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DEICTIC POINTING AND DEMONSTRATIVE USAGE IN AMERICAN SIGN LANGUAGE

Paul Twitchell

Paul Twitchell

Candidate

Department of Language, Literacy, & Sociocultural Studies

Department

This dissertation is approved, and it is acceptable in quality and form for publication:

Approved by the Dissertation Committee:

Dr. Erin Wilkinson, Chairperson

Dr. Jill P. Morford, Committee Member

Dr. Barbara Shaffer, Committee Member

Dr. Naomi Shin, Committee Member

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by

PAUL TWITCHELL

B.A., Linguistics, University of New Mexico, 2010

M.A., Linguistics, University of New Mexico, 2014

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DEDICATION

This dissertation is dedicated to my wife, Kacie, who has been the source of support and encouragement during the challenges of graduate school. I am extremely grateful for having you in my life. This work is also dedicated to my children, Breckin, Zurie and Avery, who have always loved me unconditionally.

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ABSTRACT

American Sign Language (ASL), like many different signed languages, has a systematic way of using pointing signs for multiple types of nominal reference. Possibly the most basic function of pointing is to indicate, direct and modulate reference to physical objects located in proximal and distal areas called exophoric demonstratives.

This study aims to investigate ASL exophoric demonstratives and how ASL fits within the different typological systems of demonstratives that have been documented (Diessel & Coventry, 2020). Several research questions focus on how signers direct attention to proximal and distal referents in ASL using an elicitation task. The two studies (adult and children) recorded a combined 866 demonstrative tokens and suggest that ASL has a one-demonstrative system

using a pointing sign as the primary demonstrative. However, the primary ASL demonstrative is modulated with variation in handshape, movement, and eye gaze to signal the location of the referent.

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Chapter 1: Introduction to the Research Problem

American Sign Language (ASL), which is one of many different signed languages, has a systematic way of introducing and maintaining both concrete and abstract referents in discourse using points. A point is prototypically used to direct focus and establish reference, that is, to identify referents in the discourse context. Recent studies in Cognitive Grammar suggest that two symbolic elements of pointing signs can be distinguished: the *Pointing Device* which directs attention, and the *Place* to which attention is directed (Wilcox & Occhino, 2016). Child language acquisition often uses physical hand pointing as one of many cues used in the interaction between caregiver and child. But in a signed language like ASL, pointing signs also have specific grammatical functions. One grammatical function of points in ASL is to serve as demonstratives. *Demonstratives* are defined as a specific deictic functional expression to show reference to things depending on the context, both as physical surroundings and within the discourse text itself. One example is an English statement, "This one is a dog, that one is a ball." The words, "This" and "that" are the demonstratives, while "dog" and "ball" are the referents in the spatial context of the speech act. This = dog; that = ball. Demonstratives have two goals: to specify the location of physical or abstract objects and to coordinate joint attention (Diessel, 2006). In ASL, pointing can be used for other grammatical functions in addition to demonstratives: reference point constructions, pronouns, determiners, and more. One reason that there is very little research on demonstratives in signed languages may be that the multi-functionality of points has obscured their patterning.

Demonstrative referencing is frequent in spoken child language. One reason may be that demonstratives link spoken words to the physical space around a child, showing a direction to something close by (proximal), or something far (distal). In this way, the demonstrative can serve as a cue for the eyes to guide attention to a referent and connect it to a vocabulary word as a label. Thus, a child can physically see the object and learn a new word with input from caregivers. Through demonstratives, the child perceives and associates the acquisition of each word accompanied by the demonstrative (e.g., *that* cup, *that* book). It is one of the first grammatical functions acquired in early child language acquisition (Diessel & Coventry, 2020). Over time, children learn to use demonstratives not only to indicate the location of a referent, but also as an interaction cue to convey and direct joint attention.

Joint attention is when two people are focusing on the same object, and discussing that specific object with multimodal cues of visuals and language. Joint attention is crucial for language acquisition and provides social interaction to allow shared knowledge from parent to child. When both interlocutors use demonstratives, they establish common ground, otherwise known as *intersubjectivity*. Intersubjectivity refers to a shared perception of reality between two or more individuals (Verhagen, 2005). There is intersubjectivity between people when they share the same perception of a certain scenario. For example, participants must construct meaning depending on the situation and communication surroundings. Several factors must include shared understanding based on past events and experiences (Janzen & Shaffer, 2008). Pointing is multi-functional and can be an intersubjectivity cue to gain clarity if a word or concept is misunderstood. Using a point can provide a final wrap-up of the conversation as the end of a turn-taking cue. Not only do demonstratives provide a reference, but they also provide an indicator to encourage different knowledge sharing cues of old and new information, like joint attention. Diessel and Coventry (2020) suggest a two-layered demonstrative function, “an egocentric, body-centered view of deixis is perfectly compatible with the view that demonstratives are used for both spatial and interactive purposes.” The deixis, or reference, allows a speaker to guide attention to a specific object or idea. The interactive element provides an opportunity for both the speaker and listener to check for understanding. The topic of demonstratives is using both the referent as a linguistic element and the joint attention as a cognitive processing feature. This dissertation study will address the complexity of pointing in ASL and identifying demonstrative function separately from other grammatical functions. The dissertation will also look at how children use ASL demonstratives as a part of ASL grammar. Studying ASL demonstratives will also help us learn more about demonstratives more generally, expanding upon the spoken language explanation of demonstratives.

Problem

The study of demonstratives in spoken languages has focused on the specific word forms used. For example, English has two nominal demonstratives: *this* or *that*. It is optional to use a pointing gesture with spoken demonstratives, but points are customarily produced with demonstratives, creating multimodal utterances, particularly when demonstratives function exophorically. The term *exophoric demonstrative* refers to demonstratives that direct attention to a physical referent in the communicative context and not towards the prior discourse. The use of exophoric reference requires shared knowledge between two interlocutors, in this case the focus is on the physical referents. Nevertheless, many demonstrative analyses for spoken languages focus on the consistent patterns of the word or phrases only, without respect to the possible gestural component of the utterance (e.g., Shin et al., 2020). Clark and Sengul (1978) describe the progression of demonstrative development among children. A child starts using deictic pointing gestures, adds the deictic word to the gesture, and then adds more and more deictic utterances as time goes on. This progression identifies the gestural demonstrative in early stages. In later stages, the focus would be on the deictic utterances, and the gesture is no longer the focus of investigation. Traditionally, focus on the deictic utterances has prioritized analysis of the spoken elements without including analysis of the gestural component. More recently, studies that include analysis of both spoken utterances and gestural pointing provide insight regarding the importance of both speech and gesture for joint attention (So, Demir & Goldin-Meadow 2010; Allen, Hughes & Skarabela, 2015; Capobianco, Pizzuto & Devescovi, 2017). Also, the behavior and importance of gestural pointing is a tool to increase the cue for attention (Goldin-Meadow, 2014).

In comparison, there is very little research regarding the issue of connecting ASL demonstratives and joint attention. Previous published studies of demonstratives have not taken signed languages, and signed language modality in account. However, studies on spoken language demonstratives that have included gestures used with spoken utterances of demonstratives are more applicable to the study of signed languages. Nevertheless, such comparisons must be made with caution. First, in the cross-language comparison of co-speech gesture and sign language, it is possible that the same form is not used for the same function due to the modality effect (Lillo-Martin, 2002). Further, the assumption that gestural pointing with speech functions the same as demonstrative points in ASL would not be entirely accurate. Some spoken languages use a gesture besides pointing together with spoken demonstratives. One example is the preference to use non-manual pointing (use of the nose and head to point) from of Papua New Guinea. Speakers of the language Yupno use the nose and face to direct attention while using demonstratives, and this is preferred over an index finger point (Cooperrider, Slotta & Núñez, 2018; see Peeters, Krahmer, Maes, 2021 for other languages' demonstrative examples). The case of non-manual pointing shows that manual pointing is not a universal form of gestural demonstratives in spoken languages. Finally, the assumption that manual pointing functions as demonstratives in all signed languages should be tested.

Again, there is not much discussion focused on demonstratives alone in signed language research. ASL demonstratives and manual pointing use the same modality, but copying the framework of spoken language explanations about demonstratives is not sufficient to account for ASL demonstratives. Signers can use the pointing sign for different functions in addition to demonstrative function. So, when a person uses a point in ASL, there is a need to determine what function is being expressed in the given pointing sign. To understand the goal of a specific pointing sign one must realize that it is likely to be grammaticalized in ASL. Further, the grammatical function of ASL points needs to be evaluated using all possible phonological elements of the pointing utterance. One example is the use of different non-manual markers on the face. The challenge here is to distinguish demonstratives in ASL from other grammatical pointing.

Purpose

The main aim of this dissertation is to carry out an experimental investigation focusing on grammatical identification during the joint action of ASL nominal demonstratives among signers. Two specific aspects of the ASL demonstratives were researched. One, the exophoric use of ASL demonstratives as the egocentric spatial account of references near and far from the signer.

Two, the attentional modulating use during communicative encounters to establish and/or re-establish joint attention. Lexical databases for various languages describe demonstratives as a highly used lexical item (Keuleer, Brysbaret & New, 2010). This dissertation investigated the function of ASL nominal demonstratives by eliciting exophoric reference to objects in proximal and distal spaces relative to the signer. English nominal demonstratives distinguish referents according to their proximity relative to the speaker, but will ASL signers modify their pointing signs when identifying referents that differ in their proximity? Nominal demonstratives are specific examples to refer to objects rather than events or actions. They also differ from adverbial demonstratives. An English adverbial demonstrative is, “The dog went *there*, the ball came *here*.” Herein the researcher investigated ASL at the basic nominal demonstrative level, not comparing nominative and adverbal instances.

Providing a fuller description of ASL nominal demonstratives increases our understanding of the function of demonstratives and provides the basis for cross-linguistic studies to other signed languages. We look at individual examples and patterns of adult usage of demonstratives to various referent locations. Also, we compare different examples that the users of ASL produce in a naturalistic experimental setting. An analysis of the adult signers’ demonstratives provides insight into how deictic pointing and joint attention are predictable in ASL. Subsequently, data from children provides a sense of how demonstrative usage changes as a function of the development of joint attention and intersubjectivity.

The discussion of the function of ASL demonstratives also includes a comparison with spoken language demonstratives. ASL being a spatial language, allows researchers to tease apart, compare, or contrast with spoken languages how nominal demonstratives are used across language modality. Studying ASL demonstratives can help us understand how pointing is used with demonstratives in spoken languages. We need to compare demonstrative systems across both signed and spoken languages to understand the breadth of the overall demonstrative systems. And within signed languages, we must investigate both the manual and non-manual components of demonstrative points. Lastly, by studying the patterns of manual and non-manual pointing in signed languages, we can generate interesting hypotheses about co-speech gesture used with spoken demonstratives.

Research Questions

Demonstratives are possibly considered “the most basic communicative act” (Lieven & Tomasello, 2008). They have old grammaticalizing roots which serve as historical markers of the age of a language. However, in contrast to many findings on spoken languages verifying their earlier demonstrative linguistic expression, Diessel & Coventry (2020) propose that signed languages may lack a proximal/distal contrast due to signed languages being “young” languages. Granted the gestural point has been recognized as a part of distinguishing relative locations during demonstrative expression (Kendon & Versante, 2003), but not many have focused on the use of the point in encoding space grammatically. Not only do well-established national signed languages (macro-community signed languages) have spatial grammar, but emerging signed languages do as well (see examples from Hou, 2016; also see de Vos & Nyst, 2018). Pointing is a part of the grammar of even the youngest signed languages. The use of a point has several grammatical implications in those languages, but not much discussion on the specifics of distance contrast was brought up. Researchers describing spoken language demonstratives with a rich background of history, evidence, and records can document a much longer timeline of grammaticalization than is possible for signed languages. When compared, the documented history of signed languages is too young and too sparse to allow us to look at the grammaticalization path of demonstrative use. Grammaticalization refers to the diachronic process of language change, which content words become grammatical markers. Even more problematic, demonstratives may not be acknowledged as a grammatical category by observers who oversimplify them as gestural points. However, we have records of signing deaf people dating back to Socrates' time (Bauman, 2008; De Jorio, 2000). We have several research cases on the historical grammaticalization descriptions in ASL. For example, the ASL gloss RIGHT (human, civil or legal) has been traced back to 1856 (Shaffer, 2018) and was possibility used earlier, but ASL does not have a writing system to provide documents. So, the question is: how young is too young for a language to have a demonstrative contrast system? It seems unfair to draw conclusions about specific languages that do not have a strong historical record or any record of demonstrative contrast systems.

Diessel & Coventry (2020) also emphasize the lack of consensus in studies of signed languages about the status of points, and whether they are similar to co-speech pointing gestures or have grammatical status as signs. Even though there is no evidence of a categorical encoding of the proximal/distal contrast in ASL (Morford, Shaffer, Shin, Twitchell & Petersen, 2019), it would be important to investigate whether with other non-manual cues and subtle differences in ASL parameters, we can see patterns of possible schemas for proximal and distal deictics. We also don't know if points are the only signed forms used for demonstrative functions in ASL. There may be other signs that function as demonstratives as well. We know that demonstratives in spoken languages have two distinctive articulatory forms: an auditory and a gestural form. Here we do not compare the two different language modalities (spoken and signed) and their demonstratives. Instead, we want to understand what possible patterns there are for ASL demonstratives. Two experimental studies within this dissertation address these questions.

Study 1: Is there a clear proximal and distal contrast in adult demonstratives? Are demonstratives used to manage joint attention? An experimental approach to elicit native signers' production of ASL demonstrative referents is the main data source. Description of the probabilistic patterns include manual and non-manual instances. This includes different manual pointing handshape and movement variations, and different non-manuals as well. Non-manual features may include modulations of the mouth, chin, eyes, and eyebrows occurring simultaneously, or near the same time, with the manual sign.

Study 2: When and how do children use those same probabilistic cues identified in adults? Do children distinguish proximal and distal referents with their demonstrative points? Are there any deictic examples that children use that are similar to adult demonstratives? Do children use demonstratives to establish or modulate joint attention? The data source comes from the experimental approach of eliciting signers' production of ASL demonstratives. Results from the data provides ASL demonstrative description of the patterns of the handshape, movement, and non-manual parameters. Statistical analysis of the probability of ASL demonstrative patterns are compared for both studies.

Research Approach

The experiment used here elicited nominal exophoric demonstratives in ASL to distinguish them from other grammatical functions of pointing such as pronouns, anaphoric reference, adverbial demonstratives, and others. The procedure used prompts that should elicit ASL utterances equivalent to "this," and "that" in English. In naturalistic discourse data, it would be challenging to discern demonstratives in a class of its own. Thus, a script focused solely on eliciting nominal demonstratives was a good starting point to see what pattern of forms of ASL demonstratives are produced by adults and children.

Experimental Work Outcomes

This dissertation provides results of an experimental demonstrative elicitation task in ASL. A background questionnaire from participants allows a screen of language users who prefer ASL as their dominant daily language. The study uses categorical age groupings to permit a comparison of adults to children. Assessments of communicative, language, and psychological (i.e., a Theory of Mind task) skills creates a standard baseline from the participant data pool. Dependent variables include the multiple phonological parameters of demonstratives including handshape, movement, repetition and non-manual features.

There are two independent variables in the study. One is the proximity of the placement of target objects scattered in different areas near and far from the participant. The second independent variable is related to intersubjectivity. On some of the trials, the experimenter purposely prompts misunderstanding regarding which target object the participant has identified. This experimental manipulation may induce participants to rearticulate joint attention cues in a more exaggerated manner. The experimental design will reveal whether participants modify their use of demonstratives in ASL relative to referent location and the need to establish common ground.

Rationale and Significance

It is clear that, in general, demonstratives are a crucial element of overall language acquisition. It is critical to discuss the demonstratives that deaf children are acquiring. Identifying the timeline of language development (see Zlatev, 2013) for deaf children at the production level may provide insight into acquisition and cognitive development. While typically developing hearing children acquire their first language naturally and relatively effortlessly, the deaf community does not have a defacto natural means of passing down and teaching language across generations (Cue, 2020). This is due, in large part, to the fact that the majority of deaf children are born into a language environment in which sign language is not commonly used by the parents. Consistently throughout modern history, around 91% of deaf children will have hearing parent(s) (Mitchell & Karchmer, 2004). Deaf children are thus left vulnerable and overlooked within that environment as they will not acquire language naturally. It is vital to discuss and raise awareness simply because, for the majority of the hearing parents, they may miss when their deaf child uses demonstratives to associate schemas through joint attention. Children also need to reorganize their use of gestural pointing to create complex phrases and communicative vocabulary with input from adults.

Missing out on that element may lead to a severe delay of stages on language acquisition. Educators also miss out during any language proficiency assessment as well. Language trajectory may be misinterpreted because results from assessments do not have enough information on how demonstratives function in ASL. Educators and assessors may penalize and misdiagnose children based on overlooking pointing as a possible expression of proficient use of ASL grammar. Results of assessments provided to the parent will often provoke them to feel overwhelmed. Parents may also feel that the amount of the signed language acquisition they need to learn to communicate effectively with their child at an intimate level is impossible. In addition, collecting data from deaf adults provides a template to compare outcomes on the demonstrative tasks to deaf children. The language exposure from adults to children, especially demonstratives, may show a model example of learning part of the grammar and vocabulary in ASL.

Researcher Perspectives

I grew up in New Mexico. I am a white cisgendered male, husband, and a parent of three children. As a deaf individual, I grew up exposed to signed English systems: specifically Signing Exact English (SEEII), spoken and Written English, and ASL. My post-secondary education includes linguistic, educational, and statistical topics. I have experience teaching in K-12 and college environments. I have taught deaf, hard of hearing, coda, and hearing individuals for the last ten years. I am interested in understanding ASL acquisition from both populations of L1 and L2 signers. One thing that is fascinating to me is the interaction between signers with similar and different acquisition timelines.

Chapter 2: Literature Review on Demonstratives

Purpose

This section aims to define ASL demonstratives in a manner that takes into consideration general definitions drawn from spoken languages. Demonstratives, in general, provide a modulating distance cue to indicate objects in physical surroundings. Depending on the language's demonstrative system, there are different numbers of words used to encode the proximity of the referent relative to the speaker. For example, Spanish has 3 demonstratives, Navajo has 14, German and French have 1, and English has 2. The English words *this* and *that* provide two ways to express something that is near or far from the speaker. Thus, based on the nominal demonstratives English can be described as a two-demonstrative referent system (Diessel, 2013).

Demonstratives also direct focus to the object by using joint attention during conversation interactions (Diessel, 2013). When the speaker states, "this/that," the listener is being guided to what physical object is being focused on. Both the demonstrative reference word cues and the demonstrative attentional focus guidance are instances of a combination of language and cognitive understanding. It is understood more clearly in the modality of the spoken language how to identify the general patterns of demonstratives.

Demonstratives are often used as examples to see how communication acquisition is developing for children by looking at language production and joint attention behaviors. The acquisition of ASL demonstratives appears to be based on the development and integration of both manual forms and joint attention. ASL demonstratives help us to understand further language acquisition in ASL signers. It also helps us understand their cognitive and functional development of joint attention as well.

It is possible that ASL demonstratives have a one referent system, which is rare in the patterns of spoken languages. Spoken languages typically have two or three nominal demonstratives to refer to the proximity of the referent relative to the speaker. However, even in spoken languages with two or more demonstratives, they are not used in a categorical manner. Similarly, we may find there are probabilistic patterns of ASL demonstratives that rely on factors other than proximity to the signer to modulate the demonstratives. The differences in language modality require different stances on defining the demonstrative phenomenon. While there is not a thorough description of the grammatical feature of ASL demonstratives, there is research regarding sign language points. Linguistics and developmental science topics in signed languages have identified and discussed pointing signs in corpus data, joint attention, eye gaze, and language acquisition.

Rationale for Topics

Demonstratives are an intriguing topic in various scientific fields such as cross-linguistic typology, psychology, and philosophy. Various works were conducted in strictly experimental settings, field observations, and in careful discourse monitoring because they give us insights into specific grammatical usage like demonstratives. Three central bodies of literature will describe and motivate the need to look at ASL demonstratives through a closer lens. Deictics in spoken languages will provide a foundational explanation of how demonstratives are defined. Here we see the vital role demonstratives play and how investigations of spoken language demonstratives can improve our understanding of their definition within ASL. Moreover, the role of developmental sciences regarding joint attention and the related intersubjectivity will inform our understanding of the acquisition of demonstratives. Deixis is on one side of the coin, and joint attention on the other side of the same coin. Lastly, demonstratives incorporate the theoretical framework on gestural pointing signs. The discussion to exclude or include gestures in the demonstrative analysis will provide understanding regarding various theoretical frameworks that apply to demonstratives in both spoken and signed languages. The three topics will lead to creating the overall research question of this dissertation: What are the patterns that show the form and function of ASL demonstratives across different age groups?

