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Anaphoric *that*: Difference between Adults and Children

Dorothy Ahn and Sudha Arunachalam

1. Background

In this paper we discuss a difference between adults and children in their interpretation of the demonstrative description in the form of *that N* where N refers to a noun. We are in particular interested in the anaphoric use of the demonstrative description, which refers to a familiar entity in the discourse, as exemplified in (1).

(1) I met a linguist. That linguist was happy.

Note that demonstrative descriptions can also be used in a context where a speaker refers to an actual entity present in the speech context. For example, in a context where there are two houses, the speaker can point to one of them and say the following.

(2) That$_{\rightarrow}$ house is beautiful.

While the formal term for the use of demonstratives in (2) differs by field, I call this an exophoric use, where exophoricity is defined as a reference to an entity present in the context of speech.[1] Throughout this paper, we will mark the presence of a pointing gesture with the arrow → next to the demonstrative to indicate an exophoric reference.

In the linguistics literature, a lot of focus has traditionally been given to the exophoric use of demonstratives. Kaplan (1977) famously argue that demonstratives are much like proper names in rigidly denoting an entity regardless of the embedding context. For example, in (3), where only Jin is wearing glasses and the speaker is pointing to Jimin, the sentence is judged to be false, despite the fact that in the world in which the antecedent is true, the person on the right would be Jin, and thus would be wearing glasses. Note that the use of the proper name Jimin would also be false for the same reason.

(3) If Jin and Jimin switched places, that$_{\rightarrow}$ person would be wearing glasses.

*Dorothy Ahn, Harvard University, dorothyahn@g.harvard.edu
*Sudha Arunachalam, New York University, sudha@nyu.edu

[1] The term 'exophoric' can also be used as a label for a subtype of anaphoric reference, where the entity is present in the context, but the speaker assumes that the addressee is contextually familiar to the entity. In this case, the term 'deictic' is used for uses in (2) (cf. Cornish 2010; Grosz 2019).

However, we also know that demonstrative descriptions in English allow a less well-studied anaphoric use (cf. Elbourne 2005; King 2008; Roberts 2002; Wolter 2006, a.o.), where anaphoric reference is defined as reference to a familiar entity that has been introduced in previous discourse. Thus, a speaker can introduce a referent in a discourse as in (4), and then refer back to that linguist with a demonstrative description as in (4a), without any accompanying pointing or other demonstrative gestures (such as a head tilt or palm pointing).

(4) A linguist walked in.

a. That linguist was happy.

In fact, Ahn & Davidson 2018 argued that a pointing gesture would block the anaphoric use in contexts like (4a).

In an experimental setting, English speaking adults readily allow anaphoric uses of demonstrative descriptions (Ahn & Davidson 2018). The ease with which adults interpret demonstratives without pointing anaphorically raises an acquisition question: do children have an adult-like representation of demonstratives? If so, the prediction would be that they would also interpret demonstratives with pointing as exophoric and demonstratives without pointing as anaphoric. However, the literature offers scant evidence on which to make a prediction, and in fact this literature's focus on the exophoric use in early childhood may suggest that the anaphoric reading comes later.

In the literature on cognitive and linguistic development, demonstratives are described as deriving from the pointing gesture. It is well-known that pointing develops early in development, at around 12 months or earlier (Bates 1976; Clark 1978). It is also known that the early occurrences of demonstratives such as the demonstrative pronoun *that* in English are accompanied by a pointing gesture (Clark 1978). Demonstratives are described as the link that brings children in their pre-linguistic, gestural stage to a linguistic stage.

What we know so far is as follows. First, we know that demonstratives in the earliest use are exophoric, where they are always accompanied and even preceded by pointing. Second, we know that for adult speakers, demonstratives can be interpreted anaphorically, where pointing is not present. Two questions arise. First, what determines the availability of anaphoric and exophoric interpretations of demonstratives in adults? Second, do children have an adult-like representation of demonstratives?

