Spatial Deixis in Child Development

By

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Abstract

This thesis is concerned with deictic communication in development, particularly with the use and understanding of demonstrative words: *here, there, this* and *that*. These deictic words have the role of orienting another person's attention to an object on space. The overall goal of this work is to explore the ways in which the study of demonstratives can be used to understand the development of joint attention, communication, spatial organisation, and the understanding of perspectives. Chapter 1 is an introduction to deictic communication. It presents a literature review of adults' mapping of demonstratives onto space, and of children's acquisition of demonstratives. Then, chapters 2 to 4 are three studies that focus on different stages of development: 18 to 24 months in Chapter 2, 3 to 5 years old in chapter 3, and 7 to 11 in Chapter 4. The study in Chapter 2 focuses on infants' acquisition of demonstratives. Open-source corpus linguistics and parental report data were used to describe infants' use of demonstratives in English and Spanish. Unlike previously thought, demonstratives emerged typically after the 50th word and in two-word utterances. Chapter 3 presents a study on children's understanding of demonstratives' distance contrast. Results indicate this is achieved by age 4, but no relation with theory of mind, visual perspective taking or spatial skills was found. The study in Chapter 4 focused on unconstrained demonstrative production and conceptualisation of space. Results show that demonstrative choice was immature at 7 years and still developing at 11 years. Children were sensitive to object characteristics (ownership), indicating that demonstrative use reflects conceptual instead of physical proximity distinctions from early on. Finally, Chapter 5 is a general discussion of the findings and future directions. In sum, the acquisition of demonstratives is a protracted process that emerges in infancy and extends beyond the school years.

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Author's declaration

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my own work. I also confirm that this work fully acknowledges opinions, ideas and contributions from the work of others.

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Chapter 1

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Introduction

1.1.Deictic Communication, Demonstratives and Space

A toddler pulls an adult by the hand towards the kitchen and points at the cupboard where the biscuit tin is, looks at the adult, then looks back at the cupboard and says *"ah, ah"*, and repeats again. Anyone that has ever met a toddler will recognise the situation as familiar, and will correctly guess that *"ah, ah"* means *"that cupboard – the one I'm pointing at – has biscuits, please get me some"*. It might look simple, but this toddler has achieved a crucial milestone in their social and language development, which is to engage in *deictic communication*.

What is deictic communication? As described by Levinson (1983:54), "deixis concerns the ways in which languages encode or grammaticalize features of the context of utterance or speech event, and thus also concerns ways in which the interpretation of utterances depends on the analysis of that context of utterance." In simple terms, deictic words are words that require contextual information and a point of reference in order to be interpreted correctly. Deixis can be of time, person, and space (Levinson, 2004). Time deixis includes words such as yesterday or now, that can only specify a time or date from a point of reference in which the event took place. Person deixis includes pronouns, which are words that might refer to different people: words such as *you* and *me* require a person of reference in order to make sense. In order to identify *you*, you need to know which person is *me*. And finally, space deixis: for example, *this*, in *this computer is very fast*, refers to the writer's computer and not the reader's; for the reader to understand which computer *this* refers to, contextual and spatial cues are required. Let me illustrate this with another example.

Two people are looking at the display window of a computer shop and discussing the computers' characteristics. One of them says "this computer is very fast". Such a sentence would almost inevitably require pointing to specify which computer is being mentioned. Pointing gestures are conceptualised as deictic (Kita, 2003). Like deictic words, they are meaningless without a context and a point of reference. Both the deictic word *this* and the deictic gesture, pointing, direct the hearer's focus of attention towards one particular computer in the display, and establish a link between speaker, listener and object. This three-way communication is called triadic joint attention (Tomasello, 1999; Diessel, 2006; Eilan, Hoerl, McCormack & Roessler, 2005). The situation of the toddler and the biscuits' tin is very similar to the one at the computer shop, with the difference that the toddler did not use a deictic word such as *this*, but used the verbalisation *ah* in place of a deictic word. Thus, *ah* serves the same purpose as *there* ("I want what is there") or *that* ("that cupboard has the biscuits, please, open it"). The toddler, using deictic gesture and verbalisation, has successfully conveyed a message and established triadic joint attention.

Deictic communication plays a central role in social development from very early on. Demonstrative words (such as *that* or *there*) are the most frequent spatial deictic words. Thus, the study of the acquisition, understanding and use of demonstrative words throughout development may have a great potential to expand our knowledge of social development and children's understanding of space. However, this topic has remained largely understudied. This thesis will address the acquisition of demonstratives, from infancy to late childhood.

To briefly introduce the flow of this chapter: the first part will define demonstrative words and the relevant issues in their study in linguistics and cognitive science; the second part will describe the development of deictic communication in infants and present a review of studies on the acquisition of demonstratives.

Demonstrative words: form and function. Demonstratives in English are the words *this/these, that/those, here* and *there*. *This* and *that* can function as determiners (e.g. *this* computer is very fast) or as pronouns (e.g. what is *this*?). *Here* and *there* are locative adverbs; in contrast with determiners and pronouns, they do not indicate an object, but a location (e.g. the biscuits are *there*). The words *this/here* and *that/there* refer to an entity or a location that is situated relatively close or far from the speaker, which acts as the point of reference or *deictic centre*. The close/far contrast in English demonstrative system is however not a straightforward distinction, and will be discussed in detail later in this chapter.

Demonstratives have been found in all languages, and their roots are so old that they cannot be traced (Diessel, 1999). However, their form and function vary considerably across languages. Some languages have more than two demonstrative terms; for instance, Spanish has a three-way demonstrative system (determiner/pronouns and locative adverbs, plus number and gender inflections) that conveys a close, middle, and far distance from the speaker. All languages coincide in having some sort of distance contrast anchored to the speaker (Diessel, 1999; but see Enfield, 2003). However, they might also encode some other spatial distinctions, such as uphill and downhill (Dyirbal language, Australia) or elevation (Khasi language, India).

Besides the role of situating referents on space, and as illustrated in the previous examples, demonstratives are also tools for the establishment of joint attention. This is particularly evident in some demonstrative systems, that take into account not only the speaker position, but also the hearer's position and/or focus of attention. For example, the Japanese system features three demonstrative terms that encode distance from speaker and hearer, which are, *kore* close to speaker, *sore* close to hearer and *are* far from both (Diessel, 1999). In the case of Turkish, a language with three terms as well, one of the terms (*şu*) is used to indicate an object that is not in the hearer's focus or sight, and thus serves to redirect the hearer's spatial attention (Küntay & Özyürek, 2006). The role of the hearer's position or attention in some demonstrative systems highlights the function of these words as a verbal means to establish joint attention.

Demonstrative uses and distance contrast. As previously stated, the conceptualization of English demonstrative words as words that convey close and far distance from the speaker is not precise, and there are numerous considerations to this statement. The first and most evident issue with this conceptualisation is that the distance that defines near and far space is not explicit or precise. Experimental research has defined the distinction between close and far space, and thus between the use of the proximal (*this/here*) and distal demonstratives (*that/there*), as the space situated roughly within hand reach versus out of reach (Coventry, Valdés, Castillo, & Guijarro-Fuentes, 2008; Coventry, Griffiths & Hamilton, 2014; Gudde, Coventry & Engelhardt, 2016; Caldano & Coventry, 2019). However, multiple factors may flex that boundary (see 1.2 and Chapter 4). Moreover, in specific cases the use of the proximal demonstratives extends to very large spaces, as in *this city* or *this galaxy* (Kemmerer, 1999). Considering such cases, a more accurate definition of the demonstratives distance contrast might be assigning *this/here* to the place the speaker is at, and *that/there* for the place the speaker is not. Another consideration is that the term *that* is often used within close space; according to H. Clark (1973) *that* acts as an *unmarked form*, meaning that it may be used as a *distance-neutral* term when no specific location information is required (Levinson, 2004). Contrarily, the use of *this* seems more restricted to objects within reach or locations where the person is, even if such location extends beyond the space within hand reach (e.g. *this city*).

Defining the use of the proximal or distal demonstrative depends therefore on the type of communicative situation. Some of the functions that demonstratives might take in different situations are listed in Table 1.1. Demonstrative uses can be deictic (which are the central focus of this work) and non-deictic. Deictic uses of demonstratives are exophoric, which means that they refer to objects or locations in the physical space. However, demonstratives might be used for objects or locations that are not in the space surrounding speaker and hearer, and thus are non-deictic. The most common non-deictic use is anaphora, which is used to refer to ideas, objects or people previously mentioned in discourse (Diessel, 1999; Levinson, 2004). For example, *"My friend and I met today again after a long time. I have known that girl since high school".* In this example, *that girl* refers to the previously mentioned friend, who is not present.

The deictic exophoric function of demonstratives includes gestural and symbolic (non-gestural) uses. The exophoric symbolic use includes instances that do not require pointing gestures (e.g. *this city*).

Table 1.1: Non-exhaustive typology of demonstrative uses (adapted from Levinson, 2004:108; from Diessel, 1999).

Deictic			Non-deictic
Exophoric			
Gestural		Symbolic	Anaphoric
Contrastive	Non-contrastive		

Focusing on the exophoric gestural use, we might distinguish between contrastive and non-contrastive use. A non-contrastive use would be for example *"I have climbed that mountain"* (in the case that there is only one on sight); in this case, there is no intended comparison or disambiguation with a similar mountain, thus the spatial information conveyed with the demonstrative word is not crucial for the communication. Contrarily, in a situation such as *"this computer is very fast",* pointing gestures and precise demonstrative words are needed in order to disambiguate between several potential or competing referents. A similar situation is illustrated in Figure 1.1, where there are two competing referents (two identical cups) and the speaker uses a demonstrative word and a pointing gesture to identify which cup is being referred to (*"this/that cup"*). Contrastive demonstrative use calls for the use of a proximal and a distal term to indicate the object that is relatively close or far from the speaker, even when both objects are within reach (Bonfiglioli, Finocchiaro, Gesierich, Rositani & Vescovi, 2009).

Figure 1.1: A communicative situation with two identical referents (the cups) that require a contrastive use of demonstratives. *Figure from Chapter 3.*

According to Diessel (2006), the principal function of demonstratives is deictic, exophoric, gestural, non-contrastive. As in the example of the toddler and the biscuits' tin, Diessel suggests that it is the first function of demonstratives to be acquired, and from which further functions derive (e.g. anaphoric use). In non-contrastive events, as previously stated, the boundary between the use of proximal and distal demonstratives is fuzzy.

Understanding the dynamics of the spatial distinction between proximal and distal demonstratives might contribute to our understanding of social interaction and conceptualisation of space. Some authors argue that the distinctions that demonstratives make are based mostly on distance (Coventry et al., 2008; Coventry et al., 2014; Gudde et al., 2016; Caldano & Coventry, 2019) whereas others argue that this distinction represents more of an abstract categorisation (Kemmerer, 1999, 2006) or a social-psychological distance (Peeters & Özyürek, 2016). The next section presents a review of the works in linguistics and cognitive science that have approached this question, followed by a brief discussion of the different methods and findings. It concludes with the outline of a proposal for a unified conceptual framework of the mapping between spatial demonstratives and space.

1.2.Literature Review: Demonstrative Use in Adults

The methods that have been used to study demonstrative use range from naturalistic observation to highly controlled behavioural experiments. The choice of method depends on the researcher's interest. Some authors aimed to describe the use of demonstratives in communicative settings, for which naturalistic or semi-structured observation methods are appropriate; other authors have studied demonstratives as a way to explore the conceptualisation of space and the interplay between spatial cognition and spatial language, and used experimental methods to that end.

One long-standing research question in this field is where lies the boundary between close and far space, and thus between the use of proximal and distal demonstratives. The distinction between peripersonal (roughly within hand reach) and extrapersonal (beyond hand reach) space has been proposed by some authors as the most relevant variable (Coventry et al., 2008; Coventry et al., 2014; Gudde et al., 2016; Caldano & Coventry, 2019); moreover, extensive cognitive and neuropsychological research shows that this distinction structures not only our demonstrative use, but also our conceptualisation of space (Berti & Frassinetti, 2000; Coventry et al., 2014). The *memory game paradigm* is a methodology aimed to explore the interplay between spatial demonstratives and perceptual space. Here I present some of the most relevant studies using this method. An adaptation of the memory game paradigm to developmental research is presented in Chapter 4.

Coventry and colleagues' Memory Game paradigm. This paradigm was first presented in Coventry, Valdés, Castillo and Guijarro-Fuentes (2008). It is a covert procedure to elicit demonstrative production using physical objects at various distances. Participants are told that the experiment is about the effects of language on memory for locations and that they are in the language condition; therefore, while they memorize the position of the objects (discs with shapes), they have to name them by pointing at it and using a demonstrative word and adjective (e.g. *that green star)*. Participants are unaware that their choice of demonstrative word is being studied, thus responses are not biased to any rules or researcher expectations.

Coventry et al. (2008) used the memory game paradigm to test demonstrative production in English and Spanish. Twelve equidistant locations along a table midline were used, three of them within the participant's reach (see Figure 1.2). They found that participants tended to use the proximal demonstrative within their peripersonal space and gradually less for locations further away. Moreover, by extending the participant's reaching distance with the use of a tool, the peripersonal space was equally extended, and consequently the use of *this* in the region reachable with the tool. Coventry et al. (2008) also found that the position of the addressee (the experimenter) was relevant for demonstrative production particularly in Spanish, and that the interaction with the objects (whether participants placed the object themselves) increased the use of the proximal demonstrative.

Figure 1.2: Diagram of the memory game apparatus as used in Coventry et al. (2008), showing the location marks on the table where the objects were placed with respect to the participant's position. First quadrant was reachable with the hand and second quadrant reachable with the tool. *Figure from Coventry et al. (2008).*

The memory game paradigm was used by Coventry, Griffiths and Hamilton (2014) to study not only demonstrative production, but object-location memory for the same objects and locations (see apparatus modification in Figure 1.3; a video protocol is available in Gudde, Griffiths and Coventry, 2018). Participants had to remember the exact location of the objects alongside the table midline. Results indicate that objects within peripersonal space are misremembered as closer and objects within extrapersonal space as further, indicating a categorisation of space structured around reachability, parallel to that observed in demonstrative production. Additionally, Coventry et al. (2014) manipulated variables that cross-linguistic research had found relevant for demonstrative use in other languages, namely, visibility, ownership and familiarity (Diessel, 1999). A parallelism was found once again between the use of demonstratives and memory for object location: visible, owned and familiar objects were more often referred to using *this*, and they were also misremembered to be closer. They argue that spatial language relies on spatial representations, and propose an expectation model to explain the results found in spatial and language tasks; the expectation of finding an object within reach, either due to its characteristics or to its location in peri- or extrapersonal space, is combined with the actual object location in memory, affecting it as a result. The model could be extended to explain that visible/owned/familiar objects elicit more often proximal demonstratives by the expectation of finding such objects within reach, although authors do not elaborate on the mechanism behind it. The study in Chapter 4 is a conceptual replication of this work adapted to developmental research.

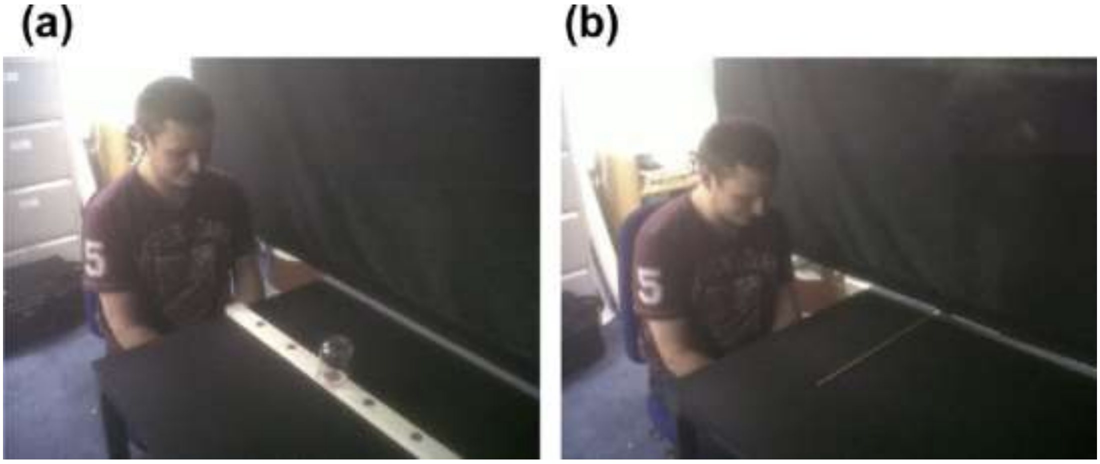

Figure 1.3: Example of the setup in the memory experiments in Coventry et al. (2014). (a) Shows the visible cover condition. (b) Shows the stick position: the stick moved either towards or away from the participant according to the participant's instructions (*closer/further*) until it was aligned with where the participant thought the object had been located. *Figure from Coventry et al. (2014).*

The tight link between demonstratives and perceptual space was further investigated by Gudde, Coventry and Engelhardt (2016). They found that demonstratives can affect memory for locations: the position of objects that were named by *this* was remembered as closer than for objects named by *that*. Again, objects in peripersonal space were misremembered as closer and objects in extrapersonal space as further, manifesting a perceptual distinction around reachable space.

Caldano and Coventry (2019) adapted the Memory Game procedure to explore the use of demonstratives in the lateral planes. They found that the hand used for pointing at the object affected demonstrative choice, because the reachable space with one hand is different than with the other hand (i.e., the participant can reach further with the right hand on the right side and not so far on the left side of the space). This study brings further evidence about the role of reachability in demonstrative production, as opposed to perceived distance to the body core.

A recent study tested the effect of distance and addressee's position in the use of demonstratives in common Estonian and Võro, two closely related languages, using the memory game (Reile, Plado, Gudde & Coventry, 2020). Results point out that the main variable affecting demonstrative use is distance from speaker, although speakers of Võro were also sensitive to addressee location.

***Other experimental approaches to demonstrative production*.** Few other studies have approached demonstrative use with highly controlled laboratory methods. Here we present three studies, all of them focused on a contrastive function of demonstratives, and one of them including EEG methods.

Bonfiglioli, Finocchiaro, Gesierich, Rositani and Vescovi (2009) studied demonstrative comprehension in Italian. Participants were presented with two objects within hand-reach, one closer than the other. They had to reach for one of the objects following an instruction that included a demonstrative word. Results indicate that grasping was faster when the word was congruent with the object position (relatively close or far). The authors argue against the distinction between peripersonal and extrapersonal space as the key distinction for demonstrative use.

Another experimental study tested contrastive demonstrative use within reachable space. Rocca, Wallentin, Vesper and Tylén (2019) studied demonstrative use in a social-interactive task by asking participants to name pairs of objects at various locations (in Danish). As expected, they found a greater frequency of *this* for the closer object and *that* for the further object (even with both within reach). Interestingly, in a collaborative task *this* was frequently used for the space close to the task partner, thus shifting the deictic centre towards the hearer. Authors present this paradigm as a more ecologically valid way to study demonstrative production, given that most actions happen in social contexts, and conclude that results reflect “object affordances for joint action”. However, this procedure studies demonstrative use with two referents, and results might not apply to non-contrastive demonstrative use.

The EEG work of Peeters, Hagoort and Özyürek (2015) also studies the relevance of social interaction and shared space. They tested demonstrative processing in Dutch by presenting participants with photographs of a person (a speaker) pointing to close and far objects and objects on the sides, paired with auditory stimuli featuring demonstrative words. Their data show a preference for proximal demonstratives within shared space (the space between the participant and the speaker), irrespective of their distance with respect to the referent, and thus do not support the speaker-centred account of demonstrative comprehension. Altogether, they suggest a revised theoretical framework of proximal and distal space (e.g. Diessel, 1999) and propose a *psychologically proximal/distal space* account of demonstrative use, in which the space between speaker and hearer (shared space) is considered psychologically proximal. They extend this conceptualisation to explain the effects of object characteristics on demonstrative use in the studies of Coventry et al. (e.g. Coventry et al., 2014; Peeters & Özyürek, 2016).

Semi-structured demonstrative elicitation. The following studies have aimed to find a balance between the rigorously controlled experimental studies and the information-rich naturalistic observation. Piwek, Beun and Cremers (2008) used a paradigm of collaborative building-blocks construction to study spontaneous demonstrative use in Dutch. Participants more often used the distal demonstrative for objects out of the focus of attention and for not accessible objects. Therefore, this study poses an argument against the distance-based distinction for demonstrative use and proposes an attention-orienting model. However, these findings could probably be interpreted under Peeters’ shared space account, as it predicts that people more often use a proximal demonstrative for objects within the space between the interlocutors, and thus the distal demonstrative is used for objects outside the attentional visual field.

A similar paradigm was used by Reile (2015, 2016) for the study of demonstratives in Estonian, but with a different distribution of the referents over a longer space. Reile found distance from the speaker the most relevant variable.

Another line of research has approached the topic with a higher emphasis in naturalistic and unconstrained demonstrative elicitation. Levinson, Cutfield, Dunn, Enfield and Meira (2018) present an extensive description of the demonstrative system of 15 unrelated languages. Their method had the starting point of a task by Wilkins (1999) and consists of a unified fieldwork protocol for the study of demonstratives cross-linguistically. It focuses on sampling various demonstrative functions (avoiding contrastive use), within various distances (from the own body to kilometres away), and considering the location of the hearer. Their conclusions highlight the importance of referent distance and hearer location in all the demonstrative systems.

***Naturalistic observation*.** Few studies have done field observation specifically of demonstrative use. Jungbluth (2003) studied demonstrative use in natural interactions in Spanish and concluded that the demonstrative system is not organised around the egocentric distance from the speaker, but around a speaker-hearer dyad. These observations coincide with the effect of speaker position found by Coventry et al. in Spanish (2008). Moreover, it provides further support to the empirical works of Rocca et al. (2019) and Peeters et al. (2015) in Danish and Dutch respectively about the significance of the shared space between the conversational partners, and where the proximal demonstrative might be used most often.

Enfield (2003) observed Lao speakers in natural interactions, and concluded that demonstratives in Lao do not indicate distance from the speaker. Instead, he proposes a complex description of demonstratives' use dependent on the social situation and the array of potential referents. However, Enfield does indicate that it might appear as if the demonstratives were used for close and far referents by "pragmatic inference", thus implying that there was a spatial meaning of demonstratives when analysed in context. Jarbou (2010) observed speakers of Jordanian Arabic and, like Piwek et al. (2008) for Dutch, argued that demonstrative use is not based on distance, but on referent accessibility.

In conclusion, studies using naturalistic field observation have criticized or rejected the near-far conceptualisation of demonstratives, although it is unclear whether these findings are specific to the languages studied or would also extend to the English language. Naturalistic methods offer interesting insight that cannot be obtained by experimental means. However, potential biases such as situation sampling and imprecisions in the distance estimations call for caution when formulating conclusions.

Neuroimaging data. The only study to date to analyse demonstrative processing with fMRI has found that demonstrative processing in discourse (isolated from visual input) recruits parietal integration areas, frontal areas involved in attention shifting, and the dorsal ("where") visual stream involved in object locations. However, evidence for a distinctive activation of the proximal versus distal demonstrative word was not found (Rocca, Coventry, Tylén, Staib, Lund & Wallentin, 2020).

Demonstratives beyond perceptual space: insight from linguistics. One of the most comprehensive accounts of demonstratives coming from theoretical linguistics is the recent book by Talmy (2018). He proposes a unified account for demonstrative use and comprehension including deictic (exophoric) and anaphoric use, arguing that they engage the same *targeting* process. The book lists a series of possible situations in which demonstratives are used, and proposes a typology of steps and cues that the hearer uses to *target* the referent in space. Demonstratives act as *triggers* to the hearer, who then uses a variety of cues to narrow down the potential referents in order to target the intended entity. For instance, if someone says *"could you pass me those, please"* the hearer will attend to any available gestural cues (i.e. pointing) to find the target. If gestural cues are ambiguous, other cues might help narrow the search down. For example, the plural in *those* indicates that the target is multiple, and therefore it might refer to a handful of almonds but not to a spoon. Another cue is hearer's attention: the hearer might understand that the object mentioned is the one that is in their focus of attention. For example, if the hearer was reading the label on the almonds' bag, they could have understood that *those* referred to the almonds. Talmy argues that the same exact process applies to the use and comprehension of anaphoric demonstratives, as they point out elements close or far within discourse. This a very interesting approach that takes into consideration the complexity of human communication and the conversational settings, and its predictions may be tested.

Discussion: How do demonstrative words map onto space? We have reviewed some studies on demonstrative use and comprehension that differ widely in their target language, methodology, and conclusions. There is as yet no consensus about what is the central variable that articulates the organisation of perceptual space and the mapping of demonstratives onto it.

Coventry and colleagues (Coventry et al., 2008; Coventry et al., 2014; Gudde et al., 2016) and Reile (2015, 2016) claim distance from the speaker (the distinction between peripersonal and extrapersonal space) to be the central feature defining demonstrative words. On the contrary, Jungbluth (2003) and Rocca et al. (2019) find social elements more relevant than distance to self, and Peeters et al. (2015) extend this social approach to a broader (rather vague) distinction of psychological distance, in which they also fit the semantic effects on demonstrative production described in Coventry et al. (2014). Levinson et al. (2018) describe demonstratives as affected by multiple spatial, social and situational factors. Other works such as Enfield (2003) and Piwek et al (2008) disregard the role of speaker-centred space and argue that demonstratives encode events and features such as hearer’s attention and object saliency. Table 1.2 recaps the main studies and findings.