Topic I - Deictics and Demonstratives

Spoken Language Demonstratives

Demonstratives are defined as a word to refer to space of where entities are placed. The English language uses the words *this* or *that* as a type of nominal modifier that direct attention to the referent. They are commonly used as a reference cue to provide context and clarity during discourse. Historically, demonstratives undergo diachronic change into other syntactic categories such as pronouns, determiners, adverbs, or prepositions in many spoken languages (Diessel, 1999; Heine et al., 2020; Pfau & Steinbach, 2006). The definition focuses on a categorical type of demonstratives. The examples from English show that in addition to nominal demonstratives, there are demonstrative adverbs also.

1. “This book here”

   [NOM DEM] [NOUN] [ADV DEM]

2. “Over there”

   [PREP] [ADV DEM]

Specifically, nominal demonstratives index the location of a referent relative to a deictic center (Fillmore, 1982; 1997). The deictic center is typically the speaker’s body, but it can be shifted to another speaker in a discourse context. When demonstratives or co-speech gestures index referents in the physical space around the speakers, they are said to function exophorically. For example, a proximal demonstrative and a pointing gesture can be used to refer to and locate a physical referent within arm’s reach, or near the speaker. Using English words such as: here, there, this, that *and* using a gestural point to a referent in physical space provides a multimodal cue. The multimodal cues in communicating words and gestures to refer to the object are being used as an attentional modulator. It is prototypically common to use a demonstrative along with a deictic pointing gesture. Languages typically have two or more demonstratives to indicate where the referent is physically (near or far) relative to the speaker and sometimes relative to the interlocutor (Diessel, 2006).

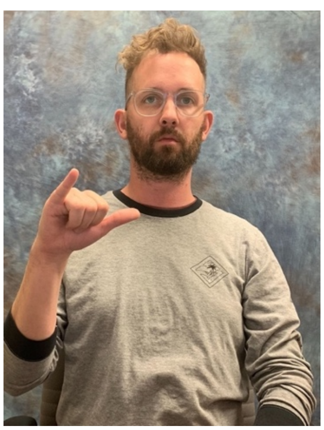
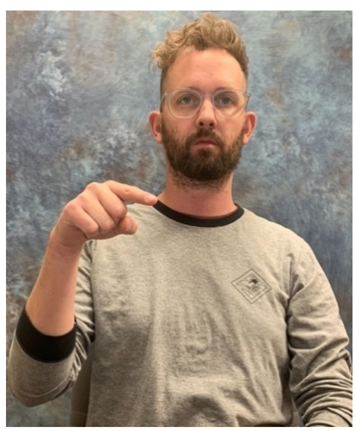
The definition of demonstratives above adds to the descriptive linguistic demonstrative definitions. Linguistic literature defines demonstratives as grammatical markers, featuring as pronouns, determiners, and adverbs. The linguistic definition analyzes demonstratives as a categorial type of nominal modifier that directs attention to the referent, however there are more elements of a demonstrative construction. Languages use multimodal constructions, and the grammar is only part of the construction. The combination of demonstrative properties from the deictic center and joint attention provides a more holistic view of the deictic exophoric demonstrative being universal in a manner that overlaps communicative and linguistic features.

For spoken languages, demonstratives are recognized as grammatical markers of physical distance between the speaker and a referent (nominal demonstrative) or location (adverbial demonstrative). Most spoken languages use a two-demonstrative system (proximal, distal), a three-demonstrative system (proximal, medial, distal), or a continuum-demonstrative system (Coventry, Valdés, Castillo, Guijarro-Fuentes, 2008). There are even a handful of languages, like German, with a one-demonstrative system. Most languages have at least two different reference points — near and far from the perspective of the speaker. Three-or-continuum-type of demonstrative system are possible but less common (Diessel, 1999). The description proximal means the object placement reference is near where the speaker is. Distal refers to a reference that is far from the speaker. Languages use the base marker of demonstratives having two or three spatial instances of proximal and distal reference. The demonstrative feature is not a specific measurement that shows distance but rather a collective understanding between language users in space and social interaction. We understand that demonstratives are a unique linguistic category that does not usually fall in the descriptive label of content words and grammatical markers alone. We know that demonstratives do strongly interact with a combination of words and prompt in social cues. One example of a social cue is the focus or joint attention behavior. Joint attention is a vital language acquisition feature discussed by developmental psychology and other specialized fields. Thus, it is imperative to include *both* the grammatical analysis and the joint attention behavior when discussing demonstratives.

American Sign Language Demonstratives

Upon reading the three- and continuum- demonstrative possibilities from languages, we can assume that languages can have unique demonstrative reference usage. There are different ranges of options in addition to the majority of two-demonstrative systems. There is a possibility that ASL has a single demonstrative system given the importance of the pointing sign for establishing joint attention. The study in this dissertation will investigate this possibility. An experimental task to elicit demonstratives referring to proximal and distal referents in ASL will show us what type of demonstratives are produced. Further analysis can provide some insight into possible additional demonstrative features if different participants are using similar patterns.

ASL has been reported to have a sign translation for the English word “that.” Baker-Shenk and Cokely (1980) offered four different signed expressions that provide demonstrative phrases for “that thing” and “that one.” Figure 1 shows the four ASL expressions glossed as THAT-ONE, THAT-ONE (emphasis in movement), THAT and THAT-ONE_INDEX. In other words, there are two different handshapes that are combined to produce these ASL translations of the English word “that”: the Y[1] handshape when signing THAT and the INDEX (IX handshape) when using the second morpheme of _INDEX in the ASL gloss of THAT_INDEX.

THAT-ONE, THAT-ONE (emphasis in movement), THAT	_INDEX[2]	THAT-ONE_INDEX
		

[1] The handshape fonts are created by CSLDS, CUHK.
[2] _INDEX is not one of the four examples from Baker_Shenk and Cokley (1980), but is included to show as the second sign for the phrase THAT-ONE_INDEX for clarification purposes. Henceforth, the three examples will be labeled as THAT, INDEX, and THAT_INDEX in this dissertation.

Figure 1. ASL Demonstratives categorical examples from Baker-Shenk and Cokley (1980).

Baker-Shenk and Cokely (1980) also mention that demonstratives in ASL need to provide clarity on the appropriate context for using each form. Interestingly, the form of the IX-handshape, or pointing sign, is used in other grammatical functions (determiners and pronouns) in addition to ASL demonstratives. Previous analysis has inconsistently explained the grammatical use of determiners in ASL (see Bahan, Kegl, MacLaughlin, & Neidle (1995) for a list of different resolutions). The content starts by stating that signed languages do not have any determiner articles. Another insight says that the index finger (or the Pointing Sign) is a possible marker for ASL determiners placed before or/and after the noun. Zimmer and Patschke (1990) mention that ASL determiners do not convey definiteness beyond the function of specifying the noun. Thus, there is no explicit semantic content to be identified. Lastly, there is no prediction or pattern in which the distribution of the pointing sign indicates with the noun phrases.

These different analyses lead to a continuous discussion regarding the ways of how the pointing signs are labeled as determiners and demonstratives in ASL. Bahan et al. (1995) explained the case of establishing a label and pattern prediction for determiners overlaps with other grammatical instances like pronouns, demonstratives, adverbial/adjective markers, and reference points. All the grammatical instances express with at least the index finger form. Thus, making it difficult to have clear categorical labels of grammatical descriptions that languages like English have. As the form of the index finger, the schematization for the pointing sign provides a specific pattern to include and predicts different grammatical usage in ASL as a marker. Manual signs for demonstratives in ASL seem to have a vague overlap with other grammatical usages. Thus, it is important to look at non-manual cues, like eye gaze, as these may clarify which grammatical patterns are explicitly used for demonstratives, as suggested by Bahan et al. (1995).

While there is a linguistic description of several ASL demonstratives: THAT, INDEX, or THAT_INDEX, Baker-Shenk & Cokley (1980 p. 221) state that, “We do not yet know how to clearly distinguish them and what are the appropriate context for using each form.” Specifically, the sequence of THAT_INDEX is more frequent compared to INDEX _THAT (and evokes two distinct units). In other words, this informs us something more about the pattern and construction of THAT_INDEX.

It is also unclear regarding the role of the specific joint attention when ASL demonstratives are being used. The form of an ASL demonstrative may depend on the status of joint attention between the signer and the addressee. Hypothetically, the index point is one example of what a caregiver uses to refer to physical objects to guide the eyes of a child as an attention cue, thus increasing intersubjectivity for the caregiver and child during the conversation. Using a demonstrative prior to naming a referent allows the caregiver to guide the child’s attention to what is being discussed prior to providing the lexical symbol used to name that object. However, there is a competing factor when using a point. For example, in ASL the point can be grammatically used as a pronoun as well. This brings us to the question about the definition (or classification) of ASL demonstratives. The overarching question of this dissertation focused on ASL nominal demonstratives, which type of signs and handshapes will be used to produce deictic reference to objects that are near or far?

These different analyses in both modalities of languages (spoken and signed) lead to a continuous discussion regarding demonstratives in ASL. Previous studies tend to be of two types. The first focuses on a descriptive definition of demonstratives as a nominal referent marker and a grammatical function in a categorical sense, or particles to connect to other grammatical features like pronouns, determiners, and adverbs. The second approach, such as that used by Diessel (2006), considers demonstratives as a unique class of linguistic expression that involves coordinating attention for interlocutors used beyond a grammatical marker. The discourse between two people uses the unique class of demonstratives as a pragmatic feature, such as joint attention, to initiate and maintain attention cues during conversations. This can be known as a social communication cue in addition to grammatical markers. Thus, this dissertation focuses on the second definition. Diessel (2006) points out if we focus only on the semantic and syntactic features of demonstratives, it excludes the communicative function of the deictic center and joint attention as a universal use of language and joint attention. With the focus of the exophoric demonstratives to include communicative patterns, I want to see how ASL demonstratives are used to manage joint attention.

Topic II - Demonstratives in Joint Attention

Joint attention is a communicative feature which involves at least three components: the actor, the addressee, and an object of reference. Both the actor and the addressee must jointly focus their attention on the same entity. The demonstrative function describes spatial reference (i.e. relative to the deictic center) and creates new joint attention or manipulates the focus of attention between previously established referents. The joint attention aspect of the demonstrative marker is for the addressee to comprehend and maintain intersubjectivity with the speaker by acknowledging when a new focus is starting or what is be continuously focused on during the conversation (Diessel, 2006), as in (3) and (4):

3. "Look, that's Bill"

*Creating a new focus for joint attention

4. "Here are two books, this one is mine, that one is yours"

*With two previously established referents (books), demonstratives can create a contrast between them, or redirect attention from one referent to a previously established referent.

Bruner (1995) explains that in addition to the joint attention used by language prompts like demonstratives, shared context and shared presupposition are also being cognitively processed. The additional features at its most competent level are considered a “meeting of the minds,” or intersubjectivity. The behavior of intersubjectivity between the actor and addressee is often constructed as facial expression, pointing, and preverbal signs that are part of the pragmatic functions of language. Thus, intersubjectivity is a part of the behavioral cues in the scope of joint attention. Intersubjectivity focuses on “being on the same wavelength” kind of understanding with the other person’s point of view. One example of an intersubjectivity behavioral measurement is the specific eye gaze following to modify the joint attention between signer and addressee.

When being prompted by demonstrative words, the signer and addressee will physically look at a new focus or switch focus between two different objects. In addition, focused on only the behavior of looking at people and shifting the focus to an object with no words is one type of joint attention called gaze following. Gaze following has several behavioral steps that the actor performs. First, the actor uses their eyes to look at the addressee, perceiving the addressee’s eyes to initiate joint attention. Then following the eyes connection from both individuals, the signer will shift eyes to the object (excluding any language prompt). With that shift and eyes prompt from the signer, the addressee will follow suit and change focus from looking at the signer to the object creating a new focus of attention. The behavior of the addressee perceiving the signer’s eye gaze movement from the person to the object and responding by doing the same eye gaze behavior is defined as gaze following. Both eye behaviors from the signer and addressee is one specific eye gaze joint attention behavior that is commonly seen by infants as a prelingual phenomenon.

Brooks, Singleton & Meltzoff (2020) looked at infants' gaze following to provide insight regarding the multiple routes for building interpersonal communication and social cognition before language input. The researchers designed an eye gaze following task. Both deaf and hearing infants would sit across from the experimenter. The experimenter, with no vocal or hand cues, would shift their eye gaze to a specific object on the left or the right side of a table placed between both interlocutors. The study wanted to see if the infants would follow the adult eye gaze towards the object without any language input. This type of joint attention focuses on pragmatic characteristics of the prelingual phenomenon.

Interestingly enough, one key finding is that deaf infants had significantly higher gaze following scores than hearing infants. Both groups of infants did show eye gaze following to maintain joint attention. However, the finding suggests that the eye gaze behaviors of deaf infants are a predominant feature of both their social and linguistic engagement. We can see that joint attention, with eye gaze behavior, does form before dialogue from infants. This research finding provides insight on eye gaze following from both signer and addressee that may occur when being prompted using demonstratives. We can observe strategies of joint attention being executed with the expression of demonstratives in discourse having one of the joint attention cues be their eye gaze following.

ASL child joint attention research mentions that pointing is another cue of joint attention and different eye-gaze behaviors, but does not label the pointing cue as a demonstrative function. Lieberman, Fitch & Gagne (2020) describe joint attention for the signer, addressee, and objects requiring multiple cues to make the connection between language and physical objects. They describe cues such as hand waving and pointing to direct attention for the addressee to modulate eye-gaze behavior from perceiving language and the object back and forth multiple times.

In short, demonstrative language cues align with joint attention communicative cues in a manner that creates a new focus or provides contrastive attentional shifting. The contrastive reference can include the addressee listening to the signer and shifting their eye gaze several times from the signer to the object. Another way to prompt the contrastive reference can include gaze following in which the signer's eyes look at the object prompting the addressee to look at the object as well. The demonstrative aspect of joint attention is one of the earliest acquisition features that children learn and use. Eye gaze is defined as a bid for an attempt as a joint action in which it allows a visual cue for acknowledgment regardless of the successful attempt. The eye gaze behaviors may be considered a controlled process despite a common assertion that eye gaze behaviors are innate (Besner, McLean & Young, 2021).

In addition, Deaf individuals show different strategies on the use of eye gaze behaviors in various social, educational, and medical settings (see Hauser, O'Hearn, McKee, Steider & Thew, 2010).

Topic III - Acquisition of Demonstratives

Demonstratives are among the earliest grammatical words that children produce (Diessel & Coventry, 2020). Demonstratives are the specific indication of a distance marker between the user and a particular object in space. It can be made with a word, gesture, or both. The concept *word* includes a lexical utterance of a vocal cue or a lexical production of a manual sign. In the case of word and gesture, it includes both spoken and signed languages. The concept of *gesture* produced on the hands has different definitions in referring to the pointing signs (a signed word) and pointing as a co-speech gesture (see Fenlon, Cooperrider, Keane, Brentari & Goldin-Meadow, 2019). The pointing sign is a grammatical feature in signed languages. The pointing gesture is considered a non-verbal communication marker in spoken languages. Thus, for both signed and spoken languages, it is possible to have a word and a gesture to be expressed as multi-modal demonstratives. The multi-modal demonstratives are mostly researched in children's language developmental stages regarding co-occurrences of words and gestures (see Kita, 2003).

Researchers acknowledge that all multimodal cues in communicating demonstratives rely on the co-occurrences of different verbal and non-verbal tools (De Pablo, Murillo & Romero, 2020). The use of a hand-following pattern and eye-gaze helps children establish form-meaning mapping. The multimodal of verbal and non-verbal interactions focus on children wanting to convey information they do not have a label for (Tomasello & Bates, 2001). Over time, the progression for children learning spoken languages shows that they produce demonstratives as single word utterances. The visual point, which previously was used in isolation, becomes a supplemental feature.

To date, there are a few studies that are concerned with the relationship between gestural pointing and demonstratives in young children (Rodrigo, Gonzáles, de Vega, Muñetón-Ayala & Rodríguez, 2004; Todisco, Guijarro-Fuentes, Collier & Coventry, 2020). The reason that there are a few studies of children that look at both speech and gesture is due to the predictable patterns of demonstratives being a speech act. One research study focuses on the specific proximal gestural pointing and verbal demonstrative production. Todisco et al. (2021) discussed language development with verbal referents using joint attention and gestural pointing being conveyed between caregivers and children. The children in this study were, on average, around two years old. The study aimed to see if the proximal deictic events across modalities are a precondition of the joint attentional behaviors. They found that both parties, caregivers and children, utilize both gestural pointing and speech modalities during cooperative attention interaction. No significance was shown towards the use of only speech (no gesture) as it had a decreased duration of joint attention compared to using both speech and gesture. The multimodal event of both speech demonstratives and gestural pointing from both parties increased the overall duration of a continuous joint attention event. The use of pointing during a joint attention event increases the intersubjectivity of the topic given by providing a more efficient concrete communication directions towards the referent. The act of both speech and gesture may provide ease for the child to connect vocabulary to the object. They suggest that regardless of the different proximal deictic productions, it is essential to look at demonstratives as a multimodal event and include gesture pointing in line with speech production for children's data.

The majority of the discussion and research on demonstratives predominately analyzes spoken utterances over gestural pointing. However, recognizing that demonstratives strongly associate with joint attention, multimodal attentional modulating helps us to see the value and role of gestural pointing. There is a need to look more at the relationship of gestural pointing and how children reorganize it to increase their vocabulary and communicative behavior. Making the connection between different topics like vocabulary acquisition, gesture usage, joint attention and eye gaze will provide further understanding regarding the classification of demonstratives on a universal level. Starting a discussion about multimodal verbal and non-verbal cues is an optimistic topic for signed language research. The discussion provides clues on how to see ASL demonstrative pointing as an important step in acquisition.

Acquisition of ASL Demonstratives

Hoffmeister (1978) observed two deaf children and how they use points in naturalistic conversation in ASL. The findings describe demonstratives as one function of pointing signs, but does not explain much about their grammatical development. There is no clear definition of ASL demonstratives, other than it is structured as a pointing sign alone. There is a possibility that ASL demonstratives use other words besides pointing alone. The case of Y-handshape, or /THAT/, may be a possible distal demonstrative distinguished from a point. Other instances may include non-manual markers and movement parameter modifications as a demonstrative. Much research also has been evaluating language acquisition for ASL infant signers, but does not discuss in depth regarding pointing and demonstratives (Lillo-Martin, 2008). This means that there is very little discussion regarding the connection between signed utterances and pointing signs.

The use of demonstratives by children provides a social benefit to the language acquisition process. When having shared attention, children can acquire vocabulary in a specific manner to connect the form and meaning of lexical items and utterance phrases. This process builds up the social and language interaction children need to thrive in life. Nominal demonstratives specifically may be overlooked as one key factor of communicative nurturing for deaf children. The assumption of oversimplification in the gestural pointing may miss the ASL demonstrative clues children produce for exophoric reference that combines both language and gesture.

Conceptual Framework - Gestural Pointing, Pointing Signs and Demonstratives

Spoken language verbal cues may be produced together with gestural pointing, but not much has been focused on the possibility of multimodal constructions consisting of two different demonstrative forms, one verbal and one gestural. The issue of categorizing demonstratives is more complex in signed languages. It proves an unexpected challenge to describe demonstratives as signed utterances alone, knowing that the gestural element provides an equally important contribution in spoken utterances (Cooperrider, 2016; Peeters et al., 2021). Figure 2 shows a conceptual framework of multimodal demonstrative productions for signed and spoken languages, considering the factors that influence demonstrative choice at the lexical, cognitive, and sociocultural levels. Any case of multimodal demonstrative discourse of gesture, nonmanual markers, spoken, written, and signed language is included. For signed languages, the pointing sign intertwines with the grammatical usage of nonmanual markers such as mouth, face, and movement modulators.

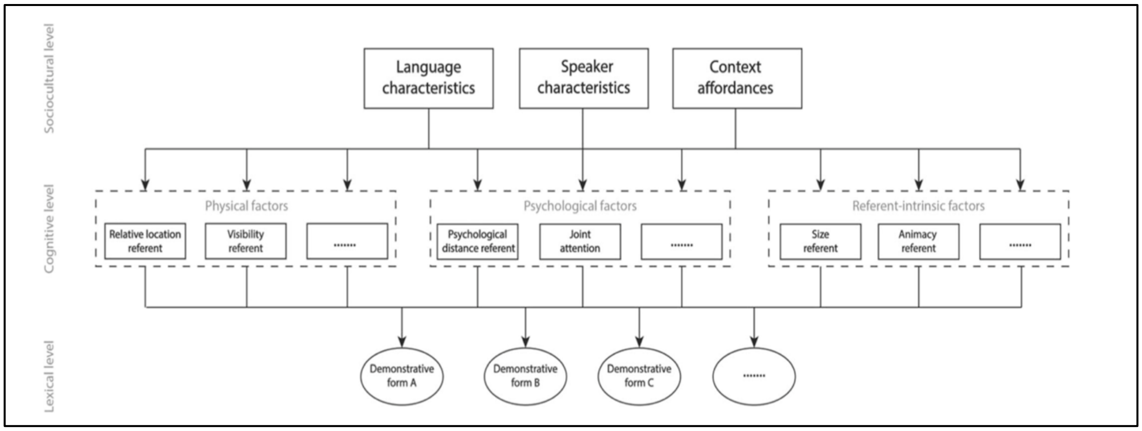


Figure 2. Peeters, Krahmer & Maes (2021) conceptual framework for demonstrative reference.

