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To cite this article: Jorrig Vogels & Josefin Lindgren (2022) The Development of Referring Expression Use from Age 4 to 7 in Swedish-Speaking Children, Discourse Processes, 59:9, 722-744, DOI: [10.1080/0163853X.2022.2132794](https://doi.org/10.1080/0163853X.2022.2132794)

To link to this article: <https://doi.org/10.1080/0163853X.2022.2132794>



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Published online: 31 Oct 2022.



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# The Development of Referring Expression Use from Age 4 to 7 in Swedish-Speaking Children

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## ABSTRACT

When telling a story, a speaker needs to refer to story characters using appropriate expressions, which requires a mental model of the discourse. We hypothesize that, compared to those of adults, children's discourse models are based more on factors that are less cognitively demanding, such as animacy, and as they grow older, discourse factors such as givenness will start to play a larger role. To test this, we conducted a longitudinal study of referring expression use in elicited narratives. Swedish-speaking children ( $n = 17$ ) were tested three times between age 4 and 7 and compared to adults ( $n = 20$ ). The results show that children, like adults, take into account if, when and how a character has been mentioned earlier when referring, but that they rely more on animacy than adults. These results indicate that the various cues for referential choices are in place in preschool children's discourse models, but are weighted differently than in adults.

## Introduction

Referring expressions are an essential part of language and communication, because they provide a link between mental representations and the outside world, identifying persons or objects in the world for an addressee. Therefore, learning the appropriate use of referential forms is an important aspect of acquiring a language. Choosing an appropriate way to refer to persons and objects in discourse requires the speaker to keep track of whether and how the referent has been mentioned before. For example, referents that are new in the discourse (referent introduction) are prototypically referred to with indefinite noun phrases (NPs), whereas given referents that have already been mentioned (referent reintroduction or maintenance) can be referred to with definite NPs or pronouns (e.g., Gundel et al., 1993; Prince, 1981). In turn, the choice between a definite NP and a pronoun is partly driven by how recently the referent was mentioned and whether it was the discourse topic (e.g., Hendriks et al., 2014). Keeping track of whether a referent is given or new in the discourse requires sufficient memory resources to maintain and update the preceding discourse. In addition, it has been argued that the speaker needs to take the listener's knowledge into account and adjust their use of different referential forms accordingly (Gundel et al., 1993; Gundel, 2010; Hendriks et al., 2014; but cf. Arnold, 2008). For example, for the appropriate use of a pronoun the speaker may need to consider whether the referent is currently in the listener's focus of attention. Taking the interlocutor's perspective requires Theory of Mind skills, allowing a speaker to determine how accessible the referent is to the listener. All this information needs to be stored and maintained by the speaker in a mental model of the discourse (Johnson-Laird, 1983). An important question is how such complex discourse models are formed and develop during childhood. Since maintaining a discourse model requires sufficient working-memory capacity as well as Theory of Mind skills, both of which children may still

be developing, children's discourse models may initially be impoverished compared to adults,' or be based on discourse factors that are less cognitively costly to implement, for example because they stay constant throughout the discourse.

In this paper, we present a longitudinal study in which we follow the development of referring expression use in elicited narratives of monolingual Swedish-speaking children from age 4 to age 7, and compare their narratives to those of adults. We investigate both referent introduction and anaphoric reference to previously introduced referents (referent reintroduction and maintenance). Specifically, we aim to explore the changes in the role local discourse factors such as givenness, recency and topicality play in children's referential choices over time, and the degree to which children rely on more global factors such as animacy.

### **The acquisition of referring expression use**

Producing adequate referring expressions to create a referentially cohesive discourse is not a trivial task for a number of reasons: First, languages provide a variety of referring expressions to choose from. For example, languages may have indefinite and definite NPs (e.g., *a boy*, *the boy*), demonstrative NPs (e.g., *this boy*), different types of pronouns such as demonstrative (e.g., *this*) and personal pronouns (e.g., *he*), and null forms, which all have their own use in the discourse. In order to acquire the referential system of a language, children thus need to understand that the different forms are used for different functions in the discourse, for instance that indefinite NPs are typically used for new referents (e.g., *once upon a time there was a little dog*), whereas definite NPs and pronouns are mostly used for referents that have been previously introduced into the discourse (e.g., *the dog became interested in a mouse and he wanted to follow it*; Gundel & Johnson, 2013). Second, in order to choose an appropriate referring expression, the speaker needs to keep the discourse in memory, which means remembering if and when a specific referent was previously mentioned. Third, the speaker also needs to monitor the interlocutor's perspective to make sure that s/he can follow the referential connections. For example, if the referent is not in the focus of the listener's attention, and is not present in the shared visual context, the use of a pronoun is infelicitous. Each of these three factors requires complex cognitive capacities: For the first, it is necessary to acquire different lexical forms and map them to pragmatic functions; for the second, sufficiently large processing capacities are needed, including a well-developed capacity to update working memory (Whitely & Colozzo, 2013) and self-monitoring; the third factor requires Theory of Mind skills (e.g., Astington & Pelletier, 2005). Taking the perspective of the listener may also require a range of other executive function skills, for instance to be able to inhibit one's own perspective (see the review in De Cat, 2015). For pre-school children, who are in the process of acquiring the use of referential expressions, maintaining a discourse model may put high demands on their capacity to update working memory (e.g., Whitely & Colozzo, 2013). Children may also lack the processing speed needed to take the listener's perspective into account (e.g., Hendriks et al., 2014; Van Rij et al., 2010). Creating a referentially cohesive discourse is therefore a challenging task for young speakers.

### **Referring expressions in Swedish**

The present study focuses on Swedish, a language in which (in)definiteness and specificity are marked morphologically. There are discourse-pragmatic rules for when the different forms are to be used (see Teleman et al., 1999, p. 269ff). An overview of the Swedish referential forms is given in Table 1.

As shown in Table 1, Swedish has an indefinite article, just like English, whereas the definiteness marker is a suffix. Next, there are four singular personal pronouns: *Hon* "she" and *han* "he" can be used to refer to all entities who possess natural gender (i.e., both animals and persons, e.g., *katten – hon* "the cat – she"),<sup>1</sup> whereas *den* "it" and *det* "it" need to agree with the antecedent's grammatical gender (common and neuter gender, respectively). Both *den* and *det* can be used with animate and inanimate

**Table 1.** The Swedish referential system compared to English.

Language	Indefinite NP	Possessive NP	Definite NP	Pronoun
Swedish	en pojke	hans gubbe	pojken/ den där pojken	han/hon/den/det/ den där/den här
English	a boy	his old man	the boy/ that boy	he/she/it/ that/this

referents (e.g., *pojken – den* “the boy – it”), although it is more common to use *hon* and *han* for human referents.

The morphological (in)definiteness markers are produced by children in spontaneous speech at around age 2 (Bohnacker, 2003, 2007; Kupisch et al., 2009); Swedish-speaking children have thus acquired the morphological means to signal different information statuses at this age, but this does not mean that they are able to use them in an adultlike manner in narrative discourse.

### **Children’s referring expressions in narratives**

Previous studies have investigated how children acquiring a number of different languages (e.g., English, French, Greek, Italian, Turkish) develop the ability to refer to characters and objects in narrative discourse using appropriate forms, with mixed findings in terms of children’s adultlikeness (e.g., Aksu-Koç & Nicolopoulou, 2015; Colozzo & Whitely, 2015; De Cat, 2013; Hickmann & Hendriks, 1999; Hickmann et al., 1996; Kail & Hickmann, 1992; Küntay, 2002; Schneider & Hayward, 2010; Serratrice, 2007; Warden, 1976; Wong & Johnston, 2004).

For Swedish, referentiality in children’s narratives has not been extensively studied. Only three larger studies of Swedish-speaking children have been published: one of character introductions in narratives by 72 monolingual children aged 4–6 (Lindgren, 2018a), one of the same children’s use of anaphoric reference (Lindgren & Vogels, 2018),<sup>2</sup> and one of 40 German-Swedish bilinguals (Lindgren et al., 2022).<sup>3</sup>

Below, we discuss the most important findings for Swedish and other languages regarding the development of referring expression use in different referential functions (introducing a new referent, reintroducing a previously introduced referent, or maintaining reference) as well as with respect to factors inherent to the referent, such as animacy and protagonist hood.