We first discuss how adult speakers of English interpret demonstratives with and without pointing in an experimental setting. Then, we discuss how children's intepretation compares to that of adults, and show that children do not interpret demonstratives without pointing to be anaphoric. In the discussion, we identify some possible sources for the differences in children's representation of demonstratives through an analysis of their eyegaze as they completed the experimental task.

2. Adult's interpretation of anaphoric *that*

Ahn & Davidson (2018) show that it is the presence of the co-speech pointing gesture that determines the availability of anaphoric and exophoric readings of demonstratives in English. In response to traditional accounts of demonstratives where demonstratives as a morphological class is contrasted from other morphological classes such as definites and pronouns in having an exophoric uses, Ahn & Davidson (2018) argue that exophoricity should not be associated to the morphological class of demonstratives as a whole. Instead, they argue that exophoricity results from the presence of pointing. They discuss three supporting arguments. First, exophoricity is not restricted to demonstratives: pronouns can be as exophoric as long as there is pointing, as shown in (5).

(5) She$_{\rightarrow}$ is happy, and she$_{\rightarrow}$ is not.

Second, without pointing, demonstratives are fully anaphoric, as shown in (4a) and also in covarying readings like (6). In fact, they also show that if pointing is added, the covarying reading is blocked as shown in (7).

(6) Every time I buy a house$_x$, [that house]$_x$ has issues.

(7) Every time I buy a house$_x$, [that$_{\rightarrow}$ house]$_j$ has issues.

Third, in an experimental setting, adult English speakers interpret demonstrative descriptions as being anaphoric when there is no pointing. In their study, they are concerned with two factors: the choice of the expression (pronoun vs. demonstrative description) and the presence of pointing (absent vs. present), resulting in four conditions in total. Participants completed a survey where they saw a video and were asked to answer a question. The sample screenshot of the video the participants saw is shown in Figure 1. The video showed a speaker in the middle with two images overlayed on each side of the speaker. The speaker first introduced one of the referents with the context sentence in (8a), and then continued with one of the four items in (8b).

Figure 1: Sample screenshot

(8) a. One woman is my friend.
b. Test sentences:
(i) She plays soccer. [pronoun, -point]
(ii) She$_{\rightarrow}$ plays soccer. [pronoun, +point]
(iii) That woman plays soccer. [demonstrative, -point]
(iv) That$_{\rightarrow}$ woman plays soccer. [demonstrative, +point]

In the [+point] conditions, the speaker pointed to the soccer player, and in the [−point] conditions, the speaker did not point or look at either of the images. After watching the video, the participant was asked to answer the question in (9) by choosing between the two images of women.

(9) Which woman is his friend?

If the participant interpreted the DP in (8b) to be anaphoric and thus linked to the entity introduced in the context sentence, they would choose the soccer player as the answer to (9). Ahn & Davidson (2018) show that in the pronoun conditions with and without pointing, adults systematically respond with the anaphoric choice. In the demonstrative conditions, the presence and absence of pointing was the determining factor for adults' responses. In the demonstrative conditions without pointing, adults systematically picked the anaphoric choice. With pointing, however, the anaphoric link was broken, and adults chose at random between the two entities. Based on these results, Ahn & Davidson (2018) conclude that a) pronouns allow pointing to compose non-restrictively while demonstratives do not, and that b) it is the presence of pointing that determines the exophoric reference with demonstratives, rather than the morphological category of demonstratives.

3. Children's interpretation of anaphoric *that*

If children's representation of demonstratives is like that of adults, we would predict pointing to be the determining factor for the anaphoric and exophoric reading of demonstratives. In other words, we would predict children to systematically interpret demonstratives with pointing to be exophoric and demonstratives without pointing to be anaphoric. It is already known that children use and interpret demonstratives as exophoric (cf. Clark 1978). In this study, we tested whether children take demonstratives without pointing to be anaphoric like adults.

