The acquisition of Swedish prepositions
A longitudinal study of child comprehension and production of spatial prepositions

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Abstract

Prepositions are acquired at earliest during the second year of life. This thesis investigates 16 children acquiring Swedish spatial prepositions, i.e. på ‘on/at’, i ‘in/at’, under ‘under’, bredvid ‘beside/next to’, bakom ‘behind/back’ and framför ‘in front’. This thesis aimed to investigate how preposition acquisition relates to language acquisition. The thesis used three different methods: eight sessions of free parent-child interaction, one structured experiment at 2;9 years and parental reports on child passive/active vocabulary from when the children were 0;9 years until they were 3;0 years old. The data gathered was correlated to scores in the parental reports at 4;0 years, which was used as a measure of communicative level, and used as a base when dividing the children into three groups: lower, average and higher score. The results showed that both parental and child preposition production, comprehension at 2;9 years, and comprehension and production predicted communicative level at 4;0 years. The results of the thesis varied depending on the method used. This highlights the importance if using several methods when investigating child language acquisition.

Keywords

Child language acquisition, Spatial prepositions, Comprehension, Production, Parent-child interaction, Structured test, SECDI
Barns tillägnande av svenska prepositioner

En longitudinell studie om barns förståelse och produktion av spatiala prepositioner

Sammanfattning

Prepositioner tillägnas som tidigast under barnets andra levnadsår. I denna masteruppsats undersöks utvecklingen av spatiala prepositioner hos 16 barn under deras 4 första levnadsår. På, i, under, bredvid, bakom och framför var prepositionerna som undersökt. Ett av uppsatsens mål var att undersöka om och/eller hur prepositionsutveckling är kopplad till språkutveckling. För att nå målet användes tre olika metoder: åtta sessioner av förälder-barn interaktion, ett semi-strukturerat test då barnen var 2;9 år gamla och aktivt/passivt ordförråd från när barnen var 0;9 år till att de var 3;0 år gamla. Detta korrelerades sedan till barnens poäng från en föräldraenkät om barnets språkförmåga vid 4;0 års ålder. Poängen vid 4-års ålder låg till grund för uppdelning av barnen i tre grupper: lägre, medel och högre språklig nivå. Resultaten från uppsatsen var bland annat att såväl föräldras som barns produktion av prepositioner, barnens förståelse av prepositionerna vid 2;9 år, och förståelse såväl som produktion av prepositioner förutsäger barnens kommunikationsnivå vid 4;0-års ålder. Resultaten skiljer sig beroende på vilken metod som använts, vilket understryker Vikten av att använda flera metoder när barns språkutveckling undersöks.

Nyckelord

Barns språkutveckling, Spatiala prepositioner, Förståelse, Produktion, Förälder-barn interaktion, Strukturerat test, SECDI
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1. Introduction

When studying child language acquisition, research has been focused on different things. Focus has been on the speech signal, as in the children’s first words, which lexical classes that are acquired first, if some languages are easier to acquire than others etc. Or, another modality has been in focus, for instance gestures and when children start using gestures, which gesture-category that is acquired first etc. For instance, in my one-year master thesis, I focused on emblematic gestures and how usage of emblematic gestures predicts later vocabulary (Tahbaz, 2017). In this thesis, Swedish spatial prepositions are in focus and how acquisition of spatial prepositions relates to language acquisition.

In this thesis, it was possible to investigate the acquisition of spatial prepositions by using several methods. Prior research based their conclusions in acquisition of prepositions on one of the methods that is used in this thesis. This thesis aim is to complement previous research in comprehension and production of spatial prepositions, and to fill the research gap in comprehension of prepositions of Swedish children’s acquisition of spatial prepositions.

When investigating comprehension and production variability of lexical classes in Swedish children’s language development, Eriksson & Berglund (1999) found that none of the investigated 228 children comprehended a preposition at age 8 months. However, at 16 months, all children understood at least one preposition (1999: 73). This thesis investigates comprehension and production of spatial prepositions in 16 children’s language development between the ages of 0;9-3:0 years (0 years;9 months-3 years;0 months). In addition to that, the comprehension and production is connected to communicative level at 4;0 years of age.
2. Background

Prepositions are a closed lexical class in many languages. This section provides the reader with more information about prepositions in general, and later in Swedish in particular, and sums up with previous research’s findings on child preposition acquisition.

2.1 Prepositions

Prepositions can be divided into subcategories: instrumental, temporal and spatial prepositions (Bolander, 2012). This thesis focuses on spatial prepositions, prepositions that express location in space and relation between objects.