### **Referent introduction**

To be able to introduce a referent appropriately into the discourse, a speaker needs to assess whether the referent is new or given in the discourse model. If the referent is new, it should be referred to with a lexical NP rather than a pronoun for the listener to be able to identify it, and usually an indefinite article is used if such forms exist in the language. Different ages of mastery of appropriate referent introduction in narrative discourse have been reported in the literature. Several studies have shown that the ability to introduce characters appropriately may not be fully developed until age 7 (Karmiloff-Smith, 1981; Küntay, 2002; Schneider & Hayward, 2010; Wong & Johnston, 2004) or even age 9 (Colozzo & Whitely, 2015; Hickmann et al., 1996; Kail & Hickmann, 1992; Kail & Sanchez y Lopez, 1997; Serratrice, 2007; Warden, 1976); before this age, children often overuse types of referring expressions that signal that the referent is already given in the discourse (definite NPs and pronouns). However, other studies found predominant use of appropriate indefinite expressions to introduce a referent that is unknown to the listener already at age 2–4 (De Cat, 2013; Emslie & Stevenson, 1981).

For Swedish specifically, the ability to introduce characters appropriately (mainly with indefinite NPs) has been found to develop steeply between age 4 and 6: Using the same narrative task and procedure as in the present study (see below), Lindgren (2018a) found that Swedish 6-year-olds produced a significantly higher percentage of indefinite NPs to introduce story characters than 5-year-olds, who in turn performed better than 4-year-olds. The 6-year-olds used almost only fully appropriate referring expressions (90%); the 4-year-olds did this in less than half of the cases (40%).

Similarly, Lindgren et al. (2022) found that German-Swedish bilingual 6-year-olds used indefinite NPs significantly more frequently in their character introductions in both of their languages (Swedish: 83%), compared to 4-year-olds (Swedish: 61%).

The reasons for the divergent results in the literature may be sought in differences in methodology, for example in the type of stimulus materials, the number of characters, or the presence/absence of joint visual attention between child and adult listener. A stimulus with less clearly identifiable characters (Lindgren, 2018a) or a higher number of different characters that are similar to each other (Aksu-Koç & Nicolopoulou, 2015) has been found to lead to a lower use of indefinite NPs in character introduction. The same holds for a study set-up with shared visual attention between the child and the listener (Kail & Hickmann, 1992). To keep the influence of such language-external factors low, the present study uses a stimulus with just three characters that are clearly identifiable, familiar to young children, and easily distinguishable from each other, and employs a procedure with no shared visual attention between child and listener. Additionally, previous studies on referent introduction have mostly used a cross-sectional design. It is possible that different samples of children from the same age group perform quite differently due to child-internal factors that could not be controlled for. For example, a particular sample may consist of children that are particularly high-performing for their age, which may make them more similar to a sample of older, but more average-performing children. For this reason, the present study investigates children's use of referring expressions longitudinally.

### **Anaphoric reference: Referent reintroduction and maintenance**

In general, children's ability to refer back to already introduced characters in narratives (i.e., anaphoric reference) seems to develop earlier than the ability to introduce new referents (e.g., Aksu-Koç & Nicolopoulou, 2015; Colozzo & Whitely, 2014; Hickmann & Hendriks, 1999). However, it remains unclear at what age children start taking the various discourse factors that characterize adults' reference production into account. In some studies of narrative discourse, 3- to 4-year-olds were found to make use of discourse cues such as recency of mention and grammatical function: They used more pronouns when the referent was the grammatical subject of the previous clause than when it was the object or when it was not mentioned in the previous clause at all (Aksu-Koç & Nicolopoulou, 2015; Hickmann & Hendriks, 1999; Hickmann, 2002). This suggests that these children were able to maintain quite detailed discourse models. In spontaneous speech, children may even be sensitive to the accessibility of referents in discourse as early as age 1.5 (Allen et al., 2015).

Other studies report that children continue to have difficulty choosing appropriate referring expressions for already introduced referents in narratives until at least age 7, especially in narratives (Bamberg, 1986; Colozzo & Whitely, 2014, 2015; Hendriks et al., 2014; Karmiloff-Smith, 1985; Leclercq & Lenart, 2013; Lehmkuhle & Lindgren, 2022). More specifically, children have been found to overuse pronouns when *reintroducing* referents that were not recently mentioned, leading to incohesive discourses (Bamberg, 1986; Colozzo & Whitely, 2014). Children may also produce pronouns to refer back to a referent that was not the discourse topic in the previous utterance, in which case adults would prefer a definite NP (Hendriks et al., 2014). The discourse topic is defined as the syntactically most prominent (subject and/or first-mentioned) referent in the previous utterance that is also mentioned in the current utterance. Hendriks et al. (2014) argue that referring to referents after a topic shift requires perspective-taking skills to ensure that the listener can interpret the reference correctly. Children may have difficulty taking the perspective of the listener, and therefore choose a pronoun as the default form to refer to referents that are given in the discourse.

*Maintaining* reference to the same referent across utterances is often considered easiest for children (e.g., Aksu-Koç & Nicolopoulou, 2015; Colozzo & Whitely, 2014). This may be because choosing a referring expression for referent maintenance can be done based on the previous discourse alone, without taking the perspective of the listener into account (Hendriks et al., 2014). For maintaining reference to prominent (topical) referents, the preferred form based on the previous discourse as well as from the listener's perspective (i.e., a pronoun or null form), also coincides with the speaker's

preference to produce economical (short, less informative) forms (Hendriks et al., 2014). Still, there are also reports of children overusing lexical NPs in contexts where the referent is in fact prominent in the discourse (e.g., Arnold et al., 2009; Karmiloff-Smith, 1985; see also the overview in Allen et al., 2015). This could be due to referents becoming less accessible in the speaker's own discourse model, for instance because of a high cognitive load (Arnold et al., 2009). It could also be due to speakers being uncertain about how the listener would interpret a pronoun (cf. Goodman & Frank, 2016).

For Swedish-speaking children's narratives specifically, findings for the development with age of referential choices in referent reintroduction and maintenance have been less clear than for referent introduction: Using the same narrative task as in the present study, Lindgren and Vogels (2018) only found that children aged 4 sometimes used indefinite NPs for referent reintroduction, and that this use had decreased significantly at age 6,<sup>4</sup> but found no further change in the children's use of referring expressions. At age 6, children still used pronouns that were unrecoverable for the listener. At the same time, even the 4-year-old children were sensitive to the difference between reintroduction and maintenance, and used only around 20% pronouns in reintroduction compared to around 60% in maintenance (Lindgren & Vogels, 2018, p. 52).

Just as for referent introduction, the mixed findings for the development of anaphoric reference may be linked to differences in methodology. For example, the presence or absence of shared knowledge between child and listener has been found to influence children's use of pronouns, with fewer pronouns in referent reintroduction when there is no shared knowledge, for example when the listener is blindfolded (Hickmann et al., 1995). Another possible explanation may be that previous research has not always clearly separated the various discourse factors that influence referent accessibility. For instance, within the category referent maintenance usually no distinction is made between reference to the topic of the previous clause and reference to a non-topic from the previous clause. However, at least in adult referential choices, topicality is considered an important factor in the choice to pronominalize (e.g., Arnold, 2010; Grosz et al., 1995). Thus, it is not yet clear whether development proceeds similarly for maintaining reference to topical and non-topical referents. This issue is addressed in the present study.

### ***Referent-intrinsic factors***

If young children between 4 and 7 are sensitive to discourse factors in their choice of referring expression, but still tend to overuse either pronouns or lexical NPs, the question is what their discourse models look like. One possibility is that young children's discourse models are impoverished versions of adults' discourse models (e.g., Bock & Brewer, 1985). For taking into account local discourse factors such as givenness, recency and topicality, working memory needs to be continuously updated to reflect the current status of the discourse referents (Whitely & Colozzo, 2013). In addition, the speaker may be required to consider the perspective of the listener, to establish how prominent the referent is from the listener's point of view (e.g., Hendriks et al., 2014). Since children have limited cognitive capacities, they may have trouble keeping track of the prominence of the characters in the discourse, and choose referring expressions based on only a limited part of the context. For example, they might only be able to take the directly preceding clause into account, resulting in difficulties with reintroducing earlier mentioned referents, or they might fail to take into account the visual presence of other potential referents. They may also lack the processing speed necessary to take the perspective of the listener into account (Hendriks et al., 2014; Van Rij et al., 2010). Such problems may lead children to overproduce either ambiguous pronouns or over-informative lexical NPs.