3.1. Methods

We followed the design of the adult study in Ahn & Davidson 2018 closely except for the reduced number of factors. Specifically, instead of manipulating both the choice of expression (pronoun vs. demonstrative) and the presence of pointing, we only compared the choice of expression and only had [-point] conditions. In the adult study, it was reported in the comments that the pointing conditions were confusing because the two sentences in the prompt were seen as disjoint narratives

and so there was no correct answer to the question. The sentences with demonstratives and pointing were also rated the lowest by a separate group of participants who provided felicity judgments (Ahn & Davidson 2018). While the degraded felicity of pointing demonstrative conditions was expected and further supports that demonstratives with pointing obligatory requires an exophoric reading, we did not want to have this as an additional complication. Further, we expect that children will have no trouble with exophoric cases given their early exophoric use of demonstratives in their own production. Thus, we only tested how children interpret pronouns and demonstrative descriptions in anaphoric contexts.

Forty-seven monolingual children between ages 2 to 5 years (mean age 4;1) were invited to the lab at the Boston University Child Language Lab to participate in the study. There were 5 two-year-olds, 15 three-year-olds, 17 four-year-olds, and 10 five-year-olds. They were shown a video that contained 12 different trials and were asked to answer the prompt in the video by pointing to the screen. A subset of the 3- to 5-year-olds had their eye gaze recorded during the study using a Tobii T60XL eyetracker, sampling at 60 frames/second. A sample screenshot of the video shown to all children is shown in Figure 2, with the sample prompt shown in (10). In the test sentence, the speaker used either the pronoun like *she* or the demonstrative description like *that baby*.

(10) One baby is my friend. — Context
{She/That baby} is sleeping. — Test sentence
Which baby is my friend? — Prompt

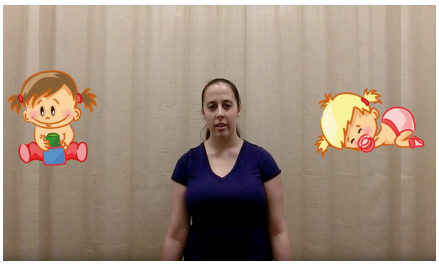

Figure 2: Sample screenshot for the children's study

After each video, the child was asked to answer the prompt by pointing to the friend of the speaker, and the response was recorded by a research assistant who was present throughout the study. The adult-like interpretation (the anaphoric choice; the sleeping baby in (10)) was given a score of 1. The trials contained animate and inanimate objects, and adjectives such as *big*, *little*, *red*, and *blue*. The full list of items used in the test are provided in Appendix I.

3.2. Results and Discussion

The average proportion of anaphoric interpretation by condition at each age (2 to 5 years) is given in Figure 3. We analyzed the data in R (version 3.5.1, R Core Team 2018) using the lme4 package (Bates et al. 2014) with a binomial mixed-effects regression with participant and item as random effects and age (in months, centered around the mean age) and condition and their interaction as fixed effects. This analyzed revealed two significant main effects: age and condition. Age was a significant predictor of anaphoric interpretation, with older children performing more adult-like than younger children (z = 2.99, p = 0.003). Also, children were overall performing significantly more adult-like in the pronoun condition than in the demonstrative condition (z = -3.77, p < 0.001). There was no significant interaction between age and condition. Note that because there were two possible choices, 0.50 is chance performance.