2.1.1 Spatial prepositions

The prepositions included in this study are: *i* ‘in/at’, *på* ‘on/at’, *under* ‘under’, *bredvid* ‘beside/next to’, *bakom* ‘behind/back’ and *framför* ‘in front’. These are spatial prepositions that describe an object’s place and location in space, sometimes in relation to something else. Relational prepositions are also spatial prepositions, but in addition to express location in space, relation to something else is expressed by them (Clark, 1973, pp. 40-3).

Locative sentences have the function to express where something is located (Bennett, 1975: 12). Locatives are not limited to express place but can express time. In English, place- and time location can be expressed with the same preposition (1975: 16). ‘In’, ‘on’ and ‘at’ are locative prepositions. The proposed definitions for spatial prepositions are: ‘in’ is a “locative interior”, ‘on’ is a “locative surface” while ‘at’ is “locative” (1975: 67). ‘Under’, ‘in front’ and ‘behind’ are locatives, although they may also be used to describe path and goal (1975: 52). ‘Beside’ expresses a spatial relation that is independent of speaker positioning (Johnston & Slobin, 1979: 530). Additionally, the preposition ‘under’ is a “locative inferior place”, ‘in front’ is a “locative anterior place”, and ‘behind’ is a “locative posterior place” (Bennett, 1975: 56).

The definitions of the prepositions are similar to the Swedish prepositional definitions. In Swedish, the prepositions *i* ‘in/at’ *på* ‘on/at’ and *under* ‘under’ can express location in both space and time. The following section describes Swedish prepositions in detail.

2.1.2 Swedish spatial prepositions

In Swedish there are basic prepositions, e.g. *på* ‘on/at’, compound prepositions, e.g. *ovanpå* ‘onto/on top of’ and prepositions that consist of several words, e.g. *på grund av* ‘because of’ (Bolander, 2012: 135). In Swedish you need to learn the appropriate preposition to almost all words separately, since the use is arbitrary. And because of arbitrariness, what preposition to use is not always certain even for native speakers (2012: 136).

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1 Relevant for the Swedish preposition *i* ‘in/at’.
2 Relevant for the Swedish preposition *på* ‘on/at’.
3 Relevant for the Swedish prepositions under ‘under’, *framför* ‘in front’ and *bakom* ‘behind’.
4 Relevant for the Swedish preposition *bredvid* ‘beside’.
Table 1. The table shows spatial prepositions in Swedish and their English equivalents. The column to the right shows example sentences with the prepositions in both English and Swedish.

<table>
<thead>
<tr>
<th>Swedish preposition</th>
<th>English equivalent</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>på</td>
<td>on</td>
<td>Barnet är på bordet. The child is on the table.</td>
</tr>
<tr>
<td>i</td>
<td>in</td>
<td>Barnet är i spjälsängen. The child is in the crib.</td>
</tr>
<tr>
<td>på/i</td>
<td>at</td>
<td>Barnet är på/i biblioteket. The child is at the library.</td>
</tr>
<tr>
<td>under</td>
<td>under</td>
<td>Barnet är under bordet The child is under the table.</td>
</tr>
<tr>
<td>bredvid</td>
<td>beside/next to</td>
<td>Barnet är bredvid dig. The child is beside/next to you.</td>
</tr>
<tr>
<td>bakom</td>
<td>behind/back</td>
<td>Barnet är bakom huset. The child is behind/in back of the house.</td>
</tr>
<tr>
<td>framför</td>
<td>front</td>
<td>Barnet är framför dig. The child is in front of you.</td>
</tr>
</tbody>
</table>

The preposition på ‘on/at’ is frequently used in Swedish and the scope of its use is widening (Bolander, 2012: 136). The word form of a preposition can look like another lexical class, for example, it can also take the form of a verb particle or be part of extended verbs (2012: 146-149). One key to determine whether a på ‘on/at’ is a particle or a preposition in speech is by listening to the intonation: a preposition is always unstressed (2012: 149).

In Swedish, as in English, there is a lexical diversity when it comes to prepositions. Different prepositions can express the same position of an object, although they are not always completely interchangeable. Thus, i ‘in/at’ and inuti ‘into’ both express containment, while på ‘on/at’ and ovanpå ‘onto’ can express support.

2.2 Child Directed Speech

Adults talk differently to a child than when speaking to an adult. Compared to Adult Directed Speech (ADS), Infant or Child Directed Speech (IDS/CDS) has a slower rate, higher pitch and exaggerated intonation contours. This has been observed in different languages and cultures and is assumed to be universal (as an example, see Fernald, 2002). Features of IDS have also been found to be present when older children, and older siblings, speak to infants (Dunn & Kendrick, 1982).

In CDS, adults tend to simplify and repeat their utterances (Snow, 1972). The features of CDS change as the child gets older: a ten-year-old child’s input consist of more complex sentences, higher mean length of utterances and less repetitiveness than the input of a two-year-old child (1972: 550-5). The prosodic patterns in IDS/CDS help children to segment words in the speech stream (Kuhl, 2004; Theissen, Hill & Saffran, 2005), and are also a cue to grammar (Fisher & Tokura, 1996).