Alternatively, children may resort to prioritizing discourse factors that do not place a large burden on their cognitive capacities. More global discourse factors such as protagonist-hood and animacy may be cognitively less demanding than local discourse factors: First, these factors generally stay constant in the discourse, and therefore do not require continuous updating of the discourse model in working memory. Second, there is no need to take the perspective of the listener, since the animacy and protagonist-hood of referents do not normally differ between the speaker's and the listener's perspective. Hence, since taking into account local discourse factors is cognitively costly, children may

primarily use pronouns for human characters and/or protagonists and lexical NPs for animals and inanimate objects. Indeed, such a tendency has been found in previous research into children's narratives (e.g., Bamberg, 1986; Colozzo & Whitely, 2015; Kail & Hickmann, 1992; Karmiloff-Smith, 1985; Lehmkuhle & Lindgren, 2022; Lindgren & Vogels, 2018; Lindgren et al., 2022; Serratrice, 2013; see also the overview in Hickmann et al., 2015). For example, Lindgren and Vogels (2018) found a significant effect of humanness on the use of pronouns to refer back to already introduced characters in narratives; their Swedish monolingual 4–6-year-olds more commonly used pronouns to refer to the human referent than to non-human animates and inanimate referents, in both reintroduction and maintenance. In addition, Lindgren et al. (2022) found that, in both their languages, Swedish-German bilinguals aged 4 and 6 more often used pronouns to introduce a human character compared to other animate characters. Similarly, Colozzo and Whitely (2015) found effects of both animacy and protagonisthood on referring expression choice in English-speaking children aged 6 to 9, although the effect of local discourse factors was stronger. Recently, Lehmkuhle and Lindgren (2022) found that main characters in German-speaking 10-year-olds' written narratives were more likely to be pronominialized than secondary characters.

Traditionally, such effects of referent-intrinsic factors have been attributed to a *thematic subject strategy* (Karmiloff-Smith, 1985): Children pick one character from the narrative that they consider the thematic subject or protagonist, and reserve pronoun use for this character, referring to other characters primarily with lexical NPs. Bamberg (1986) characterized this type of behavior as an instance of a *global strategy*, in which referential choices are made based on properties of the narrative as a whole, as opposed to an adult *local strategy*, where it is the anaphoric relations between individual utterances that determine referring expression use.

We argue that there is no need for a categorical distinction between separate strategies, with children gradually shifting from one to the other as they become older. Rather, we propose that both children's and adults' referential choices are influenced by the same set of discourse factors, only weighted differently. After all, global factors such as animacy (humanness) and protagonisthood have not only been found to influence the use of referring expressions by children, but also by adults (e.g., Anderson et al., 1983; Fukumura & van Gompel, 2011; Vogels et al., 2013), with more pronouns for animate/human referents or referents that are the main characters of a story. For example, Fukumura and van Gompel (2011) found that, in a sentence continuation task, adult speakers of English used more pronouns when they referred back to a human antecedent than when they referred to an inanimate referent, irrespective of the referent's grammatical function. These findings can be explained by the fact that human agents are generally highly salient, and are therefore more accessible in the speaker's discourse model. In the absence of sufficient cognitive resources to calculate the referent's accessibility in the local discourse context or in the listener's discourse model (cf. Vogels et al., 2015), animacy provides a principled way for children to choose a type of referring expression without much cognitive effort.

### **The present study**

As discussed above, the lack of consensus in the literature about the ages at which reference in different referential contexts is adultlike may be partly due to differences in methodology and variation in discourse contexts, but also to individual differences between children in their developmental trajectories, which makes it more difficult to directly compare age groups. To account for individual differences in children's developmental trajectories in referring expression use in oral narratives, the present study takes a longitudinal perspective, testing the same Swedish monolingual children three times between age 4 and 7 with the same narrative task. To our knowledge, no previous study employing narrative tasks has investigated the development of children's referential abilities longitudinally. In addition, relatively little is known about Swedish-speaking children's referential abilities in comparison to adults; the three previous studies of Swedish-speaking children did not include adult data and generally little is known about Swedish-speaking adults' use of referring expressions in

narratives. For this reason, the present study also includes an adult control group. The following three research questions were asked:

- (1) What is the developmental trajectory of Swedish children's use of referring expressions in narratives from age 4 to 7, and in what ways does children's use differ from that of adults?
- (2) Do children use animacy as a more important cue for referring expression choice when they are younger, and as compared to adults?
- (3) Do children use the discourse factors givenness, recency and topicality as more important cues when they are older? Are the children adultlike with respect to these discourse factors at age 7?

We hypothesize that young children choose referring expressions based on a discourse model in which animacy has a higher weight than factors that require a more detailed monitoring of the discourse, such as givenness, recency, and topicality. Specifically, this would entail that pronouns are mainly used for human referents, irrespective of their discourse function. As they grow older, children may increasingly incorporate the discourse factors in their discourse models, such that their relative weight increases with age. For adults and the children at the older ages, we expect that the choice of referring expressions is based more on discourse factors than on animacy, namely using indefinite NPs for new referents, and pronouns for referents that are recently mentioned and topical.

## Materials and methods

### Participants

Oral narratives were elicited from 17 children (10 girls), who were monolingual speakers of Swedish, and 20 Swedish-speaking adults (11 women). The adults had grown up in monolingual homes, but all of them had later learned one or more languages at school. All participants lived in a larger city in Sweden. The adults and the parents of the children signed written consent forms and filled in brief background questionnaires. According to the questionnaires, none of the participants had had any difficulties related to language development. All adult participants and all parents had at least finished secondary education; most also had some tertiary education.

The children were tested three times with 1.5-year intervals. Mean ages were 4;4 at T1 (years; months, range: 4;0–4;8), 5;10 at T2 (range: 5;5–6;2), and 7;4 at T3 (range: 6;11–7;8). Mean age of the adult participants was 29;6 (range 19–57). The children were recruited by preschool personnel from two preschools at T1, which they still attended at T2. At T3, they attended grade 1 at 13 different schools. The children were tested in their (pre)schools, and the adult participants were tested at the university. Both adults and children received a cinema ticket after having completed their participation in the study.

### Materials

The participants told narratives to either *Cat* or *Dog* from the Multilingual Assessment Instrument (MAIN; Gagarina et al., 2012, 2015). These narrative tasks, which were constructed to be suitable for children aged 4–10, consist of picture sequences with six colored pictures.<sup>5</sup> Both picture sequences depict a three-episode story with three story characters (two animals, one human), which were all included in our analysis (see Table 2). Inanimate objects were not included in the analysis. The plots of the two stories are strictly parallel: A cat/dog tries to catch a butterfly/mouse, but ends up hurting itself (episode 1). At the same time, a boy comes back from a fishing trip/visit to the store with a ball/balloon and a bucket of fish/bag with sausages. The boy sees the cat/dog hurting itself, is surprised and loses his ball/balloon. While he is recovering his lost object (episode 2), the cat/dog takes and eats the fish/sausages (episode 3). The story ends with the boy being happy that he got his ball/balloon back and the cat/dog happily munching away on the fish/sausages.

Each character appears on multiple consecutive pictures and all characters have the potential to be introduced, reintroduced, and maintained. The picture sequences do not suggest a particular protagonist of the whole stories, as visual focus in the pictures is gradually shifted from the animal characters to the human character (i.e., the human character is introduced visually in the background of the second picture and is gradually foregrounded in the remaining pictures). The animal characters on the one hand and the human character on the other are mainly advancing their own, independent, plot lines.