Some methodological considerations might put into perspective these findings. First of all, the varied task demands and constraints of each study make it difficult to draw comparisons. Specifically, the dimensions of the space on which the tasks took place, the degree to which the tasks or situations promoted social interaction and the degree of experimental control are key factors to consider.

Table 1.2: Summary of the studies on demonstrative production, organised by method used and outcome.

	Method			
Main factor for dem. use	Experimental (memory game)	Experimental (other)	Semi-structured	Observation Naturalistic
Distance from speaker	Coventry et al., 2008 Coventry et al., 2014 Gudde et al., 2016 Caldano et al., 2019 Reile et al., 2020	Bonfiglioli et al., 2009	Reile, 2015, 2016	
Social distance		Rocca et al., 2019		Jungbluth, 2003
Psychological distance		Peeters et al., 2015		
Accessibility			Piwek et al., 2008	Jarbou, 2010
Multiple factors			Levinson et al., 2018	Enfield, 2003

Arguably, the space in the tasks of Rocca et al. (2019), Piwek et al. (2008) and Peeters et al. (2015) was much smaller than in the studies that manipulated the position of the hearer using the memory game paradigm (Coventry et al., 2008; Gudde et al., 2016; Reile et al., 2020). In the first three studies, the participants could touch each other (including the distance represented in Peeters et al.'s photographs for the EEG experiment), whereas in the studies with the memory game paradigm, the participant and the interlocutor were at the ends of a 320 cm long table. Moreover, in the Rocca et al. (2019) and Piwek et al. (2008) study participants had to cooperate to solve a task, whereas the memory game required the speaker to only name the object to a passive experimenter placed at one or the other end of the table, and thus this task might not have been successful at simulating the dynamics of a conversational interaction. For these reasons, it is possible that in the Rocca et al.

(2019), Piwek et al. (2008) and Peeters et al. (2015) studies the participant's peripersonal space could have extended into the hearer's peripersonal space, whereas in the Coventry studies it did not.

Although the memory game paradigm does not seem ideal for the study of demonstratives in social interaction, it is the method that allows for the most precise manipulation of distance and thus the study of the mapping of demonstratives onto space and non-linguistic spatial conceptualisation. In turn, Rocca et al. (2019) and Peeters et al. (2015) present methods for contrastive use, with shorter spaces and with social variables, hence not allowing for the testing of spatial distribution of demonstratives with such precision. Therefore, future research might unify methods and demonstrative functions under study (contrastive or not contrastive) in order to elucidate which factor – egocentric distance, social space, or other variables – is the decisive or central factor around for the mapping of demonstratives onto space. Or perhaps, under which circumstances and in which languages each of those factors play a role in the use of demonstratives.

In conclusion, these theoretical frameworks are not completely mutually exclusive, and findings may be highly dependent on the tasks. In an attempt to integrate the variety of results from the literature, I propose an account for demonstrative mapping based on the idea of *objects' potential to be manipulable.* This proposal integrates the conceptualisation of space into peripersonal and extrapersonal, the effects of object characteristics observed in demonstrative use (Coventry et al., 2014), as well as the notion of manually affordable objects (Rocca et al., 2019; see also Rocca, Tylén & Wallentin, 2019), and might be extended to account for the effects of social interaction (Peeters et al., 2015; Peeters et al., 2016). Objects within reach, as well as visible, familiar, graspable, non-dangerous and owned objects are all objects that are potentially manipulable, either by physical or conceptual reasons, and are named more often by the proximal demonstrative. In that sense, object characteristics interact with reachable space to form a conceptual category of potentially manipulable space and objects. This is supported by the notion that the boundary between peripersonal and extrapersonal space is not clear cut. Moreover, the frequency of use of the proximal demonstrative decreases gradually and not abruptly for further objects, possibly because the reachable space can be extended through stretching and locomotion (Longo & Lourenco, 2006), that is, objects slightly far from reach may still be potentially manipulable. This idea could be extended to explain the effects of social interaction in demonstrative use described in the literature, in specific, the use of the proximal demonstrative in the hearer's peripersonal space in collaborative tasks in a reduced surface. The expectation that the conversational partner might manipulate the objects on their side to achieve a common goal might elicit the use of proximal demonstratives on their peripersonal space because the space within the partner's reach might be conceptualised as an extension of the speaker's manipulable space (the speaker can manipulate those objects by asking the hearer to grasp them). This would be one additional way in that the boundaries of peripersonal space can be bent when speakers have the perception or expectation of interacting with objects further than their own hand reach.

This proposal is also introduced in Chapter 4, where we test sensitivity to distance and ownership throughout development. We confront the idea that demonstrative use is affected by manual affordances, and suggest that the distinction is of conceptual manipulability. Moreover, sensitivity to object semantic characteristics (i.e. ownership in our study) and to distance from self appear parallelly and protractedly in development, further supporting the claim that demonstratives are not labels for close and far space. Instead, distinctions between demonstratives address a conceptual, broader perceptual distinction and reflect the way we meaningfully interact with the world.

1.3.Deictic Communication in Development

In the previous section, I presented an overview of the main concepts and issues regarding demonstrative use and space, and reviewed relevant research in adults. The second half of the chapter will present the field of deictic communication in development. First, I will briefly outline the emergence of pointing, joint attention and demonstratives in infancy, and their relevance to social and language development. Then, I present a review of empirical studies on children's acquisition of demonstratives' distance contrast and discuss the different approaches and outstanding issues and open research questions.

Pointing, demonstratives and joint attention in infancy. Before 9-months-old, infants only interact with either an object or a person (*dyadic* interactions). From 9 to 12 months onward, during what has been called the *nine-month revolution*, a major change occurs, and infants start engaging in *triadic* interactions (Tomasello, 1999). Such interactions involve a person and an object, and at least checking the other person's attention or eye gaze on the referent of interest (Tomasello, 1999). At around the same age emerges infant pointing, which is an essential element in deictic communication. Pointing is considered a universal communicative tool, although cultural variations include lip or chin pointing instead of the extended index finger (Diessel, 2006). Typical triadic joint attention events include coordinated pointing and eye gaze between two people and a referent (see Figure 1.4).

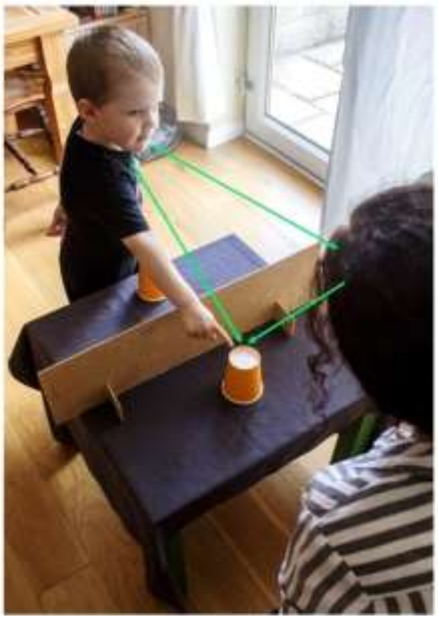

Figure 1.4: Triadic joint attention event: a speaker (the child) is directing eye gaze towards a hearer (the adult) and pointing at a referent (one of the cups).

The understanding and performing of pointing gestures is a milestone of enormous relevance in human development. Pointing means that infants can not only attend to what the adult indicates, but also direct the adult's attention towards what they are interested in. Moreover, pointing behaviour might indicate that infants acknowledge other people as *intentional beings*, which means that they are aware that others have mental states and try to influence them (Tomasello, Carpenter & Liszkowski, 2007). This behaviour is only observed in humans; trained non-human primates are capable of pointing to request an object (*imperative pointing*), but they do not point to share an interest (*declarative pointing*) (Tomasello, 1999, 2008). Moreover, the absence of interest sharing is a diagnostic criterion for autism, and reduced or impaired pointing gestures (particularly declarative) have been found in infants with this developmental disorder (for a review, see Ramos-Cabo, Vulchanov & Vulchanova, 2019).

Another developmental process that is tightly linked to the acquisition of pointing and joint attention is language development. As Iverson and Goldin-Meadow state, “gesture paves the way for language development”. The combination of pointing with single words multiplies infants’ communicative possibilities when they do not yet have the ability to form two-word utterances, and predict later vocabulary (Iverson & Goldin-Meadow, 2005). Moreover, pointing might be the way in which children request the name of the object that is their focus of attention, and thus actively help them learn new words.

Considering the early emergence of pointing, its relationship with language development and the tight link between pointing and demonstrative words, it is only expected to find demonstratives very early and frequently in child vocabulary – and that has been the general consensus to date (Clark, 1978; Clark & Sengul, 1978). Clark suggested that children start using demonstratives often among their first 10 words, and always among their first 50. She proposed a developmental sequence for deictic communication (see Table 1.3) that starts with pointing, followed with the combination of pointing with a proto-demonstrative, later pointing with a demonstrative word and a noun. Finally, (probably much later) verbal deictic reference may occur without pointing.

Table 1.3: Developmental stages in deictic communication (Clark, 1978: 97).

Stage	Gesture		Utterance
1	point		
2	point	+	*da* (= *that*)
3	point	+	*that shoe*
4			*that coat is mine*

I would like to stress that verbal deixis is not limited to demonstratives. The study in Chapter 2 analyses data from child speech and parental report and suggests that demonstratives might not emerge among the first 50 words, but more often after the 100th word and in two-word utterances. However, as Clark (1978) argues, demonstratives could take at first the form of *da* or *a* or some variation of a demonstrative. Thus, children might be using verbalisations that have the function of a demonstrative from very early in their development. As in the example of the toddler that said "*ah, ah*" to direct the adult's attention towards the pointed object (the biscuits' tin), other non-word verbalizations can act as deictic words. Moreover, words like *look* are also deictic, in that they direct the hearer's attention to a referent on space. An in-depth discussion on this issue is in Chapter 2.

1.4. Acquisition of Demonstratives: Literature Review

Two-year-olds use demonstratives as a means to establish and manipulate joint attention over particular referents, or as part of set word constructions (e.g. *I'm here!*). It is unlikely that children use and interpret demonstratives according to their spatial meaning. Although young children can use some spatial words quite early on (such as *up*, *down*), demonstratives seem particularly difficult spatial words to master. Some of the reasons why their acquisition might be delayed are the following:

- *Demonstratives' main function is not spatial contrast*. Demonstratives' most prominent function (unlike other spatial words such as *under* or *left*) is not to specify a location, but to direct joint attention. In most circumstances, pointing and eye gaze provide sufficient information to identify the referent, and knowing the spatial semantics of the word is not essential. This relates to the next point.
- *"All-rounder" demonstrative words*. The unmarked term *that* might be a valid word for most referents that are not immediately next to the speaker in non-contrastive situations. Likewise, *there* is an appropriate word for every place except for the speaker's own location. The learning opportunities in which the two words of the pair (*this/that, here/there*) are confronted (e.g. "*not that one, this one"*) might be scarce.
- *Blurry boundaries*. the distance that divides the use of proximal and distal demonstrative is not clearly defined and it might change, given the presence of other people or the characteristics of the objects or situation.
- *Complex spatial contrast.* As we detailed in the previous literature review, the exact way in which demonstratives map onto space remains unclear. Adults do not have clear rules as to when to use either demonstrative word, no more than an

intuitive and vague idea of proximity (as found upon debrief on studies using the memory game paradigm). Therefore, it cannot be explicitly taught to children and is not corrected in most situations. The adult usage of demonstratives depends on the development of the conceptualisation of space, and in the complex interplay between object semantics and the communicative situation.

- *Rapidly shifting deictic words*. Unlike other spatial words, demonstratives depend on the position of the referents with respect to the speaker. In a situation in which multiple speakers talk about the same object, they might use different demonstrative words, and more so if the elements are in motion. This, together with the previous point, create a complex learning input for infants.

In conclusion, demonstrative words are very frequent and early words, but their adult-like comprehension and production might be difficult or delayed due to their complexity and characteristics. First, according to Clark (1978), demonstrative acquisition requires acquiring the *distance principle* and the *speaker principle:* learning demonstratives encode a distance contrast and that such contrast is anchored to the speaker (and not to themselves or to the space). Then, in order to achieve an adult-like demonstrative use, children might need to have a mature conceptualisation of space (i.e. structured around peripersonal/extrapersonal space) and demonstrative words must be *mapped* or linked to that conceptualisation of space.

We know little yet about how children go from their first deictic words to adult-like usage and understanding. To the extent of our knowledge, there is only one study that has tested children's use of demonstratives in non-contrastive situations. Küntay & Özyürek (2006) tested 4- and 6-year-old Turkish-speaking children using a semi-naturalistic task. Participants worked in pairs to build a Lego construction and their use of demonstratives was observed. Authors found that children make some distinctions with demonstratives, but significantly less than adults. These results are striking. However, a limited sample size (6 participants per age group) and because it looked at a language that explicitly encodes a non-spatial feature (i.e. addressee's attention) mean this study provides limited general information about the acquisition of demonstratives. The study that we present in Chapter 4 looks at demonstrative production in children age 7 and 11 years using the memory game paradigm. It likewise finds that children use fewer contrasts than adults in demonstrative use even at age 11.

Several studies have approached children's comprehension and production of demonstratives in their contrastive function. A correct interpretation of demonstrative words implies that the child can interpret distance (close or far) from the speaker. This is very interesting from the point of view of developmental psychology, as it implies that children recognise other people as having a different perspective to their own, and thus implying a degree of theory of mind and/or visual perspective taking. Therefore, knowing the acquisition process of demonstratives might contribute further to the understanding of children's social development. Studies that have approached this topic are scarce and the variation of their reports are significant. Here I present a review of all studies to my knowledge on this topic.

Studies on the acquisition of demonstrative's distance contrast. The studies in this review have presented children with two referents and asked them to either select one from verbal cues with demonstratives or name one using a demonstrative. The experimenter's position was manipulated, either next to the child or on the opposite side with respect to the referents, to test children's interpretation of demonstratives from their own and another person's perspective, respectively.

One problem that these studies face is that demonstratives naturally appear in coordination with pointing and eye gaze, and testing them in isolation might make the situation strange or anomalous. This issue was addressed by simply giving verbal cues (an instruction containing a demonstrative word) while looking only at the child's face and suppressing gestures. Given that demonstratives are learned in the context of joint attention, if the speaker does not show attention (any kind of pointing or eye gaze) to any of the referents, demonstratives seem meaningless. From a pragmatic point of view, there is no reason for someone to look only at you when referring to objects nearby and ask for an action to be taken that could easily be performed by themselves. A second issue in the testing of demonstrative comprehension is the proximity bias response; children tend to grab the closest object to themselves.

This review features seven studies, six of them developed with similar methods around the same period (Clark & Sengul, 1978; de Villiers & de Villiers, 1974; Webb & Abrahamson, 1976; Charney, 1979; Tanz, 1980; Wales, 1986) and one later study that attempts to find predictors of demonstrative comprehension (Chu

& Minai, 2018). The methodological differences that might explain the outcomes disparities will be discussed in depth.

Clark and Sengul (1978) tested the comprehension of *here*, *there*, *this* and *that*. Two identical toys were placed at the two discs on opposite sides of the table, either near or far the experimenter but both at the same distance from the child, in order to minimize the proximity bias. Therefore, in neither of the conditions (with the experimenter at the same side or at opposite sides of the table) did the speaker have exactly the child's perspective (see Figure 1.5). The child was asked to interact with either toy following experimenter's instructions such as *"make this chicken hop"* or *"make the dog over here turn around".*

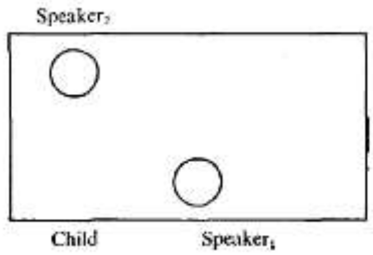

Figure 1.5: Position of child and experimenter in both experimental conditions in Clark and Sengul (1978). *Figure from the original article.*

Participants were 2;7 to 5;3 years old (*n*=36). Results indicate that children do not reliably interpret these terms as adults, not even at age 5 (only 67% of correct answers for *this* with experimenter opposite). All groups did significantly better at *here/there* than at *this/that*, and there was a proximity bias despite the layout (i.e. children picked more often the toy from their side of the table). They conclude that demonstratives are acquired after age 5, as only 5 out of 35 children seemed to interpret correctly both pairs of terms in both conditions. The authors identify some children that seem to be doing a partial contrast and find that the pattern of responses did not match a particular common strategy. Some children seemed to have a child-centred strategy (they interpreted demonstratives always from their perspective) and some had a speaker-centred strategy. Figures are unclear in the article because it collapses two experiments, but it seems that both partial-contrast strategies are equally frequent, and that most children were classified as making no contrast, i.e. using no identifiable strategy (See Table 5, p. 470, in Clark & Sengul, 1978).

To sum up, according to Clark and Sengul (1978), children acquire demonstratives after age 5 and through different trajectories. However, results need to be interpreted with caution because, as previously discussed, pragmatic factors seem most relevant in the understanding of demonstratives. Possibly, for a child to pass Clark and Sengul's task, they require the awareness and understanding of the *explicit rule* for demonstrative words. Imagine Speaker 1 in Figure 1.5 looking at the child's face and saying, "*make that cow turn around*". As mentioned in the introduction, *this/here* refers to the place the speaker is at, but *that/there* might refer to any other place, and further indications (i.e. pointing) are needed to identify the location. In order to understand the request, the child has to figure out that the speaker cannot be referring to the object next to themself, or else they would use *this,* hence *that* must refer to the other object. An added difficulty is that the other object (the correct referent in this case) is away from the child's scope of attention; moreover, it is away from the experimenter's attention, and the experimenter is not oriented to it in any way (body position, gesture, eye gaze). This situation might generate a conflict between verbal and non-verbal information, and it is likely that children (or possibly any adult outside an experimental setup) would rely more in the non-verbal cues. Thus, this task might underestimate children's understanding of demonstrative contrast.

De Villiers and de Villiers (1974) used a procedure arguably closer to a natural communicative situation and obtained much better performance. They tested the comprehension and production of *this/that, here/there* and other pairs of deictic words (*my/your* and *in front of/behind*). The set up consisted of a table divided in two by a screen and with a cup on each side. On the comprehension task, the experimenter hid an M&M under one of the cups and then gave a cue to the participant to find it, such as "*the M&M is on this/that side of the wall*" or "*the M&M is over here/there*". On the production task, the experimenter was blindfolded while another person placed the M&M under a cup. The experimenter asked the child where to find the M&M (while still blindfolded), for example, "Is it on *this* side of the wall or *that* side of the wall?", to what the child had to answer using demonstratives. The comprehension task was only performed with child and experimenter on opposite sides, whereas the production task was performed on both sides. Participants were 39 children aged 2;6 to 4;6. Results in comprehension reflect a proximity bias, and indicate that the majority of children from age 3 can distinguish between demonstratives, reaching ceiling at 4. Production results are more irregular through development: the majority of children chose the correct word without reaching ceiling, and developmental patterns are unclear. Results are to be taken with caution, given the small sample size for a developmental period of two years and the absence of a same-sides condition for the comprehension study.

The procedure in the de Villiers and de Villiers study might have simulated a more natural communicative situation with justified requests in comparison with the Clark and Sengul (1978) procedure; a hide-and-seek game, that children are familiar with, might indicate to them that the instructions are deliberately incomplete (i.e. lacking pointing) as part of the game. In other words, children might have understood that it "made sense not to point", and thus were not confused by the discrepancy between non-verbal and verbal cues. Likewise, the wall and the instruction *this/that side* make evident that there are two sides of the space to which we will refer as *this* and *that*, as opposed to the Clark and Sengul study, where *that/there* could mean "anywhere but *here/this*", thus possibly requiring the two-step mental computation previously explained.

Webb and Abrahamson (1976) tested the comprehension and production of *this* and *that* on 4- and 7-year-old children (n = 60). In this case, the referents were placed further away from the speakers, respectively at 15 cm and 62 cm away from the participants, on the floor. The comprehension task consisted in selecting one among two identical toys with cues such as *"would you pick up this/that toy?".* In the production task, children had to indicate to the experimenter which object they wanted using a demonstrative. Results indicate poor comprehension of 4-year-olds and 75% correct in 7-year-olds. As for demonstrative production, only two participants used an inappropriate demonstrative in the production task, i.e. used the proximal demonstrative for the distal object (since using *that* for either object is accepted). They compare their results with the de Villiers and de Villiers (1978) study. They argue that the de Villiers and de Villiers study is a much more "natural and supportive procedure", because of the inclusion of feedback, a clearly divided space, and the own nature of a hide-and-seek game (close to child play). Webb and Abrahamson explain their findings framed into the Piagetian theory, arguing that demonstratives do not require complex mental rotation, but only a more primitive notion of proximity, and that procedural differences could affect importantly child performance.

Charney (1979) studied the comprehension of *here* and *there* using referents placed far apart (115 cm), but adding a third condition called *neutral perspective* in which a referent was placed far from both the experimenter and the child. The instruction was: *"See the airplane? See the train? Which one is over here/there?"*. The procedure included plenty of warm-up time, such as following other instructions to manipulate the toys. This is likely to have contributed to ease the engagement in the experimental trials. Participants were 2;6 to 3;6 years old. (*n* = 25). The results show good performance from age 3. The opposite perspective condition was more challenging than the same perspective and neutral perspectives, but there was not a clear egocentric response pattern at any age.

An experiment with a slightly different approach is the study on the comprehension of *this*, *that, here* and *there* by **Tanz (1980, p83)**. Tanz tried to overcome the problems of suppressing eye gaze and gestures with the use of dolls. Two plates stood between the child and the experimenter at the sides of the table (at the same distance from both of them), and two dolls (the "speakers") were each next to a plate. The task consisted of finding a coin under one of the plates following doll cues such as *"the plate over here/there has the penny under it"* or *"this/that plate has the penny under it".* Participants were children aged 2;6 to 5;3. Performance was low at all age groups, much in line with Clark and Sengul's (1978) results. The easiest term was *this*, then the locative adverbs *here/there* and clearly the word with the least correct answers was *that*. Tanz argues that this might have been due to *saliency:* the plate next to the speaking doll receives more attention, and therefore is more likely to be chosen. However, and as mentioned in Clark and Sengul's study, the processing of *that* in this procedure could require awareness of the rule that applies to the word and a two-step mental computation. Another potential problem of this work is that the dolls were not situated on the same side of the referents as the experimenter, thus it might have been confusing to understand where the cues come from.

To sum up, the works reviewed so far indicate that demonstratives might be acquired at any point between age 3 and beyond age 7, with significant differences between studies. The effect of the different procedures was tested by **Wales (1986)**.

A within-participants design compared the effect of several methodological manipulations: a screen dividing far and close space (de Villiers & de Villiers, 1974), having the speakers on the sides (Tanz, 1980) or having the objects situated further away as opposed to on the table (Charney, 1979; Webb & Abrahamson, 1976). Participants were 4- to 7-year-old children (*n*=80), and they were asked to manipulate one of two toys with instructions such as "*make this pig jump*". Results do not show important differences between methods, except for a facilitation effect of the screen under some conditions. As in other works, no advantage of sharing perspective with the experimenter was found (i.e. no egocentric bias), but there was a proximity bias. Importantly, there was only one trial per word and condition and no practice trials, thus children's capacities might have been underestimated.

The percentage of correct answers for each age group varied little between ages 4 and 7, from slightly above 50% to around 75%, depending on the task or condition. Thus, performance at age 7 is not near ceiling, and there is a large developmental gap from the comprehension of deictics in certain circumstances up until a full contrast. Wales argues that, although children have some notion of the deictic contrasts, there is no absolute level of performance, and the competence is limited and expressed in situation-specific contexts: "*the acquisition of these terms is a gradual process of putting a system of contrasts together and learning when and how it is appropriate to apply them."*

A recent work (published during the data collection stage of the study in Chapter 3) focused on demonstrative comprehension in relationship with theory of mind. **Chu and Minai (2018)** tested demonstrative comprehension in relationship with theory of mind in English and Mandarin in 3- to 6-year-old children. They used two different procedures for testing demonstrative comprehension with the participant sharing the speaker's perspective and with a different perspective; in the first case, it was a task with two physical referents as in previous literature, whereas on the latter it was an on-screen task involving two characters. Unlike in previous works, they find better performance in the same-side condition. However, authors only analysed the number of correct answers on *this*, arguing that *that* is unspecific (i.e. might be used for any referent). Therefore, correct responses on the same side task are confounded with the proximity bias. It is also unclear whether the task for testing other-perspective demonstrative comprehension was harder, because of the absence of physical objects. Percentage of correct answers by age group are not reported. Authors claim that children first learn the demonstrative contrast from their own perspective, and that demonstrative comprehension from other's point of view is predicted by theory of mind and executive functioning. It is unclear whether this is a result of the potentially higher demands of the latter task, or whether there is a covariant such as age or language skills that develops through the age range between 3 and 6 and that may better explain the findings. Therefore, Chu and Minai's work does not provide enough evidence to prove the role of theory of mind in the acquisition of demonstratives, nor it clarifies the discrepancies in the literature. These issues will be addressed in detail in Chapter 3.