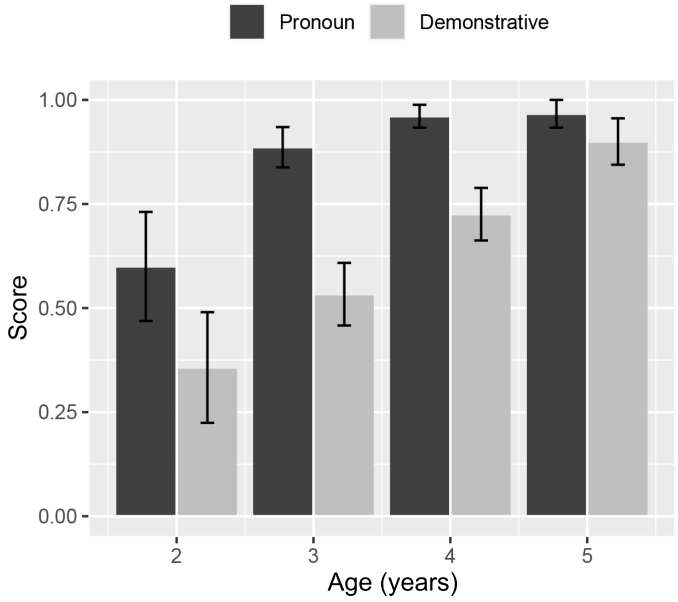

Figure 3: Average proportion of anaphoric interpretation

These results show that for younger children, demonstrative descriptions are interpreted less anaphorically than pronouns. In fact, children do not score above chance (0.50) in the demonstrative condition until age 4. There are at least two possible reasons why this might be. Each is consistent with the correct interpretation children would need to acquire in other languages (cf. Yang 2002). The first reason is that children may be treating the demonstrative descriptions as encoding only an exophoric reading. Thus, upon hearing the demonstrative, they

expect a pointing gesture. Note that an exclusively exophoric morpheme is found quite often across languages (Ahn 2017). For example, Korean has a dedicated exophoric demonstrative *ce* that resists anaphoric readings and requires pointing to an entity present in the speech context. Thus, it may be that children are initially treating the demonstrative in English as a dedicated exophoric morpheme. The second possible reason is that children are interpreting the demonstrative to be anti-anaphoric. German demonstrative pronouns are often described as referring to 'the other' referent: the non-subject or the non-perspective holder (Hinterwimmer 2015; Hinterwimmer & Bosch 2016, 2018; Wiltschko 1998)—the referent that the personal pronoun would not resolve to. It is possible that children are interpreting demonstrative descriptions to be similarly marked in comparison to unmarked pronouns, referring to the other referent that the pronoun would not resolve to.

In order to tease the two possible explanations apart, we also looked at children's eye gaze during the study, which we collected from 35 of the participants of the current study.

3.2.1. Eye gaze data

For 35 of the 3- to 5-year-old participants, we tracked their eye gaze during the study. We were particularly interested in three areas of interest (AOIs): the speaker in the middle, the target item (i.e., the sleeping baby in (10)), and the distractor item (i.e., the playing baby in (10)). We were interested in children's eye gaze during the prompt (e.g., "Which baby is my friend?") because this was immediately after the participant had heard all of the information necessary to resolve the referent: the anaphoric expression and the determining predicate.

Thus, we looked at the proportion of looks to each of the AOIs during the prompt, shown in Figure 4. We observe that children looked more at the target referent in the pronoun condition than the demonstrative condition. Although we do not have comparable data from adults, this suggests that for children, the adult-like anaphoric interpretation for the demonstrative is less accessible than the pronoun interpretation. To assess this pattern statistically, we analyzed the data with a mixed-effects regression. First, we evaluated the eye gaze data for track loss (i.e., missing data due to blinks or other tracking failures); using an inclusion criterion of 25% or less track loss during the trial, we removed 48 trials (of a total of 188 trials) from analysis. Using the eyetrackingR package (Dink & Ferguson 2015), we aggregated the data during the prompt time window into 50-millisecond bins and transformed the proportion of looking to the target during this time (excluding track loss data points, but including looks to none of the AOIs) using an empirical logit transformation (Barr, 2008). We then entered the transformed proportions into a mixed-effects regression with the following random effects: a by-subject random intercept and slope for time (in seconds), and a by-item random intercept and slope for time (in seconds); and the following fixed effects: time, condition (dummy coded as -0.5 for the pronoun condition and 0.5 for the demonstrative condition), and their interaction. This analysis revealed a significant main effect