### Procedure

The second author carried out the narrative task with all participants, acting as both experimenter and listener. The procedure was identical for children and adults. Each child participant told the same story, which was either *Cat* or *Dog*, at all testing points; the adults also told either *Cat* or *Dog*. For both children and adults, the *Cat/Dog* was administered as part of a larger battery of tasks (see Lindgren, 2018b: Chapter 3). The MAIN standard procedure was followed closely (see Gagarina et al., 2012). This procedure is as follows. The participant chooses an envelope out of three placed on the table and looks at the story inside, presented as a folded strip. When the participant has looked at all pictures, they are folded back so that only the first two are visible. The participant is then asked to begin the story. When s/he has finished telling the content of the first two pictures, the next two and later the final two are unfolded by the experimenter. At no point before or during the story telling are the pictures visible to the experimenter (the pictures are turned toward the participant during the procedure; the experimenter sees only the back of the pictures), who also acts as if the stories are unknown to her and gives only minimal prompts (e.g., *mm*, and *then?*).

All narratives were video- and audio-recorded and were transcribed in the CHAT-format (MacWhinney, 2000) by the second author, a native speaker of Swedish. Examples of narratives are given in Appendix A.

### Coding and analysis

All expressions referring to one of the included referents (see Table 2) were coded for participant, time of testing/group (T1, T2, T3, or adult control), type of referring expression, referential function, and humanness by the second author, provided that the intended referent could be determined based on the context and knowledge of the story. The coding was subsequently checked by the first author. All disagreements were solved through discussion.

For *type of referring expression*, we distinguished between the following categories: indefinite NP (e.g., *en pojke* “a boy”), possessive NP (e.g., *hans gubbe* “his old man;” only one instance), definite NP (which included both constructions with noun + definite marker, e.g., *pojken* “the boy,” and with demonstrative article + noun + definite marker, e.g., *den där pojken* “that boy”), bare noun (e.g., *pojke* “boy;” normally infelicitous as a referring expression), pronoun (e.g., *han* “he”), or null forms (i.e., *Och gubben kommer och fiskar*. “And the old man comes and Ø is fishing;” *Pojken tappar sin boll. Blir ledsen*. “The boy drops his ball. Ø Becomes sad.”). Demonstrative pronouns (e.g., *den där* “that;” very infrequent) were coded as pronouns. Referring expressions that consisted of both a definite NP and a pronoun (e.g., *han pojken* “he the boy;” infrequent) were coded as definite NPs. Plural pronouns referring to more than one referent (4 instances) were removed from the data.

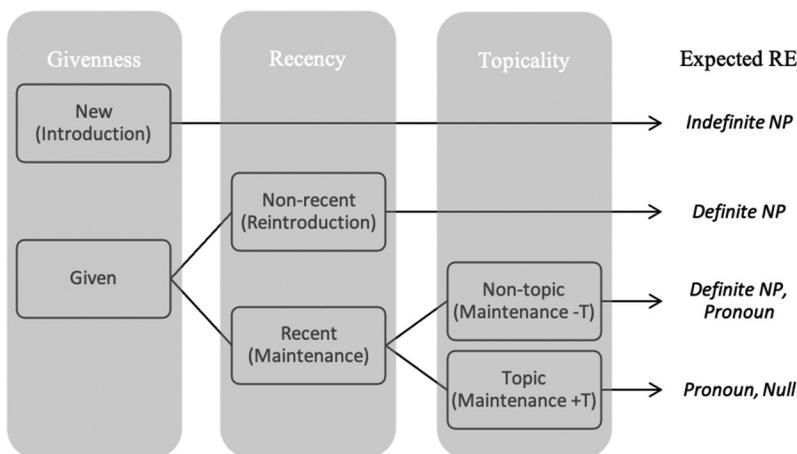
**Table 2.** Referents included in the analysis.

	Cat	Dog
<i>Character 1</i>	Cat	Dog
<i>Character 2</i>	Butterfly	Mouse
<i>Character 3</i>	Boy	Boy

For *humanness*, we coded the referent as either non-human animate or human. For the factor *discourse function*, we used a nested coding system that allows for binary comparisons in the analyses (see below): A referring expression was coded as *new* when it was the first mention of the referent (referent introduction), and as *given* when it had been previously mentioned in the discourse (anaphoric reference). Within the category *given*, referents were further coded as *non-recent* (referent reintroduction) when the referent was not mentioned in the previous utterance unit, and as *recent* (referent maintenance) when the referent was mentioned in the previous clause or utterance unit. An utterance unit was defined as either a main clause and all its non-adjunct subordinate clauses or an adjunct subordinate clause. Coordinated main clauses were thus counted as separate units. For referents that were both given and recent (referent maintenance), we furthermore coded expressions as *non-topical* (maintenance -T) when they were not the first-mentioned referent in the previous utterance unit and as *topic* (maintenance +T) when they were.<sup>6</sup> An overview of the different discourse functions and the expected referring expression types for each function is presented in Figure 1. An example of an annotated narrative is given in Appendix B.

We first analyzed the effects of Time of testing, Discourse function and Humanness on the children's choice of a particular referring expression. Here, we ran two logit mixed effects models (using the *glmer*-function in the R-package *lme4*; Bates, Mächler, et al., 2015), one on the log odds of producing an indefinite NP out of all referring expressions, and one on the log odds of producing a pronoun (including null forms) out of all referring expressions. Together these two models cover the full hierarchy of discourse functions (see Figure 1): Indefinite NPs are expected to be produced for new referents, but not for given referents, while pronouns and null forms are expected for recent (and especially topical) referents, but not for non-recent or new referents. Time (of testing), Discourse function, Humanness and Story (Cat vs. Dog) were included as fixed factors, and Participant as random factor. Interactions between Discourse function and Time, and between Humanness and Time were included. Factors with more than two levels were Helmert coded, which results in a nested categorization where one category is compared to the combination of the following categories. Thus, for Time, one predictor compared T1 with T2 and T3 together, and one predictor compared T2 with T3; for Discourse function, one predictor compared new with given referents (henceforth Givenness), another compared non-recent with recent given referents (henceforth Recency), and a third compared recent non-topical referents with recent topical referents (henceforth Topicality).

The analysis of the longitudinal data was complemented by an analysis comparing the children at T3 to the adult control group. This analysis was performed in the same way, running separate models



**Figure 1.** Overview of our nested categorization of discourse functions and the expected referring expression (RE) types for each discourse function in adult narrators.

on the log odds of an indefinite NP and on the log odds of a pronoun, except that the three-way factor Time was replaced with the binary factor Group (T3, adult).

For all analyses, we started out with a model containing the maximal random-effects structure: random intercepts for participant, and random slopes for all fixed factors and interactions. We then systematically removed first random correlations and then random effects one by one, starting with the ones with the lowest variation, testing at each step that model fit did not become significantly worse using a Likelihood Ratio Test (Bates, Kliegl, et al., 2015). Only final models are reported.

## Results

### Descriptives

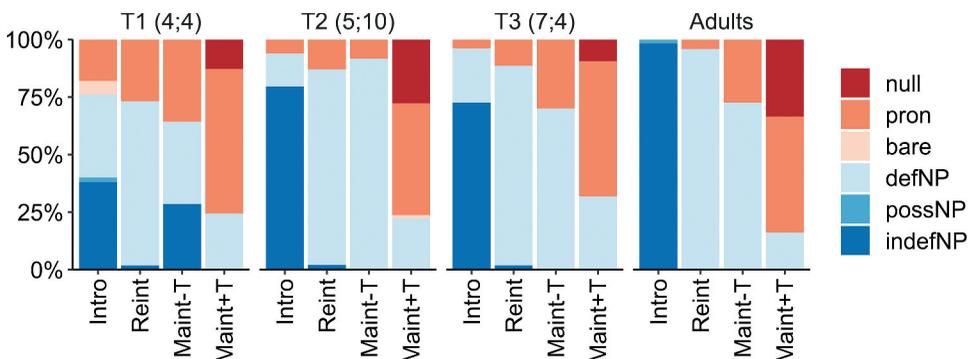
Table 3 shows the mean length of the stories per age group, both in number of tokens (words) and number of utterances, as well as the total number of referring expressions in each group. In total, 1,192 referring expressions were produced.