Conclusions. After reviewing all the developmental studies in the acquisition of demonstratives, few clear findings were found. The clearest result is that children do not learn demonstratives from a particular perspective, i.e. do not typically show an egocentric bias or a task facilitation when they share perspective with the speaker. Moreover, a potential task artifact emerged: a tendency of children to select their closest object (proximity bias). Discrepancies across studies in acquisition age are very large, and setup differences as tested by Wales (1986) do not provide a satisfactory explanation. Thus, the nature of the communicative situation and how it avoids the conflict with pragmatic or non-verbal cues (as in de Villiers and de Villiers, 1978) or task warm-ups and playful situations (as in Charney, 1979) might be the key to assessing children's real capabilities.

According to the most optimistic studies, children may understand the deictic spatial contrast in demonstratives at age 3 or 4, even when the speaker's perspective conflicts with theirs. This ability for taking other's perspective seems extraordinarily early, and might happen before acquiring the ability of spatial mental rotation or perspective taking. Framed into a larger picture of child development, it is interesting to know what skills predict this milestone. Inversely, if a particular child can interpret correctly demonstrative words, what does it tell us about their development? Chapter 3 presents a study on demonstrative comprehension in relationship with other measures of child development. It is an adaptation of the de Villiers and de Villiers (1974) study, in which we increased the number of trials and minimized the effects of the experimental isolation of demonstratives from the communicative situation by delivering the instructions through a hand puppet – an agent that appears to point or direct gaze, but in a way that is not specific to either target. The reason for choosing this procedure is that it is, as previously discussed, an arguably more natural communicative situation, and with a clearly divided near-far space. Moreover, the de Villiers and de Villiers study reported an earlier acquisition of demonstratives with respect to other studies (such as Clark & Sengul, 1978), thus it might be more sensible to children's real abilities.

1.5. Thesis Outline

This thesis will present studies on demonstratives across development and focusing on different goals. The overall purpose is to explore the possibilities that demonstrative words offer for the study of child development, and more specifically their development of deictic communication, perspective taking and their conceptualisation of space. This chapter has overviewed the concepts and issues in the study of deictic communication, and set the basis for its study in development. Chapter 2 discusses with the acquisition of demonstratives in early stages of language development, (age 18 to 24 months); Chapter 3 features a study on the acquisition of the distance contrast in demonstratives in comprehension (ages 3 to 5); Chapter 4 presents a study on children unconstrained demonstrative production (ages 7 and 11); Finally, a closing chapter will summarise the main findings and discuss further possibilities of this research topic.

Chapter 2

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Early acquisition of demonstratives

This work has been published as

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Acquisition of Demonstratives in English and Spanish

Infants communicate about objects and locations in space early in development. By interacting with their caregivers in relation to an object, they are engaging in *deictic communication.* This happens by 12 months, before children have learnt their first words, with the onset of pointing (Tomasello, Carpenter & Liszkowski, 2007). Pointing is a deictic gesture, and is crucial in language acquisition as it supports word learning and facilitates the transition to two-word utterances (Iverson & Goldin-Meadow, 2005). Demonstrative words (*here*, *there*, *this* and *that*) are deictic terms. They function to establish joint attention, and often appear in conjunction with pointing (Diessel, 1999, 2006; Todisco, Guijarro-Fuentes, Collier & Coventry, in press). Given the importance of deictic pointing in language acquisition, it is plausible that demonstratives also have a central role, and therefore would be some of the first and most frequent words of infants - this assumption has been conventional in the literature (Clark, 1978; Clark & Sengul, 1978). Clark claimed that demonstratives are typically acquired among the first 10 words, and always among the first 50. Her claim was based on observational studies with English speaking American children (Nelson, 1973; Braine & Bowerman, 1976) and single-case diaries of other languages. However, no systematic empirical work has addressed this issue.

Given the recent growth of child language databases and the emergence of tools to process them, it now seems appropriated to re-evaluate the claim that demonstratives appear at the start of language development, and are thus foundational to deictic communication and word learning. Several works on child early speech challenge the claim of an early acquisition of demonstratives. Caselli, Bates, Casadio, Fenson, Fenson, Sanderl, and Weir (1995) described the language acquisition of English and Italian speakers based on parental report with the MacArthur-Bates Communicative Development Inventory (CDI) on over 800 children, and did not find any demonstratives among the 50 words first produced in either language. These data are striking but inconclusive, since the sensitivity of parental report to detect function words in child vocabulary is as yet unclear (Salerni, Assanelli, D'Odorico, & Rossi, 2007). Rodrigo, González, de Vega, Muñetón-Ayala and Rodríguez (2004) observed deictic communication in child-mother dyads. They found deictic words to be rare before the age of two and more frequent afterwards, whereas younger infants established joint attention often by using a non-word vocalisation in combination with pointing. In line with this, Capirci, Iverson, Pizzuto and Volterra (1996) found a small proportion of deictic words in 16- and 20-month-old Italian infants, and a greater proportion of deictic gestures (in combination or not with a content word).

This evidence challenges the idea that demonstratives are essential words in early child speech. It instead suggests that deixis in early stages of language acquisition could rely on gestures, or verbal expressions other than demonstratives.

The aim of this work is to test the claim of an early acquisition of demonstratives to assess the role of these words in language development and deictic communication in infancy. To that aim, we look at child productive speech between 18 and 24 months, which encompasses the typical onset of expressive language and development towards two- or multi-word utterances. We compare demonstrative acquisition in two languages, English and Spanish, chosen because of the differential characteristics of their demonstrative systems (greater syllabic and morphological complexity in Spanish) and because both languages have a large amount of data available as open source for study. Data are obtained from two large repositories of child language acquisition: the CHILDES corpus, comprising transcripts of child spontaneous speech, and the MacArthur-Bates CDI Wordbank, comprising data from parental surveys. A secondary aim is to describe the use of demonstratives in English and Spanish in infant speech and parent-directed speech.

Demonstratives in English are the words *this* and *that* (and their plural forms *these* and *those*) and the locative adverbs *here* and *there*. *This* and *that* can function as pronouns (e.g. "what is *that*?"*)* or determiners (e.g. "*that* book on the right"). Most authors include locative adverbs in the category of demonstratives (Diessel, 1999, 2006), although their functions differ slightly; locative adverbs specify a place, whereas determiners and pronouns refer to an object, and are often not used with the aim of disambiguating object position. Spanish demonstratives have three terms instead of two, for proximal, medial and far distance, and vary not only in number but in grammatical gender. See Table 2.1 for a full list of Spanish demonstratives. We will compare data from determiners/pronouns with data from the locative adverbs, and ask whether they might have different roles in child speech and be acquired at different times. To preview the results, locatives appear to be acquired earlier, particularly in English, and unlike determiners/pronouns, they do not correlate with language development, measured by mean length of utterance (MLU). Thus, determiner/pronouns and locatives may have different roles.

Table 2.1. Demonstrative words in Spanish.

<table>
<tr><th></th><th></th><th colspan="2">Proximal</th><th colspan="2">Medial</th><th colspan="2">Distal</th></tr>
<tr><th></th><th></th><th>Det/pro</th><th>Locative</th><th>Det/pro</th><th>Locative</th><th>Det/pro</th><th>Locative</th></tr>
<tr><td rowspan="3">Singular</td><td>Male</td><td>este</td><td rowspan="5">aquí
acá</td><td>ese</td><td rowspan="5">ahí</td><td>aquel</td><td rowspan="5">allí
allá</td></tr>
<tr><td>Female</td><td>esta</td><td>esa</td><td>aquella</td></tr>
<tr><td>Neutral</td><td>esto</td><td>eso</td><td>aquello</td></tr>
<tr><td rowspan="2">Plural</td><td>Male</td><td>estos</td><td>esos</td><td>aquellos</td></tr>
<tr><td>Female</td><td>estas</td><td>esas</td><td>aquellas</td></tr>
</table>

Note: Spanish locative adverbs *aquí* and *acá*, and *allí* and *allá* will be treated as synonymous in our work.

Sources of child speech data. The CHILDES project is a collection of corpora that feature transcripts of first language acquisition (MacWhinney, 2000). The earliest transcripts date back to the 1973, and it has grown greatly since. The *childesr* package for the statistical software R now allows extracting data from all selected transcripts simultaneously. The MacArthur-Bates CDI (Fenson, Marchman, Thal, Dale, Reznick & Bates, 2007) is a family of parent inventories that collect data of child expressive and receptive vocabulary and gestures in multiple languages. It has been extensively used as a measure of language development for over 20 years. Since 2017, data are available to use in a structured database called Wordbank, that features data from more than 75000 children (<http://wordbank.stanford.edu>; Frank, Braginsky, Yurovsky & Marchman, 2016).

As methods for the study of child language acquisition, the analysis of spontaneous speech and parent report have different strengths and potential biases. The advantage of CHILDES data is that they feature naturalistic language production, including parent child-directed speech. However, they do not contain the child's total vocabulary size, and the words in a transcript might be task biased, and not fully representative of child speech in other contexts. The CDI's main strengths are very large sample sizes and that it applies the same items to all children.

Abundant studies support the CDI as a reliable and valid measure of child language development (Dale, Bates, Reznick & Morisset, 1989; Feldman, Dale, Campbell, Colborn, Kurs-Lasky, Rockette, & Paradise, 2005) with high predictive validity even several years later (Can, Ginsburg-Block, Golinkoff & Hirsh-Pasek, 2013). However, CDI data could underestimate function words in children's vocabulary, as opposed to child corpora, where they might be overrepresented (Salerni et al., 2007). Demonstratives are generally studied within the category of function words in the literature in language acquisition, together with words such as articles, prepositions, and conjunctions. (Caselli et al., 1995; Salerni et al., 2007). Moreover, it has been suggested that parents from low socioeconomic status background (SES) could be less accurate at reporting their child's vocabulary in inventories. Higher CDI total scores have been reported for low SES children relative to high SES children, whereas the literature has consistently reported a disadvantage in language acquisition for children from low SES backgrounds (Reznick, 1990; Fenson, Dale, Reznick, Bates, Thal, Pethick... & Stiles, 1994). In the case of function words, the demographic differences in parental report might be higher, because these words might be harder to detect (Fenson et al., 1994). Thus, it has been suggested that neither corpus data nor parent report are ideal methods on their own to estimate the frequency of a particular word type in child speech, and using both in combination has been recommended (Pine, Lieven & Rowland, 1996; Salerni et al, 2007).

To sum up, the principal aim of this work is to study the emergence and frequency of demonstratives in early child speech in order to re-evaluate our knowledge about the function of demonstrative words in early stages of language acquisition. An early acquisition of demonstratives (among the first 10 or 50 words as suggested by Clark) and high frequency would indicate an essential role of this word class for language acquisition and communication. Contrarily, a later acquisition or marked differences between-languages would support the hypothesis that demonstratives are just one of the possible forms of deixis, and not essential to language acquisition. Specifically, the acquisition of the first demonstrative words will be examined in relation to chronological age, mean length of utterance (MLU, in corpus data) and estimated vocabulary size (CDI data). Study 1 will examine the data from spontaneous speech and Study 2 from parent report.

Additionally, we compare the use of determiners/pronouns with that of locatives. Subtle differences between the two types of term may affect their developmental trajectory. We also compare parent and child use of demonstratives in the same conversation to examine whether parents tend to adopt the demonstratives used by the child regardless of their own perspective.

To preview the results, we find that demonstrative words do not typically appear among the first 50 words, and are more frequent in child's speech towards the age of two years and in two- and multi-word utterances than in the earliest stages of language acquisition. We find cross-linguistic differences, namely late acquisition of demonstratives in English with respect to Spanish. However, these differences are evident only in parental report data. The discussion will cover the implications for deictic communication and methodological considerations regarding the study of function words in child speech.

Study 1: CHILDES corpora

Study 1 investigates the acquisition and use of demonstrative words using data from spontaneous speech.

Method

Origin of the data. Data come from monolingual children aged 18 to 24 months from the European Spanish and British English corpora in CHILDES (MacWhinney, 2000). All transcripts that fit these criteria and included an interaction with the mother or father were selected. Seven Spanish corpora (Linaza, Vila, Serrasole, Aguirre, OreaPine, Nieva, and Ornat) and six British English corpora (Forrester, Wells, Manchester, Lara, Howe, and Cruttenden) were included. The British sample comprised 173 transcripts from 59 children, and the Spanish sample 92 transcripts from seven children (see descriptives in Table 2.2). The number of transcripts per child ranged from one to 39, and they will be analysed as independent data. Transcripts contained between 9 and 840 target-child utterances (M=240, SD=156); t-tests confirmed that there are no significant differences between languages in the number of child utterances by transcript for each of the age groups18-20 months, 21-22 months and 23-24 months (all ps>.3).

Parent data were obtained in most cases from maternal transcripts, because they were much more frequent than paternal transcripts and generally had more utterances. Paternal transcripts were used when maternal transcripts were not available. In the case of one child of the Spanish corpus (12 transcripts), the father was selected for all instances, because the mother had few utterances and was absent in three of them.

Data processing & analysis. Data were extracted and processed in R (R Core Team, 2018) in December 2019 using the R package *childesr* (Braginsky, Sanchez & Yurovsky, 2019). The number of occurrences of each demonstrative word for parent and child was computed. In Spanish we extracted proximal, medial and distal pronouns/determiners and locative adverbs (*este, ese, aquel*[1] including gender and number inflexions and *aquí, ahí* and *allí*, see Table 1) and English proximal and distal terms (*this, that, these, those, here* and *there*). In English, demonstratives also have non-deictic uses, such as *there is/are* to indicate existence or in fixed expressions such as *there you go*, and the conjunction *that* (as in *the lady that we met today*). This is not the case for Spanish. We were concerned about the possibility of children using these words non-deictically prior to the acquisition of proper demonstrative use in English. Thus, we checked manually the transcripts of the 10 children from the English corpus who produced only *that* or *there*, which could indicate this non-deictic usage (e.g., in the fixed expression *there you go)*. In all cases we found they apparently functioned as demonstrative words.[2]

All statistical analyses were performed on the raw frequencies. Due to differences in sample size between languages and the violation of the normality and homoscedasticity assumptions, non-parametric tests were used: Chi-squared tests (χ^2) were used for dichotomous variables and Mann-Whitney U Tests for continuous variables with Bonferroni adjusted alpha levels for multiple comparisons. The correlational analysis was performed with bootstrap.

[1] An alternative spelling of demonstratives in Spanish, now obsolete, features a written accent on the demonstrative pronouns (éste, ése…) to differentiate them from the determiners. *Childesr* word retrieval is sensitive to written accents, and we included both spelling forms in our search. The sensitivity to written accents allowed distinction of the verb form *está* (is) from the proximal, female demonstrative *esta*/*ésta*.

[2] We considered filtering out the non-demonstrative uses of these words using the MOR line of the transcripts, that specifies the word class of each word. However, after analysing several transcripts, we found this categorisation to be unreliable for demonstratives. Nevertheless, although the results might overestimate demonstrative use in English for parents, we do not consider this a serious concern for child data.

Table 2.2: Mean length utterance (MLU) and number of word types (number of different words) of the transcripts used, displayed by age and language.

	Spanish				English			
Age (months)	N of transcripts	N of children	MLU Mean (*SD*)	Word types Mean (*SD*)	N of transcripts	N of children	MLU Mean (*SD*)	Word types Mean (*SD*)
18	2	1	0.97 (0.07)	23 (15.56)	20	19	1.13 (0.2)	40.75 (27.29)
19	18	5	1.65 (0.5)	43.5 (17.47)	18	18	1.19 (0.21)	78.11 (47.52)
20	8	3	1.41 (0.18)	132 (45.68)	13	11	1.48 (0.36)	74.08 (56.24)
21	22	6	1.65 (0.41)	79.77 (44.43)	31	23	1.58 (0.38)	73.39 (50.47)
22	20	5	1.63 (0.36)	121.5 (63.63)	16	6	1.65 (0.26)	115.13 (23.06)
23	22	5	1.79 (0.39)	142.45 (65.91)	75	24	1.66 (0.41)	110.71 (41.53)
Total	92	7	1.64 (0.41)	100.04 (63.24)	173	59	1.54 (0.39)	90.2 (48.69)

Note: MLU was calculated on the number of words instead of morphemes, because the number of morphemes was not available for all transcripts. Therefore, unintelligible vocalisations (in the transcripts, xxx) were computed as words, and contracted forms (*I'm, what's)* were computed as one word.

Results

First, we describe children's acquisition of demonstrative words with respect to age and MLU, and which demonstrative terms appear in infancy. We then examine whether demonstratives are among children's most frequent words in our sample. Next, we look at the frequency of use of demonstratives per thousand words through development and in comparison with adult use. Finally, we test whether parents and children tend to use the same or opposite demonstrative terms within a conversation. The acquisition of the correct gender and number demonstrative forms as well as the distance contrast conveyed with demonstratives are not within the scope of this work.

Emergence of demonstratives in child speech. We first looked at the percentage of children who used at least one demonstrative word by age and by MLU (see Figure 2.1). A minimum of 60% of children used at least one demonstrative word at any age and MLU point for either language. Over 80% of children used demonstratives from the single word stage (MLU=1 to 1.5), rising to ceiling at MLU 1.5 to 2.

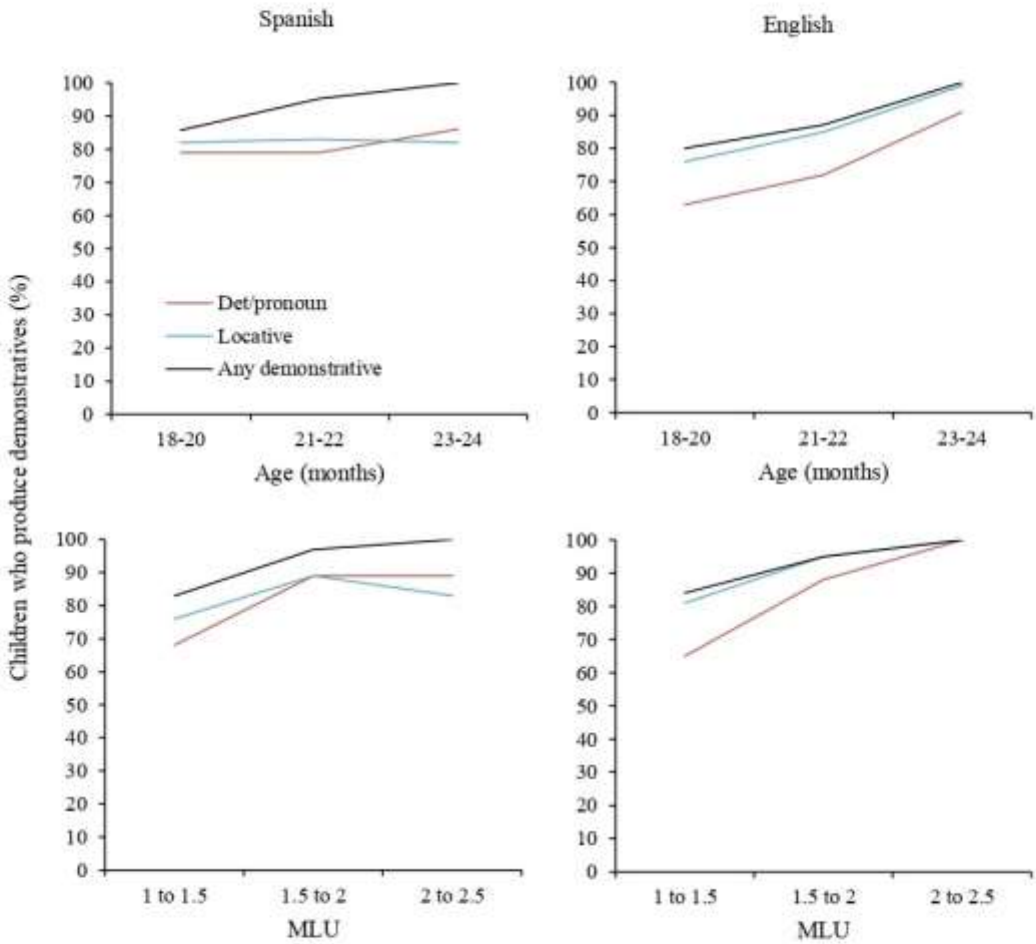


Figure 2.1: Children who produce at least one demonstrative word in CHILDES corpora, by language, above by Age and below by MLU (%).

There were no between-languages differences in the percentage of children who produced at least one demonstrative word: determiners/pronouns, χ^2 (1) = .32, p =.6; locatives, χ^2 (1) = 1.7, p =.2; or any demonstrative, χ^2 (1) = .59, p =.4. Locatives featured more often in children's vocabulary than determiners/pronouns:

in Spanish, χ^2 (1) = 3.96, p = .047; and English, χ^2 (1) = 42.76, p <.001. In Spanish, this difference was only significant for the youngest age group, 18 to 20 months (χ^2 (1) = 12.40, p <.001, Bonferroni adjusted alpha level of .017) and at none of the MLU bins. In English it was significant in the two youngest groups (18 to 20 months, χ^2 (1) = 14.25, p <.001; 20 to 22 months, χ^2 (1) = 13.85, p <.001), and the two lower MLU bins (MLU 1 to 1.5, χ^2 (1) = 20.42, p <.001; MLU 1.5 to 2, χ^2 (1) = 9.27, p =.002), Bonferroni adjusted alpha levels of .017.

Most common demonstrative terms in child lexicon. After finding that demonstratives featured in a similar proportion of Spanish and English transcripts, we tested which demonstrative words occurred in each language, irrespective of how frequently they were used. The percentages of children who used each demonstrative term at least once are displayed in Figure 2.2. A greater proportion of Spanish children than British children used proximal terms (*este/aquí*, *this/here*, χ^2 (1) = 9.5, p = .002). Contrarily, English distal terms *that* and *there* appeared in more transcripts than Spanish medial terms *ese* and *ahí* (χ^2 (1) = 9.78, p = .002). Spanish distal terms *aquel* and *allí* were rare:1% of Spanish transcripts featured the demonstrative *aquel* and 28% the locative *allí*.

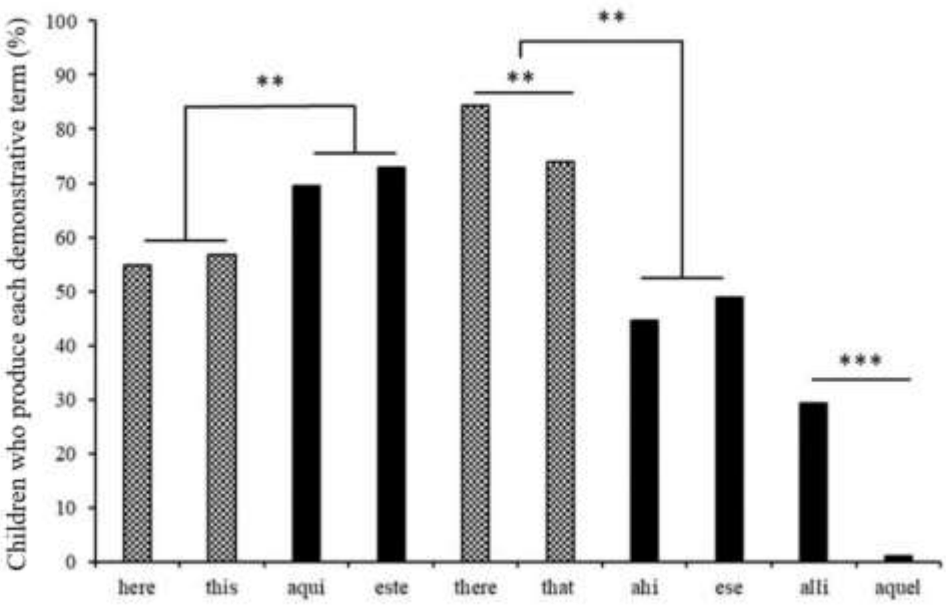


Figure 2.2: Children who use any demonstrative word in CHILDES corpora, by word (%).

Demonstrative frequency in child speech in relation to other words. Corpora transcripts were processed with the *tidytext* R package (Silge & Robinson, 2016) to extract the most frequent words in both languages. For this descriptive analysis, the *stem* transcript line was used. Some transcripts feature only the *gloss* transcript line. This contains the actual vocalisations of the child, and thus is unsuitable to count frequencies if one wishes to disregard phonetic errors. The *stem* line has the corrected word and the word root in case of verbs. There were 174 transcripts with *stem* line from English children (mean Age = 20 months) and 65 from Spanish children (mean Age = 21 months).

Word frequencies were computed for all words in all scripts for each language. Figure 3 displays the number of occurrences of the 20 most frequent words for each language. In Spanish, *este* (this), *aquí* (here) and *ahí* (there) were among the 20 most frequent words, in 11^{th}, 13^{th} and 17^{th} position respectively. In English, *there*, *that*, and *this* were among the 20 most frequent words. *There* was the single most frequent word in the corpus, and *that* and *this* occupied 4^{th} and 16^{th} positions respectively.