Recent studies within a cognitive grammar framework regarding the grammatical description of pointing constructions in signed languages distinguish two symbolic elements of a point: the *Pointing Device*, which directs attention, and the *Place*, which encodes a meaningful location (see Wilcox & Occhino, 2016 for more explanation). While the demonstrative conceptual framework does focus on the combination of multimodal use of gestural and grammar pointing, depending on certain circumstances, Wilcox and Occhino (2016) suggest a cognitive grammar explanation. "[The] pointing signs are not unanalyzable structures, but complex constructions formed from two-component symbolic structures. The Pointing Device and the Place are symbolic structures, each having phonological and semantic content." They also state that, unlike spoken languages, signed language users often perceive gestural instances as grammatical possibilities regardless of language modality. Non-signers would not see pointing as a grammatical possibility. That means labeling the index finger pointing as a gestural sign or as a pointing sign as a separate categorical identification is challenging.

Another study focusing on language processing shows that the signer will perceive all visual signals, signs, and gestures as having grammatical importance. When a user who is fluent in signed language perceives a pointing sign, the cognitive process of language is activated. On the other hand, a spoken language user may dismiss gestural indicators as irrelevant to grammatical use (Husain, Patkin, Thai-Van, Braun & Horwitz, 2009). Because the auditory language signal is dominant, visual aids for spoken language are perceived as providing a supporting role. The variety of gestural indicators from speakers does not disrupt the conversation. There is not a need to have a consistent pattern of predictable gestures made, like in signed language. The non-verbal gesture can be dismissed, or rather, perceived subconsciously.

Pointing in ASL and other sign languages is an interesting discussion regarding how it compares with spoken languages. In one adult study regarding the grammatical feature of the pointing sign, Fenlon et al. (2019) compared gestural pointing from spoken language and signed language pointing. The analysis suggests a comparison between different perceptual experiences on pointing. They describe spoken language gestural pointing as not having predictable handshape and movement patterns among different speakers. It was hard to predict which gestures were identified as a point. By contrast, users of

British Sign Language using points provided a predictable pattern of similar handshape and movement. Results from Fenlon et al. (2019) study does support the signed language pointing pattern at the phonology level that Bayley, Lucas & Rose (2002) found in their ASL results.

Bayley, Lucas & Rose (2002) examined the ASL 1-handshape citation form, a similar phonology of the index point. They found that from their dataset of 5,356 tokens from 200 different signers that there is some variation in handshape, however, the 1-handshape is constrained by grammatical features. Thus, signed languages have a different function with the point/ 1-handshape compared to spoken language gestural pointing variations. Comparisons and contrasts between gesture and signing often overlap, but any gesture (especially a point) is perceived by a deaf individual counts as language input.

The two different modalities of gesture and auditory words provides a clear connection of the specific demonstrative word and the gesture indicator. Having two distinctive modes shows obvious categorical differences with spoken language demonstratives between the spoken utterance and the gestural pointing. Analyses of spoken languages focus on the spoken demonstratives as the primary predictable pattern. The supplementary gestural pointing varies more but does appear consistently with spoken demonstratives. This is a multimodal demonstrative form described in many spoken languages; Lao, English, Spanish, Japanese, Turkish, and more coming from a cross-linguistic typological analysis (Diessel 2003, 2006). Thus, the explanation of demonstratives in ASL will differ from spoken languages. ASL is a visual language and does not have any auditorial traits. ASL does have multimodal patterns such as nonmanual markers that supplement manual forms. A more significant cross-modal difference for signed languages may be that there is only a single demonstrative form, primarily shown as a point, along with various nonmanual modulations. This pattern is not yet documented among spoken languages.

How do demonstratives stand out from other grammatical ASL pointing hand signals? This is difficult to determine. The current study approaches this conundrum by establishing the communicative context in which a signer needs to establish joint attention (by directing their eye gaze) to proximal and distal referents. While some ASL signs have traditionally been glossed as “this” and “that” implying an equivalence to English proximal and distal demonstratives, it is essential not to assume a priori that ASL has two signs that neatly correspond to these English demonstrative terms. First establishing whether and how adult signers establish joint attention to referents in these contexts will allow us to establish the target forms that children are acquiring. This process also means prompting the interlocutor to look at the target referent in question – in physical space. We are documenting the addressee’s responses marked with demonstratives and fixated eye gaze on the identified referent in space. What we observe in adult signers will lay the groundwork for our observations with child signers with respect to their acquisition of demonstratives and eye gaze behaviors.

The acquisition of ASL demonstratives will presumably be based on the development and integration of both the manual forms and joint attention. Understanding how children acquire ASL demonstratives will provide insight in understanding further about language acquisition in ASL signers. It will also provide insight into their cognitive and functional development of joint attention.

Summary

Demonstratives have been classified as more than just grammatical features. They involve a complex spatial descriptor using a holistic cognitive process of utterances, gestures, eye behavior, and attentional manipulation. Both language modalities describe deictic demonstratives as an essential acquisition milestone to pick out objects, events, and people. We understand that pointing and demonstratives need to be considered as a multi-layered communication organizing tool.

Chapter 3: Research Methodology

Purpose

We want to understand more about ASL demonstratives and how ASL fits within the different typological systems of demonstratives that have been documented. More specifically, this dissertation investigates the distinction between proximal and distal demonstratives because this contrast is frequently found in other languages. The research includes demonstrative forms by various signers, adults and children. Based on previous pilot studies, one of the most frequent forms of ASL demonstratives is pointing (Morford et al., 2019). What is challenging for studying demonstratives in ASL is that pointing is used for multiple functions.

The goal for this dissertation is to distinguish pointing as either an ASL demonstrative or as another ASL grammatical function. Prior signed language research identified that pointing can function as pronouns, determiners, reference point constructions, and demonstratives (Bahan et al., 1995). These manual signs look like the same handshape to the untrained eye (Bailey et al., 2002; Wilcox & Occhino, 2016; Fenlon et al., 2019). The differences between said categories include complex, subtle co-articulatory cues whose labels are sometimes borrowed from spoken language and gestural research terminology, adding additional confusion to this domain. However, the cues that allow us to distinguish these pointing functions are not limited to the manual form of the point: mouthing and eye-gaze, ambient location of conversation, and joint attention can also indicate the grammatical function of a point. Further, it is possible that discourse constraints also impact the interpretation of demonstratives in conversations. Thus, the present study operationalizes joint attention as an additional factor to investigate possible influences on ASL demonstratives.

In addition to describing ASL demonstrative usage in adults, the acquisition of ASL demonstratives by deaf children is also investigated. We observed the language development timing when deaf children use demonstratives to achieve joint attention. We also wanted to see the impact of the timing of input on the acquisition of demonstratives. It is important to investigate several things. One, figuring out how children are modulating ASL demonstratives. Two, with the understanding that we know how adults express ASL demonstratives, we then can compare what variables contribute to their use of demonstratives. Are there similarities or differences in children's and adult's use of demonstratives? If we found differences, then what are they? What are the possible factors that would explain differences in their usage of demonstratives?

The goal of this dissertation study is to use a psycholinguistic approach of eliciting ASL demonstratives from both adults and children. We want to understand what ASL sign variations are used to identify proximal and distal referents. An elicitation study provides insights that may answer the central question regarding proximal and distal demonstrative usage for ASL. One of the main reasons to design an experimental elicitation task is to separate the pointing sign when used as a demonstrative from other linguistic categorical uses such as to determiners, and pronouns.

Overview of Information Needed

In order to answer the overall research question of whether there are clear proximal and distal indicators that modulate ASL demonstratives, the study must carry out data collection on several sub-questions alongside the general question. First, we collect data from participants who use ASL as their primary language from adults and children. Background information guides criteria sampling to ensure that participants provide a representative sample of the ASL-signing deaf population. Adults and children interact with the experimenter in a naturalistic discourse task designed to elicit ASL demonstratives. The focus is on the proximity of the referent to the signer and whether the bid for joint attention is successful or not during the task. Both focuses provide insights into our general understanding of demonstratives in ASL.

Overview of Methodology

Participants

Ten adults and ten children participated in the ASL demonstrative task. The adult data is the focus for Study 1 and the child data is for Study 2. All participants were selected as those who use ASL as their primary language. A self-report questionnaire on language usage was collected. Data from the self-report was consistent with usage patterns of the general population of ASL language users. Note that the data collection is not restricted to users of ASL who acquired ASL from birth from deaf parents, which only reflects a mere ten percent or less of all signers in the United States and Canada area (Mitchell & Karchmer, 2004).

Background Measures

Adult and Child participants

1. A short biography of each participant's background information was recorded. Each participant filled out a form regarding information about language background, exposure, usage of language, age, and other details that were important to categorize participants into groups during data analysis.

Child participants

1. Experimenters provided assessed receptive language skills through the ASL-RST (Enns et al., 2013). All child participants showed age-appropriate proficiency in ASL.
2. Cognitive development was assessed using two "Theory of Mind" tasks. Participants, depending on age, showed a range of emerging to complete mastery of theory of mind ability.

The purpose of cognitive and language tasks is to preclude the need to delimit data collection only to deaf children with deaf parents, a common practice in acquisition studies of signed languages[3]. It also precludes the need to collect hearing loss levels to indicate how much participants can hear, even though hearing loss levels may be associated with language performance and language usage of English and ASL. However, all sign users for this study stated in their background information that their primary language is ASL. They use that language in their everyday social and communication interactions. More details regarding the ASL-RST and the two theory of mind task are elaborated in chapter 5.

Experimental Task and Design

Task.

A puzzle completion task was designed to elicit demonstratives. The task was originally designed by Bettie Petersen, with input from the directors of the Lobo Language Acquisition Lab. During the puzzle task, the participant helps the experimenter to complete a simple picture puzzle board with 25 pieces on a table without the participant touching any of the pieces.

The participant and experimenter sit across from each other, having the puzzle placed on a table between them. The placement of the pieces has a specific purpose. Half of the puzzle pieces are near the participant and the other

[3] The tradition of limiting acquisition studies of signed languages to deaf children with deaf parents (DoD) assumes that all DoD are automatically native and fluent in ASL. However, there is variation in proficiency among DoD, and some deaf children of hearing parents (DoH) who learn ASL are comparable in ASL fluency to DoD. Not including DoH in signed language acquisition studies also signals that the DoD are representative of the deaf population when in fact they only represent less than 5% of the deaf population. Many deaf children have hearing parents. By using direct assessment of ASL proficiency, the pool of children included in this study is more representative of the deaf population.

half are farther away from the participant, near the experimenter. One puzzle piece is placed at a greater distance away from both people to potentially elicit an even greater distal term compared to the rest of the pieces. The participant is told not to touch any of the pieces in order to elicit demonstrative vocabulary further. During the entire experiment, the experimenter follows a strict script designed to prompt different pieces of the puzzle for the participant to find. Each line stated by the experimenter drives the participant to either identify, follow-up, or clarify. After the prompt, ideally, some demonstratives can be predicted. For example, the experimenter says, “Which puzzle piece shows the red dinosaur’s eyes?” Then, the participant responds, using ASL demonstratives and other linguistic strategies to indicate, “this/that one.” Figure 3 shows the placement of different puzzle pieces in the picture on the left. The line divides the proximal and distal placements of the pieces. Participants are instructed not to reach over the line. The picture on the right is the completed puzzle.

Figure 3. The Demonstrative Elicitation Puzzle Task.

Design.

There are two independent variables, proximity and joint attention. Proximity refers to whether the puzzle piece is close to or far from the participant. Proximal refers to something that is close to the participant. Distal refers to something that is far from the participant. Half of the puzzle pieces were proximal; half of the puzzle pieces were distal. The joint attention variable has two trial types: Find It and Misunderstanding. In the Find It condition, the participant is asked to find a certain puzzle piece. The goal is for the participant to establish a bid for joint attention. The response from the participant expresses where the specific puzzle piece (either proximal or distal) is located. In the Misunderstanding condition, the experimenter, on purpose, creates a misunderstanding by switching attention to a different piece than previously identified by the participant, "This one?" When the participant responds, they correct the unsuccessful bid for joint attention, and use demonstratives to draw the experimenter's attention back to the original piece that they had identified. The dependent variables are focused on the demonstrative production responses from the participants and the variations of linguistic parameters within the category of handshape, movement trajectory, and the eye-gaze behavior of whether the participant looked at the puzzle piece or at the experimenter while producing a demonstrative.

Demographic Data

A total of 20 participants (10 adults and 10 children) completed the experiment with Bettie Petersen, researcher affiliated with the Lobo Language

Acquisition Lab. We determine the amount of demonstratives collected during the analysis portion of the data based on the amount of puzzle pieces. Ideally, the total data collected decides how demonstratives function in ASL. The puzzle task has 25 pieces, and the script elicits 35 total responses, including 25 responses to Find It prompts, and 10 responses to Misunderstanding prompts. The specific script is in Appendix 1 of this dissertation in English and ASL gloss.

Analysis and Synthesis of Data

First, all the data was video recorded and transcribed into ELAN (EUDICO Linguistic Annotator) data annotation software[4]. The data is summarized using multiple statistical analyses and visualization in R to provide an overview of the types of signs produced by participants. The initial video data investigation provided insights from all participants' variations of ASL demonstratives. The adult users provided a benchmark of what demonstratives a competent signer uses during the task. Children produced the same or different types of demonstratives depending on their ability and age.

The primary analysis focuses on the two independent variables incorporated into the script used during the puzzle task: Proximity and Joint Attention. To investigate whether referent location impacts the choice of demonstrative, the puzzle pieces are placed near and far from the participant. If

[4] ELAN is a tool that makes it possible to document in real time during the video what demonstratives were use in ASL opposed to audio recording software.

demonstratives differ by the proximity of the pieces, this provides evidence for a distinction between proximal and distal demonstratives in ASL.

Second, the social interactions between participant and experimenter are manipulated to determine whether joint attention influences the choice of demonstrative. There are two general prompts from the experimenter, one that asks where the piece is (Find It) and the other prompt (Misunderstanding) is a follow-up to the initial participant's response which on purpose creates a disruption of the original bid for joint attention from the participant, see Figure 4.

Figure 4. Experimenter following a script to provide prompts to participant (not shown) during the puzzle task.[5]

[5] The still shot is during a "Misunderstanding" follow up task prompt after the initial "Find It" prompt. The experimenter asked, "This one?" to the participant.

The experimenter selects a piece that the participant did not indicate and asks for confirmation that it is the correct piece. This prompt is designed to elicit a correction, with greater deictic force, in which the participant emphasizes the correct selection to redirect the experimenter's attention. These two independent variables were crossed, creating four conditions. Table 1 provides the four conditions for the entire data collection.

Referent location	Prompt from the experimenter and eliciting cues for the participant to express demonstrative in different conditions.	
1. Proximal placement	A. Find the puzzle piece without touching or moving it	B. Misunderstanding cue to elicit a follow-up from participant
2. Distal placement	A. Find the puzzle piece without touching or moving it	B. Misunderstanding cue to elicit a follow-up from participant

Table 1. The experimenter follows a script that has various prompts that include the four conditions (1A, 1B, 2A, 2B).

Several logistic regressions in R were run to determine the effect of experimental conditions on the dependent variables. We want to know whether there is an effect of the distal and proximal referent locations on participants use of certain handshapes, movement, and eye gaze. We also want to know the effect of joint attention, especially when the participant needs to redirect attention, on the handshapes, movement, and eye gaze variables of the participants' demonstrative points.

Based on the social cues seen in the misunderstanding condition, we can further understand how the maturity of the participant's joint attention and sensitivity to intersubjectivity influences the participant's attempts to redirect attention. Here, intersubjectivity skills (or, a Theory of Mind) is measured by several theory of mind assessment scores, their correlation to their age, and also by the type or amount of demonstratives seen.

The synthesis of this data provides several key features of this dissertation: one, a descriptive explanation of the ASL demonstrative patterns in both adults and children. The descriptive portion includes three concentrations: 1) different handshapes; 2) different possible movement of manual demonstrative signs; and 3) how the eye gaze contributes to the joint attention during the task from the participants' point of view. In the upcoming analyses, there are two independent variables (proximity; joint attention). The proximity variable is a binary contrast condition of the referent placement in proximal or distal space. The joint attention variable is the binary contrast of what question the experimenter asked the participant. A direct question, "Find It" as the initial question vs. the follow-up question with which the experimenter disrupts the joint attention after the initial response, a "Misunderstanding" question.

There are three dependent variables that are binary (handshape: IX vs. G; movement: straight vs. arc; eye gaze: participant looking at the puzzle piece vs looking at the experimenter). The grammatical facial expression of the mouth, cheek, and tongue emphasizes the ASL demonstrative, but is not analyzed as a dependent variable and is discussed in Chapter 6.

The demonstrative function of pointing in ASL does compete with other grammatical functions of pointing, such as pronouns and determiners, that are used as linguistic elements. By coding multiple phonetic dimensions of ASL points when they are functioning as exophoric demonstratives, we may be able to identify characteristics unique to demonstrative points as opposed to other types of points. Thus, this data contributes to a further understanding of ASL demonstratives which can be compared to ASL points with other grammatical functions to improve our understanding of the distribution of pointing signs within a signed language. Moreover, a comparison with studies of co-speech gesture produced with spoken language demonstratives may reveal similarities in demonstrative pointing across language modality.

It is essential to connect the developmental science of language acquisition and joint attention behavior. The goal to refer to puzzle pieces during the ASL demonstrative elicitation task reflected the specific signed language research about language acquisition and the importance of joint attention through demonstratives. It is critical for the ASL research community to increase our understanding of different strategies of joint attention that we can use in ASL. The data analysis of the four conditional prompts for children during the demonstrative task provides insight into language acquisition.

Limitations

Participants may identify themselves as bilinguals. They use ASL and English. With the complexity of a continuum range of usage between both languages, it is possible to have participants use English-influenced demonstratives during the ASL demonstrative task.

Summary

A deictic communication task answers the question, what is the nature of ASL demonstratives? The signed languages are understudied and do not have a vast amount of research and discussion compared to the research in spoken language demonstratives. This dissertation shows novel insights of ASL demonstratives that can contribute to signed language research. Addressing the form and function of ASL demonstratives provides insight into the organization and relationship of gestures and demonstratives in language acquisition and overall language usage.

Chapter 4: Study 1: Adults' ASL Demonstratives

Purpose

The goal of this dissertation is to understand more regarding the forms and functions of the overall usage of ASL demonstratives. One way to address the goal is to provide data from native adult ASL signers. The ASL demonstrative task has two studies. Study 1 focuses on the general demonstrative usage from ASL native adult signers. Study 2 focuses on the ASL demonstrative production from children. Both studies relied on an experimental elicitation task to provide insights to our understanding of ASL demonstratives. It also contributed with insights on how demonstratives are used gesturally, non-verbally, and multimodally. The following chapter covers Study 1 and Chapter 5 covers Study 2.

Study 1: Adults

Ten deaf adults consented to participate in the ASL demonstrative task (n = 10; 3 Male, 7 Female; mean age = 37.6 years old). The participants filled out a language background questionnaire using a confidence Likert scale of 1-6 to self-rate their ASL and English proficiency. According to the background questionnaire, the mean for confidence in using ASL was 5.8. The mean for reading English is 5.5 and writing English is 4.9. In other words, all the participants are self-reported as competent with both ASL and English languages. Background information did not include audiograms of hearing loss or the respondent's age at exposure to English/ASL.

The ASL demonstrative data fundamentally focused on the 25 “Find It” questions as the primary source of ASL demonstrative production from the participants. The 10 “Misunderstanding” follow-up questions are the basis for understanding how adults redirect their interlocutors to achieve joint attention. The physical space in which the task was carried out has been divided into two areas (identified by the rope string) including a proximal space (near participant) and a distal space (near experimenter). Because participants were instructed not to reach across the rope string, the distal space was less accessible than the proximal space.

The overall number of adult ASL demonstratives produced across all participants is 473 instances. Each demonstrative prompt was video recorded, transcribed and coded in ELAN 6.2. To control the coding of demonstrative usage, instances of sign production that did not directly discuss the puzzle piece were not coded. Thus, signing production that did not include exophoric reference through demonstratives were not coded. For example, if a participant pointed to the *location* of an empty space on the puzzle board, it was not coded as an ASL nominal demonstrative as this could be considered a locative adverb/adverbal demonstrative. The center of this analysis is on the exophoric nominal reference to the puzzle piece. The analysis focuses on the signers' systematic modulation of points within the elicitation context. Three mixed-effects binomial regressions were performed using R (R core team, 2022). The focus is on the three dependent measures: handshape, movement, and eye gaze.

Modulation of the three parameters were analyzed relative to the two conditions of proximity and joint attention.

Overall, the main findings focus on the production of points within the signing space with special attention to these three parameters of ASL. Figure 5 shows the visual areas of where the participant typically expresses the three parameters: handshape, movement, and eye gaze.