Figure 2 shows the distribution of the different types of referring expressions across the four discourse functions, and Figure 3 shows the distribution for Humanness. As can be seen in Figure 2, both the adults and the children show predominant use of indefinite NPs to introduce new referents (except at T1, where definite NPs are similar in frequency to indefinite NPs), use of definite NPs to reintroduce a previously introduced (given) referent, use of definite NPs and pronouns to refer back to a recently mentioned non-topical referent (again except for T1, where a sizable proportion of indefinite NPs are used to maintain reference to a non-topic), and use of pronouns and null forms to refer to a referent that was the topic of the previous clause. Null forms are exclusively used for referents that are topical. A few possessive and bare NPs are produced, especially for new referents by the children at T1. Figure 3 shows that pronouns and null forms are more often used for human referents than for non-human referents.

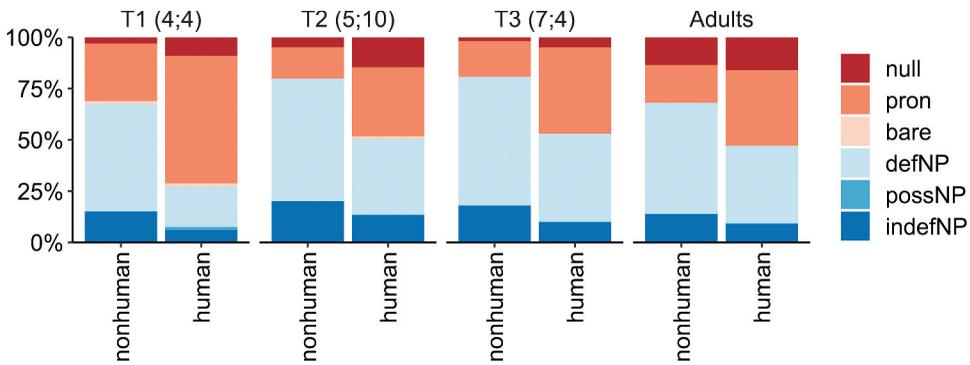
**Table 3.** The average number of word tokens (top row), the average number of utterances (center row) and the total number of referring expressions (bottom row) per story produced by the children at the three time points ( $n = 17$ ) and the adults ( $n = 20$ ).

	T1 (4;4)	T2 (5;10)	T3 (7;4)	Adults	Total
Word tokens	70.5 (28.3)	82.9 (19.9)	98.8 (24.6)	173.1 (64.2)	109.1 (57.1)
Utterances	11.0 (3.2)	13.0 (2.2)	13.9 (3.0)	21.3 (6.9)	15.1 (5.9)
Referring expressions	198	233	261	500	1,192

Standard deviations are given in brackets.



**Figure 2.** Distribution of types of referring expression by discourse function, for the children at the three time points and the adult control group (*null* = null form; *pron* = pronoun; *bare* = bare noun; *defNP* = definite NP; *possNP* = possessive NP; *indefNP* = indefinite NP; *Intro* = Referent introduction; *Reint* = Referent reintroduction; *Maint-T* = Referent maintenance, non-topical; *Maint+T* = Referent maintenance, topical).



**Figure 3.** Distribution of types of referring expression by humanness, for the children at the three time points and the adult control group (*null* = null form; *pron* = pronoun; *bare* = bare noun; *defNP* = definite NP; *possNP* = possessive NP; *indefNP* = indefinite NP).

**Table 4.** Percentages of indefinite NPs used by the children at the three time points ( $n = 17$ ) and by the adults ( $n = 20$ ), split by Discourse function (a) and by Humanness (b). The absolute numbers of indefinite NPs out of all produced referring expressions within that category are given in brackets.

(a)	T1 (4;4)		T2 (5;10)		T3 (7;4)		Adults	
<b>New</b>	38.0	(19/50)	79.6	(39/49)	72.6	(37/51)	98.3	(59/60)
<b>Given (total)</b>	3.4	(5/148)	1.1	(2/184)	1.0	(2/210)	0.0	(0/440)
(b)	T1 (4;4)		T2 (5;10)		T3 (7;4)		Adults	
<b>Human</b>	6.1	(4/66)	13.5	(12/89)	10.0	(10/100)	9.0	(19/212)
<b>Non-human</b>	15.2	(20/132)	20.1	(29/144)	18.0	(29/161)	13.9	(40/288)

### Use of indefinite NPs

We analyzed effects of Time (of testing), Discourse function and Humanness on the children's choice of indefinite NPs out of all referring expressions ( $N = 692$ ). Since indefinite NPs did not occur for topical referents, and not for recently mentioned referents above age 4, we collapsed over given, recent and topical referents, comparing only new to given referents. Table 4 shows an overview of the percentage of indefinite NPs used by the children at the three time points and by the adults, split by Discourse function (Givenness) and by Humanness.<sup>7</sup> Note that while the number of references to new information remains fairly constant over time, since each character can be introduced at most once in a story, the total number of references to given information increases substantially over time (Table 4a). The same holds for references to the human character (Table 4b), which show a proportionally stronger increase over time than references to the non-human characters.

The final model for the children's use of indefinite NPs, presented in Table 5, showed significant main effects of Time and of Givenness. Importantly, the two factors also interacted, suggesting that the effect of Givenness on the use of indefinites was stronger for the children at T2/T3 (new: 76.0%; given: 1.0%) than at T1 (new: 38.0%; given: 3.4%). No significant difference was found between T2 and T3. Finally, there was a significant effect of Humanness, with fewer indefinites for the human character (10.2%) than for the animal characters (17.8%). The effect of Story was not significant.

As shown in Figure 2 and Table 4, there was little variation in the adults' use of indefinites: Indefinite NPs were exclusively used for new referents, and all but one referring expression to introduce new referents were indefinite NPs (98.3%). Therefore, we did not statistically compare the children's performance at T3 with the adult control group. However, it is clear from Figure 2 and

**Table 5.** Summary of the final logit mixed effect model (IndefiniteNP ~ Time \* Givenness + Time \* Humanness + Story + (1 + T2 vs. T3 \* Humanness || Participant)) for the children's choice of indefinite NPs out of all referring expressions (N = 692).

Random effects	Variance	
Participant: Intercept	0.38	
Participant: T2 vs. T3	17.60	
Participant: Humanness	0.48	
Participant: T2 vs. T3 * Humanness	17.41	
Fixed effects	$\beta$	SE
Intercept	-4.40***	0.71
Time 1: T1 vs. T2/T3	1.94*	0.99
Time 2: T2 vs. T3	0.65	1.45
Givenness: New vs. Given	7.26***	1.32
Humanness: Hum vs. Non-hum	-1.51**	0.56
Story	-0.46	0.51
Time 1 * Givenness	-6.19**	1.93
Time 2 * Givenness	-0.01	1.57
Time 1 * Humanness	0.04	0.95
Time 2 * Humanness	1.03	1.61

\*\*\* =  $p < .001$ , \*\* =  $p < .01$ , \* =  $p < .05$ . Values have been rounded to two decimal points. Time = Time of testing, T1 = mean age 4;4, T2 = mean age 5;10, T3 = mean age 7;4, Hum = Human, Non-hum = Non-human. The second value of a predictor is its reference level.

**Table 6.** Percentages of pronouns used by the children at the three time points (n = 17) and by the adults (n = 20), split by Discourse function (a) and by Humanness (b). The absolute numbers of pronouns out of all produced referring expressions for that category are given in brackets.

(a)	T1 (4;4)		T2 (5;10)		T3 (7;4)		Adults	
<b>New</b>	18.0	(9/50)	6.1	(3/49)	3.9	(2/51)	0.0	(0/60)
<b>Given (total)</b>	53.4	(79/148)	37.5	(69/184)	36.2	(76/210)	46.4	(204/440)
<i>Non-recent</i>	26.8	(15/56)	13.0	(13/100)	11.4	(12/105)	4.1	(7/171)
<i>Recent (total)</i>	69.6	(64/92)	66.7	(56/84)	61.0	(64/105)	73.2	(197/269)
Non-topical	35.7	(5/14)	8.3	(1/12)	30.0	(6/20)	27.5	(14/51)
Topical	75.6	(59/78)	76.4	(55/72)	68.2	(58/85)	83.9	(183/218)
(b)	T1 (4;4)		T2 (5;10)		T3 (7;4)		Adults	
<b>Human</b>	71.2	(47/66)	48.3	(43/89)	47.0	(47/100)	52.8	(112/212)
<b>Non-human</b>	31.1	(41/132)	20.1	(29/144)	19.3	(31/161)	31.9	(92/288)

Table 4 that the children were not yet fully adult-like in their production of indefinite NPs at T3 (72.6% indefinite NPs for new referents).