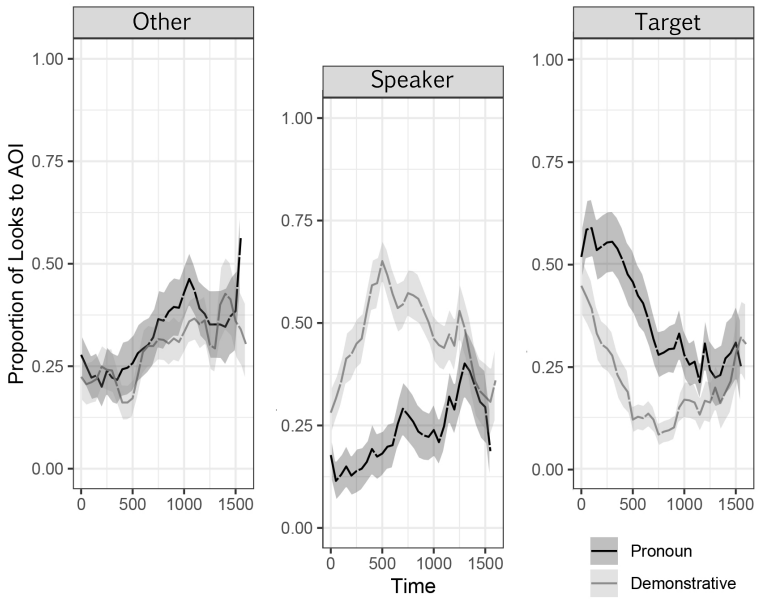

Figure 4: Proportion of looks to target during the prompt

of condition (B = -0.16, t = -3.63), no significant main effect of time, and no significant interaction.

Note from Figure 4 that children's diminished looking to the target in the demonstrative condition as compared to the pronoun condition reflects that they are instead looking to the speaker in this condition. This suggests that children might initially interpret a demonstrative description as encoding only an exophoric meaning, and are waiting for the speaker to point out the intended referent rather than resolving it through anaphora. Thus, English-speaking children seem to interpret demonstratives as only encoding the exophoric meaning, much like the Korean exophoric demonstrative (see Ahn & Davidson 2018 for data on Korean adults' interpretation of anaphoric and exphoric markers, where adults choose at random between the two possible referents upon hearing the exophoric marker *ce* regardless of whether there is pointing or not).

4. Possible analysis of demonstratives

What could be the underlying representation of demonstratives, and how would this representation be different between English-speaking adults and children?

The combination of the adult study in Ahn & Davidson 2018 and the current study with children lead us to make the following observations:

1. **Meaning contribution of pointing** Pronouns allow pointing to be supplementary, while demonstratives require pointing to be restrictive.

2. **Demonstrative interpretation** The presence of pointing determines the available interpretation for demonstratives: the absence results in an anaphoric reading, and the presence requires an exophoric reading.

3. **Acquisition of anaphoric demonstratives** While an anaphoric reading of a demonstrative is readily available for adults, children do not show adult-like understanding until about 4 years of age.

First, the morphological distinction between pronouns and demonstratives affects how obligatorily at-issue the information provided by the pointing is. In other words, pronouns allow pointing to be supplementary, while demonstratives require pointing to be restrictive. Second, the presence of pointing determines the available interpretation for demonstratives. When there is pointing, demonstratives must be interpreted exophorically, and when there is no pointing, demonstratives must be interpreted anaphorically. Third, while the anaphoric reading of demonstratives is felicitous and readily available for adults, children do not show adult-like understanding of anaphoric demonstratives as early as they show adult-like understanding of anaphoric pronouns.

These observations shed light on a possible analysis of demonstratives. There are at least three different approaches to demonstratives in the semantics literature. The first approach is to treat demonstratives as a semantically distinct element that only encodes exophoric information. This view is represented by Kaplan 1977 where demonstratives are analyzed like proper names in that they do not interact with the rest of the linguistic content and only refer exophorically. However, while this view may be compatible for languages like Korean where there is a designated exophoric marker, this view cannot account for adults' interpretation of demonstratives without pointing being fully anaphoric.