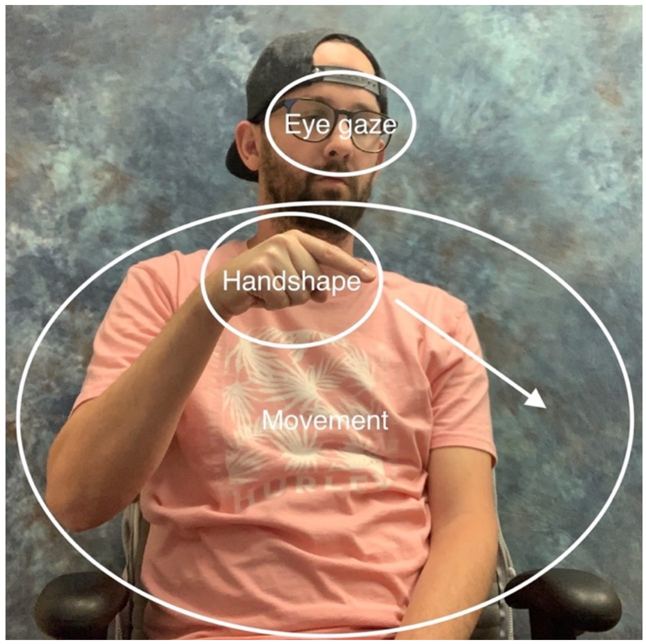


Figure 5. Visualization of parameters focus for ASL demonstratives production analysis.

Two other parameters, palm orientation and location, are included in the coding system, but were not analyzed in this dissertation. Information on the handshape parameter provides a description of the ASL demonstrative form. It provides an answer if there are different handshapes that are being used to refer to things that are near or far. The handshape also provides information regarding strategic attentional modulation when joint attention is needed to be refocused. The movement parameter of the straight line and the arc may show insight regarding the proximity of the referent. Details regarding the wrist, elbow, shoulder, and body leaning movement were not included for analysis. The modulation of eye gaze was predicted to provide insight into the management of the bid for joint attention during the production of demonstratives. Specifically, when the participant is expressing a manual demonstrative, the eye gaze reenforces the demonstrative expression bid by either looking at the experimenter for confirmation or at the puzzle to stress where the puzzle piece is located.

<table>
<tr><th colspan="2">ASL Demonstratives Mixed-Effects Binomial Regressions Variables</th></tr>
<tr><th>Independent Variables</th><th>Dependent Variables (parameters)</th></tr>
<tr><td>Proximity
(Distal, proximal)</td><td rowspan="2">1. Handshape (IX vs. G)
2. Movement (Straight vs. Arc)
3. Eye Gaze (looking at experimenter vs. puzzle piece)</td></tr>
<tr><td>Joint attention
(Find-it, misunderstanding)</td></tr>
</table>

Table 2. Overview of all variables analyses used the ASL demonstratives.

The following sections report qualitative description followed by quantitative findings from the recorded ELAN dataset of all the ASL demonstratives produced from the adult participants. Mixed-effects binary logistic regressions were carried out using the glmer function in the lme4 package (Bates, Maechler, Bolker, Walker, Christensen Singmann & Dai, 2015) for R (R

Core Team, 2022). Each mixed-effect binomial regression is shown individually: handshape, movement, eye gaze.

Overall ASL Demonstrative Findings

A total of 10 adults produced 473 ASL demonstratives from the elicitation task. The amount of demonstrative production per participant varied (min = 34; max = 63) with an average of 47 demonstratives produced by each participant during the entire puzzle task. Recall that 12 of the puzzle pieces are strategically placed a distal area and 13 are placed in the proximal area. This gave the participants a nearly equal opportunity to produce proximal and distal demonstratives. Likewise, for the misunderstanding trials five prompts were to puzzle pieces in the distal area and five prompts were to puzzle pieces in the proximal area. See Appendix 1 for a detailed script of all the experimenter prompts in English and ASL gloss. For each question (25 Find It and 10 Misunderstanding trials) participants expressed an average of 1.6 demonstratives. In the case of a participant responding to a question with multiple demonstratives, each demonstrative was coded individually. For example, one prompt asks the participant which puzzle pieces have green leaves. There are four possible pieces. Some participants will identify one piece, while others will identify several pieces that have green leaves, in which case, several demonstrative signs were used. All of the individual demonstratives were coded; none were excluded. Figure 6 shows the percentage of distal and proximal demonstratives expressed by each participant.

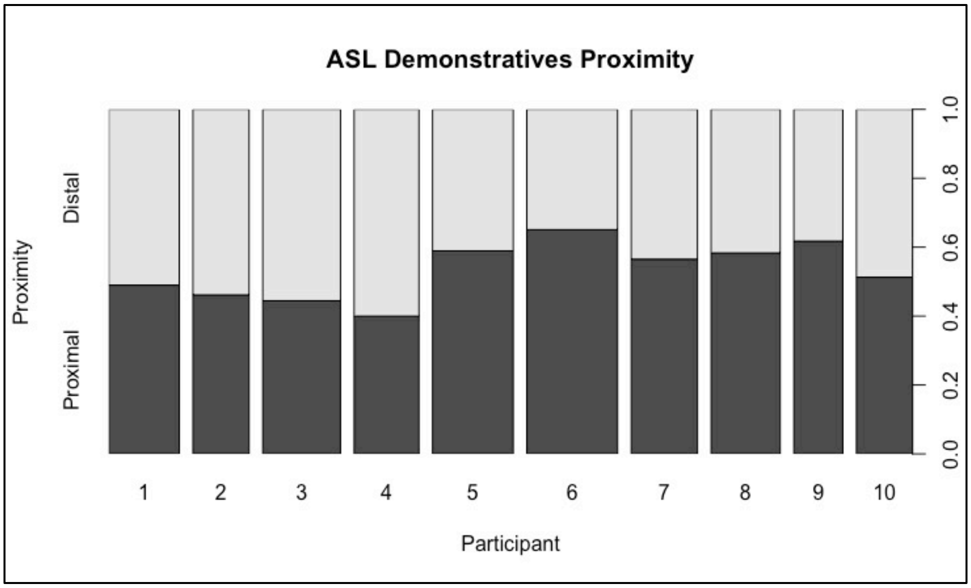


Figure 6. Referent responses of ASL demonstratives during puzzle task (n = 473, Distal n = 220, Proximal n = 253).

The responses relative to proximity showed that each participant, on average, produced 22 distal and 25.3 proximal ASL demonstratives. Figure 7 shows the total amount of responses per participant relative to the Find It and Misunderstanding conditions. The responses relative to joint attention showed that each participant, on average, produced 36 demonstratives in response to Find It prompts and 10 demonstratives in response to Misunderstanding prompts.

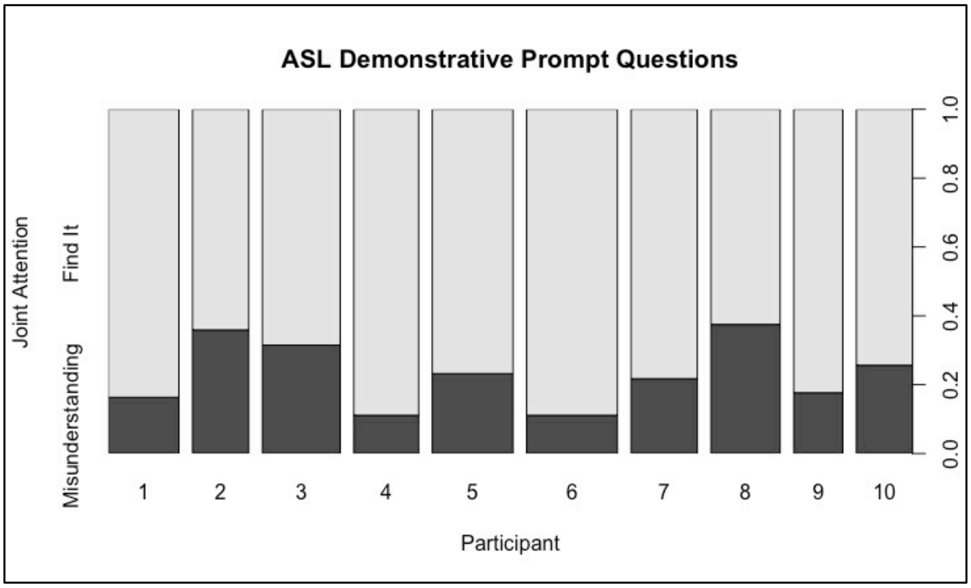


Figure 7. Participant responses to the ASL demonstratives puzzle tasks x Joint Attention Prompt (Total n = 473, Find It n = 365, Misunderstanding n = 108).

Description – ASL Nominal Exophoric Demonstratives

For the first time, we used a cohesive linguistic, psychological, and cognitive approach to identify ASL demonstratives relative to other types of pointing. Previously, ASL demonstratives have been described, but without usage data to support the purported forms. 93% of demonstratives were in the form of pointing handshapes consistent with prior description of ASL demonstratives using either an extended index finger (IX), or an index finger bent 90 degrees at the metacarpophalangeal joint (G). The remaining 7% of demonstratives used handshape variations that were not previously described in the literature. There are a total of 8 different one-handed handshapes. There may be more handshape variation, but these were not found in the data. To be clear, we must be careful before assuming that there are 8 clear-cut demonstrative types or more for ASL. We found a little variation that accounts for 7% of the demonstratives, but no categorical use of these handshapes across different demonstrative functions. One example is using the handshapes Y_IX or Y_G (THAT_INDEX). To be clear, other handshapes were produced to identify referents in this task, but not with pointing signs. In particular, signers sometimes produced classifier constructions to specify the referent (B, CLAW/puzzle piece) on rare occasions. More importantly, we did not find any production of Y handshape as a stand-alone demonstrative for referents near and far despite the inclusion of the sign glossed as THAT in the prior literature as one of the ASL demonstratives.

The instances of the production of Y handshape were always produced as a collocation with the IX or G sign (n = 36).[6] There must be a reason for all the wide variety of handshapes and an underlying connection between the form and function of the handshapes when using a demonstrative. Two explanations come to mind. First, it is possible that there was greater emphasis on joint attention when producing Y_IX / Y_G. The possibility of having just the singular handshape of IX to provide a bid for joint attention may not be enough to distinguish similar competing objects (for example, two similar leaf

[6] The Y_IX and Y_G collocations were coded in a single category with IX or G as the final handshape. IX = 19, G = 17, total = 36 instances. See subsection "Y_IX as a Possible Multi-Word Expression" for more information.

puzzle pieces). If so, the use of the additional handshape of Y prior to IX provides an emphasis cue of pinpointing the target object. The second explanation is to modulate joint attention while using classifiers to clarify the spatial referent. When a classifier construction sets up multiple objects in a visual space emulating where the physical objects are placed, stating the Y_IX stresses where the specific target is located in the signing space where several object locations are included.

The Y_IX / Y_G includes an internal handshape change with one movement, a straight trajectory, that has a final handshape hold of the IX-point. No instances of the Y_IX / Y_G phrase were produced with an arc movement in the dataset. The final IX-point indicator enables several things to happen when it is expressed. One, in a clear transition of the Y to the IX, the final handshape would be either the IX or a G. Two, in a few production expressions from the adults, the demonstrative sign shows that the thumb and pinky finger may still linger with different variations of ILY, IX with pinky extension and others. Lastly, during the majority of the time when the Y_IX is used, the palm was down.

Only one other rare example was the use of IX on the right dominant hand and the Y on the left non-dominate hand. Again, the Y handshape was not a stand-alone sign as a demonstrative in this particular case. The rare case of using two hands to express an ASL demonstrative leads to the second point, in this experiment, we are looking for the demonstrative usage and referent to objects that are seen, a more exophoric demonstrative referent. During the experiment, we were asking in real time what the participant saw in front of them and encouraged them to refer to specific puzzle pieces on the table. The stand-alone Y handshape may be used as a different type of demonstrative, as a more abstract referent to a different time, as labeled as an invisible or visually obscured entity (Peeters, Krahmer & Maes, 2021). It is possible that the stand-alone Y handshape may be used for endophoric demonstrative reference, that is, to refer to topics previously discussed in discourse. During the session with the participant, even when general questions were asked prompting discussion outside of the puzzle task, there were no instances of participants using the Y handshape which would translate to a possible endophoric reference. The endophoric demonstrative is typically used to refer to a contextually ambiguous expression during the discourse that refers to topics previously discussed in a nonphysical object referent setting.

One major question remains regarding how ASL demonstratives are expressed regarding referents that were activated to refer to previous discourse information. It is possible, in naturalistic discourse, that the stand-alone Y handshape demonstrative may occur only as an endophoric demonstrative. Regardless, the results from the adults' data expressing ASL demonstratives provides a glimpse of possible predictions of the deictic referent in exophoric usage. The study provided a replicable elicitation script that could be used with other signed languages to investigate the demonstrative system used to reference physical objects. We know little of other signed languages demonstrative systems based on experimental data. We know now that ASL has a one-demonstrative system with some variation in the movement and facial expression relative to referent location. The results also provide a foundation for investigating child acquisition of ASL demonstratives.

Overall, the participants were responsive and provided an expected number of ASL demonstratives which was analyzed for each dependent variable. The first variable is the handshape parameter.

ASL Demonstrative Handshape Findings

We ask, first, whether there are clear proximal and distal contrasts in the handshape parameter from the adults' demonstrative production. As Table 3 shows, adults used a clear one-hand, pointing index finger 93% of the time (n = 441), labeled as IX or G. Together, the IX and G were the two dominant handshapes that were used during the puzzle task[7]. The salience and visibility of the pointer finger provided a directional focus to where objects are in space.

[7] Those two handshapes were the same for the co-speech gestures accompanying Spanish demonstratives este/esta and ese/esa (Mendieta Rodriguez, (2022).

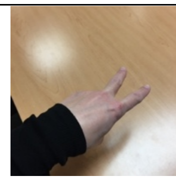
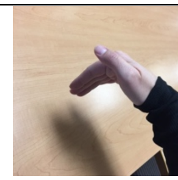
Handshapes of ASL Demonstratives				
				
IX	G	2_IX	Other	Y
312	129	22	10	0

Table 3. All the labeled handshapes ASL demonstratives from the participants (n = 473)[8].

The pointing index finger did exhibit variations, but still is clearly the dominant handshape for demonstrative pointing. The fine-grained handshape form variations have the base of a canonical extended index finger with some modification to the remaining fingers. For example, the G handshape includes a right angle between the palm and the index finger. Several handshapes were produced with an extended index finger, but because they also included other extended fingers (the pinky) or an atypical configuration of the fist, they were labeled as "other." The 2_IX handshape was used on multiple occasions to refer to two puzzle pieces simultaneously, which could be translated as "these two puzzle pieces". The 2_IX uses both the dominant pointer finger and the middle finger as the main indexical features of the handshape. In addition, we see that many of the demonstrative points had variation with the palm orientation,

[8] Note that zero instances of the Y handshape were found as a stand-alone indicator as a demonstrative. Instead, the Y_IX and Y_G were recorded with IX or G as the final handshape.

for example having the palm down, up, and inward towards the participant's body.

Table 3 revealed zero instances of using only the Y handshape to express an exophoric demonstrative in this data set. This is contrary to previous ASL descriptions of ASL demonstratives as using two different handshapes: IX and Y (Baker-Shenk & Cokely, 1980). With the focus on handshape, ASL seems to not use the two demonstrative system common in English. A proposal suggests that ASL uses a one-demonstrative referent system with the use of a pointing index finger as the dominant feature. To investigate whether this handshape was modulated relative to the location of a referent or the status of joint attention between the signer and the experimenter, a mixed-effects binomial regression was carried out comparing the use of the standard handshape (IX) and the most common modulation (G – index is at a right angle to the palm). For this analysis, the 2_IX and 8 of the 10 'other' handshapes were included in the standard handshape category (IX) because the index finger was in the same plane as the palm of the hand (n = 342). The remaining 2 of the 'other' handshapes were included in the G handshape category because the index finger was at a right angle to the palm (n = 131). Based on the responses, there was a high likelihood of the IX handshape being used the majority of the time, 72%. Figure 8 shows no statistically significant effects of proximity or joint attention on handshape. One interpretation of this finding is that participants produce ASL demonstratives with one handshape and use movement or eye gaze to distinguish proximity and to reestablish joint attention during misunderstanding trials. There is no clear difference of one handshape being preferred for initial Find It trials and another handshape preferred for Misunderstanding trials.

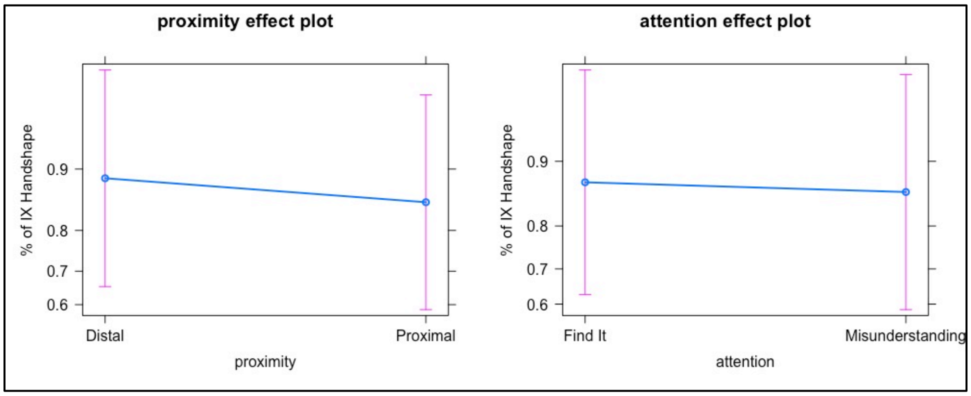


Figure 8. No statistically significant effect of attention or proximity on the use of the IX handshape vs. G handshape ($p = 0.70$; SD = 2.1; $p = 0.23$, SD = 2.1).

In addition, the statistical analysis of the mixed-effects binomial regression that compares IX and G handshape showed an interaction between proximity and joint attention that is not significant, but could be investigated in future studies, see Figure 9. The figure indicates that the G handshape is used more frequently for proximal than distal referents overall. However, in misunderstanding contexts, the likelihood of using a G handshape *decreased* for distal referents but *increased* for proximal referents.

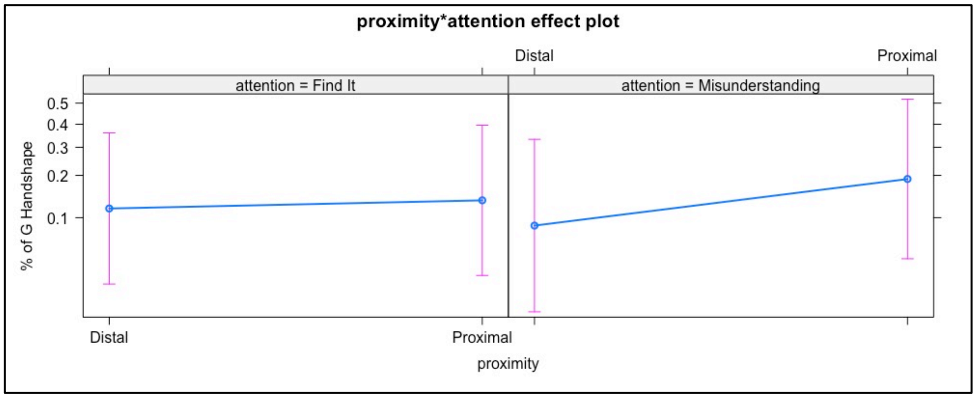


Figure 9. The interaction of attention and proximity on the use of G handshape vs. IX handshape was not statistically significant (p = 0.25, SD = 2.1).

To summarize the handshape parameter results of ASL demonstratives, a form of a single pointing index handshape was used 93% of the time. It is interesting that we observed 7% of demonstratives were produced with a different handshape, but each of these also included a pointing handshape in addition to other extended fingers or unusual configurations of the fist. Two examples of a different handshape include the handshape that resulted from the production of the multi-word phrase /THAT_INDEX/ and from the use of a classifier construction that included demonstratives.

There were no statistically significant effects of proximal vs. distal locations of the referent or of the joint attention condition on the handshape used by adult signers. These results indicate that ASL has a one-demonstrative system that is possibly comparable to several spoken languages like French and German. While ASL demonstratives do not provide strikingly different handshapes for near and far referents, there is a possibility that the movement feature could be influenced by proximity and joint attention usage. Movement is the second dependent variable that was analyzed in the demonstrative data set.

ASL Demonstrative Movement Findings

Two movement trajectories were coded as binary dependent variables, a straight and an arc motion of the ASL demonstratives produced by the participants. Other types of movement (i.e. wrist, elbow, shoulder and body leans) were found and recorded, but were not analyzed in this dataset. The movement analysis focused on whether there was a proximity contrast and attention modulation in the movement parameter of the ASL demonstratives.

