

D. Nuhbalaoglu & S. Özsoy (2014): "Linearization in Noun Phrases in Turkish Sign Language." Talk presented at Formal and Experimental Advances in Sign Language Theory (FEAST), University of Venice, Venice, 09-11.06.2014.

D. Nuhbalaoglu (2014): "Personal Pronouns in Turkish Sign Language." Paper presented at Second International Conference: Linguistic Rights of the Deaf, Moscow, 20-22.05.2014.

D. Nuhbalaoglu (2012): "The Bridge Between Phonology and Orthography: Soft G as an Empty Onset [O(x)] in Turkish." Talk presented at Sixteenth International Conference on Turkish Linguistics (ICTL), Middle East Technical University, Ankara, 18-22.09.2012.

D. Nuhbalaoglu (2009): "Turkish Emphatic Reduplication: In Search for the Source of the Interpolated Consonant." Talk presented at Second Mediterranean Graduate Students Meeting in Linguistics (MGML 2), Mersin University, Mersin, 12-13.03.2009.

7. GRANTS

10-12.2017	Graduate School of Humanities Göttingen (GSGG) PhD Dissertation Completion Grant
2012-2014	The Scientific and Technological Research Council of Turkey (TÜBİTAK**)** PhD Scholarship
04-12.2008	Boğaziçi University Institute of Social Sciences Master Studies Scholarship

8. MEMBERSHIPS

Sign Language Linguistics Society (SLLS)
Society for Sign Language and Communication of Deaf (GGKV)
German Linguistics Society (DGFS)
The Society of Turkic, Ottoman and Turkish Studies (GTOT)

9. LANGUAGES

Russian (Native)
Turkish (Native)
English (Fluent)
Azerbaijani (Fluent)
German (Upper Intermediate)
Ottoman Turkish (Reading)
Turkish Sign Language (Intermediate)
German Sign Language (Upper Intermediate)