### Use of pronouns

We analyzed the effects of Time, Discourse function, and Humanness on the children's choice of pronouns, including null forms, out of all referring expressions (N = 692). Table 6 shows an overview of the percentage of pronouns used by the children at the three time points and by the adults, split by Discourse function and by Humanness.

The final model for the children is presented in Table 7. There were significant main effects of Givenness, Recency and Topicality on the use of pronouns (including null forms) vs. all other expressions, with more pronouns for given referents (41.3%) than for new referents (9.3%), more pronouns for recent (65.5%) than for non-recent given referents (15.3%), and more pronouns for recent topical referents (73.2%) than recent non-topical referents (26.1%; see Table 6). There was also a significant main effect of Time: At T1, children produced more pronouns in general (44.4%) than at T2/T3 (30.4%). The difference in pronoun use between T2 (30.9%) and T3 (29.9%) was not significant.

**Table 7.** Summary of the final logit mixed effect model (Pronoun ~ Time \* Discourse function + Time \* Humanness + Story + (1 + New vs. Given + Given non-recent vs. Recent + T2 vs. T3 \* Humanness || Participant)) for children's use of pronouns, including null forms, out of all referring expressions (N = 692).

Random effects	Variance	
Participant: Intercept	1.31	
Participant: Givenness	1.79	
Participant: Recency	1.48	
Participant: Time 2	2.13	
Participant: Humanness	2.12	
Participant: Time 2 * Humanness	6.91	
Fixed effects	$\beta$	SE
Intercept	-1.60***	0.36
Time 1: T1 vs. T2/3	1.54***	0.38
Time 2: T2 vs. T3	0.03	0.61
Givenness: New vs. Given	-3.18***	0.67
Recency: Given non-recent vs. Recent	-3.08***	0.57
Topicality: Recent non-topic vs. Topic	-2.09***	0.58
Humanness: Hum vs. Non-hum	2.47***	0.49
Story	-1.08	0.64
Time 1 * Givenness	0.71	0.91
Time 2 * Givenness	0.84	1.29
Time 1 * Recency	1.05	0.82
Time 2 * Recency	0.76	1.02
Time 1 * Topicality	0.63	1.12
Time 2 * Topicality	-2.24	1.49
Time 1 * Humanness	1.12	0.66
Time 2 * Humanness	-0.40	0.98

\*\*\* =  $p < .001$ . Values have been rounded to two decimal points. Time = Time of testing, T1 = mean age 4;4, T2 = mean age 5;10, T3 = mean age 7;4, Hum = Human, Non-hum = Non-human. The second value of a predictor is its reference level.

**Table 8.** Summary of the final logit mixed effect model (Pronoun ~ Group \* Discourse function + Group \* Humanness + Story + (1 | Participant)) comparing the use of pronouns out of all referring expressions (N = 761) between the children at T3 and the adult control group.

Random effects	Variance	
Participant: Intercept	0.56	
Fixed effects	$\beta$	SE
Intercept	-0.96***	0.20
Group: T3 vs. Adults	0.21	0.39
Recency: Non-recent vs. Recent	-3.65***	0.34
Topicality: Recent non-topic vs. Topic	-2.07***	0.34
Humanness: Hum vs. Non-hum	1.04***	0.26
Story	0.29	0.35
Group * Recency	1.02	0.65
Group * Topicality	1.60*	0.76
Group * Humanness	1.21*	0.52

\*\*\* =  $p < .001$ , \* =  $p < .05$ . Values have been rounded to two decimal points. T3 = mean age 7;4, Hum = Human, Non-hum = Non-human. The second value of a predictor is its reference level.

Furthermore, there was a significant effect of Humanness, with more pronouns for the human character (53.7%) than for the animate characters (23.1%). There were no significant interactions between Time and Givenness, Recency or Topicality, or between Time and Humanness. The effect of Story was not significant.

Next, we compared the proportion of pronouns out of all referring expressions ( $N = 761$ ) between the children at T3 and the adult control group. Because the adults did not produce pronouns for new referents, the variable Discourse function only compares recent with non-recent (given+new) referents, and recent non-topical referents with topical referents. The final mixed effects model is presented in Table 8. We found significant main effects of Recency and Topicality, with more pronouns for recent (69.8%) than for non-recent referents (6.9%), and more pronouns for topical referents (79.5%) than for recent non-topical referents (28.2%). This latter effect was qualified by a significant interaction with Group, suggesting that the difference between topical and non-topical referents was larger for the adults (topic: 83.9%; non-topic: 27.5%), than for the children at T3 (topic: 68.2%; non-topic: 30.0%). Furthermore, there was a significant main effect of Humanness, with more pronouns for the human character (51.0%) than for the non-human characters (27.4%; see Figure 3). This effect was also qualified by a significant interaction with Group, suggesting that the effect of Humanness was larger for the children at T3 (human: 47.0%; non-human: 19.3%) than for the adults (human: 52.8%; non-human: 31.9%).

## Discussion

In this paper, we have reported results from a longitudinal study of Swedish monolingual children's use of referring expressions in narratives from age 4 to 7, comparing them to an adult control group. Narratives were elicited from 17 children at three time points (mean ages 4;4, 5;10 and 7;4 at T1, T2, and T3, respectively) and from 20 adults, using the *Cat/Dog* stories from the Multilingual Assessment Instrument for Narratives (MAIN; Gagarina et al., 2012, 2015). The three research questions concerned how referring expression use develops with age (RQ1), whether children use animacy as a more important cue for referring expression choice at a younger age (RQ2) and whether they use discourse factors as a more important cue at an older age (RQ3), all in relation to adults' referring expression use. Here, we summarize and discuss the results for these research questions in turn.

### RQ1: Development with age

With respect to the general development with age, the children were found to generally use more pronouns at age 4;4 than at the later time points, but with no further reduction in the use of pronouns from age 5;10 to 7;4 or with respect to the adult control group. This finding suggests that especially younger children may overuse pronouns at the expense of more informative expressions. As children start to become aware that pronouns may be ambiguous, they may start using pronouns more strictly, favoring more specific referring expressions. At the same time, the children showed sensitivity to all discourse functions already at age 4;4, in line with earlier studies (e.g., Aksu-Koç & Nicolopoulou, 2015): They used significantly fewer pronouns when introducing new referents than when referring back to already introduced referents, indicating that children at this age are sensitive to givenness in the linguistic context. They also used fewer pronouns when reintroducing given referents than when referring to recently mentioned referents, suggesting that children take into account the recency of a referent in their referential choices. Finally, they used more pronouns for referents that were the topic of the previous utterance than for non-topical referents, suggesting that young children can also distinguish referents based on their topicality.

### RQ2: Animacy

In addition to the effects of discourse function, we found a clear humanness effect on the use of pronouns across all three time points as well as for the adult group, with the human character attracting more pronouns than animals. This shows that, in line with earlier studies, the degree of animacy is an important factor in preschool children's choice of referring expression (Bamberg, 1986;

Colozzo & Whitely, 2015; Hickmann et al., 1995; Kail & Hickmann, 1992; Serratrice, 2013), as well as in adults' reference production (Fukumura & van Gompel, 2011; Vogels et al., 2013).