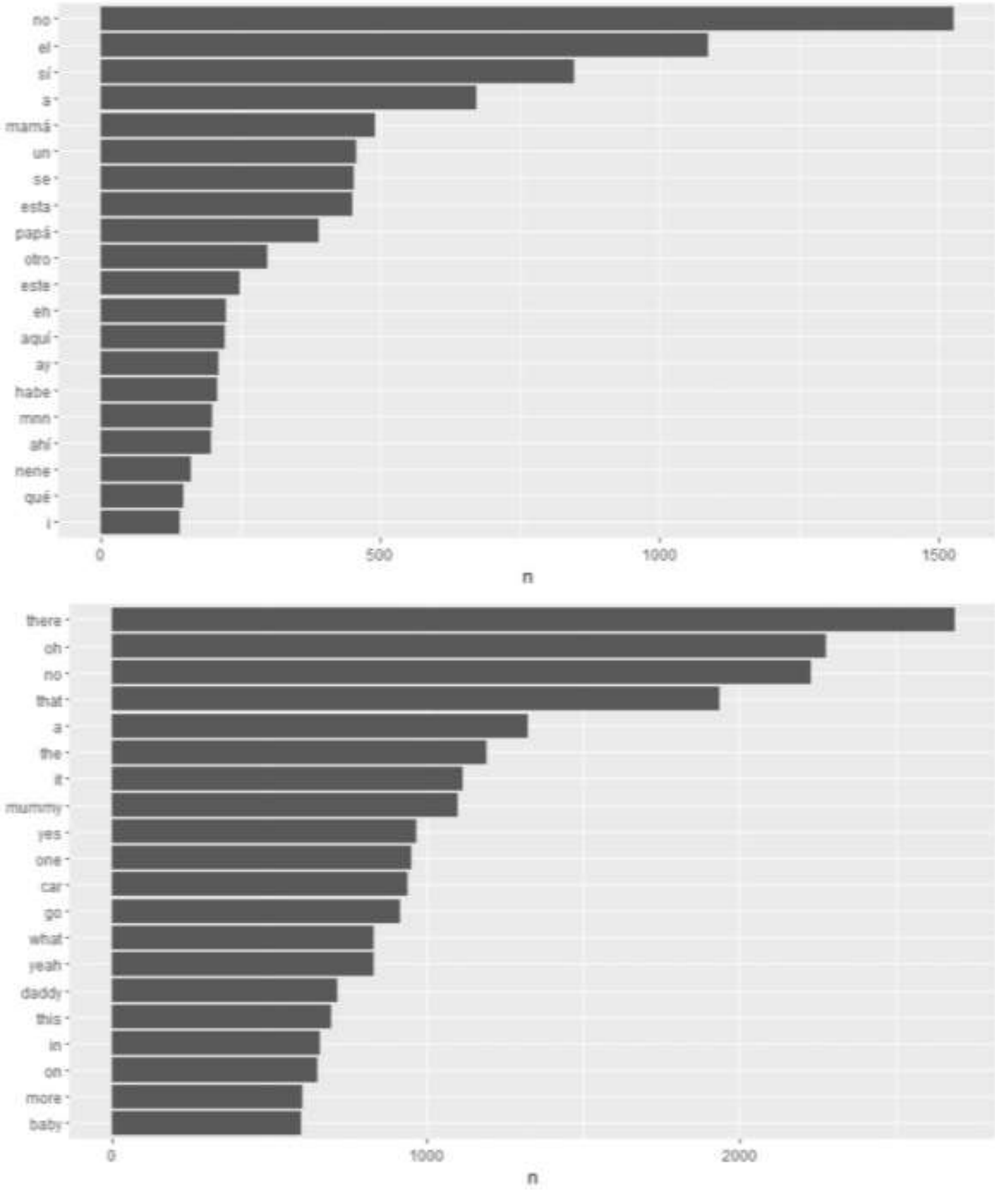


Figure 2.3: Word frequency of the 20 most frequent words in CHILDES corpora in Spanish, above, and British children, below. Notice in the Spanish plot the 8th word *esta* does not refer to the demonstrative word, but to the root of the verb *estar* (to be).

Demonstrative frequency in child and parent speech. The number of demonstratives per thousand words was computed for determiners/pronouns and locatives in both languages and is displayed in Figure 2.4. In child speech, determiners/pronouns were equally frequent in Spanish and English (28 vs 31 occurrences per thousand words, Mann-Whitney U Test, Z=1.0, p=.32). However, locatives were much more frequent in English than in Spanish in child speech (45 vs 22 occurrences per thousand words, Z=3.7, p<.001). In parent speech, both determiners/pronouns and locatives were slightly more frequent in English than in Spanish (determiners/pronouns, 26 vs 25 occurrences per thousand words, Z=3.6, p<.001; locatives, 15 vs 14 occurrences, Z=2.1, p=.03).

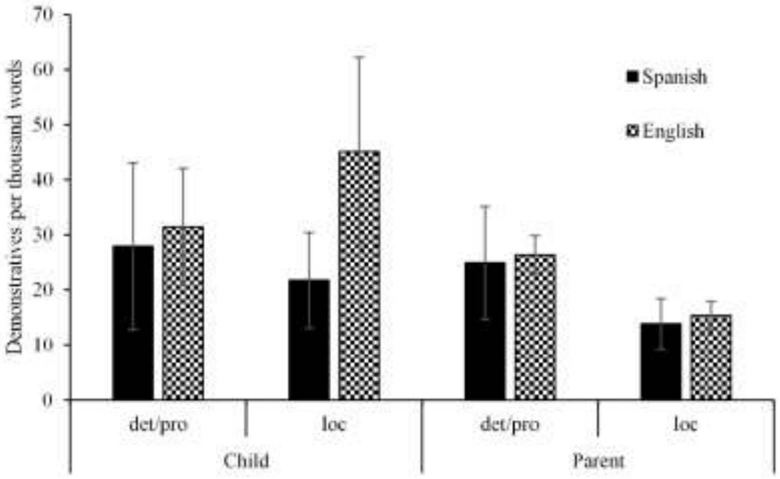


Figure 2.4: Mean frequency of determiner/pronouns and locatives per thousand words in CHILDES corpora, by language and speaker. Error bars correspond with the 95% confidence interval for mean. Note: demonstratives were present in all Spanish parents' transcripts and in 98% of British parents' transcripts.

Next, we examined demonstrative frequency across the age and MLU range using correlational analysis[3]. There were positive correlations between MLU and determiner/pronoun frequency in Spanish (r=.25, p=.02) and English (r=.20, p=.009): determiners/pronouns were more frequent in children with longer MLU. Locative adverbs did not significantly correlate with MLU in Spanish (r=.17, p=.11) or English (r=-.10, p=.19). Age correlated with MLU in English, r =.40, p<.001, but not in Spanish, r=.14, p=.2. Correlations between demonstrative frequency and age did not approach significance (rs<.15, ps>.14).

[3] Due to the number of outliers in the sample, bootstrap based on 1000 bootstrap samples was calculated. In none of the significant correlations did the 95% bootstrap confidence interval contain zero; therefore, we can be confident of the correlations' significance.

We also examined possible differences in child-directed speech across development. Parent demonstrative frequency correlated negatively with child MLU: parents used more demonstratives at the early stages of language acquisition and parent usage decreased with child language development: in English, r=-.17, p=.031, and Spanish, r=-.22, p=.037. Nevertheless, parents' and children's demonstrative frequency correlated positively in English, r=.41, p<.001, and Spanish, r=.277, p=.008. Changes in frequency of demonstrative words by MLU for children and parents are displayed in Figure 2.5.

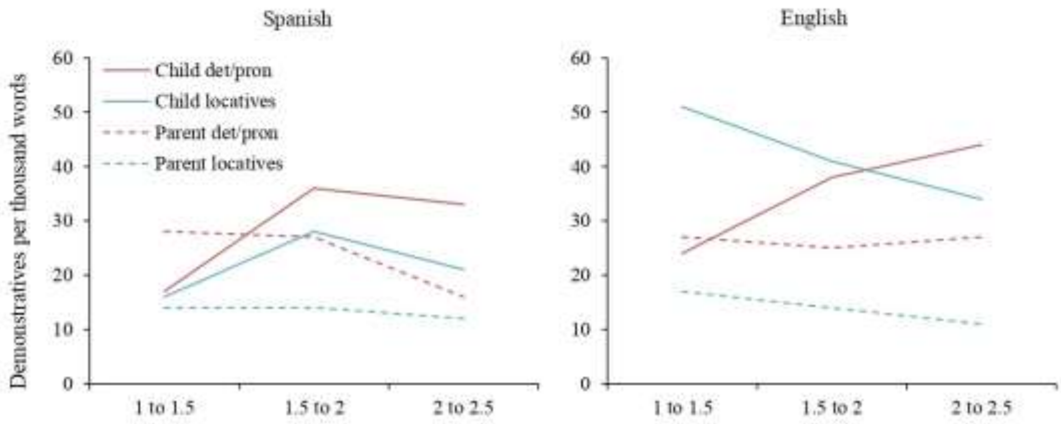


Figure 2.5: Demonstrative frequency per thousand words for children and parents at each level of MLU in CHILDES corpora.

Demonstrative types in child and parent speech. This analysis examined the relationship between the demonstrative words used by each parent-child dyad, particularly whether they tend to use the same demonstrative words during an interaction. A correlational analysis was performed on the frequency of each demonstrative word per thousand words between speakers (parent and child) within transcripts. Results are displayed in Table 2.3. Parents tended to use the same determiners/pronouns as the children, and rarely used others. This was also the case for distal locatives, but when children used proximal locatives parents were equally likely to use distal or proximal (English), or distal or medial (Spanish).

Table 2.3: Within-transcripts correlations between parent and child demonstratives' frequency per thousand words. Data from CHILDES.

			Child					
			Det/pronoun			Locative		
		Parent	Proximal	Medial	Distal	Proximal	Medial	Distal
Demonstrative	Spanish	Proximal	**.21***	-.00	-.04	**.26***	.03	-.03
		Medial	.17	**.42****	.05	.24*	**.19**	.03
		Distal	-.07	-.06	**-.02**	-.14	.04	**.40****
	English	Proximal	**.17***	-	.13	**.22****	-	.00
		Distal	.13	-	**.27****	.23**	-	**.28****

Conclusions of Study 1 (CHILDES data). Analysis of the spontaneous speech of 18 to 24 month old English and Spanish speaking children revealed that demonstratives are used by more than half of children from age 18 months, and at the single-word utterance stage. However, it is not until children are starting to produce two-word utterances that we see demonstratives in nearly all children. There were no significant between-language differences. What CHILDES data do not reveal is the order of acquisition of demonstratives, nor whether they appear among the first 50 words. That will be examined using parental report (CDI) data in Study 2. Findings from the descriptive analysis of CHILDES data on demonstrative use and parental input will be discussed in the General Discussion.

Study 2 (based on CDI-Wordbank data)

Study 2 investigates the acquisition of demonstrative words in English and Spanish using data from parental report. Specifically, we look at when the majority of children use demonstratives with respect to their vocabulary size and age in both languages.

Method

Origin of the data. Data come from 277 monolingual speakers of European Spanish and 673 of British English, between the age of 18 and 24 months. Sample distribution by age is displayed in Table 2.4. Data sources: López Ornat, S., Gallego, C., Gallo, P., Karousou, A., Mariscal, S., & Martínez, M. (2005); Floccia (2017).

Table 2.4: Sample size and mean productive vocabulary size and *SD* for each age and language group. Data from CDI Wordbank.

	Spanish		English	
Age (months)	Sample size	Vocabulary Mean (*SD*)	Sample size	Vocabulary Mean (*SD*)
18	50	70 (79)	118	51 (60)
19	27	84 (64)	109	82 (82)
20	36	117 (105)	144	110 (93)
21	41	144 (105)	75	130 (92)
22	38	184 (125)	28	151 (118)
23	30	230 (122)	112	187 (121)
24	55	257 (161)	87	220 (113)
Total sample size	277	No. items: 588	673	No. items: 418

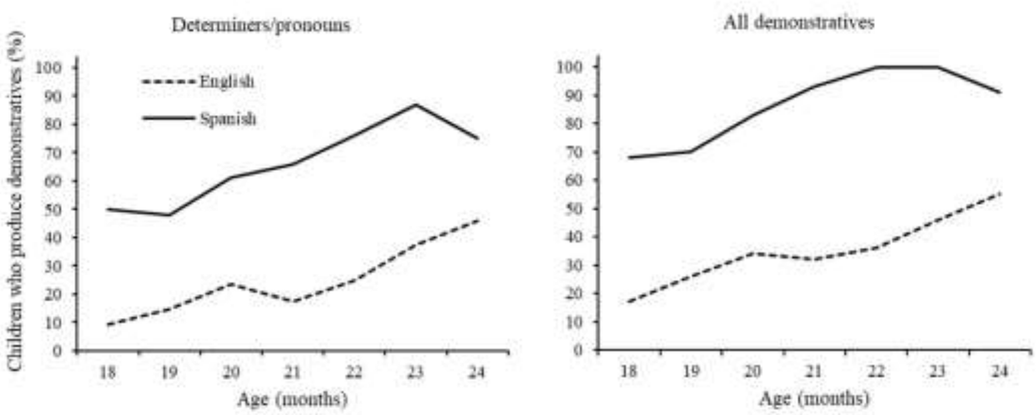
Instrument. The instruments used were the Oxford CDI for British English and the Words and Sentences for European Spanish (Hamilton, Plunkett & Schafer, 2000; López et al., 2005). These questionnaires are not a direct translation of each other, but an adaptation to fit linguistic and cultural differences. Therefore, although they include the same word categories, the Spanish version features more items (588) than the British one (418). The average vocabulary size for each age and language group is displayed in Table 4.

Demonstrative words in the English instrument include *this*, *that* and *there*, but not *here*, nor the plural forms *these* and *those.* The Spanish questionnaire features all demonstrative words, including gender and number variations (13 items, see Table 1).

Data processing & analysis. Data were extracted and processed using the *wordbankr* R package (Braginsky, 2018) on 25/11/2019. To make the two languages comparable, in Spanish we worked only with the singular forms of demonstratives[4]. A dummy variable was computed to indicate whether a child produced any demonstrative word, irrespective of the frequency. The percentage of children that produced demonstratives was compared at each Age and MLU level. Age levels were each month from 18 to 24 months. Minimum vocabulary size (CDI score) was binned in groups of 50 words (CDI score of 0 to 50 words, 51 to 100 words, and up to 400). Chi-squared tests on the raw data were used throughout. Two separate analyses were made, one for determiners/pronouns only, and one for all demonstratives including locatives.

Results

Acquisition of demonstratives by age in CDI data. Figure 2.6 displays the percentage of children who used at least one demonstrative word by age and language group. From 21 months onwards, more than half the Spanish children used at least one determiner/pronoun (*este*, *ese* and/or *aquel*). Including locatives, 68% of Spanish children produced at least one demonstrative word from 18 months, and approached 100% at 22 months. In contrast, only 9% of British children produced at least one determiner/pronoun word by 18 months, 17% when including locatives. At 24 months, less than 50% of English speakers produced determiner/pronouns, and 55% when including locatives. At any age point, a greater number of Spanish children compared to British children produced at least one demonstrative, whether or not locatives were included in the analysis (all χ^2s (1) > 10, *p*s <.001, Bonferroni adjusted alpha level of .007).



[4] None of the children produced only plural forms of demonstratives; plural forms in Spanish were always acquired after the singular forms. Therefore, this selection had no effect on the findings.

Figure 2.6: Children who produce any demonstrative word by age and language (%). Data from CDI Wordbank.

Acquisition of demonstratives by vocabulary size in CDI data. Figure 7 displays the percentage of children who used demonstratives by minimum vocabulary size (CDI score) for each language. Less than half of the English speakers produced determiners/pronouns below a vocabulary of 300 words. Including locatives, more than half of the children produced at least one demonstrative from 200 words on, and reached ceiling after 350 words. For the Spanish sample, more than half of children produced determiners/pronouns from a vocabulary of 50 words on, and when including locatives, from 0 to 50 words, reaching ceiling at a vocabulary of 150-200 words. More Spanish children than British children produced demonstratives up until a vocabulary of 250 words, either considering determiners/pronouns alone or with locatives (all χ^2s (1) > 10, *p*s <.001, Bonferroni adjusted alpha level of .006). There were no significant between-language differences thereafter (all χ^2s (1) >3, *p*s >.1).

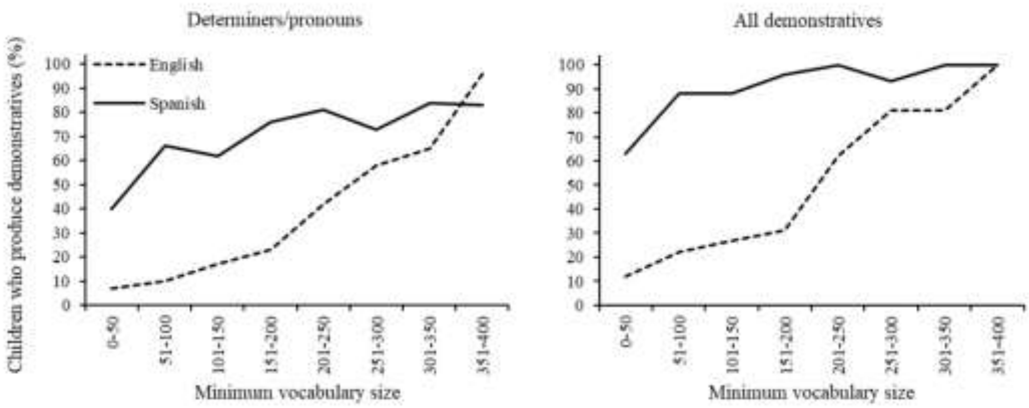


Figure 2.7: Children who produce demonstrative words by vocabulary size (%). Data from CDI Wordbank.

Conclusions of Study 2 (CDI-Wordbank data). Data from parental report reveal important crosslinguistic differences. The majority of Spanish speakers use at least one demonstrative from 18 months and among their first 50 words if locatives are included, whereas English speakers do not use demonstratives up until age two and a vocabulary size of 200 words, and even later if considering determiners/pronouns only. It was expected that fewer children would use demonstratives in CDI data compared to CHILDES data. However, the striking crosslinguistic differences solely in CDI data suggest possible sampling differences.

Demonstrative production and parental education in the Spanish sample. In the Spanish CDI sample, high education families were over-represented, with 77% of parents having college and graduate education. Maternal education is not reported in the British data, although it is presumably lower, since authors state that their sample SES was representative of the British population (sample composite or SES measurement were not reported in detail; Hamilton et al., 2000). Thus, our hypothesis is that the lower report of demonstrative use in British sample is due to the higher proportion of parents with low education, and the associated bias of underestimating children's knowledge of function words (Fenson et al., 1994). This was tested by analysing the differences in report of demonstrative words between high education level (college and University, *n*=222) and low education level parents (primary and secondary school, *n*=52) in the Spanish sample (missing cases, *n*=3). The mean age of children of both groups did not differ significantly (Mann-Whitney U, *Z*=-.38, *p*= .7), nor the total CDI score (Mann-Whitney U, *Z*=-.65, *p*= .5). More parents with higher education reported that their children used demonstratives, 88% vs 77%, $\chi^2(1) = 4.56$, *p*= .03. This supports the hypothesis that parental education might play a role in their accuracy in reporting demonstrative production. However, only 34% of British parents from our data reported demonstrative use, thus sampling issues cannot fully account for the cross-linguistic differences in Study 2.

General Discussion

This work aimed to describe the acquisition and use of demonstrative words in infants and possible cross-linguistic differences. In Study 1, we analysed corpus data, that allow measurement of mean length of utterance (MLU), word frequency and parent input. In Study 2, we looked at data from parental report, that feature a measure of vocabulary size and a large sample size. Results will help understand the role of demonstrative words in deictic communication and language acquisition in infancy. They are also interesting from a methodological point of view, contributing to assessing the suitability and validity of parental report and corpus analysis in the study of function words.

First, we asked whether demonstratives appear among children's first 50 words and at the earliest stages of language development (18 months). Results on age of acquisition differ between measures: according to the CDI results (Study 2), only around half of the English speakers use demonstratives by 24 months, whereas nearly all Spanish speakers used at least one demonstrative by the age of 22 months. In contrast, corpus data (Study 1) indicated that the majority of children of both languages produced at least one demonstrative word from 18 months and all of them did at 24 months. Data from CHILDES indicates that the majority of children from both languages use demonstratives from MLU 1 to 1.5, and reach ceiling with an MLU of 1.5 to 2. Data from the CDI showed at what point in vocabulary acquisition demonstratives appear. The majority of Spanish speakers have a demonstrative among their first 50 words (after the 50th word if considering determiners/pronouns only), reaching ceiling after the 150th word. In contrast, the majority of English speakers do not use demonstratives before their 200th word, reaching ceiling only after their 350th word. This reflects a great discrepancy between CDI and CHILDES data, and it is unclear which one of these sources reflects a more accurate estimation. Nevertheless, we can confidently say that demonstratives do not typically appear before the 50th word, and they are more frequent in two-word utterances. We cannot make any firm statement about possible cross-linguistic differences because the results we obtained were very different between the two sources. We will discuss the possible methodological and sampling sources of discrepancies.

It was expected that the CDI data would underestimate demonstrative production with respect to corpus data (Salerni et al., 2007); however, CDI data also show striking differences between languages, while the corpus data do not. We suggested that differences might be due to sample SES disparity between languages and measures. This bias could have affected the results at two levels: first, because children of parents with higher education levels have an advantage for language development (Hoff, 2006); and second, because parents of low educational level may underestimate children's knowledge of function words in language inventories (Fenson et al., 1994). In contrast to the CDI data, the CHILDES sample for English may have an overrepresentation of higher SES families: one of the two largest corpora that compose the English corpus (Manchester corpus) is formed of middle-class families, while the other (Wells) has a representative sample extracted from the birth censuses. Thus, the average SES level in the British sample might be higher in CHILDES than in CDI data. Comparisons between high and low education parents in the Spanish sample support the hypothesis that low educational level parents might underestimate their children's use of demonstratives, but it is unlikely that it can fully explain the magnitude of the differences between languages in CDI data. One possibility is that language-specific factors, such as phonetics, might pose a disadvantage for the identification of demonstratives in English. Having listened to several CHILDES transcripts, our subjective impression is that young infant's verbalisations of *there* and *that* were often hard to distinguish from babbling, whereas the Spanish words *esto* or *aquí* were easier to recognise, perhaps because they are disyllabic words.

As argued in the introduction, neither checklist nor observational methods alone are ideal for estimating the proportion of particular word types in children's early vocabulary (Pine et al., 1996). However, combining both methods did not offer conclusive results either, because it is unclear whether the disparity between the two studies is due to methodological or sampling differences. We encourage researchers to take into consideration demographic variables in studies of this kind, while further research that will apply both methods to the same participants is needed to evaluate its impact in the results.

The second aim of this work was to describe the use of demonstratives in child spontaneous speech (Study 1). The analysis of CHILDES data revealed no significant differences between languages in the acquisition of demonstratives with respect to age and MLU. However, it did show that proximal demonstratives appear more often in Spanish and distal demonstratives in English, both in terms of frequency of use and of percentage of children using them at least once. Thus, whereas the use of demonstratives by infants is not a language-specific communicative tool, the preferred demonstrative term varies across languages.

One striking finding is that locatives and determiners/pronouns do not seem to have the same function in language development. Locatives appear earlier and are more frequent, particularly in English and in earlier stages. They are less complex than determiners/pronouns, which are more frequent in children with higher MLU. The most salient difference between languages in children transcripts is in the locative *there/ahí*. In English, it was the most frequent word in children's lexicons, and its frequency was particularly high in the youngest children. In contrast, the Spanish equivalent *ahí* (and the proximal *aquí*) was no more frequent than the determiner/pronouns. Our hypothesis is that *there* in English (unlike locative adverbs in Spanish) functions as a fixed expression instead of a deictic term, or as a verbalisation linked to a particular action. This was the case for the children studied by Harris, Barrett, Jones, and Brookes (1988) and Barrett, Harris and Chasin (1991), who found that children acquired *there* among the first 10 words, but they used it in a very specific context: for example, one participant would only use it with the action of handing a toy. This use might be a precursor of the acquisition of deictic words (i.e., of generalising *there* to indicate location). However, the analysis of transcripts provides limited context, particularly those of infants in the single-word stage, and thus makes it difficult to assess when children use demonstratives in a ritualistic way or as a deictic communication tool. Future research in the development of deictic communication might take this into consideration, and perhaps analyse separately determiners/pronouns and locatives.

Another interesting difference between the two languages is in the frequency of demonstratives: in English, two demonstratives, *there* and *that*, were among the five most frequent words of child's lexicon, whereas in Spanish the most frequent demonstratives, the proximal terms *este* and *aquí*, are the 11^{th} and 13^{th} most frequent words. Demonstrative words were also very common in parent speech, although parents used fewer demonstratives than children per thousand words, presumably due to their larger vocabulary.

The analysis of spontaneous speech also allowed description of parent use of demonstratives. Data revealed that parents use more demonstratives in children's earlier stages of language development, as indicated by a negative correlation between parents' frequency of demonstratives and children's MLU. This might indicate that parents move on to use words that are more complex than demonstratives at the moment in their child's language development when they are acquiring new words at a fast rate.