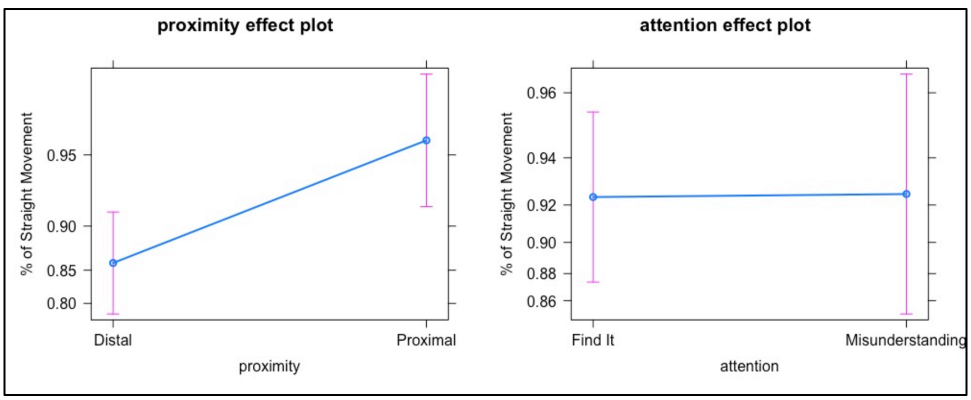


Figure 10. The effects of Proximity and Joint Attention on the production of straight vs. arc movement.

The figure on the right showed no statistically significant effect of attention on the use of straight vs. arc movement. In the Find It condition, the signer did not show a bias for a movement type when expressing an ASL demonstrative. Likewise, no bias was found for the Misunderstanding condition. The figure on the left, by contrast, showed a strong statistically significant effect of proximity on movement trajectory. Specifically, the participants rarely produced an arc movement to refer to referents in the proximal space. The arc movement trajectory was more frequent for referents in the distal space ($p < .0001$***, SD = 0.5). The chart on the left of Figure 10 illustrates the significant effects of proximity on straight and arc movement. Importantly, participants used a straight movement for the majority of both proximal and distal referents (straight n = 425 vs. arc n = 48). However, participants used the straight movement trajectory more often with the proximal (blue dot ~95%) than the distal referents (blue dot ~85%). Overall, the effect of proximity on movement is highly significant and strong. The CIs (pink lines) show no overlap when comparing distal and proximal results, but there is some variation within the overall participants' responses for proximity.

In other words, the participants expressed the straight and arc movement as a demonstrative contrast to objects near and far. It is physically possible to produce both straight and arc movement for both proximal and distal referents. However, the analysis revealed that participants very rarely produce an arc movement when referring to referents that are close to them. In contrast, both straight and arc movement are used in distal referencing – which leads to another question – what does the movement variation (or continuum) in distal referents tell us about the use of ASL distal demonstratives?

The results of the movement parameter provide insight to the understanding given that ASL is a one-demonstrative system as a finding, the form of the demonstrative is modulated in a manner that is sensitive to the location of the referent. When comparing ASL general pointing to the specific articulation of the movement trajectory of demonstratives, the trajectory may provide clues to how gestural pointing has changed through grammaticalization in the grammar of ASL. The specific arc movement may be restricted to exophoric demonstratives in signed languages. For example, a detailed description of Spanish demonstrative co-speech gestures showed no arc movement to refer to either distal or proximal referents in their data set (Mendieta Rodriguez, 2022). The comparison with Spanish multimodal demonstrative results may suggest that the arc movement in ASL has grammatical value and is unique, as opposed to labeling the ASL arc movement as a general standard gestural movement, making it overlooked as the general demonstrative gestural pointing behavior.

While ASL movement provided a modulating difference for proximity in demonstratives, one more dependent variable is analyzed, the eye gaze behavior. When participants express the lexical sign using a demonstrative as a first bid for joint attention to refer to the object in place, they are using specific movement trajectories to be clear where the puzzle piece is in the given space. In addition, participants are also using their eye gaze to possibly have a second joint attention bid to align with the ASL demonstrative. We are curious about the second joint attention bid, the eye gaze as a binary dependent factor of looking at the puzzle piece vs. looking at the experimenter when expressing the demonstrative at the same time. The eye gaze is the third and final parameter that is analyzed for ASL demonstratives.

ASL Demonstrative Eye Gaze Findings

The final observation of the analysis looked at the eye gaze behaviors of the participants when they are expressing ASL demonstratives. For each demonstrative produced by the participant, we coded whether their eye gaze was directed either to the referent (the puzzle piece) or to the experimenter. Of the 473 responses, we found that participants directed their eye gaze to the referent on the majority of the trials (n = 424). However, the eye gaze to the referent behavior was significantly greater for distal referents (blue dot, ~95%) than for proximal referents (blue dot, ~90%). The overall effect of proximity on eye gaze is significant. The distal and proximal CIs (pink lines) are wide and overlap with each other, showing considerable variation across participants.

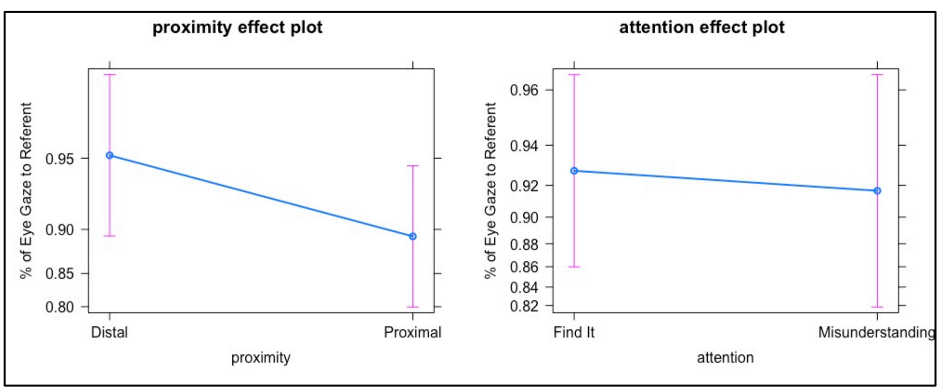


Figure 11. The effects of Proximity and Joint Attention on the production of Eye Gaze to the Referent vs. the Experimenter.

The figure on the right shows no statistically significant effect of attention on the use of eye gaze to referent vs. eye gaze to experimenter. Participants were not reestablishing joint attention during misunderstanding trials by tilting their heads up and looking at the experimenter, but rather continue to look at the puzzle piece along with the ASL demonstrative sign and possibility repeat the sign. In other words, this task did not facilitate participants to behave differently in both conditions. The figure on the left shows a statistically significant effect of proximity on eye gaze. Specifically, the participants were more likely to look at the referent when referring to distal referents than to proximal referents. Eye gaze to the experimenter was more frequent when referring to proximal referents. ($p = 0.01^*$, $SD = 0.9$).

Again, the value of having a one-demonstrative system for ASL is the need to pay attention to the eye gaze when necessary. Often, with the focus of the ASL demonstratives being on the handshape and movement, it is easy to forget the importance of non-manual expressions. It is interesting to observe that our hypothesis did not match the participants' responses for eye gaze behaviors. Most of the participants responses did not initially look at the experimenter and shift their eye gaze towards the puzzle piece to clearly direct attention to the intended referent. Regarding the question of if there was any joint attention modulation of the eye gaze during ASL demonstrative productions, we found there was no statistical effect. Thus, the hypothesis that joint attention would influence eye gaze was not confirmed. It may suggest the participants assumed that the experimenter paid attention to the direction of their eye gaze to identify the intended referent on all trials, and thus, the deictic value of eye gaze was greater than the use of eye gaze to evaluate intersubjectivity within the confines of this task. This means the participant did not need to reinforce or excessively modulate the ASL demonstrative eye gaze behavior towards the experimenter to reestablish joint attention.

Chapter 5: Results of Study 2 – Children's ASL Demonstratives

Purpose – Study 2: Children

The second study focuses on children's acquisition of ASL demonstratives. With parental consent, 10 children (average age = 5 years, 6 months; min = 3 years, 3 months; max = 7 years, 1 month) participated in the study[9]. Half of the children (n = 5) had deaf parents and were exposed to abundant input in ASL from birth. Half of the children (n = 5) had hearing parents and were exposed to more restricted input in ASL. A background questionnaire asking for demographic information was filled out by the parent or guardian. Depending on the ASL language status of the parent, children were placed in either the abundant or the restricted language input category. The children completed the experiment demonstrative elicitation puzzle task and then an ASL assessment called the ASL-RST (Enns et al., 2013). The average score on the ASL-RST was 110, with the lowest being 87 and the highest being 126. All scores from the children were in the average or above average range for their age group, corresponding with age-appropriate language proficiency (see Enns et al., 2013 for standard scores tables). Finally, the child completed two theory of mind tasks in ASL to test the participants' cognitive ability (Schick, de Villiers, de Villiers, & Hoffmeister, 2007). The first theory of mind task involves several conversational questions to which the child must respond after watching a Tom &

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[9] The data were collected by Bettie Petersen and provided by the Lobo Language Acquisition Lab at the University of New Mexico.

Jerry cartoon. One example asks the child if the cat named Tom realizes that the mouse Jerry was not tied to the fishing line as bait. Jerry is replaced with the big dog instead without Tom realizing it. If the child explains that Tom does know that he's catching the dog, the child does not have a Theory of Mind skill. If they respond that Tom still thinks Jerry is tied to the line, then they do have a Theory of Mind skill. The second theory of mind task is the "Smarties Task", involving a bag of M&Ms that contains crayons. Once the participant sees the contents of the M&Ms bag, they are asked several questions about what they initially thought was in the bag, and what their teacher would expect to find in the bag if the child showed the bag to his/her/their teacher. Based on the responses from both tasks and taking in consideration the child's age, we can infer age-appropriate levels of development of intersubjectivity. The two youngest participants showed an emerging sense of Theory of Mind relative to the self, while the remaining eight participants demonstrated Theory of Mind with respect to both themselves, and others. Given the results of the language and cognitive tasks, no child participants were excluded from the ASL demonstratives analysis. The reason for administering the language and cognitive tasks was to verify that no additional disability besides deafness would prevent the children from successfully completing the experimental elicitation task. If any participants had scored below age-appropriate levels on the language and/or the cognitive task, they would be excluded from this data set. See Table 4 for an overview of child participant information. There is one specific note on Table 4 that provides details about the specific ASL input. We can see that there was no strong correlation between ASL input and the ASL-SRT scores. For example, the two participants that are 81 months old provide an interesting comparison. The 81-month-old with restricted ASL input scored higher than the 81-month-old with abundant ASL input on the test. Thus, ASL test scores are a direct assessment of ASL language skills compared to grouping children in the basis of their parents' hearing status. The grouping would continue the promotion of deaf children with deaf parents (abundant) which is less than 5% of the deaf population as compared to deaf children with hearing parents (restricted), who represent the majority of the population. In short, the focus of the children data analysis will focus on Age in months and the ASL-RST scores.

Participant age	**Age in months**	**ASL Input**	**Total ASL Demonstratives**	**ASL-RST score**
3 years, 3 months	39	Restricted	43	94
4 years, 2 months	50	Abundant	32	126
4 years, 2 months	50	Abundant	46	124
4 years, 10 months	58	Abundant	39	114
6 years, 1 month	73	Restricted	35	87
6 years, 9 months	81	Abundant	38	109
6 years, 9 months	81	Restricted	42	113
6 years, 10 months	82	Abundant	35	117
7 years, 1 month	85	Restricted	39	108
7 years, 4 months	88	Restricted	49	106

Table 4. General information regarding each child's information on age, amount of ASL demonstratives, language input and scores.

The total session was around an hour long for the child. Results are separate from the adult data from Study 1. All the demonstratives produced by the children were video recorded and converted to ELAN 6.2 files for data analysis. Statistical analyses were calculated using R (R core team, 2021).

Overall Children's ASL Demonstrative Findings

This study examines when and how children use ASL demonstratives and whether their uses match that of adults (Study 1). Are there any deictic examples that children use that are like adult demonstratives? The adults did modulate movement and eye gaze while distinguishing proximal and distal reference with demonstrative points. We want to see if the children produce the same ASL demonstratives with modulation of the parameters of handshape, movement, and eye gaze. The children completed the same experimental puzzle task to elicit demonstratives that was completed by the adults, described in Chapter 4.

The children were asked to identify puzzle pieces in proximal and distal spaces in response to "Find It" and "Misunderstanding" prompts. To answer the question regarding whether children distinguish proximal and distal referents with demonstrative points, each response identifying a puzzle piece was coded in ELAN. The responses to pieces closer to the participant were labeled as proximal. The responses to pieces past the dividing line on the table were labeled as distal.

As Figure 12 shows, out of the 513 pointing signs recorded, 115 instances were excluded due to their grammatical function as personal pronouns or as locative adverbs or adverbial demonstratives referring to an empty space on the puzzle board. This left a total of 398 nominal demonstratives expressed during the task.

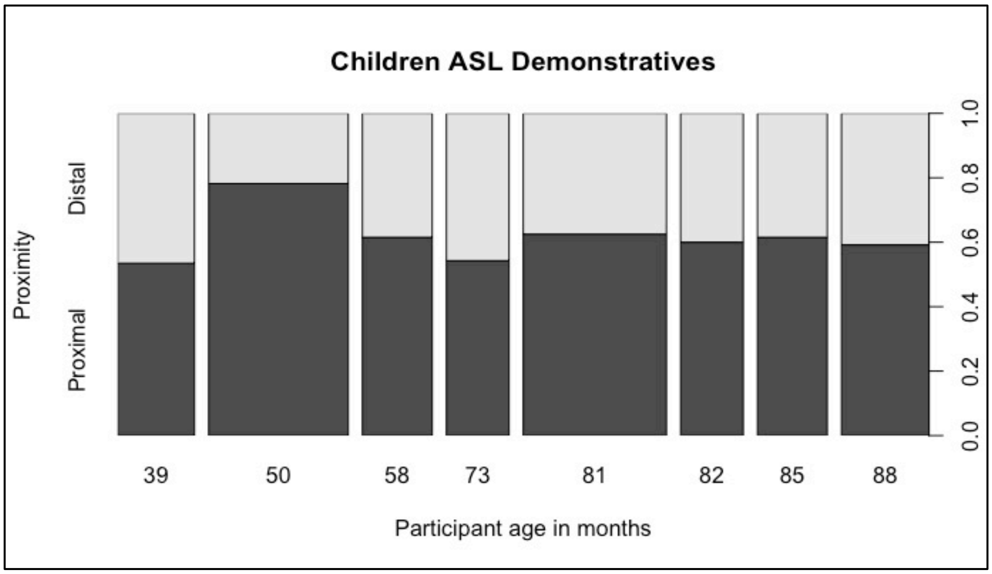


Figure 12. Responses of ASL demonstratives during puzzle task (n = 398; Distal n = 147, Proximal n = 251).

In addition, a total of 320 “Find It" responses and 78 “Misunderstanding” follow-up responses were recorded and identified for the source of joint attention behaviors, see Figure 13. Recall that joint attention can influence the choice of demonstrative form in spoken language since one communicative function of demonstratives is used to re-direct attention to objects or to re-establish intersubjectivity during discourse. It is important to see whether ASL demonstratives are modulated to achieve joint attention during discourse.

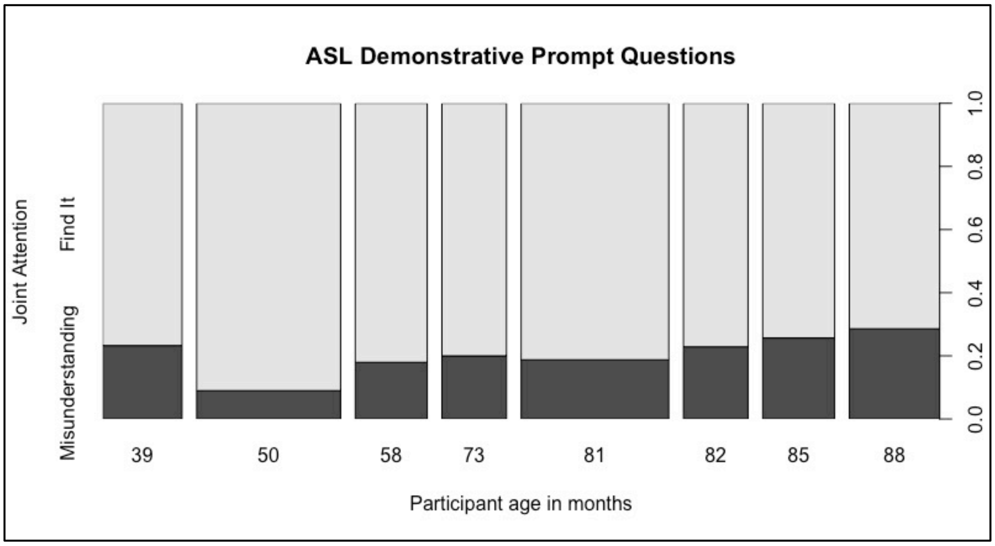


Figure 13. Proportion of ASL demonstratives produced in response to “Find It” vs. “Misunderstanding” prompts. Shown in range of age reported. (n = 398; Find It n = 320, Misunderstanding n = 78).

With the overall data collected and converted for analysis, we move to the overview of the type of analysis used. As with the adult experiment, I used a mixed-effects binomial regression analysis, using proximity and joint attention as the independent variables. The dependent variables are handshapes, movement, and eye gaze. Grouping of the data is focused on the range of age in months.

Handshapes – Children’s Results

One of the dependent variables in this study was handshape, with IX and Y being the primary handshapes predicted by the prior literature. In the adult study, IX and G were more common. In the child study, IX and G were still predominant, but there was more variation in the handshapes. I found several new handshapes that were not produced by the adults. First, several participants signed an E with the extended index finger (n = 28). This can be considered as a different form of IX with the thumb and middle finger not overlapping in a fist, but more of an E handshape type. Second, several participants signed an X handshape (n = 21). Interestingly, the X handshape behaves similarly to the G handshape in a downward pointing motion.

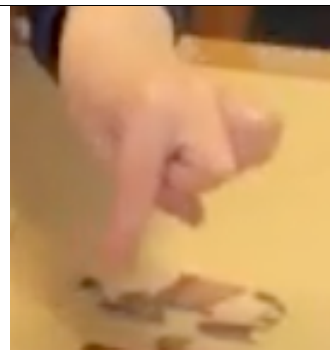
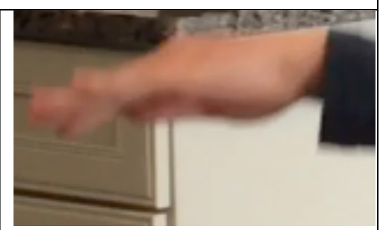
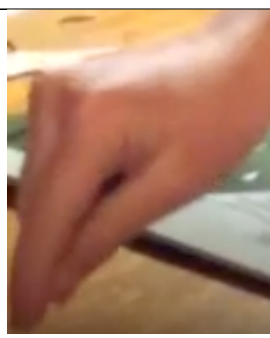
Children Handshapes of ASL Demonstratives		
		
IX = 191	E_IX = 28	Other = 10
		
G = 148	X = 21	Y = 0

Table 5. Handshape variety during puzzle task n = 398.

It is understandable that children produced more variety compared to adults. They are still in the language development stage. Nevertheless, the most common handshapes are IX and G. Hence, an analysis of the handshape relative to proximity and joint attention will be focused on IX and G. To do so, the data from IX and E_IX will be combined as IX. Then the G and X will be combined as G. The other data will be excluded, which leaves IX (n = 219) and G (n = 196) with a total of 388 demonstratives points in general. The index pointing finger accounts for 97% of the ASL demonstratives produced by the participants. Further, in this case, there was no Y handshape used by the children, therefore the data from the children provide additional support for the conclusion that ASL has a one-demonstrative system.

Recall the handshape was the dependent variable, with the IX and G as possible variants. The independent variables were proximity and joint attention. As Figure 14 shows, the effect of proximity was highly significant and strong (n = 388; p = 2.34e-06***, SD = 0.03). The IX handshape was used more often (blue dot ~70%) with the distal referents than the proximal (blue dot ~50%). The CIs (pink lines) show no overlap when comparing distal and proximal results and the variation is minimal.

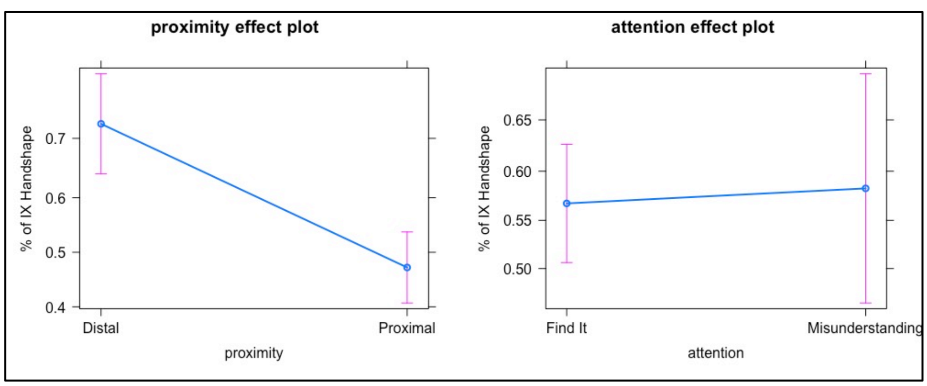


Figure 14. The effects of Proximity and Joint Attention on the production of the IX vs. the G handshape.