The second approach is to treat demonstratives as anti-anaphoric elements that refer to the less salient entity. Hinterwimmer (2015) and Hinterwimmer & Bosch (2016, 2018), for example, argue that German demonstrative pronouns are more marked than personal pronouns in that they refer to the non-salient, non-perspective holder referent that the unmarked pronoun would not resolve to. Note that their analysis focuses on demonstrative pronouns, which correspond to English *that*, rather than demonstrative descriptions such as *that baby* that we used in our study. This analysis is not easily extended to the current data set. The data from children's eye gaze, in which they appear to be looking to the speaker for more information, suggests that English-speaking children are treating demonstratives as exophoric, rather than as an anti-anaphoric element.

The third approach is to treat demonstratives as an extension of definite descriptions. For example, King (2008), Elbourne (2008), and Nowak (2014) analyze demonstratives as being identical to definite descriptions but having an additional modifier, while Roberts (2002) and Wolter (2006) analyze demonstratives as carrying an additional presupposition than definites. Ahn (2019) extends this analysis to pronouns and argues that demonstratives carry one additional restriction than definite descriptions and pronouns. Further, she argues that the additional information that demonstratives carry comes from co-speech gestures. For example, while a pronoun like *she* returns the unique entity that meets *phi*-features such as being feminine, the definite description like *the girl* returns the unique entity that is a girl in the given context, and a demonstrative description like *that girl* with a pointing gesture to a location *a* returns the unique entity that is a girl *and is at location a* in the given context.

This analysis can account for the three main findings we report above. First, regarding the meaning contribution of pointing, the semantic difference proposed in Ahn 2019 predicts pronouns to allow supplementary readings of pointing and demonstratives to require restrictive readings. The main difference with demonstratives is that they require two kinds of restrictions: the same kinds of restrictions that a pronoun or a definite takes (features like gender and number, as well as a noun restriction) *and* gestural information. Because both arguments must form the restriction of demonstratives, it is predicted that pointing is part of the restrictive meaning for demonstratives. On the other hand, pronouns do not have such a requirement. Second, the proposal makes a concrete prediction about the anaphoric and exophoric interpretations of demonstratives. Because there is a dedicated slot for pointing, the analysis predicts exophoric readings to be required whenever there is pointing present, which is borne out by the adults' data where they do not interpret demonstratives with pointing as anaphoric. Also, when there is no pointing, the dedicated slot can be filled with contextual information, which would lead to anaphora. Thus, without a pointing gesture, adults interpret *that girl* to mean the unique girl that has been previously introduced in discourse. If we treat this as a last-resort accommodation, we can account for why the absence of pointing leads to an anaphoric interpretation. Third, the analysis allows us to explain the difference between adults and children. When demonstratives are used in the absence of pointing, adults accommodate by filling the additional slot with contextual information. As for children, we propose that it is this process of accommodation that they have difficulty with. This is supported by their looks to the speaker upon hearing the demonstrative, which suggests that they are waiting for the additional cue such as pointing or eye gaze.

What is the nature of the difficulty children experience in this accommodation process? There are many possible causes. For example, it could also be that the option of filling the additional argument slot with contextual information is not an option for children to start with, and that they are confused when no gestural cue is provided. It could also be that the ability accommodate a demonstrative without

pointing through anaphora develops over time. Note that pragmatic accommodation was shown to be difficult for children in this age range (Reuter et al. 2018); three-year-old children's failure to understand negative sentences was attributed to their failure to accommodate an out-of-the-blue negation that was not supported by the discourse. Another possibility is a general difficulty in switching from an initial interpretation (i.e. exophoric) to an alternative interpretation (i.e. anaphoric). This is left for future investigation.

5. Conclusion

In this study, we investigated children's interpretation of demonstratives without pointing. We start with the observation that adults systematically interpret demonstratives with pointing exophorically and demonstratives without pointing anaphorically, and ask whether children are adult-like in their interpretation of demonstratives without pointing. We show that while children interpret pronouns without demonstratives as anaphoric from age 2, they do not interpret demonstratives without pointing as anaphoric until age 4, showing a delay. The eyegaze data shows that children are significantly more likely to look at the speaker and not to the target object upon hearing the demonstrative than the pronoun, suggesting that they are treating demonstratives as a dedicated exophoric morpheme and waiting for further cues such as pointing. We end with a possible analysis of demonstratives that can account for the findings. We show that analyzing demonstratives as carrying an additional restriction than pronouns for gestural information can account for the main findings and allow for a possible explanation for why children differ from adults. In particular, we propose that while adults readily accommodate demonstratives without pointing by filling the additional slot with contextual information, children have difficulty with such accommodation process.