Interestingly, the frequency of use of each demonstrative term correlated between parent and child. This has potentially interesting implications for later development of spatial demonstratives to convey distance and semantic information. That parent and child are using the same demonstrative word in a given speech suggests that children are not switching the demonstrative term, as happens in adult speech: frequently in an interaction with objects, the speakers view them from opposite sides and therefore use opposed demonstratives (the speaker may use *this* for an object closer to them, whereas the conversational partner refers to the same object with *that*). Our hypothesis is that parents repeat the demonstrative that the child uses in order to reinforce their word learning, while the spatial content of demonstratives (close or far) is not relevant at this stage. Taumoepeau and Ruffman (2008) have demonstrated that mothers are sensitive to what their child can and cannot understand in this age range; when talking about mental states, the speech parents use is only slightly more complex than their child's current level and within their zone of proximal development (Vygotsky, 1980), plausibly in order to aid their learning. This would predict that parents use demonstratives without considering their spatial dimension or deliberately adopt their child's perspective when the distance contrasts are too complex for the child's current level. One example of such behaviour might be in the following script (Anne, 1;11, free play with mother).

Child: What [is] baby doing?
Mother: Which baby?
Child: This baby.
Mother: This one?
Child: Yeah
Mother: Oh dear that baby's fallen out of the pram.

In this example, the child uses the proximal demonstrative, then the mother repeats it, but her next sentence features the distal demonstrative for the same referent. The child, mother, and the referent (the baby doll) do not apparently change location during the exchange, so the mother's appropriate demonstrative would have been *that*. However, the mother first repeated the child's demonstrative as a reinforcement. Here is another example, in Spanish (Mendía, 1;08, free play with mother, includes video):

Child and mother are playing on the floor. Child turns around and refers to a game that is located slightly further, indicating that he would like to play with it some more. The child uses the proximal demonstrative and the mother uses it too.

Child: éte [: éste]. - *This.*
Child: má [: más]. - *More.*
Mother: muy bien (.) ¿más? - *Very well. More?*
Child: má [: más]. - *More*
Mother: ¿éste? - *This one?*
Mother: ¿hacemos éste otra vez? - *Do we do this one again?*
Child: títo [/] [?].
Mother: ¿éste otra vez? - *This one again?*

This hypothesis, however, should be taken with caution, since there are frequent examples where it does not occur. There are also numerous events in which it cannot be assessed because only parent or child use demonstratives. Parents' use of demonstratives according to the child's perspective might be limited to a specific developmental stage. Further research could investigate parent-child synchrony of demonstratives in video-recorded interactions, to see at what stage in development parents take their children's perspective with demonstrative words and how it influences their subsequent acquisition of the spatial contrast.

Results from the CHILDES corpora are to be interpreted with caution because of the small sample size in Spanish (seven children). Individual differences and preferences might have been overrepresented in our results. The CHILDES database would benefit from more contributions of early speech in languages other than English. Particularly, parent-child interactions in video format would be a valuable addition to the study of deictic communication in infancy.

Conclusion

We studied the acquisition and frequency of demonstrative words in English and Spanish using transcripts of spontaneous speech and parental report data. Results indicate that demonstratives do not typically appear before the 50th word and are more frequent at the two-word-utterance stage than at the onset of productive language. This work challenges previous claims about the acquisition of demonstratives (Clark, 1978). In line with other studies that have looked at deictic communication in infants (Capirci et al., 1996; Rodrigo et al., 2004), we conclude that demonstratives may not be the most frequent means of early verbal deixis; other words or verbalisations may take that function earlier in development, whereas demonstratives become more frequent in more elaborate utterances later on. Our work is limited to two languages and shows important discrepancies between measures; nevertheless, it might encourage researchers to pay closer attention to other word types or vocalisations when studying verbal deixis in early language development.

From a methodological point of view, comparing parental report and spontaneous speech data in the study of function words has highlighted the potential limitations of both measures. Further research needs to examine the suitability, limitations, or improvement of both methods for the study of function words in child speech.

Chapter 3
-
Demonstrative Comprehension

Comprehension of Spatial Demonstratives and its Predictors

Demonstrative words (*here, there, this* and *that* in English) are very early and frequent words in child speech (Clark & Sengul, 1978; Diessel, 2006; González-Peña, Doherty & Guijarro-Fuentes, 2020). In coordination with pointing, they serve to direct an interlocutor's attention to an object on space, and so establish joint attention (Diessel, 1999). A correct understanding of demonstratives requires interpreting them relative to the speaker, and might be linked to the development of visual perspective taking and theory of mind observed around age four. However, it is as yet unclear at which point in development a mature comprehension of demonstratives is achieved, and the developmental milestones associated to it are unknown. This study is aimed to describe the acquisition of demonstrative comprehension and the developmental processes it is tied to.

Demonstrative words in English are defined as proximal (*here*, *this*) and distal (*there*, *that*), with flexible boundaries between them. The distal *that* is often used as a generic or unmarked term to refer to any object (Clark, 1973; Levinson, 2004); however, when speakers need to disambiguate between two objects they use *this* for the closer object to themselves and *that* for the further object, even when both are within hand reach (Bonfiglioli, Finocchiaro, Gesierich, Rositani & Vescovi, 2009). Despite the apparent simplicity of these words, the developmental process towards an adult-like use of demonstratives might extend even beyond the school years (González-Peña, Coventry, Bayliss & Doherty, *under review*).

It is clear that young children use and understand spatial demonstratives. However, this does not entail their understanding of the distance contrast. Few studies have addressed this question (Clark & Sengul, 1978; de Villiers & de Villiers, 1974; Webb & Abrahamson, 1976; Charney, 1979; Tanz, 1980). They presented participants with two competing objects and asked them to choose one according to cues with demonstratives. The acquisition ages reported vary considerably across studies: Charney (1979) and de Villiers and de Villiers (1974) find good performance by 3.5 years old, whereas Clark and Sengul (1978) and Tanz (1980) report poor performance at age 5, and Webb and Abrahamson (1976) even at age 7.

Experiments in demonstrative comprehension face at least two challenges: First, to suppress non-verbal cues without making the communicative situation anomalous and confusing. In the above studies, the experimenter looked at the child's face while delivering the instruction, whereas the more natural behaviour is to look and/or point at the object. Tanz (1980) solved this issue by delivering the instructions through dolls. Dolls or puppets can move in a way similar to people, are naturally treated as agents by children, but do not provide eye or head direction cues to the location of the referent. The second challenge is the response proximity bias, children's tendency to pick the closest object irrespective of the instruction or speaker's position. Some studies have solved this issue by placing both objects at the same distance from the child (Clark & Sengul, 1978; Tanz, 1980), with the disadvantage that it cannot fully assess children's demonstrative comprehension from their own position.

Discrepancies between studies in acquisition age might reflect a fragmentary understanding of demonstratives. Children show good understanding only under certain circumstances, suggesting that they lack explicit knowledge of demonstratives' distance contrast, or that it is not solid enough to rely on. Instead, children might preferentially attend to pragmatic and contextual cues to interpret demonstratives. For instance, if the experimenter asks the child to manipulate an object while giving no gesture information and maintaining eye gaze towards the child, all the cues seem conflicting with the verbal cue. Moreover, if the object is on the experimenter's side, presumably the child could infer that there is no reason why someone could ask to manipulate an object within their hand reach. Thus, children might rely more on any of those cues rather than on the demonstrative word. Procedures that minimize the conflicting cues or that are more similar to an ordinary communicative situation might thus reflect better children's real understanding of demonstrative's distance contrast, as it has also been argued by Charney (1979). De Villiers and de Villiers (1974) tested demonstrative comprehension using a hide-and-seek game, which is a situation that is familiar to children and with a clear goal. This might be the reason why they found an earlier acquisition age than Clark and Sengul (1978) or Webb and Abrahamson (1976). Moreover, de Villiers and de Villiers' experimental setup featured a screen dividing the space in close and far, making this distinction more evident, and possibly facilitating children's demonstrative comprehension (Wales, 1986). For these reasons, an adaptation of the de Villiers and de Villiers experiment will be used for this study.

The acquisition process of demonstratives, or the errors that children make, might provide important clues about the way they process these words. Following

Piagetian claims that children take an egocentric perspective in spatial tasks, it has been assumed to be similar with spatial words. This might be the case with words such as *left* and *right*, that children master from their perspective years before being able to indicate left and right body parts on another person (Laurendeau & Pinard, 1970). However, it is unclear whether children's demonstrative comprehension starts with a self-centred interpretation. Previous studies are not conclusive and report several different error patterns for demonstratives and other deictic terms such as *in front of* and *behind* or the verbs *come* and *go*¸ most of them not compatible with an egocentric account (Wales, 1986).

The purpose of this work is to describe the acquisition of spatial demonstratives and frame it into a broader picture of child development by determining which skills predict it. According to Clark and Sengul (1978), adult-like comprehension of demonstratives implies the acquisition of the *distance principle* and the *speaker principle*; this is, children need to learn that demonstratives entail a distance contrast, and that such distance is anchored to the speaker. Acquiring the distance principle requires some spatial ability; first, the notion of close and far, and second, spatial working memory to consider the dimensions of space and the position of different elements in it. In turn, the speaker principle entails the acknowledgement that the interlocutor may have a different spatial relation with respect to the referents. This might recruit visual perspective taking and theory of mind abilities. Children are able to take into account others' incompatible visual or mental perspectives on a situation from about four years, roughly the age that some studies suggest for the acquisition of demonstrative comprehension. However, the link between these two milestones has not yet been tested. To investigate the skills underlying acquisition of the distance contrast in demonstrative comprehension, this study includes a battery of developmental tests to evaluate spatial skills, theory of mind and visual perspective taking as well as general language skills.

To sum up, the aim of this work is to examine the development of demonstrative comprehension, comparing the position-relative understanding of the words *here, there, this* and *that*, and to find predictors in language skills, spatial skills, theory of mind and visual perspective taking, in order to situate demonstrative comprehension into a broader picture in child development.

To preview the results, we found that demonstrative comprehension is strikingly unrelated to theory of mind and visual perspective taking, and that children do not find it harder to interpret demonstrative words when the speaker is at the opposite location with respect to the referents. Implication for our understanding of deixis and pragmatics will be discussed.

Method

Participants

Participants were 90 children age 3 to 5 years old (56 female, M_{age}= 49 months, *SD*=6, range 38-60). Participants were monolingual English speakers without any known developmental or language disorder. Language skills have consistently been linked to socioeconomic status (SES), in particular to maternal education (Hoff, 2005). Therefore, sampling aimed to represent children from diverse socioeconomic backgrounds. Schools and nurseries were selected among the most deprived and most privileged of Norfolk, UK. There were 43 participants from low SES neighbourhood and 47 from high SES neighbourhood, and the groups did not differ in age (t (88) = -.50, p=.62). An additional group of 20 five-year-olds (age range 61 to 69 months) took part. They performed at ceiling, average correct answers 93% (*SD*=9%) and therefore are not included in the analysis. An additional 10 participants did not complete all the tasks and their data were excluded from analysis.

Data collection was done in two stages, the first one with older participants, 39 to 60 months, mean age 52 months, and the second one of younger 38 to 51 months, mean age 44 months. Preliminary analysis on the data of the first stage indicated that acquisition age was lower than expected, and motivated further data collection in a second stage focused on 3-year-olds. The visual perspective taking task was included only in the first stage because it was considered too difficult for younger children, and the TOSA-3D task was added to the second stage as a more age appropriate measure of visuospatial construction than the ROCF.

Tasks

Demonstrative comprehension task. This task tested the comprehension of the words *here*, *there*, *this* and *that*, based on the de Villiers and de Villiers (1974) procedure. This procedure resembles a typical child game, allowing a relatively natural communication situation, and uses a screen to divide near and far space. Unlike in the original procedure, instructions were delivered using a hand puppet.

The participant was asked to find an object, a dinosaur figure, under one of two identical paper cups on a table following verbal clues. A 15-cm-tall plywood wall divided the table. Participants walked away and faced the wall while the experimenter placed the dinosaur under a cup. To avoid auditory cues, the experimenter stood up and lifted both cups in every trial. A tablecloth muted the toy placement sound. Then, the experimenter used a hand puppet to give the child a clue for finding the object. The instructions were: *"The dinosaur is under the cup on this/that side of the wall"* and *"the dinosaur is over here/there".* The experimenter avoided giving non-verbal cues by looking only at the puppet, and the puppet's face was directed towards the child or the wall, while arms performed ambiguous gestures.

To encourage participants to think well which cup to grab and avoid proximity bias, we hid a sticker together with the toy for every trial, and children obtained it only when their answer was correct. This is similar to the De Villiers and Villiers procedure (1974): they hid a chocolate that the child was allowed to eat only if they gave a correct answer. Participants always kept the dinosaur toy at the end of the experiment.

The position of experimenter and participant was manipulated: either at the same side of the table or at opposite sides. The practice trials were in a 'neutral' position, with the participant located on one end of the wall (see diagram in Figure 3.1): participants had both objects at the same distance and their position with respect to the objects was different to the experimenter's position, but not conflicting.

There were four practice trials in neutral position, and then 8 experimental trials in each of the 2 sessions: four in the same-sides condition and four in opposite-sides. The order of the two conditions was counterbalanced between participants and between sessions. The trials were randomised, with the following constraints: The object could not appear on the same location more than 2 consecutive times, the location of the object could not follow a pattern such as ABABABAB or AABBAABB, and the words of the same pair (*this/that, here/there*) could not appear consecutively.

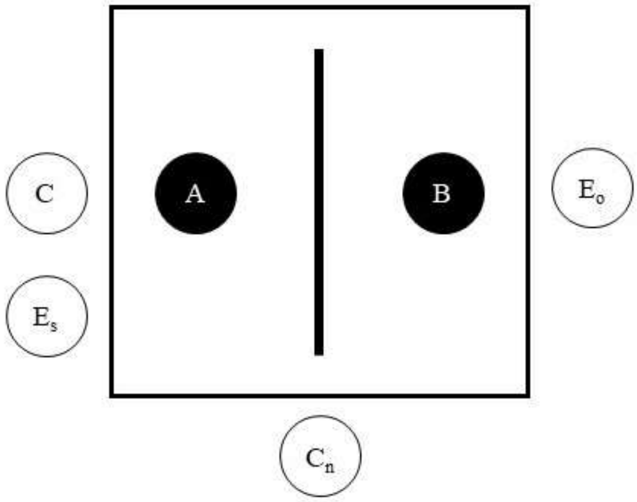


Figure 3.1: Diagram of the experimental set up, where A and B are the cups, C is the child and E the experimenter, Es in the same-side condition, Eo in the opposite-side condition, and Cn is the position of the child in the warmup neutral-condition trials.

Unexpected transfer false belief task. It tests children's understanding of other's beliefs, and requires contrasting reality with a character's false belief (Baron-Cohen, Leslie & Frith, 1985). The task is performed with two dolls. One doll, Sally, is playing with a marble, then leaves it in her basket and leaves. While Sally is not looking, the second doll, Anne, changes the marble from Sally's basket to her box, and leaves as well. After check questions (*where is the marble? Where was the marble in the beginning?*), Sally returns, and the child is asked *"where will Sally look for her marble first?"*. Children pass the false belief task if they understand that Sally does not know the actual location of the marble.

Information and Receptive vocabulary from WPPSI-IV (UK version). These tasks assess language development. The Information task consists in questions such as "what do people use to stay dry in the rain?" or "what is the opposite of South?". It requires both language comprehension and production, and general knowledge. In the Receptive vocabulary task, the child has to point at the picture that best describes the word that the examiner says (for example, *butterfly*, *gnawing* or *parallel*) from four options. Both tasks present trials of increasing difficulty and are stopped after the participant answers incorrectly or does not give an answer to three questions consecutively. The advantage of using language subtests from the WPPSI intelligence scale with respect to other more widely used tasks in research (such as the BPVS) is that they assess language in a broader sense, not limited to vocabulary, and are a quickly administered standardised measure (10 to 15 minutes for the both tasks), valid from 2;6 up to 7.

Visual Perspective Taking (VPT): This task was adapted from Bigelow and Dugas (2008). After a familiarisation stage, the experimenter sits at a table on the opposite side of the participant, and presents animal pictures on the table such that the picture will appear the right way up to one of them and upside down to the other. The experimenter asks the participant for the orientation of the animal from the experimenter's perspective. The instruction is: "When *I* look at the turtle, do *I* see the turtle standing on its feet, or do *I* see it laying on its back?". There were 2 practice items and 6 experimental trials. Additionally, there were 3 randomly allocated questions on the child's perspective on the same items. No feedback or corrections were given.

Rey-Osterrieth complex figure B (ROCF-B), copy. This measures visuospatial constructive skills and the executive functions of planning and visual working memory. Participants copy a geometrical image looking at the model and without time limit. We used the figure B, the simpler figure generally administered to children under the age of seven rather than the one often used in clinical neuropsychology. The scoring is in four indexes: number of elements, overlap (elements overlapping, touching or detached), precision, and proportion. A detailed description of the task is in the Appendix.

TOSA-3D, test of spatial assembly. This task assesses spatial ability. It was chosen as a more age appropriate task than ROCF for younger children, because it does not require drawing. Participants have to reproduce 6 Duplo block constructions in order of increasing difficulty. They are given a 3D model that they can manipulate or rotate, and only the necessary blocks to reproduce it. The task was administered following the authors' procedure (Verdine, Golinkoff, Hirsh-Pasek, Newcombe, Filipowicz & Chang, 2014), except that it was stopped after 2 consecutive errors. Qualitative measures were not collected and participants were awarded a point for each fully correct construction.

Procedure

Participants were tested across two sessions no more than a week apart. The first task of each session was the demonstrative comprehension task, and the rest were administered pseudo randomly, alternating tasks with high and low verbal load.

Data Processing

Data collection was performed in two stages, the first one featuring older participants. In the second stage, the VPT task was supressed and the TOSA-3D task was added as a more appropriate measure of spatial cognition in younger children with respect to ROCF. Additionally, two more tasks were administered and not included in this report: a task on the comprehension of the words *in front of* and *behind* was piloted in the second stage but was performed by chance, and a second order false belief task, administered only to 5-year-olds.

The ROCF task was scored by two naïve coders. Inter-rater reliability was calculated on 21 drawings using intra class correlation coefficient (ICC) based on a mean-rating, absolute agreement, two-way mixed effects model. ICC was above 0.97 for Number of elements, Overlap and Precision and was 0.63 for Proportion.

No outliers were removed, and robust analysis methods were used instead.

Results

There were more female than male participants, particularly among the younger children; data related to performance by gender would be confounded with age and are not reported.

Results by task

Demonstrative comprehension. The percentage of correct answers on the 16 experimental trials are displayed in Figure 3.2. The percentage correct answers for the youngest group of 3;0 to 3;6 years old is 69% (61% for the distal terms) reaching 75% at age 4. A two-way ANOVA with speaker position (same side versus opposite side) and demonstrative term (proximal versus distal) as factors was performed on the number of correct answers. There was a null effect of speaker position (F<.5, p>.4); contrary to hypothesis, position of the experimenter (next to or opposite the child) did not affect performance. Instead, a main effect of demonstrative term was found, $F(1,88)=11.85$, $MSe=7.61$, $p=.001$, $\eta_p^2=.12$. Performance on the proximal words *this* and *here* was significantly better than *that* and *there* (see Figure 3.3). There was an interaction between speaker position and demonstrative word, $F(1,88)=22.05$, $MSe=37.85$, $p<.001$, $\eta_p^2=.20$. Proximal terms with speaker on the same side and distal terms with the speaker on the opposite side had significantly more correct answers, thus indicating a proximity bias.

A proximity bias measure was computed for each child by subtracting the number of times a participant chose the further cup from the number of times a participant chose the closest cup, irrespective of the verbal cue. The measure ranges from 8 (always chose the closest cup) to -8 (always chose the furthest cup). Descriptive analysis on the proximity bias variable confirmed a tendency for children to grab the closest cup, with a mean of 1.36 and a 95% confidence interval between .8 and 1.9.

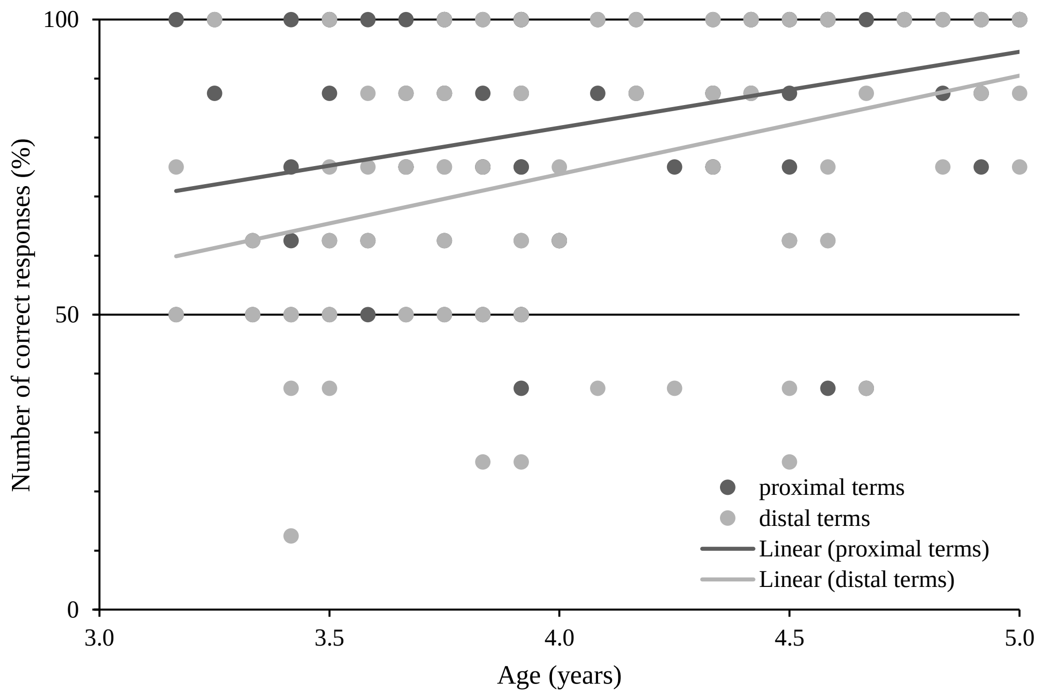


Figure 3.2: Scatterplot of the percentage of correct answers by age, of proximal and distal demonstrative words. Lines are linear fit to the correct answers for each pair of words (proximal vs distal).

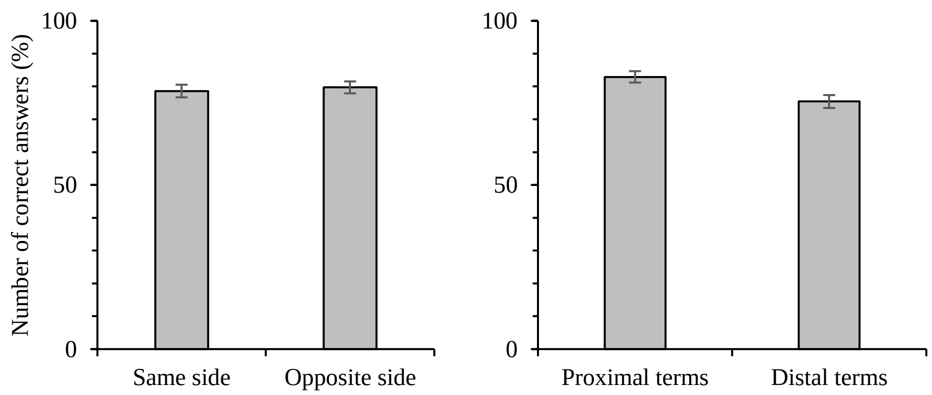


Figure 3.3: Percentage of correct responses. On the left correct responses by speaker position, on the same side as the participant or on opposite sides. On the right, responses by demonstrative term, proximal (*this, here*) versus distal (*there, that*). Error bars correspond to the 95% confidence interval.

False belief task. The percentage of participants that passed the false belief task by age group was the following: 67% of 3 to 3;6-year-olds, 67% of 3;7 to 4-years-old, 90% of 4;1 to 4;6-years-old, and 82% of 4;7 to 5-year-olds passed the false belief task.

Language skills: Information and Vocabulary. Language tasks are the only tasks that children from high and low SES neighbourhoods performed significantly different. The mean scores of Vocabulary in the low and high SES group were 13.8 and 17.2 respectively, t (88) =-3.6, p=.001. The mean scores of Information were 14.5 and 16.8 in low and high SES respectively, t (88) =-2.3, p=.023.

ROCF – copy. The distribution of scores across Age is displayed in Figure 3.4. Up until almost age 4, scores distribute very close to 0, suggesting that this task might lack sensitivity to assess spatial skills in younger children. These children do not yet possess the necessary graphomotor skills to copy the figure and are not familiar with copying tasks or geometrical figures.