The figure on the right shows no statistically significant effect of attention on the use of IX handshape vs. G handshape.

The results show that when children did point with a target goal of the IX and the variant of E_IX handshape, most likely they referred to a physical object in a distal space. When they used a G handshape and the variant of X handshape, there was a higher chance that they referred to a physical object close to their deictic center, that is, in proximal space. While we saw a high percentage of ASL demonstratives used as an index point, it is interesting that there is nevertheless predictable variation in the handshape used for exophoric referencing. Thus, the importance of handshape variations in children reveals the start of their language growth to develop a more fined tuned demonstrative representation that the adults used; IX and G.

Movement – Straight, Arc, and Repetition – Children's Results

The movement dependent variable had the straight and arc movements as possible variants. In the adult study, the straight movement was more common. In the children's study, we ask, did the children modulate movement in a predictable fashion when expressing the ASL demonstratives? The adult results in Chapter 4 rarely repeated their points and investigation for their data is futile. However, there was enough repetition data for the children to analyze in this particular dataset. The children participants produced both straight (n = 337) and arc (n = 61) types of movement trajectory (n = 398) during the task. As Figure 15 shows, the child participants, like the adult participants, also used the straight movement trajectory for the majority of the responses. However, children used the straight movement more often with the proximal (blue dot ~ 95%) than the distal referent (blue dot ~91%). Overall, the effect of proximity on movement is significant, the CI's (pink lines) are wide and have a lot of overlap, indicating a large amount of variation across the children. In which case, children did use both straight and arc movements for both distal and proximal references. However, there is a trend that children are using the straight line more frequently for proximal referents. The arc movement trajectory was more frequent when referring to referents in the distal space (n = 398, p = .007**, SD = 2.3).

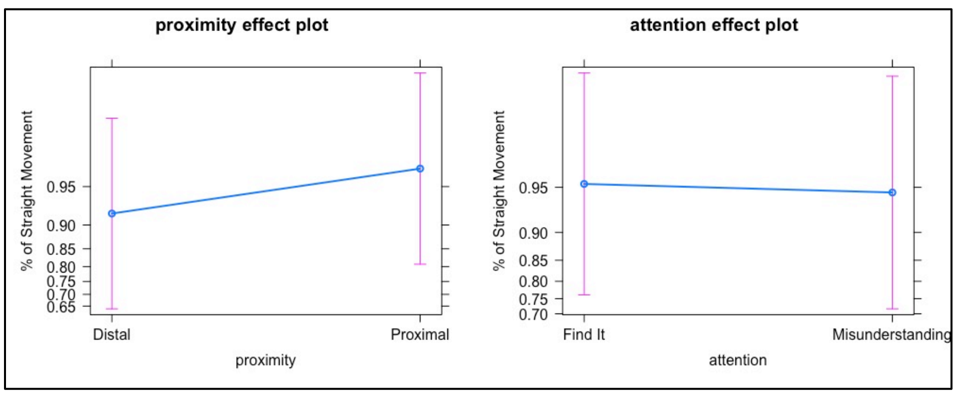


Figure 15. The Effects of Proximity and Joint Attention on production of the straight vs. arc movement.

The figure on the right shows no statistically significant effect of attention on the use of straight vs. arc movement. In other words, especially in the misunderstanding condition, the participants' use of movement did not alter to engage a more successful joint attention in the follow-up response.

Again, for both adults and children, the proximity of the referent impacts the usage of straight vs. arc movement in ASL demonstratives. However, the statistical effect has a lower strength for children. One interpretation would be that children are starting to understand the importance of the arc movement for signaling a distal proximity value. By contrast, referents close to the participant requires a more crisp, clear straight movement to grammatically mark the proximal form. To emphasize the straight movement, the children used repetition of the ASL demonstrative. Again, this movement modulation was seen only rarely among adults.

Movement Results – Repetition.

One big difference between the children's responses and the adult's responses was the way children repeated ASL demonstratives while waiting for the experimenter to identify the intended puzzle piece. The majority of the time, children would not repeat ASL demonstratives ($n = 321$; 83% of the time). However, when the repetition was expressed, it would be a quick redundant movement repeating the demonstrative about 3 or 4 times ($n = 77$; 19% of the data was produced with repetition).

Figure 16 shows a statistically significant correlation between age and the amount of ASL demonstrative repetition children produced. Each point represents an ASL demonstrative produced with a precise range of zero through four repetitions. Results of the linear regression show a correlation between age and the amount of ASL demonstrative repetition usage for each response. Using Pearson's product-moment correlation, results show a small negative correlation ($n = 398$, $cor = - 0.11$, $t = - 2.34$, $p < 0.01$*, 95% CI = - 0.2, - 0.01) reflecting a decrease in repetition as children increased in age. Younger children responded with more repetition. In other words, we can see a correlation trend of younger children producing more repetitions to the same referent of the object. When children become older, the repetition decreases, but it is still present. Adults rarely produced repetition from their dataset, thus correlation analysis for adults' repetition can prove difficult and can be taken into consideration for future studies. This is an interesting finding. The data implies that the function of 'repetition' may become more specialized as children become more linguistically proficient – at the discourse level. However, we still do not know exactly the function(s) regarding the repetition in ASL demonstratives.

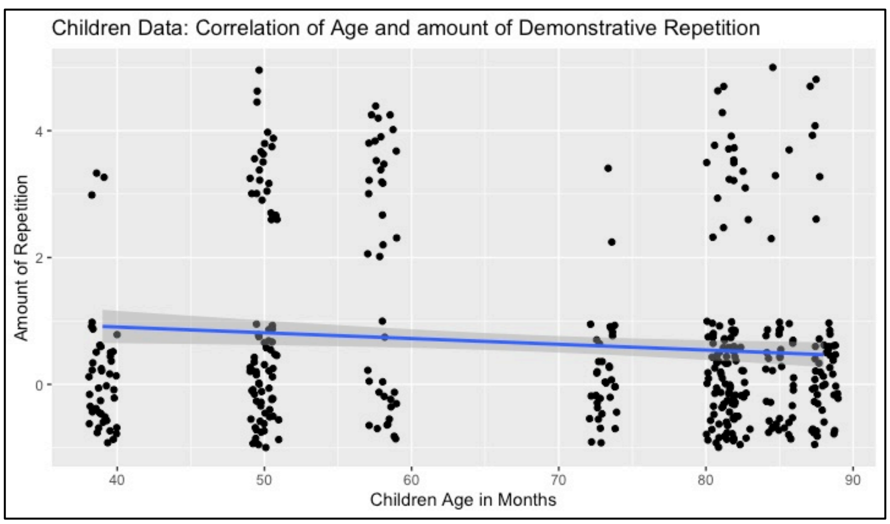


Figure 16. Correlation of Age and Repetition[10]

Another question emerges about repetition from the children's data: is repetition predicted by the proximity and joint attention factors? Figure 17 shows

[10] Figure 14 y-axis shows the individual scatterplot in a category cluster limited to only with the amount being 0 repetition up to 4 repetitions. There is no negative repetition or 5 repetitions on the y-axis.

the effect of proximity on repetition is highly significant and strong. Children would repeat the ASL demonstrative more often when referring to referents in the proximal space, and less often when referring to referents in the distal space ($p < .0001$***, SD = 0.85). Interestingly, there was a slight increase in repetition during misunderstanding trials, but no statistical effect was found during this task. One possibility is that there were not an ample number of misunderstanding trials to elicit sufficient data to identify this pattern. Alternatively, children might engage joint attention with other cues such as a hand wave being used as a specific grasp for attention. This is one instance of the possibility of co-constructing cues with ASL demonstratives as joint attention to the object.

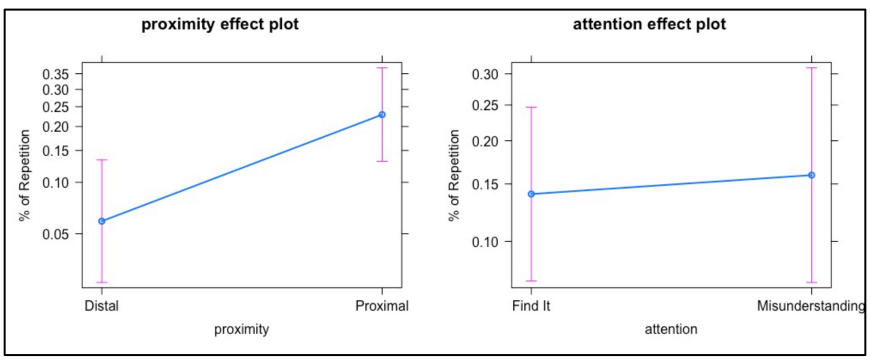


Figure 17. The Effects of Proximity and Joint Attention on production of the no repetition vs. use of repetition.

The figure on the right shows no statistically significant effect of attention on the use of no repetition vs. use of repetition. The figure on the left, shows a strong statistically significant effect of proximity on repetition movement. Specifically, the participants are more likely to produce a repeated demonstrative movement to refer to referents in the proximal space compared to referents in the distal space (n = 398, p <.0001***, SD = 0.85, CIs do not overlap).

In summary, children do exhibit use of a straight vs. arc, and use of repetition movement when expressing an ASL demonstrative. The straight movement is overall the dominant movement. However, there are cases of children modulating the movement to express differences in proximity of the referent. The overall behavior of repetition is interesting as it reveals how ASL demonstratives are being expressed with deictic force. This is a tentative conclusion about why the children's repetition is produced more often for proximal referents is the increased modulation to clearly show more deictic force of the referent's location. During the task, adults did not produce a high rate of repetition movement due to using different strategies to modulate deictic force. However, it is possible to have a repeated demonstrative repetition in ASL. It is only in this kind of exophoric demonstrative experiment task that we did not find adults use the repetition. For example, when an adult responds with an ASL demonstrative, the final movement stays still, in a holding manner, until the experimenter touches the puzzle piece in the puzzle board and then the participant moves their hands. While children would continue to repeat the movement until the experimenter either makes eye contact with the child or touches the puzzle piece. The last variable focuses on eye gaze behavior of the children.

Eye Gaze – Children's Results

Another dependent variable in this study was the eye gaze. The data were coded for whether the participant looks at the referent (target puzzle piece) or at the experimenter when producing an ASL demonstrative. In the adult study results showed the eye gaze to the referent was predominant. In the children's study, results were like the adults' results. I measured where each child's eye gaze was directed when they produced demonstratives during the task to determine whether eye gaze was an important component of the demonstrative. ASL demonstratives may be produced with a variety of non-manual signals, but the current study focuses solely on the eye gaze behaviors associated with demonstratives. During the elicitation task children would respond with a demonstrative with either their eyes looking at the referent (puzzle piece) or at the experimenter. We focused on their initial gaze during the start of the ASL demonstrative sign production. Figure 18 shows a statistically significant effect of proximity on eye gaze to the referent. While there is a high overall percentage of participants' eye gaze at the referent ($n = 310$), the children aligned their eye gaze and their demonstrative points to the referent more often for distal referents (~95%) compared to proximal referents (~70%). Overall the effect of proximity on eye gaze is highly significant and strong ($n = 398$, $p < .0001$***, $SD = 1.08$). The CIs (pink lines) show minimal overlap when comparing distal and proximal results, but there is some variation within the overall participants eye gaze for proximity.

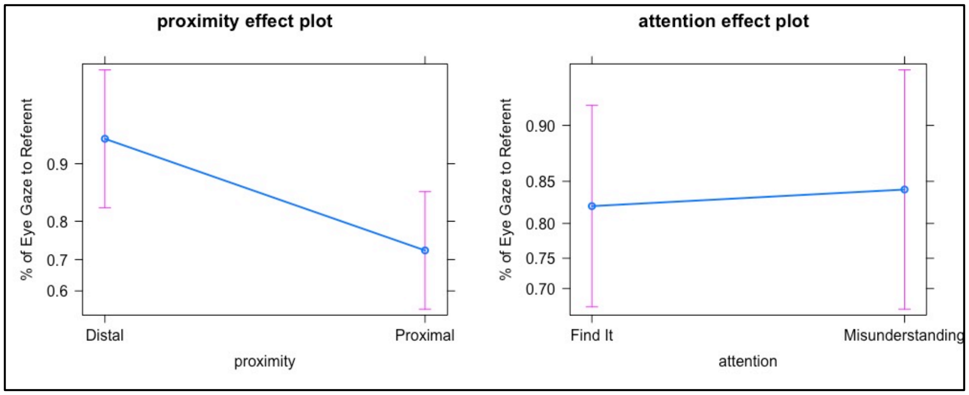


Figure 18. Effects of Proximity and Joint Attention on Children's Eye Gaze to the referent or the experimenter

The figure on the right shows no statistically significant effect of the attention condition on the use of eye gaze to referent vs. eye gaze to experimenter. Participants were not using eye gaze to the experimenter as a cue to reengage joint attention during misunderstanding trials.

One interpretation of this result is that it illustrates the importance of eye gaze as a deictic cue when using ASL demonstratives to distal referents. Distal referents are harder to identify in space than proximal referents, so signers may provide two complementary deictic expressions to pinpoint the object's physical location more clearly: use of hands and use of eye gaze. This is similar to the adults data. While using ASL demonstratives to proximal referents, the eye gaze is less salient due to the increased context affordance focused on the hands and a decreased context need for the eye gaze. In other words, the ASL demonstrative of the index finger seems sufficient to refer to objects close to the participant and the eye gaze in proximal areas has a less supportive role as an ASL demonstrative. In short, the eye gaze has a role for both distal and proximal referents while the ASL demonstrative is being expressed. It is just a matter of how to modulate the eye gaze expression more saliently during distal spatial referencing.

Summary – Overall Children's Results

The results from the children's ASL demonstrative production supports the hypothesis of ASL having no categorical distance contrast, and having a one-demonstrative system. Children use an index finger as the ASL demonstrative 97% of the time during the task. There were no instances of a Y  handshape that would suggest a two-demonstrative system like English. Results are similar to adults' ASL demonstrative production as well, see Table 6.

	Tokens	Proximity	Joint Attention
Adults Dependent Variable			
Handshape	473	$p = 0.23$ SD = 2.1	$p = 0.70$ SD = 2.1
Movement	473	$p < 0.0001$*** SD = 0.5	$p = 0.96$ SD = 0.5
Eye Gaze	473	$p < 0.01$* SD = 0.9	$p = 0.6$ SD = 0.9
Children Dependent Variable			
Handshape	388	$p < 0.0001$*** SD = 0.03	$p = 0.81$ SD = 0.03
Movement	398	$p < 0.001$** SD = 2.3	$p = 0.72$ SD = 2.3
Eye Gaze	398	$p < 0.0001$*** SD = 1.08	$p = 0.69$ SD = 1.08

Variables included in regression model: Independent Variables = Joint Attention, Proximity; Dependent Variables = Handshape, Movement, Eye Gaze.

Table 6. Mixed-effects binomial regression predicting ASL demonstratives, 20 deaf signers (10 adults, 10 children).

Summarizing across both Study 1 and Study 2, results show several statistically significant effects of proximity on ASL demonstrative form. I did not find any effects of joint attention on the form of ASL demonstratives. The main implication is the signed production of ASL demonstratives used a form of an index pointing along with modulations of handshapes (children only), movement, and eye gaze expressions. Both the movement and eye gaze are used to narrow reference to a distal referent. The arc movement and looking at the referent are not used during "Misunderstanding" trials any more than during a "Find It" trial. One suggestion is the repetition movement in the children's data may be a strategy to show an increased deictic force of the exophoric demonstrative to maintain intersubjectivity.

A post hoc test was evaluated to determine if children and adults were showing demonstrative tendencies with a developmental change. To be certain of a developmental change in ASL demonstratives on age, I compiled the data from the two groups (adults, children) into a single regression having age as continuous effect. I tested each dependent variable (handshape, movement, eye gaze) to see if there was a developmental effect using age.

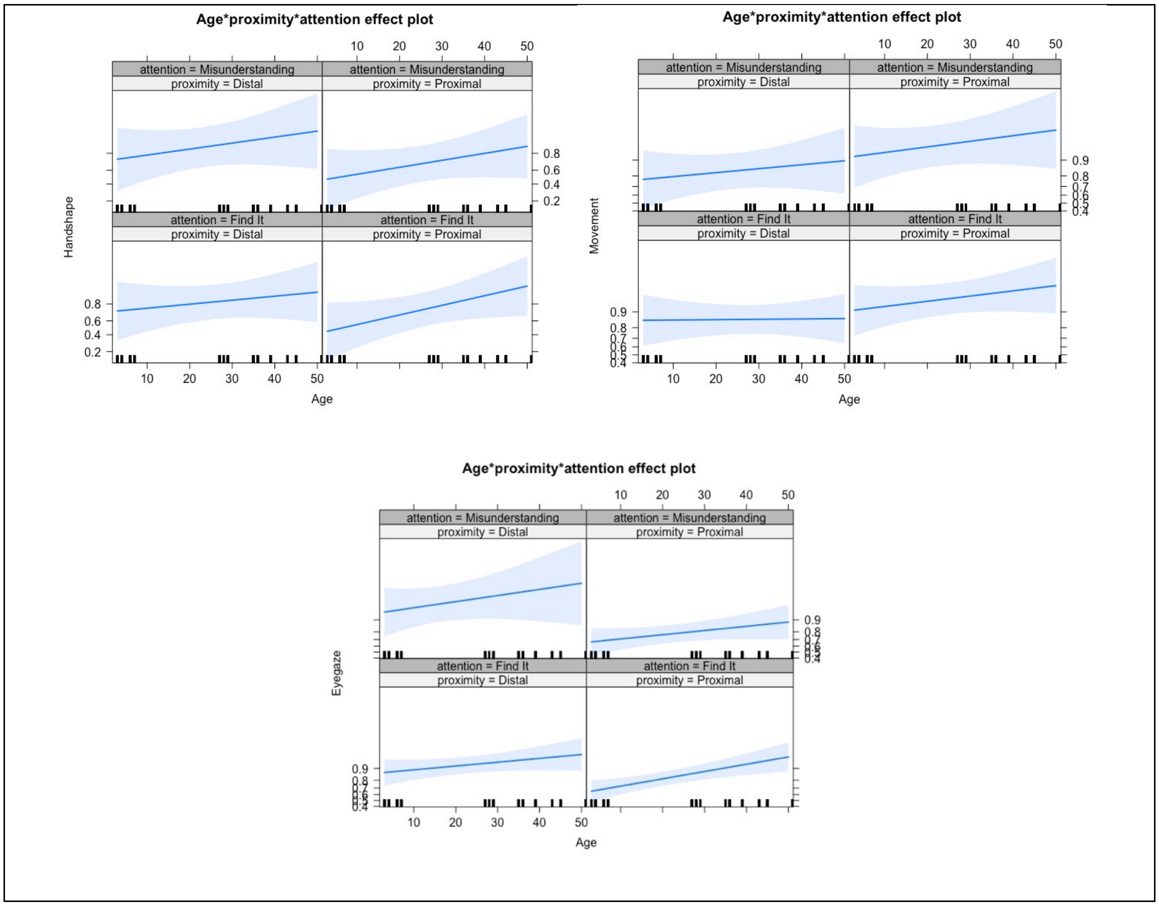


Figure 19. Post Hoc Test on Handshape, Movement & Eye Gaze variables n = 871, age in years range 3 – 51.

Figure 19 reveals a significant finding. There was a specific age effect on the proximity (proximal vs. distal) for the group on the handshape IX vs. G ($p < 0.004$** SD = 1.68). This may be interpreted as the change is in the absence of an effect of handshape for the adults compared to the children having a significant effect. One interpretation is that the adult's arm reach and referent center are larger than the child when producing ASL demonstratives. The movement and eye gaze findings did not reveal a developmental effect. However, starting a young age, children are already showing sensitivity to the same factors that influence the production of ASL demonstratives that adults use. Clark & Sengul (1978) explain that children's usage of demonstratives at an early age is relative to the child's development of a theory of mind. ASL demonstratives support the idea that during developmental stages of language acquisition, children are already attentive to referents and the contextual usage in which it supports communication between parent and child in learning vocabulary. Exposing and encouraging deaf children to learn ASL at an early age supports the idea that social interactions are needed to continuously refer, connect, and comprehend new vocabulary words and concepts to thrive and to develop a strong linguistic foundation (Tomasello & Bates, 2001).

I propose that index pointing in deaf children should not be assumed to be a general point, but may instead be assumed to reflect grammatical development. For example, when a child is using ASL and uses an index point, it may be perceived as a gestural point. However, the pointing is a part of the grammatical system of ASL; children acquiring ASL must learn how to modulate points to function as demonstratives. Demonstratives alone reflect a part of the grammatical system of ASL, but they are also important for supporting children's vocabulary development in ASL. Specifically, parents rely on demonstratives to emphasize the connection between a physical object and connect it to an ASL vocabulary word. The demonstrative behavior for ASL is unique in ways that sensitivity to the repetition movement and eye gaze may need to be perceived as well. Again, this dissertation provides a controlled experiment design to see exactly what children are producing for ASL demonstratives. The results here align and add to different ASL observational work, typology and linguistic descriptions (Hoffmeister, 1978; Baker-Shenk & Cokely, 1980; and Pfau & Steinbach, 2011).