There was also an effect of humanness on the children's use of indefinite NPs, with a lower proportion of indefinites for the human character than for the animals. This would corroborate the view that children's referential choices are informed partly by global, inherent properties of referents (see also Lindgren & Vogels, 2018, where more indefinite NPs were found in reference to inanimate objects than to animate or human characters). However, given the tight coupling between indefinite NPs and character introductions, at least from age 5 (see Figure 2), the effect may also partly or completely be explained by the fact that the children at the later time points more frequently referred to the human character in general than to the animal characters. After all, if indefinite NPs are exclusively used to introduce new characters in the story, each character cannot be referred to with an indefinite NP more than once. Other referring expressions, such as definite NPs and pronouns, are not subject to the same constraint. Hence, when characters become more likely to be referred to, this will lead to an increase in definite NPs and/or pronouns, but not indefinite NPs. In turn, the number of indefinite NPs will constitute a smaller proportion of the total amount of referring expressions. This might explain why indefinite NPs are proportionally less frequent in references to humans than to non-humans.<sup>8</sup> If so, the animacy effect on indefinite NP use would still be in line with the proposed role of inherent factors in referential choices, but indirectly, via likelihood of reference.

Our hypothesis that the effect of animacy would diminish over time in favor of discourse factors such as givenness, recency and topicality was partly borne out: For the children, we did not find evidence for a decrease in the size of the humanness effect over time. However, the humanness effect on pronoun use was significantly larger for the children at T3 than in the adult control group, suggesting that children at age 7 are still relying more on humanness as a cue for referential choice than adults.

### **RQ3: Discourse factors**

We predicted that a decrease in the role of animacy in referential choices would coincide with an increase in the use of local discourse factors. As with animacy, the effect of local discourse factors on the children's use of pronouns did not significantly change with age, apart from the general decrease in pronoun use. However, at age 7;4 children still did not show the same sharp distinction between the different discourse functions in terms of pronoun use as the adults, who used no pronouns for introducing new referents, only very few for reintroducing given referents, and primarily pronouns and null forms for referring to referents that were the topic of the previous utterance.<sup>9</sup> Indeed, whether a referent was only recently mentioned or also topical had a significantly stronger effect on pronoun use in the adults than in the children at T3.

The children's use of indefinite NPs to introduce new referents did increase significantly between age 4;4 and age 5;10, suggesting that, between age 4 and 5, children are getting better at using indefinites based on the referent's givenness in the discourse. Nevertheless, at age 7 the children still produced fewer indefinite NPs in introductions than adults, in favor of definite NPs (and a few pronouns). Thus, it seems that at least until age 7, children are still learning to take the local accessibility of referents in the discourse into account in their choice of referring expression; they are not yet adultlike in this respect. That the adultlike use of referring expressions based on the local discourse takes a long time to acquire is supported by the results from Lehmkuhle and Lindgren (2022), where the effect of discourse function (reintroduction vs maintenance) on referring expression use in written text was found to be stronger for adults than for 10-year-olds.

### **Comparison with cross-sectional data**

The results from our longitudinal study are generally consistent with findings from cross-sectional studies reported in the literature, but there are also differences. For all discourse functions, development of referential ability seems to be very steep between age 4;4 and 5;10. However, after that development seems to level off, which is in contrast to previous studies that found further development also after age 6 (e.g., Colozzo & Whitely, 2015; Hickmann et al., 1996). At age 7, the children are more adultlike in their dealing with anaphoric reference, although even at this point, they do not rely as much on discourse factors as adults, especially regarding topicality. On the other hand, this lack of development in the use of referring expressions from 5;10 to 7;4 is in line with results from a study investigating comprehension and production of narrative macrostructure (story structure) in the same children (Lindgren, 2019). This suggests that for these children as a group, the ability to produce cohesive narratives in general does not change much during this period.

Furthermore, our result for referent introduction at age 7;4 was not according to our expectations; since the 6-year-olds in the cross-sectional study of Swedish-speaking children by Lindgren (2018a) produced as many as 90% fully appropriate expressions<sup>10</sup> to introduce story characters, and this study used the same stimuli as in the present study, we expected the children to almost exclusively use indefinite NPs at age 7;4. This was not the case; the children's performance was even somewhat lower at age 7;4 compared to age 5;10 (79.6% indefinite NPs at age 5;10: 72.6% at age 7;4). Thus, the 7-year-olds are quite far from adultlike in referent introductions, relatively often using definite instead of indefinite NPs.

On the other hand, our findings for referent introduction are in line with previous (cross-sectional) research arguing that the adult-like use of referring expressions for referent introductions is mastered later than the use of pronouns and lexical NPs in reintroduction and maintenance (e.g., Hickmann & Hendriks, 1999) and that children's ability to introduce referents using adult-like expressions continues to develop even after age 7 (e.g., Colozzo & Whitely, 2015; Serratrice, 2007). The 6-year-olds in Lindgren (2018a), therefore, may have been an exceptionally well-performing group compared to the 5-year-olds in the same study; in that respect, our longitudinal study has the advantage of testing the same children at each age, avoiding the problem of inter-group differences in cross-sectional research.

This latter example stresses the need for combining cross-sectional studies with longitudinal research to get a fuller picture of children's developmental trajectories. Future studies should preferably investigate development longitudinally in children at older ages as well, i.e., look at development in the same children also after age 7. Results from a recent study where the children of the present study were followed until age 9 and which included a broad measure of the ability to introduce referents appropriately (Lindgren, 2022) as well as other narrative aspects, indicate that these abilities develop further between age 7 and 9. Additionally, qualitative in-depth analyses of individual children's narratives at different ages are needed in order to fully understand variation in developmental trajectories.

### **Limitations**

While longitudinal data has the advantage over cross-sectional data that children's performance can be compared with that of their younger selves, a longitudinal methodology also has some drawbacks. One practical issue is that it is more difficult to collect data from enough participants, especially across longer time spans (since, for instance, participants may move, change school, or withdraw consent in the meanwhile). This makes it harder to get sufficient statistical power to detect hypothesized effects in the data.

The apparent lack of development in the introduction of new referents discussed above might also be a consequence of our longitudinal methodology: At age 7, the children may have remembered that they told the same story 1.5 years before, and the characters were therefore already familiar to them. Similarly, since children were also telling the story three times to the same person,

they might have been putting less effort in telling a clear story the third time, since they may expect the listener to be familiar with the story and its characters after having heard it twice. Such familiarity effects could have led to fewer indefinite NPs than may be expected if the children were telling the story for the first time. Alternatively, children may have been less engaged in their story telling, and hence less inclined to take the listener's perspective.<sup>11</sup> Although we initially presumed that the 1.5-year intervals between consecutive testings would be long enough for any familiarity effects to wear off, it may be worth testing for such effects in future research, for example by employing three different addressees at the three time points or by comparing longitudinal and cross-sectional data.

Finally, a limitation not related to the longitudinal methodology is that the MAIN materials have not been created with a counterbalancing for animacy in mind: The picture sequences contain two animal characters, but only one human character, and the degree of animacy may not be completely parallel between the Cat and Dog stories (e.g., the butterfly in the Cat story could be considered lower in animacy than its counterpart in the Dog story, the mouse). Future studies may want to resort to materials specifically created for testing animacy effects on referring expression production.

## Conclusions

In sum, the results of the present study indicate that at age 4, children are sensitive to several discourse factors, suggesting that they are keeping track of whether and how referents were mentioned in the preceding linguistic context. This is in line with research suggesting that young children already create quite sophisticated discourse models (Colozzo & Whitely, 2015; Hickmann & Hendriks, 1999). At the same time, their discourse models are not yet adultlike, as indicated by the relatively frequent use of definite expressions to introduce referents, the use of pronouns to (re)introduce referents, and a lower sensitivity to topicality than adults. Due to cognitive limitations (e.g., on working memory or Theory of Mind), children's discourse models may be impoverished compared to adults' (Bock & Brewer, 1985). However, our findings suggest that where children make non-adultlike referential choices (either overproducing ambiguous pronouns, or using repetitive lexical NPs), these choices may nonetheless be motivated by factors that also play a role in adults' referential choices (see also Colozzo & Whitely, 2015; Serratrice, 2013). More specifically, instead of generally resorting to the more economical pronouns (Hendriks et al., 2014), children tend to produce pronouns to refer to human characters and lexical NPs to refer to animals to a greater degree than adults. Since the degree of animacy of a referent normally remains constant during a narrative, animacy or humanness is a factor that requires relatively little cognitive capacity. As children's cognitive capacities grow, their use of animacy as a cue for referential choices may decrease as the role of more structural discourse factors increases. However, also in adults animacy influences the choice between a pronoun and a lexical NP in cases where the discourse conditions for pronoun use have been met (see Fukumura & van Gompel, 2011; Vogels et al., 2013). It seems, therefore, that the difference between adults' and children's discourse models mainly constitutes a difference in the weighing of discourse factors that are already in place, with factors requiring a greater cognitive capacity gaining more weight over time. That is, our results are consistent with multiple-constraint accounts of reference production, in which various factors influence referential choices at the same time (e.g., Arnold, 2001; Hendriks et al., 2014; Kaiser, 2010). Based on the linguistic input, children gradually acquire the adult-like relative importance of the different factors.