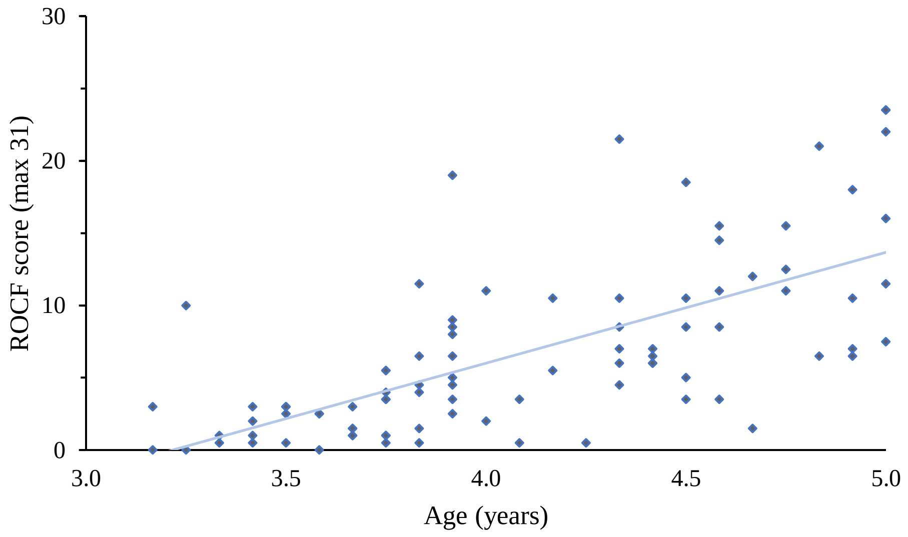


Figure 3.4: Scatterplot with the distribution of total ROCF scores by Age.

VPT. This task was administered to only one first subset of participants, mean age 52 months. According to the criteria of the original procedure, children pass the task when they give at least 5 out of 6 correct answers. Following this criterion, 43% of children passed the task.

TOSA-3D. This task was administered to the second subset of participants, mean age 44 months. Score distribution is consistent with the one on the original paper. Most participants had between 2 and 4 correct answers out of 6 (mean 2.7, *SD* = 1.2).

Results: correlations

The highest correlation with Demonstrative comprehension was Information (r=.55, p<.001). It also correlated significatively with Age (r=.41, p<.001), Vocabulary (r=.30, p=.004) and ROCF (r=.38, p<.001). Demonstrative comprehension did not correlate with False belief, r=.06, p=.60. The correlation between demonstrative comprehension and VPT calculated on the 63 participants of the first data collection stage was r=.29, p=.02. The correlation between Demonstrative comprehension and TOSA-3D calculated with the 27 participants on the second stage of data collection was not significant, r=.28, p=.15. See the remaining correlations for the two data collection stages in Table 3.1.

A correlation analysis controlling for Age and Information in each stage of data collection revealed that no other variable correlates with demonstrative comprehension, rs<.2, however, it shows moderate non-significant correlations with TOSA-3D, r=.33, p=.11. and Vocabulary r=.34, p=.1 in Stage 2 (see Table 3.1).

Predictors for Demonstrative Comprehension

Multiple regression analysis was used to determine the contribution of spatial and language skills and ToM/VPT to the performance in demonstrative comprehension. The forced entry method was used, because there was no previous research to suggests what variables would be good predictors. We wanted to test whether variables other than general language skills (Information) predict demonstrative comprehension, therefore entered Information in the first step and the rest of variables in the second step. Information predicted 29% of variance in demonstrative comprehension (p<.001). Adding Vocabulary, False Belief and ROCF into the model added 0.2% of explained variance, and the change was not significant (p=.36). A summary of the regression model is in Table 3.2.

Table 3.1: Correlations between all variables and partial correlations for both data collection stages.

Stage 1, n=63: correlations between all variables

	2	3	4	5	6	7
1. Dem. comprehension	.39**	.45***	.08	.01	.29*	.34**
2. Age		.46***	.32*	.18	.21	.61***
3. Information			.40**	.31*	.28*	.42**
4. Vocabulary				.15	.43***	.37**
5. False Belief					-.01	.03
6. VPT						.34**
7. ROCF						

Note: * *p* <.05; ** *p*<.01; ****p*<.001.

Stage 2, n=27: correlations between all variables

	2	3	4	5	6	7
1. Dem. comprehension	-.02	.60**	.54**	.03	.20	.28
2. Age		.12	.13	-.11	.50**	.21
3. Information			.54**	.18	.23	.07
4. Vocabulary				-.19	.28	.10
5. False Belief					-.15	-.24
6. ROCF						.35
7. TOSA-3D						

Stage 1: partial correlations controlling for Age and Information

	2	3	4	5
1. Dem. comprehension	-.17	-.16	.18	.08
2. Vocabulary		.03	.36**	.18
3. False belief			-.10	-.16
4. VPT				.24†
5. ROCF				

Stage 2: partial correlations controlling for Age and Information

	2	3	4	5
1. Dem. comprehension	.34	-.13	.14	.33
2. Vocabulary		-.35	.17	.05
3. False belief			-.15	-.24
4. ROCF				.28
5. TOSA-3D				

Note: † = *p*=.059

Table 3.2: Linear model of predictors of demonstrative comprehension with 95% bias corrected and accelerated confidence intervals reported in parentheses. Confidence intervals and standard errors based on 1000 bootstrap samples.

Step 1	*b*	*SE B*	*β*	*p*
Constant	7.17 (5.71, 8.77)	0.78		.001
Information	0.35 (0.25, 0.44)	0.05	.55	.001
Step 2				
Constant	7.69 (5.60, 9.77)	1.10		.001
Information	0.33 (0.20, 0.46)	0.07	.52	.001
Vocabulary	-0.01 (-0.15, -0.14)	0.07	-.02	.856
False Belief	-0.68 (-1.78, 0.46)	0.58	-.09	.241
ROCF	0.06 (-0.04, 0.15)	0.05	.14	.163

Model summary: Step 1, adjusted R^2=.291, p<.001; Step 2, adjusted ΔR^2 =.002, p=.36.

Discussion

Children's comprehension of the demonstrative's spatial contrast and its predictors were tested in the most extensive study to date. Results indicate that the distance contrast is mastered by most children by age 4. Performance was not facilitated by sharing position with the speaker, and only language skills and not theory of mind predicted demonstrative comprehension. These unexpected results impact upon the way we understand demonstrative words and add to our knowledge about deictic communication.

First, we asked whether children's demonstrative comprehension starts being self-centred. Results show a striking null effect of speaker position in demonstrative comprehension, and an interaction between speaker position and demonstrative term. With experimenter and participant on the same side there was a greater number of correct answers for the proximal terms, whereas with experimenter and participant on opposite sides there were more correct answers for distal terms. The child's tendency to pick the closest cup indicates a proximity bias and it is likely the source of the interaction. Given this, I conclude that performance was overall not facilitated by being at the same location as the speaker. To recap Clark and Sengul's two principles (1978), demonstrative comprehension requires learning the *distance principle* and the *speaker principle*. The null effect of position indicates that there is not a developmental stage in which the distance principle but not the speaker principle have been acquired; instead, both principles may be acquired simultaneously. Considering the child's learning context, this is not an unreasonable assumption. Parental input might come from the child's own location, i.e. when the child is sitting on the caregiver's lap, just as often as from a different location, for instance when parent and child play with toys, both sitting at opposite sides of them. Therefore, only when children realise that demonstratives' distance contrast is anchored to the speaker can they learn the distance contrast in them. In conclusion, the process of acquiring an adult-like interpretation of demonstratives is not a decentring process; in words of Charney (1979), the child is never *centred* on his own viewpoint in the first place.

Next, results indicate that proximal terms (*this, here*) were easier than distal terms. A possible explanation for this is that proximal terms do not need as much disambiguation (e.g. pointing) compared to distal terms, because they can refer only to the speaker's location, whereas *that/there* might be anywhere except the speaker's location (Tanz, 1980). Findings on the acquisition of personal pronouns (*you* and *I*) may be extrapolated to the acquisition of demonstratives: like *that*, *you* shifts referent more often than *I*, because a given speaker may use *you* to refer to anyone except to themselves, unlike *I*. Moreover, the pronoun *you* is also acquired after *I* (Clark, 1978; Charney, 1980). An alternative explanation for the better performance in proximal demonstratives might be saliency; the object next to the speaker would be more active in the child's attention and they would be more likely to choose it (Tanz, 1980). The proximity bias might be explained by the same attentional issue, although it could also indicate difficulty of inhibitory control.

The correlation and regression analyses revealed that demonstrative comprehension and theory of mind (false belief task and, in Stage 1, VPT) are unrelated, in spite of developing around the same time. The theory of mind task correlates with language development, as is has been typically found in the literature, and so does demonstrative comprehension. This makes the dissociation in our results even more pronounced. Our findings indicate that demonstrative's interpretation does not require a *representation* of other people's thoughts or points of view (VPT, theory of mind). Instead, it may only need level 1 VPT. In contrast with level 2 VPT (turtle task), level 1 VPT does not involve representing how objects might look from another person's perspective, but only a notion of what the other person can or cannot see (Flavell, Everett, Croft & Flavell, 1981). Tasks that may involve level 1 VPT are turning a drawing for another person to see it or playing hide-and-seek, both behaviours that are observed in 2-year-olds. Personal pronouns, acquired by age 3, have been found to be developmentally related with level 1 VPT. Ricard, Girouard and Décarie (1999) tested children's use and understanding of personal pronouns and found a significant correlation with the performance on level 1 VPT tasks, such as placing an object so that it is occluded for someone's point of view. Thus, like the acquisition of pronouns and demonstrative words might be supported on the same basic notion of perspective. It does not require representing other person's point of view, but a basic notion of proximity.

General language development (Information task) but not vocabulary was a strong predictor of demonstrative comprehension. The Information task requires both language comprehension and production and general knowledge. This might be an additional indication that the acquisition of demonstratives does not depend on high level mentalising or spatial skills, but on the ability to understand and use language in a broader sense, highlighting the role of pragmatics. According to Bates (1976), language cannot be understood in isolation from the context in which the communication develops, and demonstratives – deictic words whose function is to link the discourse with the spatial world – might be the most paradigmatic case. Hearers interpret language aided by contextual cues and by knowing the speaker's possible intention or goal, instead of merely applying syntactic rules. Following the argument in the introduction, the procedure used might play a critical role in children's demonstrative comprehension. In our study, most children show good comprehension by age 4, which fits the results of de Villiers and de Villiers (1974), but is much earlier than the acquisition age suggested by other works such as Clark and Sengul (1978) and Webb and Abrahamson (1980). Arguably, a procedure in which the goal is clear (finding a toy) and non-verbal cues are naturally supressed with the use of a puppet has successfully minimized possible conflicts between cues and allowed testing children's understanding of the words.

The pragmatic component in the interpretation of spatial demonstratives might be higher than for other spatial words. People use their knowledge of the situation and the interlocutor to identify the referent that the demonstrative word signals (Clark, Schreuder & Buttrick, 1983). Children might be able to understand the distance contrast in demonstratives in particular situations years before they form a precise and explicit rule about them that can be used in all situations. This is not specific for demonstrative words: Clark found that young children might understand the word *on* only in the usual contexts or situations, for example, *on the table*, and not *on the cup* (Clark, 1972, in Tanz, 1980). This indicates that they rely on their knowledge about the actions that are usually performed on particular familiar objects (tables or cups), and that contextual information prevails over their knowledge of the word *on* in this case.

To sum up, in spite of the diffuse boundaries between proximal and distal demonstratives and that their distance information is anchored to the speaker, children can understand them without a mature knowledge of other people's thoughts or visual perspective. The early comprehension of demonstrative words could be supported by pragmatic cues, and would start by distinguishing a place near the speaker signalled by the words *this* and *here*, years before children have acquired clear, explicit rules on demonstrative words that could be applied to any context.

Chapter 4

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Demonstrative production

This work has been submitted for publication as
González-Peña, P., Coventry, K. R., Bayliss, A. P. & Doherty, M. J.,
The extended development of mapping spatial demonstratives onto space.

The Extended Development of Mapping Spatial Demonstratives onto Space

Spatial demonstratives (e.g. *this* and *that* in English) are among the most important, oldest and highest frequency terms in all languages (Deutscher, 2005; Diessel, 1999). They appear early in development, perhaps in the first 50 words produced (Clark, 1978; but see González-Peña, Doherty & Guijarro-Fuentes, 2020), and act with deictic pointing to establish joint attention (Diessel, 2006). Extensive research has highlighted the complexity of demonstrative words, revealing that their use reflects not only object proximity with respect to the speaker, but object properties such as visibility, familiarity and ownership (Coventry, Valdés, Castillo, & Guijarro-Fuentes, 2008; Coventry, Griffiths & Hamilton, 2014; Gudde, Coventry & Engelhardt, 2016; Caldano & Coventry, 2019). However, it is yet unknown whether such object properties are core semantic features of demonstratives in English, or instead are a product of associations between those characteristics and space. The present work addresses this question using the developmental method, by examining when sensitivity to spatial and semantic characteristics emerges in the production of demonstratives.

There is abundant evidence for a fundamental division of perceptual space into peripersonal (reachable) and extrapersonal (non-reachable) space, that is relevant for both non-linguistic spatial categorisation and for demonstrative use. *This* and *that* mark the distinction between peripersonal and extrapersonal space (Coventry et al., 2014; Gudde et al., 2016). Speakers use *this* more often for objects within their reach (Caldano & Coventry, 2019) even when they can reach longer than usual aided by a tool (Coventry et al, 2008). The boundary between peripersonal and extrapersonal space is not abrupt, because the space within reach can be stretched through body movement or locomotion (Longo & Lourenco, 2006), thus, we observe a gradual decrease in frequency of use of *this* in extrapersonal space.

Demonstrative choice and whether an object is in peripersonal or extrapersonal space, have similar effects on memory for object location. Participants consistently overestimate object distance for objects in extrapersonal space – objects normally referred to by *that* – in memory tasks (Coventry et al., 2014; Gudde et al., 2016). Similarly, manipulating the demonstrative word used to name the objects affects memory: objects that participants referred to by *this* were remembered as being closer than objects referred to by *that* (Gudde et al., 2016). These findings suggest a parallel conceptualization of space and spatial language based on reachability.

In addition to reachability, both spatial memory and demonstratives are affected by semantic factors. Coventry et al. (2014) found that object ownership, visibility and familiarity affect demonstrative use: owned objects, visible objects and familiar ones were more often named using the proximal demonstrative. These properties also affect memory for object locations: owned objects, visible objects and familiar ones were remembered as closer in a non-linguistic memory task.

The relation between demonstrative choice and semantic object properties extends beyond the spatial. Rocca, Tylén and Wallentin (2019) asked English, Italian and Danish speakers to assign spatial demonstratives to lists of words in a purely semantic task. Participants typically chose proximal demonstratives for harmless and small or graspable objects, and distal demonstratives for larger and dangerous objects. They argue that these object properties tap onto object affordance: a small object such as a book might be grasped, whereas a dangerous or large object (e.g., a crocodile) might not.

These studies support the claim that demonstratives encode not only distance from the speaker but also semantic properties of objects. In English this is implicit, revealed by demonstrative use. However, some other languages explicitly encode the semantic properties discussed above. For example in Supyire, spoken in Mali and the Ivory Coast, demonstratives explicitly encode ownership, and in some native American languages demonstratives encode visibility (Diessel, 1999).

To sum up, research indicates that demonstrative production and non-linguistic spatial processing are affected by distance and by object characteristics. However, it is unclear how all the findings fit into a unified mechanism. It has previously been suggested that the relation between demonstrative choice and spatial and semantic factors is mediated by the expectation of finding owned, familiar or visible objects closer to oneself (*Expectation Model*, Coventry et al., 2014; Gudde et al., 2016). An alternative account has been recently proposed by Rocca et al. (2019). They suggest that semantic effects on demonstrative use can be encapsulated under the concept of manual affordance, defined as an object's potential or ease of manipulation based on its physical characteristics. However, manual affordance cannot account for the effect of ownership on demonstrative choice or memory for locations (Coventry et al., 2014); ownership, familiarity, or visibility do not affect an object's manual affordances, but do impact the likelihood or expectation of interacting with it. Because semantic characteristics are not explicitly encoded in the English demonstrative system, it is unclear how they integrate with it.

There are at least two possible ways in which object semantics could integrate into the English demonstrative system. One is that the physical reaching distance is the core feature, and semantic effects on demonstrative production are purely associative or expectation effects, a product of, for example, having encountered repeatedly owned objects in peripersonal space or dangerous objects in extrapersonal space. A second possibility is that both physical and semantic factors contribute equally to the production of demonstratives, and thus the core conceptualisation of demonstratives is based not on physical distance, but on meaningful relations with objects and space. Our aim is to use the developmental method to distinguish these two possibilities.

Demonstratives in child development: Surprisingly, little is yet known about children's demonstrative production. Children use the words *this* and *that* from the earliest stages of their lexical development, but do not use them to establish a distance contrast (Clark, 1978). Studies suggest children may begin to distinguish between demonstratives in comprehension in preschool (de Villiers & de Villiers, 1974; Tanz, 1980) or slightly later (Clark & Sengul, 1978; Webb & Abrahamson, 1976). Sensitivity to distance in demonstrative production might emerge before age four (de Villiers & de Villiers, 1974) although other studies place mature use at some point later than seven years (Webb and Abrahamson, 1976). Küntay & Özyürek (2006) took a different approach, and observed demonstrative production during a cooperative task in four- and six-year-old Turkish-speaking children. They found that children encode some distance distinctions in their demonstrative production, but not as consistently as the adult control group, thus suggesting a long development of a mature demonstrative production. Importantly, with the exception of Küntay and Özyürek, all developmental studies have tested a contrastive use of demonstratives in a disambiguation task between two referents, thus focusing on a specific limited use of demonstratives. Here we examine children's spontaneous use of demonstratives in non-contrastive communicative situations and how they map onto space.

The present study: The Memory Game Paradigm: To explore this matter, we used the *memory game* paradigm developed by Coventry et al. (2014). This method allows for testing the effect of object distance and object characteristics simultaneously. Participants see real objects at varying distances and are asked to name them using a demonstrative word, while being naïve to the purpose of the study. A non-linguistic memory for object locations task allows us to study spatial mapping using the same objects and locations. This paradigm has the strength that it can be used developmentally, being comprehensible to children and not susceptible to response bias towards the experimenter's expectations in adults.

Coventry et al. (2014) manipulated object ownership, visibility, and familiarity through a series of experiments on demonstrative production and memory for locations. Uncovered objects and objects with a transparent cover were named more often by *this* than occluded objects. Familiar shapes were also more often named by *this* than unfamiliar shapes. Finally, *this* was used more frequently to refer to the location of a coin when it belonged to the participant (i.e. when it was the payment for their participation) rather than when the coins belonged to the experimenter. All object characteristics that elicited an increased production of the proximal demonstrative also resulted in objects being remembered as closer in non-linguistic memory for location tasks.

In adapting Coventry et al.'s (2014) procedure to the developmental research we elected to study ownership, as it is a familiar and relevant concept from early in life. Both adults and young children verbally express sensitivity to ownership (Kanngiesser & Hood, 2014; Nancekivell & Friedman, 2014; Nancekivell, Friedman & Gelman, 2019).

The memory for object locations task is well within children's capabilities. Remembering object location (a bag, the biscuit jar, the way to school) is an everyday task, that children solve by using both landmarks and coding metric information (Huttenlocher & Lourenco, 2007). Our memory task requires egocentric coding of metric information in a continuous space, using no more cues than the distance to self and the spatial frame (table edges). Infants are already capable of this from as early as 5 months (Newcombe & Huttenlocher, 2003). Children's bias in object-location memory has been described as drifting towards the centre of the space early in development and towards the edges from around the age of six (Huttenlocher, Newcombe & Sandberg, 1994), a qualitative change attributable to an increase in spatial working memory capacity (Schutte & Spencer, 2010). The primary reason for including the memory task in this study is to allow comparison on a spatial-only task across groups, to make sure that differences in demonstrative production are not attributable to a different conceptualization of space.

Specifically, this work investigates the emergence of spatial and semantic distinctions in demonstrative production. If demonstrative distinctions are based upon an elementary notion of reachability, one should find that they should emerge in development first, with semantic effects emerging later. If on the contrary demonstratives' semantics are complex, reachability and semantic factors are both core to the concept of demonstratives. One might therefore predict that age of acquisition will be later, and the process of acquisition protracted. If this is the case, we additionally expect the effects of ownership and distance to emerge together in development.

To sum up, in this study we investigate the influence of egocentric distance and ownership on demonstrative production cross-sectionally in children and adults for the first time, using an adaptation of the *Memory game* paradigm (Coventry et al., 2014). A non-linguistic memory task using the same objects and locations serves as a baseline measure of spatial development. We tested 7- and 11-year-old children and adults. Seven-year-olds were selected as the oldest age-group to feature in previous literature (Webb & Abrahamson, 1976). Eleven-year-olds were selected as the oldest age-group within the same schools as younger participants. To preview the results, across two experiments we find that, while memory for object location is relatively stable over the age range, demonstrative production develops protractedly, and the parallel emergence of semantic and distance distinctions in development indicates that demonstratives are not grounded on simple reachability distinctions, but semantic characteristics are equally important in demonstrative conceptualization in English.

Experiment 1

Method

Participants. Participants were 26 seven-year-olds (15 female, M_{age}=7 years; 0 months, range 6;6–7;6), 26 eleven-year-olds (13 female, M_{age}=11;3, range 10;9–11;9) and 29 adult Psychology undergraduates (16 female). Children attended a school in Norwich. All were native English speakers with normal or corrected-to-normal vision and no known neurological or developmental disorders. Data were excluded from one additional 11-year-old due to poor depth perception (>110 arcseconds on the Frisby Stereotest) and from one additional 7-year-old because they could not recall the toy ownership assignment. Further exclusions due to failure to follow task instructions are detailed in the Results section, along with demographics of the final samples submitted to analyses.

Apparatus & Materials. The *Memory Game* apparatus was adapted from Coventry et al. (2014), comprising a 120cm wide table with adjustable lengths of 120cm, 150cm, and 180cm (increasing for each age group to account for hand reach), covered by a featureless black cloth. A wooden bar was positioned at the long midline with four coloured dots placed equidistantly from one another (25cm, 30cm and 35cm for each table, respectively). Only the first two dots were within the participant's reach, and this was confirmed at debrief. Black curtains surrounded the three sides of the apparatus (see Figure 4.1). Two plastic dinosaur figures (3x5x1.5cm) were used. They were identical except for an identifying sticker (orange or purple). Opaque glasses and an indication stick were used. Experimenter-A operated a hand puppet in the demonstrative production task. The Frisby Stereotest was used to measure stereoacuity.

Figure 4.1: Photographs of experimental setup. Experimenter-A (left), participant (middle) and Experimenter-B (right). Left panel shows the recall stage of the Memory Task. Following object removal, Experimenter-A places the indication stick at the edge of the table and the participant indicates which direction to move the stick to match the location of the previous object. The right panel shows the Demonstrative Production Task. The target object (the dinosaur that jumped) is at the furthest location in this case, whereas the other dinosaur is stationary at the edge

of the table. Colour dots have been added for illustration purposes; the dots present in the actual experiment were easily visible to participants.

Design & Procedure. At the start of the experimental session, Experimenter-A sat beside the participant, while Experimenter-B stood out of view, behind a side table. Participants were shown the two dinosaur figures and were asked to choose one to keep as a reward for participating, by indicating without touching it. They then completed the Memory for Object Location Task, followed by the Demonstrative Production Task. The tasks were in this fixed order to avoid language effects on the memory task.

Task 1: Memory for Object Location. Participants wore opaque glasses while Experimenter-B placed an object at one of the four locations. Participants were then allowed to look at the object for 10s. The glasses were then put back on for 10s while Experimenter-B removed the object and flipped the location bar to conceal the dots. Experimenter-A had her back to the table, unable to see the object positions. Next, the participant had to tell Experimenter-A where the object had been: *"I will point with this stick and you have to say "closer!" or "further!"* [gestures] *until you think the stick is pointing to where the dinosaur was".* The pointing stick was held perpendicular to the edge of the table such that its tip would pass over the previous location of the object (see Figure 1, left). The stick started 8, 10 or 12cm closer or further away from object location (counterbalanced) and was moved at 2cm by second (paced by a ticking watch) until the participant told her to stop. Participants could correct their decision. Participants completed 2 practice trials then 12 experimental trials (3 each for the owned and not owned objects, in peripersonal and extrapersonal regions). Trials were randomised, with the constraint that the same object (owned or not-owned) could not appear twice in the same location consecutively, and the same location could not be used three times consecutively.

Task 2: Demonstrative Production, Participants were asked to tell the puppet, 'Charlie', which dinosaur "jumped": *"Did you know that dinosaurs jump sometimes? But they only jump when Charlie is not looking. Now what you have to do is to pay attention, because sometimes Charlie will ask you if a dinosaur jumped, and you have to tell him. But Charlie is not so good at English, he doesn't understand many words. The only words he understands are 'this one' and 'that one'."* For each trial, Experimenter-B made the dinosaur jump while placing it on a dot, while the other dinosaur was kept on the middle of the table edge (see Figure 1, right). Then Experimenter-A, using the puppet, would ask *"Hi! Did any dinosaur jump? (…) Which dinosaur jumped?"* If the participant did not use demonstratives, they were reminded that the puppet could not understand, and the instructions were delivered again.