One common shortcoming from studies such as this is the generalization of results found for ASL to all signed language Deaf communities. ASL only represents one out of the hundreds of signed languages and signing communities in the world. More signing child language acquisition work is needed at a typological level; cross-linguistic sign language comparison is rare. Another common shortcoming is the assumption that the index pointing in ASL is functionally similar to the co-speech pointing gesture used by hearing people, and that points provide a common underlying system in which gesture and signing stems from the same multimodal referential utterance. There is a blurred, grey area when comparing and analyzing gesture and signing in a linguistic format. Many questions still remain regarding ASL demonstratives in children's language behaviors. How does the comprehension of ASL demonstratives influence signing children's developing language skills? Does endophoric reference in ASL behave similarly or differently to the exophoric demonstratives from these studies? This study contributes an important discussion regarding the underrepresentation of signed languages demonstratives documented in the World Atlas of Language Structures (WALS).

The common theoretical and data discussion and comparison of demonstratives is not well represented in different signed languages. The children's demonstrative study provides a step towards an increased understanding of demonstrative behaviors. The study also provides information supporting the idea that ASL does align with prototypical language acquisition and does not delay overall linguistic ability even when a child does not hear or understand the dominant spoken language.

Chapter 6: Overall Discussion; Conclusions and Recommendations

Overall Discussion

Both studies provided several consistent findings based on several mixed-effects binomial regressions. The linguistic description indicates that ASL demonstratives are expressed as a form of a pointing sign for around 90% of the total data, consistent with the claim that ASL has a one-demonstrative system. The findings are different than previous accounts that identified IX, Y and Y_IX as categorical ASL demonstratives for proximal (IX) and distal (Y, Y_IX) referents (Baker-Schenck and Cokely, 1980). Further, the findings of this study reveal significant effects of specific referent location on movement and eye gaze for both groups. Children's production of demonstratives for specific referents had significant effects of referent location on the handshape and the movement repetition as well.

In this chapter I will describe my qualitative analysis of ASL demonstratives. The first half of the chapter describes how ASL demonstratives are used in the context of a classifier construction. The next section will focus on the specific collocation of THAT and a point (Y_IX) with internal handshape change while expressing the ASL demonstrative as a multi-word expression. Lastly, I will describe a specific facial expression, called a *facial compression*, which provides insight into a possible additional non-manual modulator for ASL demonstratives. To end the chapter, I provide closing remarks summarizing the main qualitative findings and recommending follow-up analysis for future studies. The purpose of this chapter is to provide a qualitative analysis regarding specific instances of ASL demonstratives that were not explained in the quantitative results. The overall narrative is to discuss and explain the exophoric demonstrative point in a clause, beyond the lexical level.

ASL Demonstratives in Classifier Constructions

Classifiers in ASL are defined as the connection of a mental representation of the entity in question between the visual representation of reality and its linguistic phrase (Emmorey & Herzig, 2003; Lessard, Jarashow & Veltri, 2002). ASL classifiers are considered as a type of ASL predicate. They can also be used as complex constructions in noun, verb, and prepositional phrases. There are five main types of ASL classifiers: semantic, size and shape specifiers, instrumental, body part specifier, and whole body representation (Suppula, 1982; 1986). Classifiers are considered to express spatial relations between entities and are well documented in various signed languages (Zwitserlood, 2012). In the current study, adult participants did produce ASL classifier constructions with the intent to specify spatial relations between the target referent of the demonstrative and other referents nearby, i.e. similar to prepositions in English. A possible translation of one such classifier construction used during the demonstrative elicitation task may be "The puzzle piece that is next to the rope string," or "The one [piece] that is next to the other puzzle piece." The use of spatial classifiers in the adult ASL demonstrative production data was a strategy to represent the space within which the intended referent was located, so that a demonstrative could more clearly identify the intended referent among multiple possible similar referents. The videos analyzed in ELAN show different classifier constructions used in the adult ASL production. 7% of ASL demonstratives produced during the puzzle task incorporated classifier constructions. The most common classifier construction in the adult data has handshapes that were produced with the non-dominant hand, while the demonstrative was produced with the dominant hand. The left hand produced the classifier, while the right hand produced the main demonstrative form. The two hands expressed a multi-simultaneous phrase of the spatial relations between two objects (i.e. the rope and puzzle piece or two puzzle pieces). Table 7 represents the instances of two adult participants using a two-handed expression of a classifier and a demonstrative. To be clear, the classifier constructions were produced in addition to the adult dataset of exophoric demonstratives and were not coded as a type of exophoric demonstrative. None of the child participants produced classifier constructions in the demonstrative elicitation task. The most common classifier produced by the adults was the use of the pinky handshape to indicate the rope string as one referent and the IX☞ demonstrative to locate the puzzle piece relative to the string. The other most common classifier produced by the adult was the claw handshape in one hand and the IX☞ handshape in the other hand to locate the target puzzle piece relative to other puzzle pieces. These are examples of classifier constructions incorporating endophoric demonstratives. The individual points produced with a classifier construction were not included in the 473 adult demonstratives. The reference to the object rope string, or puzzle piece being the classifier and the demonstrative point showing the reference of where the target puzzle piece is being pointed. These are particularly interesting because the objects represented by the classifiers were present in the discourse context. Nevertheless, signers found it advantageous to represent these objects with classifiers in order to improve the deictic specificity of their demonstrative points. Furthermore, one would argue that this type of construction is more complex due to mental representations embedded in this type of construction than utilizing the literal physical space, deictic reference.

	
This/that piece is next to the rope. [[CL: pinky ROPE / LINE][DEM_IX]]	This/that piece is ajacent to the other puzzle piece. [[CL: CLAW PIECE][DEM_IX]]

Table 7. Possible non-dominant hand as a classifier supporter for the IX demonstrative use.

While the classifier construction included ASL demonstratives, the current study analyzed the demonstrative points independently, not the whole classifier phrase. Another construction in the adult dataset was the multi-word expression of using both Y handshape and IX handshape with a straight movement trajectory.

Y_IX as a Possible Multi-Word Expression

Baker-Shenk and Cokely (1980) described four different categorical demonstratives in which one is described as using the Y_IX[11] handshape. They state that demonstratives are related to pronouns, are frequent and are a single sign. However, they acknowledge the need to distinguish different types of demonstratives. I suggest a novel multi-word phrase that functions as a demonstrative intensifier, specifically, the label THAT_INDEX and the facial expression as a deictic force demonstrative marker in ASL. THAT_INDEX is a movement and internal handshape change in which the focus on the specific object referent is intensified compared to the general ASL demonstrative. This demonstrative form was produced 36 times by adult participants in Study 1. Interestingly enough, the way the adults use Y_IX suggests that this may be a multi-word expression, similar to the expression “That one” in English. Following are the reasons that support an interpretation of this form as a multi-word expression. A multi-word expression is defined as a fixed sequence of forms used in association with a specific meaning such that the syntax and semantics become emancipated from the productive use of the individual forms making up the expression. First, we did not find any production from participants

[11] The Y_IX refers to both the IX and G final handshape.

with the phrase, INDEX_THAT, which suggests that there is grammatical value for the phrase ordering of THAT_INDEX. Second, while studies have focused on the use of the individual lexical item THAT and of the point IX, the possibility that they form a multi-word expression when used in a fixed order has not been fully examined. Finally, the meaning of THAT_INDEX in Study 1 conveyed a high degree of certainty about the selection of a puzzle piece, providing a possible semantic value that is unique to this fixed sequence of signs.

Two current online lexical databases provide examples and frequency usage of variations of THAT and IX in ASL. ASL Signbank (Hochgesang, Crasborn, & Lillo-Martin, 2020) and ASL-LEX (Caselli, Sehyr, Cohen-Goldberg & Emmorey, 2017) online databases that have detailed linguistic description of the possible range of demonstratives in ASL. ASL Signbank lists the following demonstratives as deictic and indexical pointing: THAT, RELATIVE-THAT, THIS, IX, IX_1, IXarc, IXtracing. ASL-LEX has POINT_INDEX, THIS/IT, and THAT as deictic pointing. The ASL-LEX 2.0 database (contains 2,723 signs and includes cross-references to ASL Signbank, and others) provided a frequency rating in which 129 deaf signers identified the frequency of occurrence of signs used in everyday setting. The rating is a scale of 1 – very infrequent to 7 – very frequent. Results from ASL-LEX 2.0 stated the frequency of THAT had a mean = 5.5 and POINT_INDEX (or IX) had a mean = 5.8 (Sehyr, Caselli, Cohen-Goldberg, & Emmorey, 2021).

Pointing or IX, has a high frequency of grammatical uses in ASL (Cooperrider, 2020). Using a point in ASL is also considered a deictic point in which it provides a foundation for the core of demonstrative constructions (Morford et al., 2019; Pizzuto & Capobianco, 2008). Further, pointing is also commonly used in multimodal referential utterances in spoken languages (Diessel, 2006; Diessel & Coventry, 2020; Peeters et al., 2021).

The focus on individual lexical demonstrative description is the first step in understanding demonstratives. A new label of the multi-word expression connects two high frequency lexical signs. As previously stated, from the data we found no stand-alone account of a participant using only the Y handshape as a nominal demonstrative. The use of the multi-word phrase Y and IX was produced in the data. All instances started with a subtle form of Y. The handshape of the combination of ILY is an example of phonological reduction (blending of 2 distinct handshapes. One suggestion is the phrase THAT_INDEX is a phonological reduction form with the handshape ILY. The phonological reduction involves two handshapes not having a clear handshape transition during one movement. Other examples of multi-word constructions in ASL are discussed in the cases of NOT (Wilkinson, 2016), KNOW (Janzen, 2018), and LOOK (Hou, 2022).

More investigation is needed to analyze the multi-word expression of the ASL demonstrative THAT_INDEX which was produced by 7 out the 10 adults and no instances from the children’s data. In other words, this expression seems to suggest two explanations. On one hand, because there are no instances of a clear construction in the data production from children, the THAT_INDEX may be an adult complex construction that requires more time to develop during language acquisition. Or, on the other hand, in contrast where children used repetition to increase the deictic force of their demonstratives, they may learn to use the multi-word expression THAT_INDEX at a later age. However, it is difficult to determine at this stage because none of the participants (adult and children) produced THAT by itself during their experiment responses. It is possible that over time the repetition-like demonstrative modulation connects and transitions indirectly to the adult modulation of demonstratives to exophoric referents such as THAT_INDEX or CL construction.

Table 8 shows the adult participant productions of the multi-word phrase of THAT_INDEX during the elicitation task. Recall from both ASL demonstrative datasets, at the individual word production level, that participants did produce a straight or arc movement trajectory for both proximal and distal referents. A chi square analysis on the multi-word expression of THAT_INDEX was conducted using R. Results showed no statistically significant effects of proximity or joint attention on the handshape THAT_INDEX in the chi square results. However, one interesting item to note during the analysis was that all the instances of THAT_INDEX were produced with a straight movement trajectory, even for distal referents so it needs not be analyzed for movement. The straight movement for THAT_INDEX is highly predictable. No instances of an arc movement trajectory were produced with the multi-word expression. It is possible that the arc movement is used very rarely, and was not observed in this study. It is also possible that due to the internal handshape change, the movement parameter is constrained to the straight trajectory. This provides additional evidence in support of the argument that the sequence is a fixed multi-word expression. Further, the restriction to the straight movement may have a semantic motivation due to the discourse context of speakers expressing certainty when using this multi-word expression. The arc movement may be semantically incompatible with the emphatic meaning.

Multi-word expression THAT_INDEX

Adult participants demonstrative production of THAT_INDEX			
	Find It Condition	Misunderstanding Condition	Total
Proximal Referents	16	3	19
Distal Referents	15	2	17
Total	31	5	36

Table 8. 7 of the 10 adult participants used THAT_INDEX demonstrative (n = 36)[12].

[12] THAT_INDEX is produced with a straight movement to refer to proximal and distal referents. The Y and IX internal handshapes are in transition during the straight movement trajectory to refer to both distal and proximal referent.

In short, the multi-word phrase of THAT_INDEX has a role to refer to comparable objects. THAT_INDEX grammatical role is to provide a stronger clarity of which referent in space is being focused with the emphasis on the straight movement and internal handshape change from Y to IX. In this study, participants used this phrase to distinguish between several puzzle pieces. All instances were quick to the eye and if one is not being careful, the initial Y handshape can be lost in perceiving this multi-word expression as just an IX point.

Facial Compression (Non-manual Parameter)

In addition to eye gaze, one facial expression was observed with demonstratives on multiple occasions and was labeled as a *facial compression*[13]. Research to date had described nonmanual markers as integral to several grammatical features in ASL. To name a few grammatical features using nonmanual markers focusing on the face: relative clauses, conditionals, rhetorical questions, and negation (Friedman, 1976; Baker & Padden, 1978; Liddell, 1980; Lucas & Valli, 1992). A simultaneous nonmanual marker that sometimes co-occurs with ASL demonstratives labelled as *facial compression* can be added to this list. Table 9 is an example of facial compression which consists of an eyebrow lowering and pursed rounded lips while signing an ASL demonstrative.

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[13] Credit is due to Barbara Shaffer who identified the facial compression non-manual feature.

Facial compression – aligning with ASL demonstrative

6 Adult participants demonstrative production of facial compression			
	Find It Condition	Misunderstanding Condition	Total
Proximal Referents	7	1	8
Distal Referents	10	3	13
Total	17	4	21

Table 9. Non-manual feature of compression of the eyes, cheeks, and mouth while simultaneously signing the ASL demonstrative (n = 21).

In this analysis, I analyze the facial compression feature as an ASL nonmanual marker, as an intensifying modulator of the demonstrative locational referent. I did not analyze the facial compression feature in the previous analyses, but instead focused on eye gaze. In the various task conditions and puzzle piece placement, the use of facial compression is an expression to facilitate an increase of clarity for a more specific referent in space. The facial compression from the adults also modulates the eye gaze as a possible demonstrative intensifier similar to the children's repetition movement behaviors. Again, with various productions across conditions of proximity and attention, no results of a statistical effect on the use of facial compression for specific conditions were found. However, due to having six participants out of ten produce the facial compression it is important to discuss and include it for future studies. The use of the face in pointing gestures is actually quite common, especially in New Mexico. Facial compression needs to be added to the broad category of (nonmanual) grammatical functions in descriptions of ASL grammatical features. The finding of the expression from the ASL demonstrative dataset aligns with discussion of the overlap of observational findings of participants' selection of specific demonstrative forms and the selection of a type of articulator beyond the use of hands (i.e. facial compression, eye gaze, chin raising, nose, and lip pointing). In future work, investigating the facial expressions that accompany spoken demonstratives may provide further insights on the relative location of the referent and the status of joint attention between the speakers (Orie, 2009; Cooperrider & Núñez, 2012; Sherzer, 1973).

Conclusion and Recommendations

The goal of this dissertation was to investigate implications of the grammatical usage of ASL demonstratives produced by native signers. Study 1 and Study 2 provided an in-depth analysis of both adult and child fluent signers of ASL who produced a dataset of exophoric demonstratives focused on referring to puzzle pieces in a puzzle completion task. Adults used a form of an index finger as the ASL demonstrative 93% of the time. Children also used the form of the index finger 97% of the time. A continuum of ASL nominal exophoric demonstrative modulators were identified relative to the proximity of the referents such as arc movement in both groups, repeated demonstrative movement in children, increased use of eye gaze to distal referents in both groups, facial compression in adults, and more.

The previous definition of ASL demonstratives providing four different signs used in categorically distinct contexts (Baker-Shenk & Cokley, 1980; Bahan et al., 1995) should be revised in accord – ASL nominal exophoric demonstratives form a one demonstrative system with a continuum range of handshape, movement, and eye gaze modulators to increase specifications to the physical referent – and the definition should evolve with more research and increased understanding of ASL demonstratives, including endophoric referents. ASL exophoric demonstratives are found to be produced with a combination of specific handshapes and movement relative to the location of the referent. However, based on this controlled study design, it would be worthwhile to explore how joint attention is achieved in naturalistic discourse with respect to the production of ASL demonstratives. Several factors may be considered for this reasoning. Joint attention can be achieved through hand waves, tapping of shoulders, flickering lights and other filler pragmatic expressions that require touch, use of technology, and other visible features. During the task, the participant continuously attended and interacted with the experimenter. The task environment was in a quiet one-on-one setting. A higher modulating use for directing and redirecting joint attention may have not been needed for this particular task. If we compared the demonstrative task in this dataset to an environment with higher distraction cues such as a large group discussion, or multiple visual cues, perhaps joint attention status would have elicited a greater variety of ASL demonstrative forms. With the

ASL demonstrative definition in place, it is time to take stock of how the current definition matches with spoken languages.

To compare with the various spoken languages and their typological demonstrative contrasts, we are interested in explaining the number type of distance contrast demonstrative system that ASL has. For example, Spanish has a three-way demonstrative contrast. Navajo has more than five-way demonstrative contrast, 14 to be exact. English has a two-way demonstrative contrast. Diessel (2013) recorded that majority of the world's spoken languages have a two-way contrast system (n = 126). The second most common system is the three-way contrast (n = 88).

Prior to this dissertation, we had little record of the description of the distance referent contrast type that ASL demonstratives have (Morford et al., 2019). Thus, for this analysis regarding ASL demonstratives, we suggest that ASL demonstratives are indeed a one-demonstrative system, with no distance contrast. Languages like German, French, Kera, Supyire, Koyrabora Senni, and Koromfe also have no distance contracts in demonstratives as well (Diessel, 2013). This dissertation provides the first clear description of one signed language's grammatical use of nominal demonstrative referents. It is recommended not to overgeneralize the assumption that the one-demonstrative system is what the signed, village, and community languages use, or that languages use a gestural pointing demonstrative.

Future investigation of strict experimental design to only elicit demonstrative phrases is in dire need for more signed languages other than ASL. One main reason to collect more data is to compare and distinguish the common pointing feature across several grammatical usages before typologically analyzing signed language demonstratives. Another reason to conduct more investigation is to see how second language (L2) hearing signers benefit in order to understand more about ASL demonstratives. A question to be explored in the future is: would hearing signers produce similar ASL exophoric demonstratives with similar distributions of handshapes, movement, and non-manual expressions for distal and proximal referents and for joint attention conditions? The findings regarding L2 hearing signers would inform how language experience and the use of ASL shape their usage of demonstratives to be either similar to hearing non-signers' usage of gestural pointing or in a manner identical to ASL deaf signers.

The design from the dissertation could be used to investigate further how signed languages are being taught to children who are learning and acquiring demonstratives. The developmental trajectory of demonstrative production from children is important to see which specifics in the ASL demonstratives are produced in early ages (for example, pointing) vs. in later ages which complex demonstratives occur (for example, THAT_INDEX). In this dissertation, the development trajectory based on the age of kids showed significance in the specific manner of ASL demonstratives in repetition movement. The younger the child, the more repetition used and the older the child gets, the less repetition movement produced for demonstratives. More data on children with age variation and more variety of language experience may provide more information of other ASL demonstrative acquisition findings. The role of ASL_RST for this dissertation showed that all children in this study were scored with an average or above average with language skills in their age group. The study did not have any child participant, regardless of restricted or abundant input, that scored below the language standard scores. Participants divided in the restricted (n = 5) or abundant (n = 5) category did not show a huge difference in production of ASL demonstratives in the task: Abundant = 190 demonstratives, Restricted = 208 demonstratives. Thus, there was not enough data to look at the developmental trajectory of ASL demonstratives for this dissertation. In addition, the task did have a list of questions for both adults and children with the intent to prompt participants to produce demonstratives in a naturalistic conversation before the eliciting ASL demonstrative task. Unfortunately, the dataset for this dissertation did not have any recorded naturalistic demonstratives from either adults or children. For future studies, a discourse or interview with a focus on the eliciting task would be a good way to see whether participants express exophoric demonstratives in social or educational settings similarly to an experimental setting.

Naturalistic exophoric demonstratives are challenging to label and categorize. The purpose of this dissertation was to record an elicited demonstrative description in ASL distinguished from other grammatical pointing. ASL nominal demonstratives are a complex referent system of one demonstrative manual production along with a continuous range of parameter modulations and nonmanual representation. The categorization of nominal and exophoric ASL demonstratives align with the demonstrative theoretical framework in the lexical, social, and cognitive levels of analysis (Peeters et al., 2021). Future work can use a demonstrative task focusing on the endophoric referents in ASL. Moving forward, the research of ASL demonstratives should investigate multi-word phrases, L2 production, children's comprehension and the ASL system of endophoric demonstratives.

Appendix 1. Script Questionnaire from Puzzle Task in English.

Experimenter has a 25-piece bordered puzzle. Experimenter and child sit across from each other at a card table. The experimenter sets up the pieces so that all the pieces are in front of them, and the child has the board close to them. The experimenter explains that the child will direct the experimenter to put the puzzle together by responding to questions from the experimenter.