## Notes

1. Recently, a gender-neutral third-person pronoun, *hen*, has been established in Swedish. However, since it did not occur in our data we will not consider it further here.
2. 15 of the 17 children in the present study were part of the 4-year-olds group in Lindgren (2018a, 2018b) and Lindgren and Vogels (2018). The data from the children in the present study, with the addition of a fourth testing

point at age 9, has also been analyzed in a recent study investigating different narrative skills (Lindgren, 2022). This study included a broad measure of the children's ability to introduce referents (a score from 0–12 points based on the appropriateness of the referring expressions used to introduce the story characters and one important inanimate object), which is different from the more fine-grained analyses of the present study, and is therefore not described further here.

3. Additionally, Strömquist and Day (1993) compared the performance on referential cohesion in Swedish monolingual 3–5-year-olds ( $N = 8$ ) and 5–8-year-olds ( $N = 8$ ) to adult L2 learners ( $N = 5$ ) and adult native speakers ( $N = 6$ ). However, it is not clear exactly how their total score was calculated, making it difficult to compare the results to those of other studies.
4. One possibility is that these indefinite NPs were not referential, but merely descriptive, i.e., children were describing the various characters they saw in each of the pictures. Previous studies (e.g., Berman & Slobin, 1994) have found that some children aged 3–4 produce picture descriptions instead of narratives as a response to a picture-based narrative task; this could have been the case also in the study by Lindgren and Vogels (2018).
5. MAIN, including the picture sequences as well as the standardized procedure for administrating it (see section 2.3), is available in a large number of different languages (e.g., Swedish, English, Russian, German) after registration from <https://main.leibniz-zas.de/en/main-materials/main-materials/>.
6. This definition of topic differs slightly from that in Hendriks et al. (2014), who based it on Centering Theory (Grosz et al., 1995). In the latter, discourse topicality is taken as a combination of syntactic prominence (subjecthood) and pronominalization, while we only define topicality in terms of syntactic prominence. We operationalized syntactic prominence as first mention rather than grammatical function, but in our data, the first-mentioned referent was always the subject, so these operationalizations are identical in this case.
7. The total number of references coded as 'new' (Table 4a) does not always amount to 51, which is the expected number if each child introduced each character exactly once (17 children x 3 characters). This is because sometimes a character was never introduced, and hence never mentioned at all in the story.
8. We thank an anonymous reviewer for pointing out this confound.
9. The relatively more frequent use of null forms at T2 in Figure 2 is striking. This pattern may be related to an increased use, most notably by some children, of short sentences continuing the same topic, in which the topic may easily be dropped. We will leave this issue to future research.
10. Note that in that study, 'appropriate referring expressions' for introducing referents not only included indefinite NPs, but also possessive NPs.
11. We thank an anonymous reviewer for these suggestions.

## Acknowledgments

We thank the children and their parents, as well as the adult participants, for taking part in this study. We are also grateful to two anonymous reviewers for their thorough reading and helpful comments.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## Funding

This work was supported by the Netherlands Organization for Scientific Research (NWO) under Grant 275-89-0360 to the first author.

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## Data availability statement

The data and analysis script for this study can be accessed from the following OSF repository: <https://doi.org/10.17605/OSF.IO/QSN7V>

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## Appendix A: Examples of narratives

The examples of transcribed narratives below have been adapted from the original CHAT-format to increase readability. The following special symbols are used: (.) = short pause; (...) = very long pause; / = utterance unit separator.

### MoSwe4-11 (female, T1, age 4;3, Dog story)

(...) eh (...) det kom en hund / och den försökte ta (.) råttan / sen slog hunden sig i trädet / (...) och sen (...) sprang den iväg / (.) och ballongen fastnade i trädet / (.) ehm han klättrade upp / och tog ner ballongen / (...) sen tog han ballongen / (...) och hunden åt upp korvarna

“(...) uh (...) there came a dog / and it tried to take (.) the rat / then the dog hit himself in the tree / (...) and then (...) it ran away / (.) and the balloon got stuck in the tree / (.) uhm he climbed up / and took the balloon down / (...) then he took the balloon / (...) and the dog ate up the sausages.”

### MoSwe4-18 (male, T3, age 7;1, Cat story)

det är en katt som ska jaga en fjäril / och då hoppar den i en buske / och då kommer just en kille / och den jagar en fjäril / den har kommat och hoppat i taggbusken / och då se och så då tappar han sin boll / för han blir för han blir chockad eller nåt och då eh i vattnet / och då kommer katten fram / (.) och så lägger han ifrån sig sina saker han håller i / och då tar han upp det med fiskespöt / medans katten försöker äta fisk / och sen äter katten fisk på sista bilden / och då fick han sin boll

“There is a cat who will chase a butterfly / and then it jumps into a bush / and right then a boy comes / and it chases a butterfly / it has comed and jumped in the bush / and then see and then he drops his ball / because he becomes because he becomes shocked or something and then uh in the water / and then the cat comes forward / (.) and then he puts down his things he is holding / and then he takes it up with the fishing rod / while the cat tries to eat fish / and then the cat eats fish in the last picture / and then he got his ball.”

### MoSweA-07 (male, adult, age 22, Dog story)

det var en gång en hund och en pojke / pojken hade en gul ballong och en påse med korv / hunden fick syn på en råtta / men råttan sprang iväg / och hunden (.) hunden slog sig / och råttan kom undan / samtidigt så tappa(de) pojken eh sin gula ballong / och ballongen fastnade i ett träd / men det gjorde inget / för pojken kunde ju klättra / samtidigt så hade han glömt sin påse med korv som han tappat när han tappade ballongen / det fick hunden syn på / och började kalasa på korven / pojken fick tillbaka sin ballong / och så levde de lyckliga i alla sina dagar

“Once upon a time there was a dog and a boy / the boy had a yellow balloon and a bag with sausage / the dog saw a rat / but the rat ran away / and the dog (.) the dog hit himself / and the rat got away / meanwhile the boy dropped uh his yellow balloon / and the balloon got stuck in a tree / but it was alright / because the boy could climb / meanwhile he had forgotten his bag with sausage that he dropped when he dropped the balloon / that the dog saw / and started to feast on the sausage / the boy got his balloon back / and then they lived happily ever after.”



## Appendix B: Example of an annotated transcript

Table B1. Annotation of the first 8 utterance units of a narrative (MoSwe426, female, T2, 6;0, Cat story).

N	Utterance unit	Expression 1	Function 1	Expression 2	Function 2
1	det var en katt en gång (.) som hittade en fjäril "there was a cat once (.) who found a butterfly"	en katt "a cat"	Intro	en fjäril "a butterfly"	Intro
2	och sen så ville katten ta fjärilen "and then the cat wanted to catch the butterfly"	katten "the cat"	Maint+T	fjärilen "the butterfly"	Maint-T
3	hon hann inte she did not reach	hon=KATT "she=CAT"	Maint+T		
4	(.) sen så blir killen rädd "(...) then the boy becomes afraid"	killen "the boy"	Intro		
5	fjärilen flog bort eh flog förbi "the butterfly flew away uh flew past"	fjärilen "the butterfly"	Reint		
6	sen kunde inte katten (.) springa efter "then the cat could not run after"	katten "the cat"	Reint		
7	han vart i en buske då "he became in a bush then"	han=KATT "he=CAT"	Maint+T		
8	(.) pojken hittade inte sin röda fotboll "the boy did not find his red football"	pojken "the boy"	Reint		

N = utterance unit number. Intro = referent introduction. Reint = referent reintroduction. Maint+T = referent maintenance, topic. Maint-T = referent maintenance non-topic.