Following Coventry et al.'s method (2014), we told participants that Task 2 was a memory game like Task 1, and occasionally asked memory questions such as *"On which dot was your dinosaur last?"*. The purpose was to create a cover story to test demonstrative production without influencing it. This was not felt necessary for the 7-year-olds. We assume they are not fully aware of the experimenter role as researcher, and therefore would not make assumptions about the motives of the study that could bias their responses. Moreover, the demonstrative task as it was presented to them (spotting the bouncing dinosaur to a distracted puppet) seemed an appropriate game for this age group. Thus, we chose not to increase the attentional demands and task length by adding the memory questions. None of the participants seemed confused with the task or asked the reasons to do it, nor figured out our interest in demonstrative words in the debrief.

Participants who perseverated using only one demonstrative were told *"Charlie is starting to get bored that you always say 'that'; you can also say 'this'"*. Certainly, it is expected that some participants use *that* as an unmarked term for all locations (Clark, 1973; Levinson, 2004), but that behaviour would not be informative for the purpose of our study, which is not to describe child's habitual demonstrative use, but to identify their mapping between demonstratives and perceptual space and how it changes across development.

The data of participants who used only *that*, systematically alternated demonstratives throughout or declared using a strategy were discarded prior to analysis. Participants completed two practice trials and 16 experimental trials, two trials per object per location. These were randomised within two blocks with the same constraints as the memory task.

Results

Memory task. *Data processing and exclusions:* The accuracy for object-location memory was calculated by subtracting actual object distance from the distance estimate indicated by the final position of the stick; positive numbers indicate an object was remembered as being further away from the participant than it actually was. Trials with estimation errors greater than 3*SD* from the mean absolute error for each group were removed prior to analysis (1%). One 11-year-old participant did not complete the task due to time constraints and these data were excluded prior to the analysis. Thus, the final sample comprised 26 seven-year-olds, 25 eleven-year-olds and 29 adults.

Analysis. The mean memory errors for each condition are shown in Table 4.1. A 2x2x3 mixed-factors ANOVA with Region (peripersonal, extrapersonal) and Ownership (owned, not owned) as within-participants factors and Age Group (7-year-old, 11-year-old, adult) as the between-participants factor, was conducted on mean memory errors. This analysis revealed a significant main effect of Region, $F(1,77)=32.58$, $MSe=739.85$, $p<.001$, $\eta_p^2=.36$, due to underestimation of distance for closer objects (mean memory error: peripersonal region=-3.06; extrapersonal region=-0.20). The main effect of Age Group was significant, $F(2,77)=10.33$, $MSe=170.68$, $p<.001$, $\eta_p^2=.21$, because accuracy increased with age. No other effects approached significance (Fs<2,ps>.3), including the main effect of Ownership ($F=.4$, $p=.5$).

Table 4.1: Mean and standard deviations of the mean memory error for each condition and age group (cm) in Experiment 1.

	Peripersonal Region		Extrapersonal Region	
	Owned Mean (SD)	N.O. Mean (SD)	Owned Mean (SD)	N.O. Mean (SD)
7-year-old	-4.46 (4.28)	-4.64 (3.73)	-1.46 (4.69)	-1.29 (5.26)
11-year-old	-2.75 (3.01)	-4.02 (3.58)	0.45 (3.97)	0.52 (3.56)
Adults	-1.44 (2.45)	-1.61 (3.61)	0.70 (3.92)	0.44 (3.89)

This clear null effect of Ownership allows us to collapse this factor and look at the data across the four locations (see Figure 4.2). A 4x3 mixed-factors ANOVA with Location (4 levels) as within-participants factors and Age Group (7-year-old, 11-year-old, adult) as the between-participants factor, was conducted on mean memory errors. There was a significant main effect of Location, $F(3,77)=17.07$, $MSe=739.85$, $p<.001$, $\eta_p^2=.18$. This effect is linear (within-participants contrasts $F(1,77)=40$, $p<.001$, $\eta_p^2=.34$) and reveals a memory underestimation for closer objects and progressive over estimation for objects further away. The main effect of Age Group was significant, $F(2,77)=61.71$, $MSe=1011$, $p<.001$, $\eta_p^2=.45$, because accuracy increased with age, but again, there was no interaction between Location and Age Group (*F*s<2,*p*s>.3).

Demonstrative production task. *Data processing and exclusions:* Five 7-year-olds, three 11-year olds and five adults were excluded due to systematic demonstrative use (e.g. only saying *that* or otherwise perseverating with an alternating pattern). The final sample comprised 21 seven-year-olds, 23 eleven-year-olds and 24 adults.

Analysis: Figure 4.3 represents the percentage of use of *this* by age group and location. The percentage of trials in which *this* was used for each condition is shown in Table 4.2.

Table 4.2: Mean and standard deviations of the use of the demonstrative this for each condition and age group (%) in Experiment 1. The locations are numbered 1 to 4 from the closest to the furthest. (N.O.= Not owned).

	Location 1		Location 2		Location 3		Location 4	
	Owned Mean (SD)	N.O. Mean (SD)	Owned Mean (SD)	N.O. Mean (SD)	Owned Mean (SD)	N.O. Mean (SD)	Owned Mean (SD)	N.O. Mean (SD)
7-year-old	40 (37)	43 (35)	43 (28)	40 (33)	40 (33)	31 (33)	26 (25)	29 (29)
11-year-old	59 (38)	48 (40)	48 (38)	33 (32)	33 (41)	35 (37)	24 (39)	09 (19)
Adults	79 (32)	75 (35)	52 (47)	46 (35)	25 (32)	13 (22)	17 (28)	15 (27)

A 4x2x3 mixed ANOVA with Location and Ownership as within-participants factors and Age Group as between-participants factors was conducted. Greenhouse-Geisser degrees of freedom adjustments were applied where sphericity was violated. A main effect of Location, $F(2.5,162.8)=27.36$, $MSe=4.39$, $p<.001$, $\eta_p^2=.30$ showed participants used *this* more for closer locations and *that* for further ones, confirmed by a significant linear contrast ($F(1,65)=60.36$, $MSe=10.92$, $p<.001$, $\eta_p^2=.48$). The interaction between Location x Age Group was significant, $F(6,65)=5.18$, $MSe=.69$, $p<.001$, $\eta_p^2=.14$ because the effect of location is present in Adults, $F(2.04,47)=33.24$, $MSe=5.88$, $p<.001$,$\eta_p^2=.59$, and 11-year-olds, $F(3,66)=6.35$, $p=.001$,$\eta_p^2=.22$, but non-significant in 7-year-olds, $F(2.3,46.8)=1.77$, $MSe=.25$, $p=.18$,$\eta_p^2=.08$. The only other main effect or interaction to approach significance was Ownership, with a trend for using *this* more often for owned objects, $F(1,65)=3.8$, $p=.055$, $\eta_p^2=.06$ (see Figure 4.4). No other interactions were significant (F's<1, p's>.5).

Discussion

The pattern of biases for memory for locations was consistent across all age groups. Participants misremembered objects in peripersonal space as closer than those in extrapersonal space. We did not find an ownership effect on memory for object location. For demonstrative production, adults used the proximal demonstrative *this* more often in the closest locations, replicating Coventry et al.'s (2008, 2014) findings. This effect does not appear in 7-year-olds, and in 11-year-olds is weaker than in adults. Regarding ownership, Coventry et al. (2014) found that participants used the proximal demonstrative more often for owned objects than not-owned objects. We obtained a trend congruent with this finding that fell short of conventional significance. We speculate that this shortfall was due to type of stimulus. While the children were keen to take the dinosaur home after the experiment, adults were not. This motivated a replication using stimuli with enhanced ownership value for all participants.

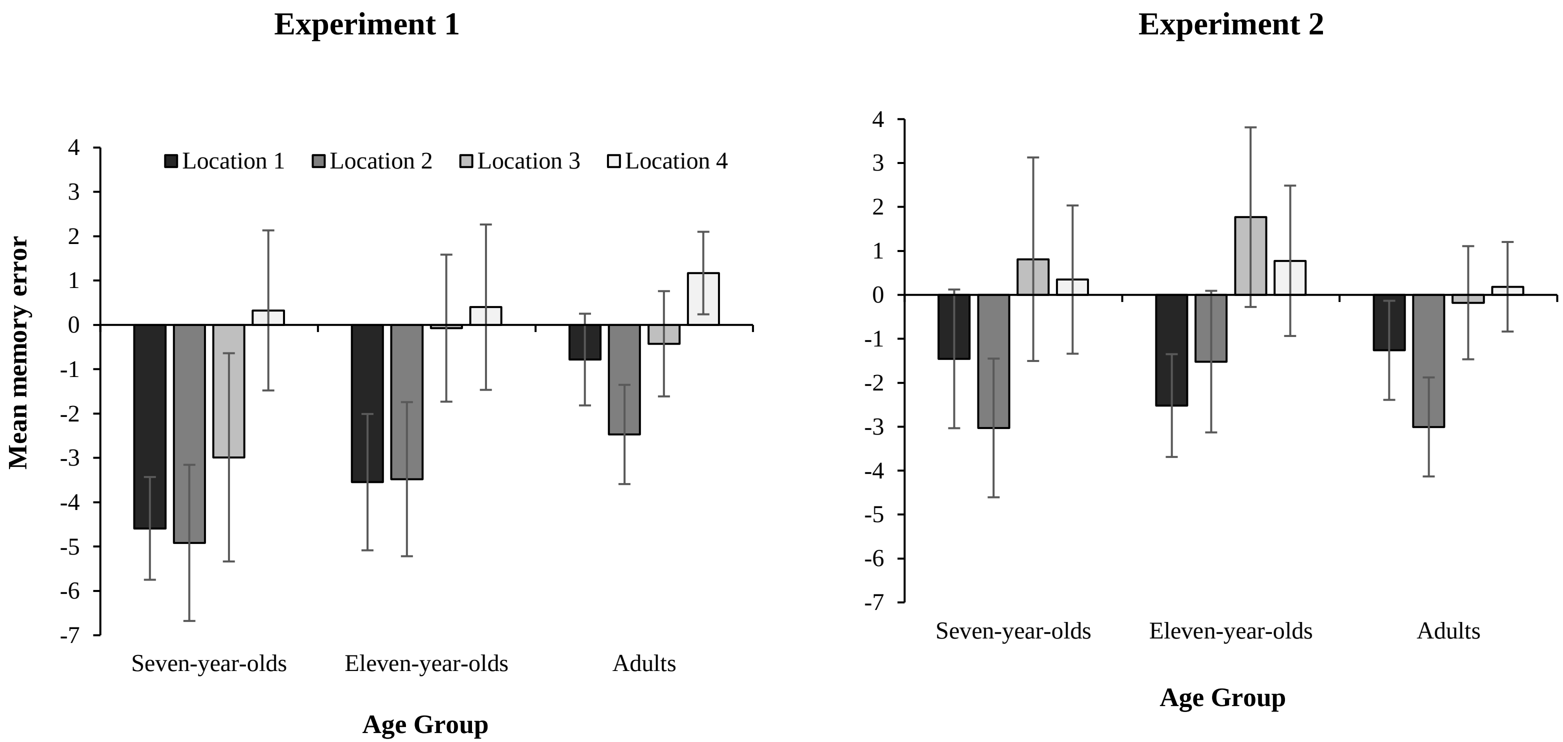

Figure 4.2: Mean memory error per age group and location for both experiments. The locations are numbered 1 to 4 from the closest to the furthest one. Error bars represent the 95% confidence interval.

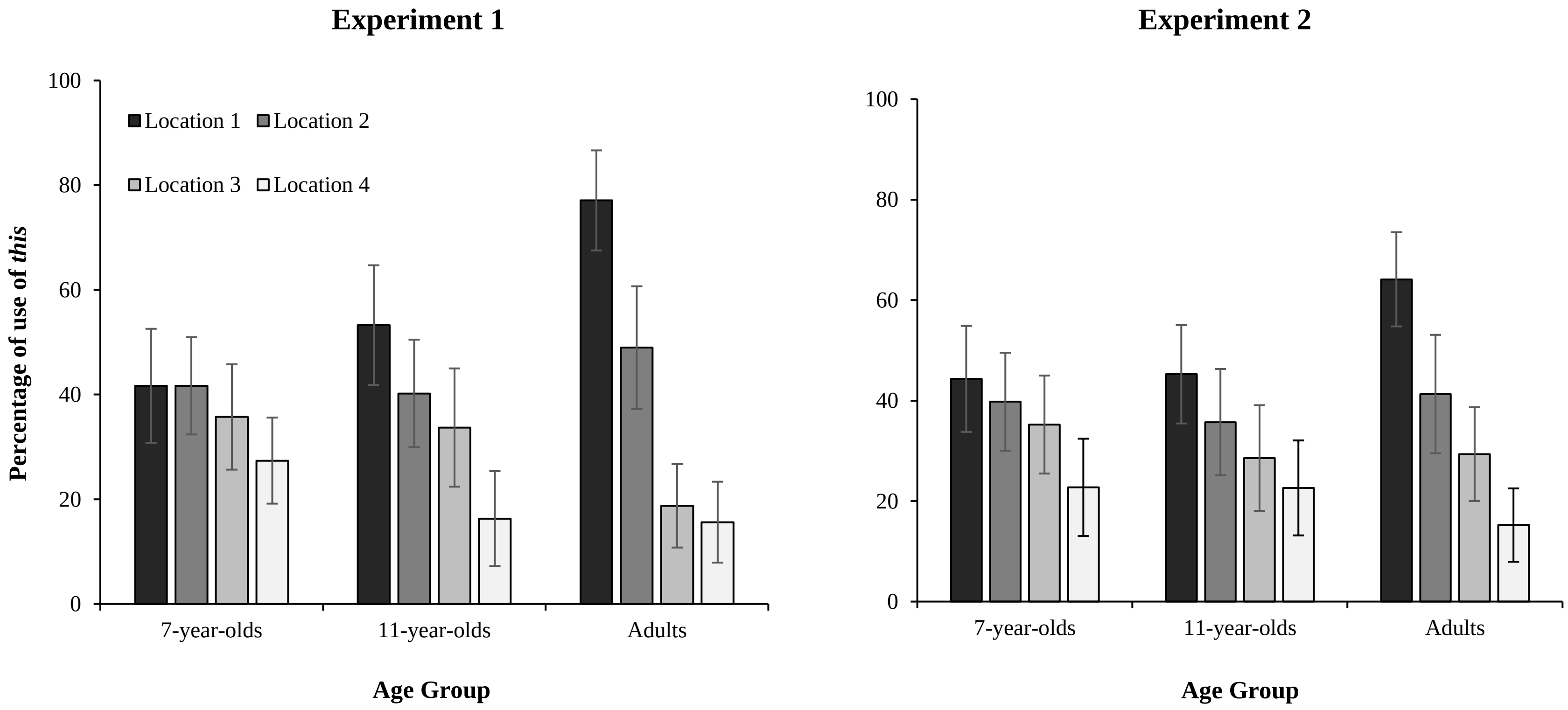

Figure 4.3: Percentage of use of *this* per age group and location for both experiments. The locations are numbered 1 to 4 from the closest to the furthest one. Error bars represent the 95% confidence interval.

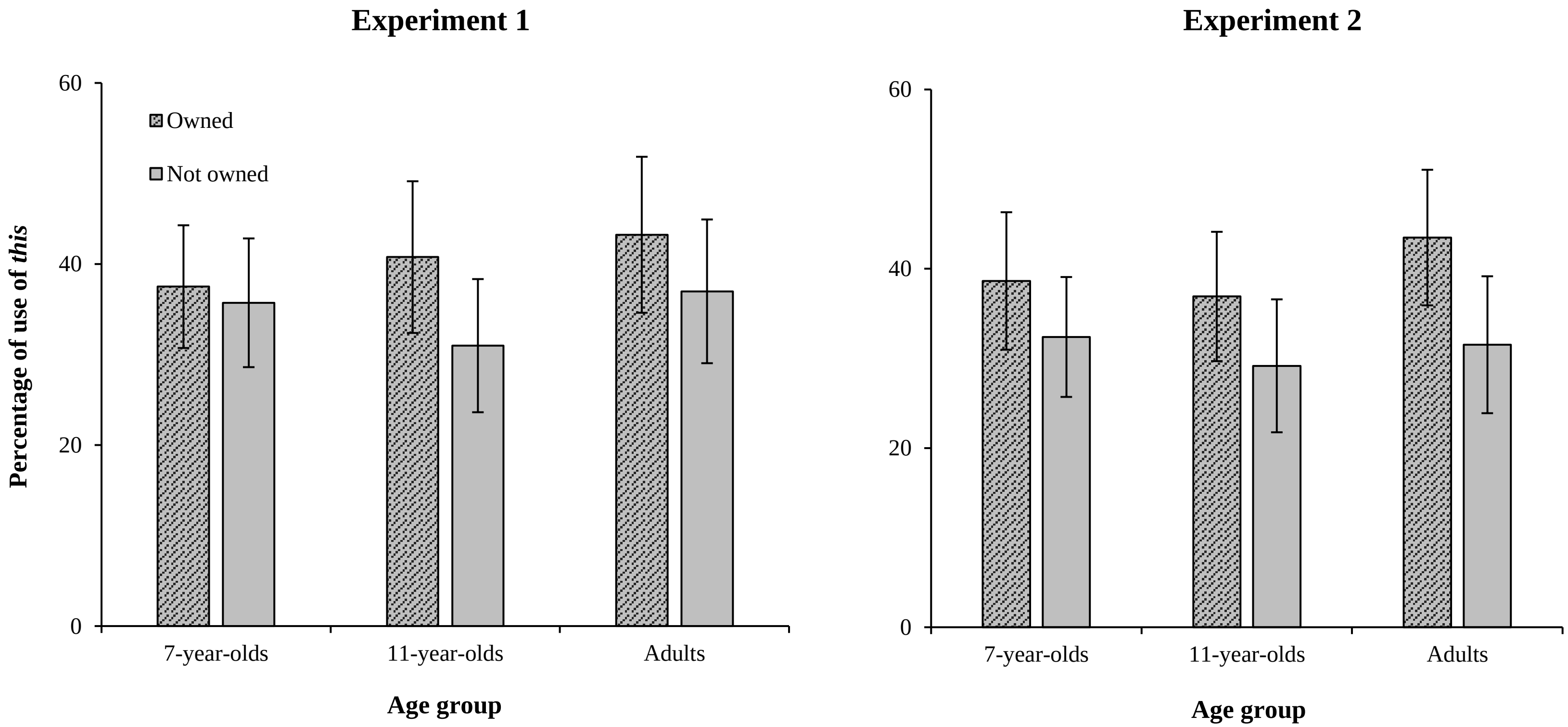

Figure 4.4: Percentage of use of *this* per age group and ownership condition comparing the two experiments.

Experiment 2

Experiment 2 replicates Experiment 1 using stimuli of higher perceived value to all participants. This was done by adding a token with an economical value to the dinosaur stimuli. We predicted the same pattern of results for both tasks, with a stronger ownership effect.

Method

Participants. Participants were 25 seven-year-olds ($\underline{M}_{age}$=6;11, range=6;5–7;5), 28 eleven-year-olds ($\underline{M}_{age=}$10;11; range=10;4–11;6), and 28 adults (19 female). The children attended three schools in Norwich. Data from one additional 7-year-old were excluded due to poor depth perception. The adults were university students and the general public and received £4 payment.

Apparatus & Materials. The only change was that the dinosaur figures were attached to a gold coin-shaped token worth £4.

Design & Procedure. The procedure remained as for Experiment 1, except for the ownership information given at the beginning of the experiment. Adults were told that they could exchange the token for payment. Children were told that the coin was worth £4, and they could give it to their teacher to buy books, paints, and other attractive school materials. This allowed us to use identical stimuli for all age groups while avoiding ethical issues associated with payment of children.

Results

Memory task. *Data processing and exclusions:* Trials with errors greater than 3*SD* from the mean of absolute error for each group were eliminated (2%). Data from two 7-year-olds and two 11-year-olds who did not complete the task due to time constraints were excluded. The final sample comprised 23 seven-year-olds, 26 eleven-year-olds and 28 adults.

Analysis: Data for all conditions is displayed on Table 4.3. The same analysis as in Experiment 1 revealed a significant main effect of Region, $F(1,74)=29.79$, $MSe=605.64$, $p<.001$, $\eta_p^2=.29$, due to greater distance underestimation of closer objects. Ownership was again non-significant, $F(1,74)<1$, $p>.9$ and the main effect of Age Group was not significant in this case ($F(2,74)<1$, $p>.4$), nor were the interactions (Fs<2,ps>.15).

Table 4.3: Mean and standard deviations of the mean memory error for each condition and age group (cm) in Experiment 2.

	Peripersonal Region		Extrapersonal Region	
	Owned Mean (SD)	N.O. Mean (SD)	Owned Mean (SD)	N.O. Mean (SD)
7-year-old	-1.61 (5.13)	-3.17 (5.03)	0.55 (4.01)	0.67 (5.08)
11-year-old	-2.27 (3.70)	-1.78 (3.33)	0.63 (3.16)	1.87 (4.33)
Adults	-1.88 (2.93)	-2.43 (3.15)	-0.23 (2.89)	0.26 (2.58)

Because of the null effect of Ownership, we could again collapse the factor to analyse the effect of Location. These data are displayed in Figure 4.2. The same analysis as in Experiment 1 revealed a significant main effect of Location, $F(2.7,74)=11.43$, $MSe=224.91$, $p<.001$, $\eta_p^2=.13$ (corrected with Greenhouse-Geisser). This effect is linear (within-participants contrasts $F(1,74)=20.73$, $p<.001$, $\eta_p^2=.22$) and reveals a memory underestimation for closer objects and progressive over estimation for objects further away. The main effect of Age Group was not significant, $F(2,74)<1$, $p>.4$, and there was no interaction between Location and Age Group ($F<1$, $p>.5$).

Demonstrative production task. *Data processing and exclusions:* The data of 3 seven-year-olds, 7 eleven-year-olds and 5 adults were excluded because of systematic use of demonstratives. The final sample comprised 22 seven-year-olds, 21 eleven-year-olds, and 23 adults. The percentage of trials in which *this* was used for each condition is shown in Table 4.4.

Table 4.4: Mean and standard deviations of the use of the demonstrative *this* for each condition and age group (%) in Experiment 2. The locations are numbered 1 to 4 from the closest to the furthest. *(N.O.= Not owned).*

	Location 1		Location 2		Location 3		Location 4	
	Owned Mean (SD)	N.O. Mean (SD)	Owned Mean (SD)	N.O. Mean (SD)	Owned Mean (SD)	N.O. Mean (SD)	Owned Mean (SD)	N.O. Mean (SD)
7-year-old	41 (32)	48 (38)	48 (32)	32 (32)	45 (37)	25 (25)	20 (39)	25 (25)
11-year-old	48 (29)	43 (35)	40 (33)	31 (36)	33 (36)	24 (33)	26 (33)	19 (29)
Adults	67 (28)	61 (36)	50 (42)	33 (38)	37 (34)	22 (29)	20 (24)	11 (25)

Analysis. The same analysis as in Experiment 1 revealed a main effect of Location, $F(3,189)=19.89$, $MSe=2.26$, $p<.001$, $\eta_p^2=.24$: participants used *this* more for closer locations and *that* for further ones, as in Experiment 1, confirmed by a linear contrast, $F(1,63)=51$, $MSe=6.72$, $p<.001$, $\eta_p^2=.45$). The main effect of Ownership was significant, $F(1,63)=9.50$, $MSe=.99$, $p=.003$, $\eta_p^2=.13$: unlike in Experiment 1, participants reliably used *this* more often for owned objects (see Figure 4.4). The interaction between Location and Group was not significant, $F(6,63)=1.92$, $MSe=.22$, $p=.08$, $\eta_p^2=.06$. No other main effects or interactions approached significance, *F*'s<2, *p*s>.15.

Discussion

As in Experiment 1, for memory for locations we found the same location effects across age groups and no effect of ownership. In demonstrative production, participants used the proximal demonstrative more often for closer locations than for further ones in all three age groups. The age differences showed a trend in the same direction as those in Experiment 1, but in this case they were not significant. The modified stimuli elicited a greater use of *this* for owned objects on the demonstrative production task, consistent with previous literature.

General Discussion

Two experiments were conducted to examine when in development distance (reachability) and ownership affect demonstrative production. This was in order to understand whether spatial demonstrative mapping is articulated primarily around object reachability or if semantic object properties have a core relevance. Results show that semantic effects (ownership) on demonstrative production are uniform across age groups, but the influence of reachability on demonstrative choice may be more protracted in development, as indicated in Experiment 1. However, this conclusion cannot be made with confidence because, although the age differences in Experiment 2 were in the same direction, they did not reach significance (see below for discussion).

Our work on demonstrative production is, to the best of our knowledge, the first developmental work to systematically test non-contrastive demonstrative production across graded distances. The key finding is that the sensitivity to distance on demonstrative production continues to develop after the age of seven. In our sample of 7-year-olds, the effect was absent in Experiment 1 and present in Experiment 2, but with a data pattern that is largely similar between studies. This emergence appears surprisingly late in development, given research that suggested children may be capable of using *this* and *that* contrastively before age 4 (de Villiers & Villiers, 1974), but are compatible with those of Küntay and Özyürek (2006) in Turkish, who found that demonstratives were not yet used in an adult fashion at the age of 6. Our study is the first to look later in development to confirm that this process extends even further, beyond the age of seven, even in a language with a relatively simple demonstrative system.