Sample Script wording:

"We're going to put this puzzle together, and here are the rules. I'm going to ask you questions about the pieces, and you will have to tell me which piece to put in the puzzle. You aren't allowed to touch the pieces, only I can touch them, but you'll have to tell me which pieces to put in the puzzle. There's a second rule. Your hands can't cross this line (point to barrier), OK?"

Question type	Script:
	TRAINING TRIAL – Code, but do not include in totals First, let's put the green dinosaur together. Which pieces have the green dinosaur on them? *(If child doesn't answer, could point to each pile with green pieces and ask – these? These? Or these?).*
Find-it	1. Which one has his eye? If response is uninterpretable, repeat: ***Which one*** has his eye? If response is still uninterpretable, say: Here's one with his eye. (*Researcher puts piece in puzzle.*)
Find-it	2. Which one has his other eye?
Misunderstanding	3. This one? (researcher chooses wrong piece)
Find-it	4. Which one has his teeth?
Find-it	5. Which one has his nose?
Misunderstanding	6. This one? (researcher chooses wrong piece)

Find-it	7. Now, let's find the water pieces. See the blue water *(pointing to the puzzle border)*? Which one has water on it? (*3 possible; water piece #1*)
Find-it	8. There are more pieces with water on them. Which one should we put here? (*water piece #2*)
Misunderstanding	9. This one? (researcher chooses wrong piece)
Find-it	10. Which one goes here? (*water piece #3*)
Find-it	11. Now we have some of the brown dinosaur. Which one has his back?
Misunderstanding	12. This one? (researcher chooses wrong piece)
Find-it	13. Which one has his legs?
Find-it	14. Which piece has his eye?
Misunderstanding	15. This one? (researcher chooses wrong piece)
Find-it	16. Which one has his other eye?
	17. See how his head has spikes (*pointing to the puzzle*). Which piece has his head? (*2 possible, spiky head piece #1*)
Misunderstanding	18. This one? (researcher chooses wrong piece)
Find-it	19. Which piece goes here (*spiky head piece #2*)
Find-it	20. Which piece has his nose?
Misunderstanding	21. This one? (researcher chooses wrong piece)
Find-it	22. Now we have some of the red dinosaur. Which piece has his eyes?
Find-it	23. Which piece has his neck?
Misunderstanding	24. This one? (researcher chooses wrong piece)
Find-it	25. Which piece has his head?
Find-it	26. See the green leaves (*pointing to the border*). Which piece has leaves? (*4 possible with leaves, leaf #1*)
Misunderstanding	27. This one? (researcher chooses wrong piece)
Find-it	28. There are more pieces with leaves. Which one do you want to put next? (*leaf piece #2*)
Find-it	29. There are other pieces with leaves. Which one do you want next? (*leaf piece #3*)
Find-it	30. Which one goes here? (*leaf piece #4*)
Find-it	31. Which one has the trees? (*2 pieces with trees*)
Misunderstanding	32. This one? (researcher chooses wrong piece)
Find-it	33. What other piece has trees? (*tree piece #2*)
Find-it	34. We only have two pieces left. Which one goes here?
Find-it	35. Which one goes here?

Appendix 2. Script Questionnaire from Puzzle Task in ASL Gloss.

Question type	Script:
	TRAINING TRIAL – Code, but do not include in totals FIRST, TWO-OF-US PUT GREEN DINOSAUR TOGETHER. DON'T TOUCH. WHICH HAVE GREEN DINOSAUR WHICH? *(If child doesn't answer, could point to each pile with green pieces and ask – these? These? Or these?).*
Find-it	1. GREEN DINOSAUR HIS EYE WHICH? If response is uninterpretable, repeat: ***Which one*** has his eye? If response is still uninterpretable, say: Here's one with his eye. (*Researcher puts piece in puzzle*.)
Find-it	2. GREEN DINOSAUR OTHER EYE WHICH ?
Misunderstanding	3. This one? (researcher chooses wrong piece)
Find-it	4. GREEN DINOSAUR HIS TEETH (CL) WHICH?
Find-it	5. GREEN DINOSAUR NOSE WHICH?
Misunderstanding	6. This one? (researcher chooses wrong piece)
Find-it	7. NOW LET FIND WATER AREA. SEE BLUE WATER *(point to the puzzle border)*? WHICH BLUE WATER WHICH? (*3 possible; water piece #1*)
Find-it	8. HAVE MORE PUZZLE WITH WATER, WHICH SHOULD WE PUT WHICH? (*water piece #2*)
Misunderstanding	9. This one? (researcher chooses wrong piece)
Find-it	10. WHICH HERE PUT WHICH (*water piece #3*)
Find-it	11. NOW WE HAVE SOME BROWN DINOSAUR. HIS BACK (CL:ARCH) WHICH?
Misunderstanding	12. This one? (researcher chooses wrong piece)
Find-it	13. BROWN DINOSAUR HIS L-E-G (CL: STOMP) WHICH?
Find-it	14. BROWN DINOSAUR HIS EYE WHICH?
Misunderstanding	15. This one? (researcher chooses wrong piece)
Find-it	16. BROWN DINOSAUR HIS OTHER EYE WHICH?
	17. SEE HIS HEAD HAVE (CL)SPIKES (*pointing to the puzzle*). WHICH HAS HIS HEAD? (*2 possible, spiky head piece #1*)
Misunderstanding	18. This one? (researcher chooses wrong piece)
Find-it	19. WHICH PUT HERE WHICH? (*spiky head piece #2*)
Find-it	20. BROWN DINOSAUR HIS NOSE WHICH?
Misunderstanding	21. This one? (researcher chooses wrong piece)
Find-it	22. NOW WE HAVE RED DINOSAUR. HIS EYE WHICH?
Find-it	23. RED DINOSAUR HIS NECK WHICH?

Misunderstanding	24. This one? (researcher chooses wrong piece)
Find-it	25. RED DINOSAUR HIS HEAD WHICH?
Find-it	26. SEE GREEN LEAVES (CL) (*pointing to the border*). WHICH CL: PIECE HAVE GREEN LEAVES WHICH? (*4 possible with leaves, leaf #1*)
Misunderstanding	27. This one? (researcher chooses wrong piece)
Find-it	28. NOW HAVE MORE LEAVES HAVE. WHICH WANT PUT NEXT WHICH? (*leaf piece #2*)
Find-it	29. HAVE OTHER CL:PIECE LEAVES WHICH PUT WHERE (*leaf piece #3*)
Find-it	30. WHICH PUT WHERE? (*leaf piece #4*)
Find-it	31. WHICH ONE HAVE TREE? (*2 pieces with trees*)
Misunderstanding	32. This one? (researcher chooses wrong piece)
Find-it	33. WHAT OTHER CL:PIECE HAVE TREE (*tree piece #2*)
Find-it	34. WE HAVE 2 MORE FINISH. WHICH PUT WHERE?
Find-it	35. OTHER PUT WHERE?

References

Allen, S. E., Hughes, M., & Skarabela, B. (2015). The role of cognitive accessibility in children's referential choice. *The acquisition of reference 15*, 123-153.

Bahan, B., Kegl, J., MacLaughlin, D., & Neidle, C. (1995). Convergent evidence for the structure of determiner phrases in American Sign Langauge. *In FLSM VI: Proceedings of the Sixth Annual Meeting of the Formal Linguistics Society of Mid-America*, (pp. Vol. 2, pp. 1-12).

Baker, C., & Padden, C. (1978). Focusing on the nonmanual components of American Sign Language. In P. Siple, *Understanding language through sign language research* (pp. 27-57).

Baker-Shenk, C. L., & Cokely, D. (1980). *American Sign Language: A Teacher's Resource Text on Grammar and Culture.* Washington, DC: Gallaudet University Press.

Bates, D., Maechler, M., Bolker, B., Walker, S., Christensen, R., Singmann, H., & Dai, B. (2004). lme4: Linear mixed-effects models using Eigen and S4. *R package version 1.1-7*.

Bauman, H. D. (2008). *Open your eyes: Deaf studies talking.* U. of Minnesota Press.

Bayley, R., Lucas, C., & Rose, M. (2002). Phonological variation in American Sign Language: The case of 1 handshape. *Language Variation and Change 14(1)*, 19-53.

Besner, D., McLean, D., & Young, T. (2021). On the determination of eye gaze and arrow direction: Automaticity reconsidered. *Canadian Journal of Experimental Psychology/Revue canadiemme de psychologie expérimentale 75(3)*, 261.

Brooks, R., Singleton, J. L., & Meltzoff, A. N. (2020). Enhanced gaze-following behavior in deaf infants of deaf parents. *Dev Sci*.

Bruner, J. (1995). From joint attention to the meeting of minds: An introduction. *Joint attention: Its origins and role in development*, 1-14.

Capobianco, M., Pizzuto, E. A., & Devescovi, A. (2017). Gesture-speech combinations and early verbal abilities: New longitudinal data during the second year of age. *Interaction Studies, 18(1)*, 55-76.

Caselli, N. K., Sehyr, Z. S., Cohen-Goldberg, A. M., & Emmorey, K. (2017). ASL-LEX: A lexical database of American Sign Language. *Behavior research methods 49 (2)*, 784-801.

Clark, E. V., & Sengul, C. J. (1978). Strategies in the acquisition of deixis. *Journal of child langauge 5(3)*, 457-475.

Cooperrider, K. (2016). The co-organization of demonstratives and pointing gestures. *Discourse Processes, 53 (8)*, 632-656.

Cooperrider, K. (2020). Fifteen ways of looking at a pointing gesture. *https://doi.org/10.31234/osf.io/2vxft*.

Cooperrider, K., & Núñez, R. (2012). Nose-pointing: Notes on a facial gesture of Papua New Guinea. *Gesture 12(2)*, 103-129.

Cooperrider, K., Slotta, J., & Núñez, R. (2018). The preference for pointing with the hand is not universal. *Cognitive Science 42*, 1375-1390.

Coventry, K. R., Valdés, B., Castillo, A., & Guijarro-Fuentes, P. (2008). Language within your reach: Near-far perceptual space and spatial demonstratives. *Cognition 108(3)*, 889-895.

Cue, K. R. (2020). Hegemonic Deaf and Hearing Cultures in the United States: A Deaf ecological system perspecitive. *Doctoral Dissertation*. Beaumont, TX: Lamar Univeristy.

De Jorio, A. (2000). *Gesture in Naples and gesture in classical antiquity: a translation of La mimica degli antichi investigata nel gestire napoletano, Gestural expression of the ancients in the light of Neapolitan gesturing*. Indiana University Press.

De Pablo, I., Murillo, E., & Romero, A. (2020). The effect of infant-directed speech on early multimodal communicative production in Spanish and Basque. *Journal of Child Language 47*, 457–471.

De Vos, C., & Nyst, V. (2018). The time depth and typology of rural sign languages. *Sign Language Studies 18(4)*, 477-487.

Diessel, H. (1999). Demonstratives: Form, Function, and Grammaticalization. (Typological Studies in Language, 42.) Amsterdam: John Benjamins.

Diessel, H. (2003). The relationship between demonstratives and interrogatives. *Studies in Language. International Journal sponsored by the Foundation "Foundations of Language"*, 27(3), 635-655.

Diessel, H. (2006). Demonstratives, joint attention, and the emergence of grammar. *Cognitive Linguistics 17*, 463-489.

Diessel, H. (2013). Construction grammar and first language acquisition. *The Oxford handbook of construction grammar 347*, 364.

Diessel, H. (2013). Distance Contrasts in Demonstratives. In: Dryer, Matthew S. & Haspelmath, Martin (eds.) WALS Online (v2020.3) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.7385533

Diessel, H., & Coventry, K. R. (2020). Demonstratives in spatial langauge and social interaction: An interdisciplinary review. *Frontiers in Psychology 11*.

ELAN (Version 6.2) [Computer software]. (2021). Nijmegen: Max Planck Institute for Psycholinguistics, The Language Archive. Retrieved from https://archive.mpi.nl/tla/elan. (n.d.).

Emmorey, K. &. (2003). Categorical versus gradient properties of classifier constructions in ASL. In *In Perspectives on classifier constructions in sign languages* (pp. pp. 231-256). Psychology Press.

Enns, C. E., Zimmer, K., Boudreault, P., Rabu, S., & Broszeit, C. (2013). American Sign Language Receptive Skills Test. Winnipeg, MB: Northern Signs Research, Inc.

Fenlon, J., Cooperrider, K., Keane, J., Brentari, D., & Goldin-Meadow, S. (2019). Comparing sign langauge and gesture: Insights from pointing. *Glossa: a journal of general linguistics 4(1)*.

Fillmore, C. J. (1982). Towards a descriptive framework for spatial deixis. *Speech, place and action: Studies in deixis and related topics*, 31-59.

Fillmore, C. J. (1997). Lectures on Deixis. Standford: CSLI Publications.

Friedman, L. (1976). Phonology of a Soundless Language: Phonological Structure of the American Sign Language. *Unpublished doctoral dissertation*. Univeristy of California, Berkeley.

Goldin-Meadow, S. (2014). Widening the lens: what the manual modality reveals about langauge, learning and cognition. *Philosophical Transactions of the Royal Society B: Biological Sciences, 369(1651)*.

Hauser, P. C., O'Hearn, A., McKee, M., Steider, A., & Thew, D. (2010). Deaf epistemology: Deafhood and deafness. *American annals of the deaf 154(5)*, 486-492.

Heine, B., Kuteva, T., Long, H., Narrog, H., & Wu, F. (2020). Where do demonstratives come from?. *STUF-Language Typology and Universals*, *73*(3), 403-434.

Hochgesang, J., Crasborn, O., & Lillo-Martin, D. (2020). ASL Signbank. Haskins Lab, Yale University.

Hoffmeister, R. J. (1978). The development of demonstrative pronouns, locatives and personal pronouns in the acquisition of American Sign Language by deaf children of deaf parents. *Unpublished doctoral dissertation*. University of Minnesota.

Hou, L. (2016). 'Making hands': Family sign languages in the San Juan Quiahije community. *Austin: University of Texas at Austin dissertation*.

Hou, L. (2022). LOOKing for multi-word expressions in American Sign Language. *Cognitive Linguistics*.

Husain, F., Patkin, D. J., Thai-Van, H., Braun, A. R., & Horwitz, B. (2009). Distinguishing the processing of gestures from signs in deaf individuals: AN fMRI study. *Brain research 1276*, 140-150.

Janzen, T. (2018). KNOW and UNDERSTAND in ASL: A usage-based study of grammaticalized topic constructions. . In K. A. Nordquist, *Functionalist and usage-based approaches to the study of language: In honor of Joan L. Bybee (Studies in Language Companion 192)* (pp. 59-87). Amsterdam: John Ben.

Janzen, T., & Shaffer, B. (2008). Intersubjectivity in interpreted interactions. In J. Zlatev, T. P. Racince, C. Sinha, & E. Itkonen, *The Shared Mind: Perspectives on intersubjectivity* (pp. 333-355).

Kendon, A., & Versante, L. (2003). Pointing by hand in 'Neapolitan'. In S. Kita, *Pointing: Where Language, Culture and Cognition Meet* (pp. 109-137). Mahwah, NJ: Erlbaum.

Keuleers, E., Brysbaert, M., & New, B. (2010). SUBTLEX-NL: A new measure for Dutch word frequency based on film subtitles. *Behavior research methods, 42(3)*, 643-650.

Kita, S. (2003). *Pointing: Where langauge, culture, and cognition meet.* Psychology Press.

Lessard, P., Jarashow, B., & Veltri, D. (2002). Classifiers: a closer look. *Treehouse Video LLC*.

Levinson, S. C. (2004). Deixis. *In The handbook of pragmatics*, 97-121.

Liddell, S. K. (1980). *American Sign Language syntax.* The Hauge: Mouton.

Lieberman, A., Fitch, A., & Gagne, D. (2020). The social dynamics of joint attention in ASL interactions between deaf children and their parents. *IASCL conference*.

Lieven, E., & Tomasello, M. (2008). Children's first language acquistion from a usage-based perspective. In P. Robinson, & N. Ellis, *Handbook of cognitive linguistics and second language acquistion.* London: Routledge.

Lillo-Martin, D. (2002). Where are all the modality effects? In R. P. Meier, K. Cormier, & D. Quinto-Pozos, *Modality and structure in signed and spoken languages* (pp. 241-262). Cambridge University Press.

Lillo-Martin, D. (2008). Sign Language Acquisition Studies: Past, Present, and Future. *Sign Languages: Spinning and Unraveling the Past, Present, and Future ed. R. M. de Quadros. TISLR 9.* Florianópolis, Brazil: Editora Arara Azul.

Lucas, C., & Valli, C. (1992). *Language contact in the American Deaf community.* San Diego: Academic.

Mitchell, R. E., & Karchmer, M. (2004). Chasing the mythical ten percent: Parental hearing status of deaf and hard of hearing students in the United States. *Sign Language Studies*, 138-163.

Mendieta Rodriguez, F. (2022) Hand orientation in Spanish monolinguals co-speech gesture constructions. Paper presented at the 15th High Desert Linguistics Society Conference, Albuquerque, NM, November 2022.

Morford, J. P., Shaffer, B., Shin, N., Twitchell, P., & Petersen, B. T. (2019). An exploratory study of ASL demonstratives. *Languages 4(4)*.

Orie, O. O. (2009). Pointing the Yoruba way. *Gesture 9(2)*, 237-261.

Peeters, D., Krahmer, E., & Maes, A. (2021). A conceptual framework for the study of demonstrative reference. *Psychonomic Bulletin & Review, 28(2)*, 409-433.

Pfau, R., & Steinbach, M. (2006). *Modality-independent and modality-specific aspects of grammaticalization in sign languages*. Universitätsverlag Potsdam.

Pfau, R., & Steinbach, M. (2011). Grammaticalization in sign languages. In H. Narrog, & B. Heine, *The Oxford Handbook of Grammaticalization* (pp. 683-695). Oxford: Oxford University Press.

Pizzuto, E. A., & Capobianco, M. (2008). Is pointing "just" pointing?: Unraveling the complexity of indexes in spoken and signed discourse. *Gesture 8(1)*, 82-103.

Rodrigo, M. J., Gonzáles, A., de Vega, M., Muñetón-Ayala, M., & Rodríguez, G. (2004). From gesture to verbal deixis: a longitudinal study with Spanish infants and toddlers. *First Language 24(1)*, 71-90.

Schick, B., De VIlliers, P., De Villiers, J., & Hoffmeister, R. (2007). Language and theory of mind: A study of deaf children. *Child development 78(2)*, 376-396.

Sehyr, Z., Caselli, N., Cohen-Goldberg, A. M., & Emmorey, K. (2021). The ASL-LEX 2.0 Project: A database of lexical and phonological properties for 2,723 signs in American Sign Language. *The Journal of Deaf Studies and Deaf Education, 26(2)*, 263-277.

Shaffer, B. (2018). Tracing the Origins of Legal Terminology in ASL: Perspectives for ASL/English Interpreters. *Journal of Interpretation*, *26*(1), 4.

Sherzer, J. (1973). Verbal and nonverbal deixis: The pointed lip gesture among the San Blas Cuna. *Language in Society 2(1)*, 117-131.

Shin, N., Hinojosa-Cantú, L., Shaffer, B., & Morford, J. P. (2020). Demonstratives as indicators of interactional focus: Spatial and social dimensions of Spanish esta and esa. *Cognitive Linguistics 31(3)*, 485-514.

So, W. C., Demir, Ö. E., & Goldin-Meadow, S. (2010). When speech is ambiguous, gesture steps in: Sensitivity to discourse-pragmatic principles in early childhood. *Applied psycholinguistics 31(1)*, 209-224.

Supalla, T. (1982). Structure and acquisition of verbs of motion and location in American Sign Language. *Unpublished doctoral dissertation*. University of California, San Diego.

Supalla, T. (1990). Serial verbs of motion in ASL. *Theoretical issues in sign language research 1*, 127-152.

Team, R. C. (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing. Vienna, Austria. 2012.

Todisco, E., Guijarro-Fuentes, P., Collier, J., & Coventry, K. R. (2021). The temporal dynamics of deictic communication. *First Langauge 41(2)*, 154-178.

Tomasello, M., & Bates, E. (2001). *Langauge development: The essential readings.* Blackwell Publishing.

Verhagen, A. (2005). Constructions of intersubjectivity. Discourse, syntax and cognition. Oxford: Oxford University Press.

Wilcox, S., & Occhino, C. (2016). Constructing signs: Place as a symbolic structure in signed langauges. *Cognitive Linguistics 27.3*, 371-404.

Wilkinson, E. (2016). Finding frequency effects in the usage of NOT collocations in American Sign Language. *Sign Language & Linguistics 19(1)*, 82-123.

Zimmer, J., & Patschke, C. (1990). A class of determiners in ASL. In C. Lucas, *Sign Langauge Research: Theoretical Issues* (pp. 201-210). Washington DC: Callaudet University Press.

Zlatev, J. (2013). The mimesis hierarchy of semiotic development: Five stages of intersubjectivity in children. *Public Journal of Semiotics (4)2*, 47-70.

Zwitserlood, I. (2012). Classifiers. In R. Pfau, M. Steinbach, & B. Woll, *Sign language: An international handbook.* Berlin: Mouton de Gruyter.