Appendix I: Experimental stimuli

Item	Predicate 1	Predicate 2
balloon	red	blue
box	red	blue
bird	flying	sitting
bee	flying	sitting
boy	happy	sad
girl	happy	sad
man	tall	short
woman	tall	short
dog	big	little
ball	big	little
cat	sleeping	playing
baby	sleeping	playing

References

Ahn, Dorothy. 2017. Definite and demonstrative descriptions: a micro-typology. In *Proceedings of GLOW in Asia XI*, volume 1, 33—48. MIT Working Papers in Linguistic.

Ahn, Dorothy. 2019. That thesis: A competition mechanism for anaphoric expressions. Doctoral dissertation, Harvard University.

Ahn, Dorothy, & Kathryn Davidson. 2018. Where pointing matters: English and Korean demonstratives. *Proceedings of North East Linguistic Society 48* .

Bates, Douglas, Martin Mächler, Ben Bolker, & Steve Walker. 2014. Fitting linear mixed-effects models using lme4. *arXiv preprint arXiv:1406.5823* .

Bates, Elizabeth. 1976. *Language and context: The acquisition of pragmatics*. Academic Press.

Clark, Eve. 1978. From gesture to word: On the natural history of deixis in language acquisition.

Cornish, Francis. 2010. Anaphora: Text-based or discourse-dependent?: Functionalist vs. formalist accounts. *Functions of language* 17:207–241.

Dink, J.W., & B. Ferguson. 2015. An R library for eye-tracking data analysis .

Elbourne, Paul. 2008. Demonstratives as individual concepts. *Linguistics and Philosophy* 31:409–466.

Elbourne, Paul D. 2005. *Situations and individuals*, volume 90. Mit Press Cambridge, MA.

Grosz, Patrick. 2019. Pronominal typology and reference to the external world. *Proceedings of the 22nd Amsterdam Colloquium* 563–573.

Hinterwimmer, Stefan. 2015. A Unified Account of the Properties of German Demonstrative Pro- nouns. *P. Grosz, P. Patel-Grosz and I. Yanovich (eds). The Proceedings of the Workshop on Pronominal Semantics at NELS 40* .

Hinterwimmer, Stefan, & Peter Bosch. 2016. Demonstrative pronouns and perspective. *The Impact of Pronominal Form on Interpretation. de Gruyter, Berlin* 189–220.

Hinterwimmer, Stefan, & Peter Bosch. 2018. Demonstrative pronouns and propositional attitudes. In *Pronouns in embedded contexts at the syntax-semantics interface*, 105–144. Springer.

Kaplan, David. 1977. Demonstratives. *Themes from Kaplan* .

King, Jeffrey C. 2008. Complex demonstratives, qi uses, and direct reference. *Philosophical Review* 117:99–117.

Nowak, Ethan. 2014. Demonstratives without rigidity or ambiguity. *Linguistics and Philosophy* 37:409–436.

R Core Team. 2014. *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

Reuter, Tracy, Roman Feiman, & Jesse Snedeker. 2018. Getting to no: Pragmatic and semantic factors in two-and three-year-olds' understanding of negation. *Child development* 89:e364–e381.

Roberts, Craige. 2002. Demonstratives as definites. *Information sharing: Reference and presupposition in language generation and interpretation* 89–196.

Wiltschko, Martina. 1998. On the syntax and semantics of (relative) pronouns and determiners. *The Journal of Comparative Germanic Linguistics* 2:143–181.

Wolter, Lynsey. 2006. That's that: The semantics and pragmatics of demonstrative noun phrases. Doctoral dissertation, University of Calfornia Santa Cruz.

Yang, Charles D. 2002. *Knowledge and learning in natural language*. Oxford University Press on Demand.