As a caveat, it is unclear why an effect of distance was absent in the youngest group of children in Experiment 1 and present but weak in Experiment 2. A possible explanation is that the higher perceived value of the object in Experiment 2 also made distance distinctions more evident. However, the data patterns were largely similar in both experiments, and there were no interactions between distance and ownership; thus, it is unclear whether object characteristics interact with the distance effects, and further research is needed to look into this possibility. It is possible that sensitivity to distance in demonstrative production could start with very far distances, as there was a noticeable decrease in the use of *this* beyond one-meter distance in the youngest group. An additional factor that might explain the late development of adult-like demonstrative production is that mature demonstrative production requires conveying spatial content in an incidental way, as opposed to when explicit location information is requested. Employing an appropriate demonstrative in an object-naming task demands a fast on-line integration of spatial and semantic information, that might still be developing over this age. There is some evidence for this: multimodal integration brain areas, confirmed to be involved in spatial demonstrative comprehension (Rocca, Coventry, Tylén, Staib, Lund & Wallentin, 2020) are some of the last brain regions to complete their maturation process.

In contrast, no age effects were found in the extent to which demonstratives are used to mark object ownership. Thus, to the variety of effects of ownership in young children (e.g., Nancekivell, Friedman, & Gelman, 2019) this study can add the influence of ownership on demonstrative choice, from at least 7 years. These data suggest that semantic factors affecting demonstrative choice are robust even in the youngest age group, supporting the view that reachability is not necessarily the primary factor in the acquisition of demonstratives in development.

In contrast to the demonstrative data, memory for object location was stable across age groups. Although children were less accurate than adults, no qualitative developmental changes were observed, and errors were affected by whether an object was placed in peripersonal or extrapersonal space across all groups. However, it would be premature to confirm that children categorize perceptual space as a function of reachability as adults do; our results could indicate merely that their memory bias pulls towards the edges of the table, as previously reported in children age 6 and older (Huttenlocher et al., 1994). In our experimental setup, both the center of the table and the boundary between peripersonal and extrapersonal space overlap for all three age groups. What we can confidently extract from this task, however, is that children do carve up this particular space in the same fashion as adults, allowing us to attribute the changes in demonstrative production to extra-spatial maturation.

Contrary to previous research with adults (Coventry et al., 2014), we found no reliable effect of ownership on object-location memory. This perhaps means that the ownership effect can best be detected in designs with more trials per condition (e.g. Coventry et al 2014 had 24 trials across 6 locations, while the current study was adapted for developmental research to have 12 trials across 2 regions). Regardless, results in the memory task show a clearly distinctive pattern of memory errors across the four locations that is stable throughout development, which makes it a valuable tool to establish a spatial-cognition baseline from which to study demonstrative production.

The present study suggests that the mapping between perceptual space and demonstratives develops over a protracted period, years after children incorporate demonstratives into their lexicon and after they develop a mature spatial mapping. Our findings are against the conception of demonstratives as simple labels for close and far space, and propose that demonstratives reflect higher order conceptual distinctions. The sensitivity to ownership that we observe throughout development extends Rocca et al.'s (2019) claim that demonstratives encode object manual affordance. Although ownership does not impact on the object's physical potential to be grasped, it implies that the speaker is or is not allowed to interact with it. This indicates that semantic effects in demonstrative production operate at a conceptual level, as opposed to the physical-mechanical level described by Rocca and colleagues (2019).

We suggest that semantic factors, rather than being add-ons to an initial distinction between reachable and non-reachable space, may provide at least an equally fundamental driver for the acquisition of demonstratives. Ownership marks who is allowed to primarily interact with an object, irrespective of whether an object is reachable or not, and in that sense, it can be argued that ownership is a more fundamental conceptual primitive than mere reachability. The focus on demonstratives referring to spatial regions has neglected the importance of semantic factors which merit more careful consideration from a developmental perspective.

This study is the first to simultaneously study spatial memory and spatial language throughout development. Overall, results indicate that spatial demonstrative use develops over an extended period of time. Sensitivity to object properties and object distance undergo protracted and parallel development. We conclude that demonstratives are not simply labels for near and far space. Instead they indicate meaningful conceptual distinctions that reflect the way we interact with objects in space.

Chapter 5

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General Discussion

The Very First Words, a Very Slow Development

Throughout this work, the use and understanding of demonstrative words in child development has been examined, from the first words to the end of primary school. Children start using demonstratives at age 2, get a hold of the distance contrast at age 4, and seven years later they are still in the process of mapping them onto space. This late development is an unexpected finding. A possible explanation is that demonstratives have multiple layers of functionality and complexity that are acquired in a staggered learning process.

Early in social and language development, the function of demonstratives is, essentially, sharing attention. Demonstratives pair with pointing to indicate to another person where to look or what to do. This function does not require distinctions of proximity; in fact, it does not forcefully need a demonstrative word, and other words or non-word verbalisations could take that same role. It is later on that children start acquiring demonstratives' proximity dimension, and here again there are multiple layers of complexity. Children understand the distance contrast by age 4, thus they are possibly able to use demonstratives according to proximity in simple situations (i.e. contrastive use) at that age or shortly after. However, the non-contrastive use of demonstratives (as tested in Chapter 4) involves a more complex, higher order distinction. More than simply indicating to someone where to look, or specifying whether it refers to the closer or the further object, non-contrastive demonstrative use seems to reflect a deeply engrained, fundamental organisation of space based on what we can immediately interact with. Adult usage of demonstratives integrates object location and characteristics in deictic communication, and this complexity accounts for why children at age 11 do not yet use them fully as adults. In sum, the long development of demonstrative words reflects their multidimensional and complex character.

The present chapter summarises how this thesis contributes to our knowledge in multiple fields, and what research questions and future directions may be explored next.

Demonstratives as a Tool to Study Child Development

The main focus of this work has been to use demonstratives as a mean to study the development of deictic communication, theory of mind and spatial cognition.

Early deictic communication. In Chapter 2 we looked at the emergence of demonstrative words, a milestone that had been typically associated with the onset of language and ability for directing joint attention. However, finding that demonstratives were more frequent in the two-word-utterance stage indicates that early deictic communication might not be grasped through the study of demonstratives. Thus, researchers interested in it should not limit their target words to demonstratives, because it might miss an important developmental stage. Instead, the focus should be on any vocalisation that is paired with pointing or to related observable behaviours.

Theory of mind and visual perspective taking. The idea that motivated the study in Chapter 3 is that demonstrative comprehension must involve the understanding of another person's point of view. This was not the case. Its evident dissociation with any task except for the linguistic ones meant that demonstrative comprehension does not require a representation of another person's perspective on the objects. However, other spatial deictic words might be.

During the data collection for Chapter 3, a task to test the comprehension of the words *in front of* and *behind* was piloted. Performance was at chance level, indicating that these words are more difficult than demonstratives. This word pair could indeed involve mental representations or mental rotation, similar to that required in level 2 visual perspective taking acquired around age 5 (see the turtle task, Chapter 3). Unfortunately, the *in front of* and *behind* task was performed in the second stage of data collection, that involved a younger sample and in which the turtle task was not used. Future research could explore the possibilities that the other spatial deictic words might offer for the study of theory of mind and visual perspective taking.

The conceptualisation of space. Chapter 3 concluded that spatial skills, as measured with a block construction and a drawing task, did not predict demonstrative comprehension. Likewise, in Chapter 4 it was found that children's memory for object locations (unlike demonstrative production) was not qualitatively distinct from adults', as the same memory biases towards the edges of the table were found across all age groups. Therefore, the developmental study of demonstratives did not grasp changes in spatial cognition in these works. However, future research using more specific or fine-grained spatial tasks may find developmental differences in spatial cognition that could account for the differences in demonstrative comprehension or production.

As discussed in Chapter 1 and 4, demonstrative use might be grounded on a fundamental division of space between peripersonal and extrapersonal, or between what can be manipulated or not. Results from Chapter 4 suggest that children might effectively conceptualise space like adults, but demonstratives might not be fully mapped to that space yet. However, judging by the absence of the ownership effect in all groups in Chapter 4's memory task, it is possible that it lacked enough power to conclusively assess children's organisation of space, and that this might have been immature. Future research could use a new adaptation of the memory game method to assess developmental changes in the conceptualisation of space. The task should include a space much larger than the one used in Chapter 4 (in which the hand reach was at the table centre) and manipulate object characteristics such as ownership, visibility or agreeability.

Children's differences in spatial processing might be studied with neuroscientific techniques. Ongoing research with adults uses fMRI to investigate the differential processing of peripersonal and extrapersonal space in spatial tasks, and of spatial demonstratives in discourse. In the future, these studies could extend to developmental research, and reveal whether children have specialised neural networks for the processing of the different regions of space as it has been found in adults, or at what point in development is this specialisation complete. This line of research would provide a new focus to the study of neuro-cognitive development, and in particular the integration of language and space.

Future directions: studying the acquisition process of the distance contrast as a means to study child-directed speech. Little is known yet about the way parents facilitate children's learning of difficult words, particularly deictics. Chapter 2 suggested the possibility that parents could use the same demonstrative term as the child, instead of switching as is typically appropriate. Studying whether parents scaffold or correct their children's use of deictics might be a valuable contribution to our knowledge of language acquisition, and may also reveal parents' intuitive understanding of the child's capacities. Moreover, it would be interesting to describe different parental styles and study their developmental outcomes.

The acquisition of demonstratives' distance contrast may be studied in children aged 2 to 3 years old. I conducted a preliminary analysis of filmed parent-child interactions (Tommerdahl corpus, CHILDES). Studying demonstrative use in naturalistic situations requires developing an observational coding system with a satisfactory inter-rater reliability. The biggest challenge was to judge objects' distance as within or out of reach of the speakers, and coding the presence or absence of competing objects that might elicit contrastive use of demonstratives. This is particularly relevant to distinguish the use of *that* as a generic term or within a contrastive pair. Alternatively, observing parent-child interaction at the laboratory could facilitate this task; either parent, child, and/or object position could be fixed, or the space (e.g., a mat) could be divided in small quadrants to allow an objective coding of distance.

Advances and Next Steps in the Understanding of Demonstratives

Relevant findings for linguistic research. This work has contributed to expand our understanding of demonstrative words with several key findings. Chapter 2 concluded that the widely accepted claim that demonstratives are among the first words of infants was not correct, thus updating our knowledge of demonstrative words and challenging the previous conception of demonstratives' early function in joint attention. Chapter 2 also showed that proximal demonstratives were more frequent in Spanish and distal demonstratives were more frequent in English, both in child and parent speech. These cross-cultural differences might be of interest for linguists; specifically, the unmarked demonstrative term (i.e. the demonstrative word that might be used non-contrastively irrespective of distance) might vary between languages. In English, the unmarked demonstrative it is the distal *that*, but in Spanish it could be the proximal *este*. However, as discussed in Chapter 3, proximal terms are more specific than distal terms, because a proximal term may signal only an object or location next to the speaker, whereas a distal term could refer to any object or location anywhere else. Therefore, the notion of using a proximal demonstrative as an unmarked term seems contra intuitive. Future research could dig further into this crosslinguistic difference and extend it to more languages.

Particularly interesting for linguistics might be the findings in Chapter 3. Children's early demonstrative use, predicted solely by their general language development, did not seem to involve a challenging processing. Moreover, previous findings of poor performance on demonstrative comprehension at age 5 or 7 indicate that 4-year-old children do not know the rule for the interpretation of demonstratives, but can understand demonstratives under certain circumstances. They might only be able to perform the task as long as the verbal cue does not conflict with the rest of cues: eye gaze and gesture, and what they expect the adult might do or request (see Chapter 1 and 4 for an in-depth discussion of the methodological issues). This has interesting implications for linguistics, because it provides further evidence of the relevance of pragmatics, as opposed to a model that presupposes the application of a set of rules.

Towards an integrative theory of demonstrative use. The study of demonstrative words has seen a surge of research and debate in the last years. There are several challenges that the field must overcome in order to progress towards a comprehensive knowledge.

An integrative theory will necessarily require developing further methodological approaches. As discussed in Chapter 1, some of the discrepancies between theories may lay in the methods used and variables tested. The methodological multiplicity is reflected on the many different theoretical accounts, that are occasionally either fragmentary or vague. A multi-method approach with different levels of experimental control would help to integrate accounts. In my view, and using Occam's razor, demonstrative use should be explained with a general principle instead of with a collection of different effects. We proposed in Chapters 1 and 4 that demonstrative use could reflect distinctions based on the potential manipulability of objects. This possibility needs thorough testing, but it has the potential to explain every effect found so far, and that should be the goal of theoretical accounts. Future research should also take demonstratives out of the lab and observe how the findings fit everyday language use. Furthermore, theories should be extensible to symbolic and anaphoric demonstrative uses, which might follow similar rules but are do not refer to physical space. And finally, an integrative theoretical framework will necessarily incorporate the growing advances in neuroscience. As previously discussed, the mapping of the neural networks engaged in the processing of space and spatial demonstratives will play an important role in defining our theoretical models. Deictic communication is a multifaceted field, in which psychology, linguistics and neuroscience must converge towards an integrated comprehensive framework.

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Appendix

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ROCF-B

ROCF-B: Coding, reliability and application in developmental research

The Rey-Osterrieth Complex Figure (ROCF; Rey, 1940, Osterrieth, 1944; in Luzzi, Pesallaccia, Fabi, Muti, Viticchi, Provinciali & Piccirilli, 2011) is a drawing test widely used in clinical neuropsychology. It assesses not only visuospatial performance, but executive functioning and memory, and it is of easy administration. The goal of this text is to describe the ROCF task, its administration and scoring, and to encourage developmental researchers to employ it.

The analysis of drawing provides rich information about spatial representations. Neuropsychological assessments feature drawing tasks, such as drawing a clock to detect visual neglect, or copying the drawing of a house to detect visual agnosia. Drawings have been used in research for instance in the study of William Syndrome, a genetic disorder characterized for severe impairment in visuospatial processing (for a review, see Bellugi, Lichtenberger, Jones, Lai & St. George, 2000). These drawings are interpreted qualitatively, which is useful for clinical research and practice. However, there are few standardised drawing tests that might be suitable for non-clinical developmental research.

The ROCF usually features in any standard neuropsychological assessment. It consists in copying a complex drawing, a geometrical figure structured around a rectangle with four quadrants and the two diagonals, with numerous elements inside and outside that structure (see Figure 6.1, left). The task consists in copying the figure with the model present and without time limit. Then, there is a short-term recall at 5 minutes and a long-term recall at 30 minutes. The ROCF has several scoring systems that measure not only the presence and accuracy of elements, but the strategy and organisation of the drawing. It has been found that children are able to copy this drawing with more or less accuracy from age 6. They start by copying it in a piecemeal fashion, and from age 9 start organising the drawing around the central rectangle (Akshoomoff & Stiles, 1995; Nakano, Ogino, Watanabe, Hattori, Ito, Oka & Ohtsuka, 2006). The ROCF, in particular the analysis of the type and strategy of copy, provides information about executive functioning subcomponents such as planning, perseverance and working memory (Watanabe, Ogino, Nakano, Hattori, Kado, Sanada & Ohtsuka, 2005), and it is sensible to neurodevelopmental disorders such as ADHD (Rubiales, Russo, González & Bakker, 2017).

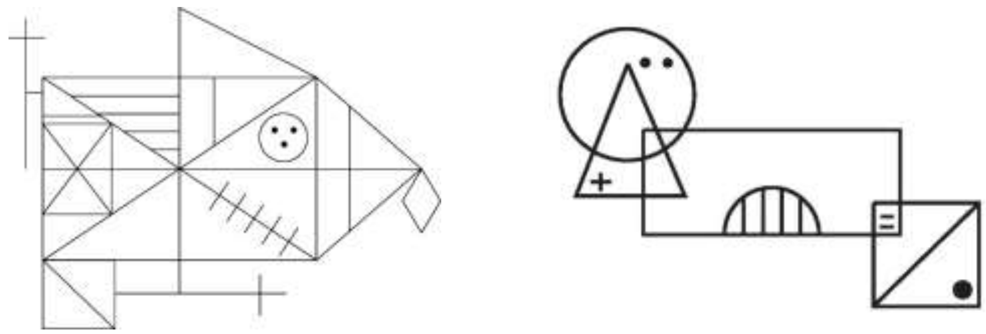

Figure 6.1: ROCF and ROCF-B.

Much lesser known is the alternative simplified version of the ROCF, its B form. The ROCF-B is composed of four partially overlapping main figures, and seven other elements (see Figure 6.1, right). It is indicated for its use with children age 6 or younger. Luzzi et al. (2011) consider its simplicity an advantage with respect to the ROCF, and they propose its use for the clinical work with dementia patients. They found the ROCF-B to have enough sensitivity to distinguish older adults with high and low level of education.

The ROCF-B could be an excellent test for researchers interested in assessing young children's visuospatial cognition, because of its quick administration and rich quantitative and qualitative information. However, it does not have enough research to date, and specifically, it lacks a unified accurate scoring system and standard scores for age groups. Alternative tests are either more focused on graphomotor performance than on spatial representation (e.g. Berry and Buktenica's test of visual-motor integration) and have little predictive value (Duffey, Ritter & Fedner, 1976).

The developmental pattern in the copying of the ROCF-B was described by a qualitative study (Danis, Lefèvre, Devouche, Serres, Prudhomme, Bourdais & Pêcheux, 2008). The authors observed that young children start drawing detached figures, then figures next to each other and finally the overlaps. This reflects a change from a fragmentary to an integrated spatial representation that might be interesting to assess in relationship with other developmental changes.

Scoring of the ROCF-B. The original scoring system evaluates four different aspects of the copy: number of elements, overlaps of the main figures, precision, and proportion (see the complete instructions in Luzzi et al., 2011).

Number of elements. The figure is formed by 11 elements. Participants obtain one point for each recognizable element, regardless of its location, and half point if they are distorted.

Overlaps: There are four overlaps between the main figures. The triple overlap between circle, triangle and rectangle was not achieved by any participant. There score was two points for each correct overlap, only one point for drawing the figures connected without overlapping or for an extreme overlap, and none if the figures were detached. Figure 6.2 shows two drawing examples that differ in the integration or the overlap score. The drawing on the left has no overlap between the main figures, and the arch with the four lines that should be inside the rectangle is outside, as if the figures had been drawn sequentially from left to right. The drawing on the right is more integrated and includes some full and partial overlaps.

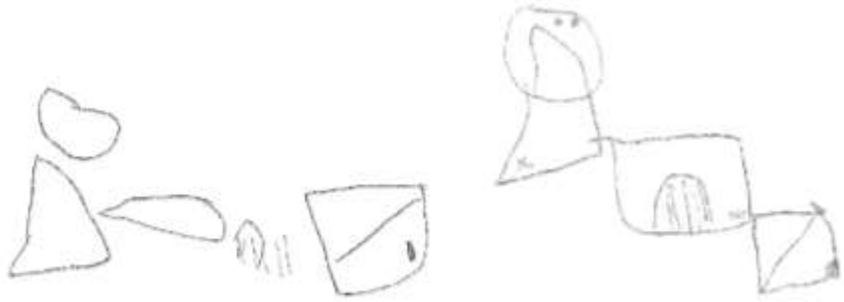

Figure 6.2: Examples of drawings with none and poor overlap.

Proportion between the four principal elements and *Precision:* These two indexes reflect the detail of the drawing, as opposed to the overall structure.

ROCF-B inter-rater reliability. The drawings were scored by two naïve coders. A problem that arose when using this figure is that the original instructions were ambiguous; there were no clear guidelines for considering an element as distorted or unrecognisable, and any scribble could potentially be interpreted as a circle or rectangle. Moreover, we had a preference against penalizing children for poor graphomotor skills (e.g. crooked lines). Therefore, the coders received a four-hour training with the researcher, until consensus on the scoring criteria was agreed.

The agreement was first tested with eight drawings. Some inconsistencies were spotted. After discussion and clarification, the coders rated 21 drawings, on which inter-rater reliability was calculated for each index individually.

A two-way fixed effects intra-class correlation (ICC) for absolute agreement was used (see Landers, 2015, for a step-by-step guide to choose and perform an ICC test). The two raters were very consistent, with an agreement of .98 in Number of elements, .98 in Overlap, .98 in Precision and .63 in Proportion.

ROCF-B in the study on demonstrative comprehension. The ROCF-B correlated with nearly every task that we administrated (see Table 3.1). Moreover, scores' improvement with age indicates that the ROCF-B has the sensitivity and demands appropriated for this age range (see score distributions in Figure 6.3). However, this task is not suitable for children that are not yet familiar with drawing or that do not have sufficient graphomotor skills. They often are discouraged and do not want to try, or insist on drawing something that they know.

For the study presented in Chapter 3, the ROCF-B was administered to a total of 120 children from age 3;0 to 5;9. The ROCF-B total score correlated significantly with Age (r=.72, p<.001), Information (r=.27, p<.001), Vocabulary (r=.53, p<.001) and Visual perspective taking (r=.44, p<.001). A marginally significant correlation was found with TOSA-3D (another visuospatial task, r=.35, p=.065). After controlling for Age, ROCF still had a significant correlation with Information (r=.46, p<.001) and Vocabulary (r=.19, p=.034).

The lack of specificity might be addressed by further research, that could look into which indexes are best indicators, or develop a qualitative scoring system that would reflect the child's strategy (such as the BQSS for the ROCF). Moreover, it would be interesting to see how this task correlates with other measures of visuospatial skills and executive functioning.

Conclusion. The ROCF-B is an information rich task of very easy administration, high inter-rater reliability and suitable for children from at least 4 years. Developmental researchers might benefit from the use of this task, and further studies could deepen into its properties and predictive value.

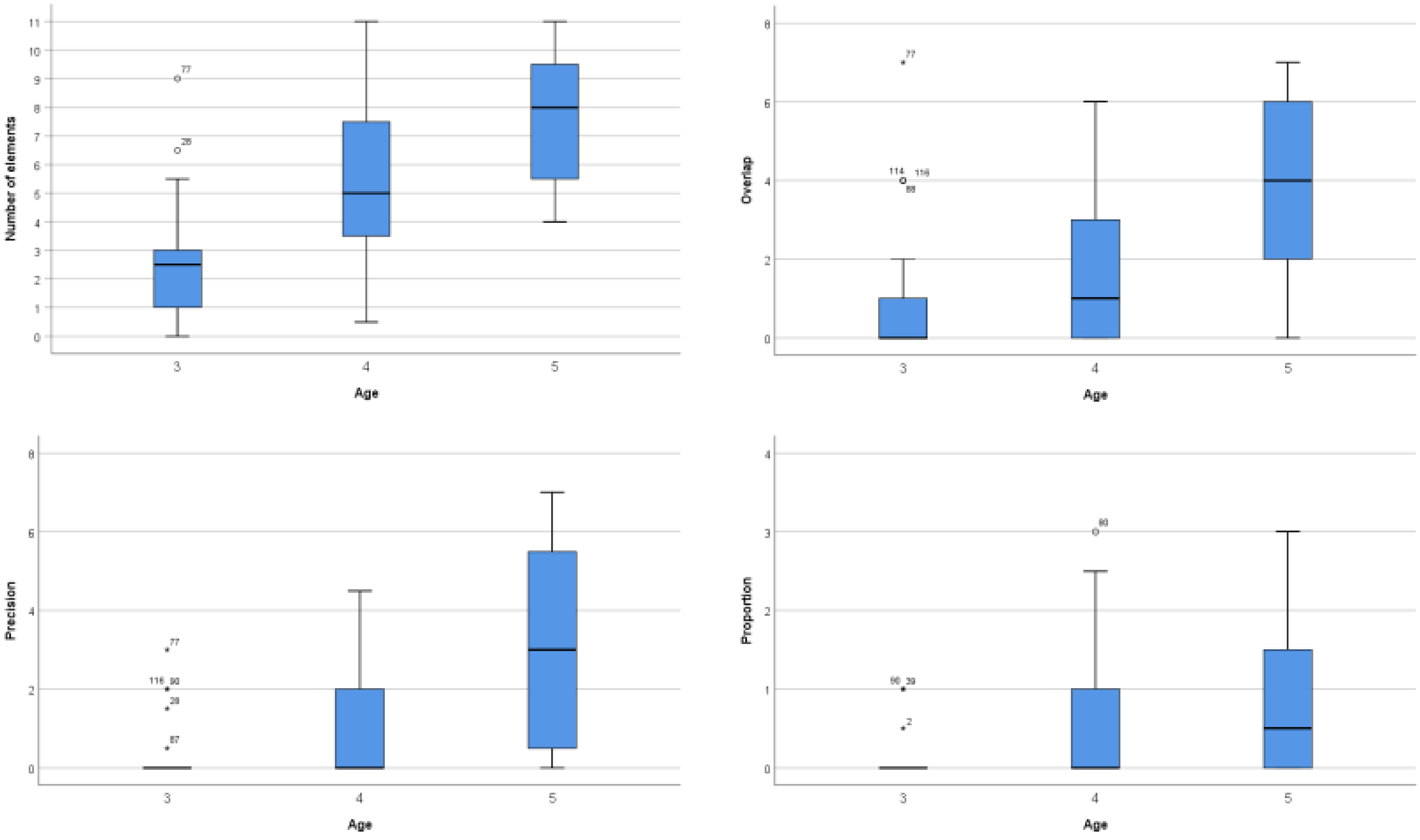

Figure 6.3: Box plots with ROCF-B scores for each index and age group