Prepositions, together with other function words, are the most common word forms in parental CDS (Richthoff, 2000, 112; Bolander, 2012: 135; Strömqvist, Richthoff & Ragnarsdottir: 2001:8).

2.3 Acquiring prepositions

The following section gives the reader a report on previous research on child preposition acquisition. The last section sums up the research on Swedish acquisition of prepositions.
2.3.1 Spatial prepositions in child language acquisition research

This section provides the reader with a sample of the existing research on acquisition of prepositions in different languages. The sample is mainly from German and English as they are languages typologically related to Swedish.

The complexity hypothesis for prepositions predicts that ‘in’, ‘on’ and ‘under’ should be produced before ‘beside’, ‘in front’ and ‘behind’. The hypothesis predicts this due to the latter requiring an additional parameter besides location, namely relation. It also predicts that in antonymous preposition pairs, as ‘in front’ and ‘behind’, the positive preposition ‘in front’ should be acquired before the negative preposition ‘behind’ (Clark, 1973: 56). Additionally, the hypothesis predicts that prepositions that express location in space are learned before prepositions that express both location in space and relation to something else (1973: 19-20).

However, Johnston and Slobin (1979) investigated the acquisition of locative pre/postpositions in Italian, Serbo-Croatian, Turkish and English, and found that children started producing prepositions that express basic locative relations in a specific order: ‘in’, ‘on’, ‘under’ and ‘beside’ are the first prepositions acquired by children, while ‘front’ and ‘behind’ are acquired later. In contrast to the complexity hypothesis, Johnston & Slobin (1979) found that ‘behind’ was acquired before ‘in front’. They suggested that that ‘back’ is acquired before ‘in front’ due to salience in input. Hence, it is more likely to talk about something that is behind another thing than to talk about something that is completely visible (1979: 531).

Furthermore, prepositions have been shown to be produced in a similar pattern cross-linguistically: first children produce ‘in/on/under/beside’ and later ‘behind’ and ‘in front’ (Johnston & Slobin, 1979: 540). The prepositions ‘in’ and ‘on’ are the first to appear in the children’s vocabulary, presumably because these are used about containment and support (Clark, 1973, Johnston & Slobin, 1979).

When investigating the acquisition of spatial prepositions it is assumed that children interpret the prepositions as adults. Therefore, Johannes, Wilson & Landau (2016) investigated if children interpret the same meaning of the prepositions ‘in’, ‘on’, ‘behind’ and ‘in front’. Johannes et al. (2016) found that four-year-old children seem to use the preposition ‘on’ in a less differentiated area of use compared to six-year-olds and adults (2016: 184).

Are some prepositions easier to comprehend than others? This question was asked and investigated in children learning English and children learning Dutch by Gentner & Bowerman (2009). The purpose was to investigate what semantic categories in spatial prepositions that are the easiest to master; containment or support. The process of comprehension of the prepositions is claimed to depend on the child’s ability to detect the patterns in which the preposition is used. If the pattern is not clear, the child needs more input with examples of usage areas where the preposition is used until the child can detect the not-as-clear pattern in which the spatial preposition is used. Thus, when a child starts comprehending a preposition, the child has understood the conventions of the preposition. In unclear cases, the spatial expression takes longer to acquire (2009: 478).

In a similar study, with a similar purpose, Casasola & Cohen (2002) found that children learning English form spatial representations that express containment (i.e. ‘in’) earlier than spatial representations for support (i.e. on). This was interpreted as some spatial relations being more difficult to learn than others (2002: 256). The representation of the spatial relation containment (i.e. in) is comprehended at the age of 0:6 years, while support (i.e. ‘on’) is comprehended later (Casasola, Cohen & Chiarello, 2003).

The previous paragraphs have handled preposition production and preposition comprehension in relation to acquisition order. The following paragraphs show a few more examples concerning mainly preposition comprehension in child language acquisition research.

Children learning English comprehend the prepositions ‘on’ and ‘under’ early, typically during their second year of life. Meints, Plunkett, Harris, and Dimock (2002) investigated the comprehension of English prepositions and found that the prepositions evolve from prototypical positions to more
atypical positions. Furthermore, the children comprehend prepositions easier when the prepositions describe the positioning of an inanimate object than animate objects (2002: 119).

Johnston (1984) tested the understanding of the prepositions ‘in front’, ‘behind’ and ‘beside’ with objects that differed in size, and inanimate/animate objects that are considered to have a natural front and back. In her results, it is suggested that children’s understanding of ‘behind’ means that an object is “‘hidden by’ and/or ‘made-inaccessible-by’” something (1984: 419). She also found that some children used ‘in front’ for positions that would be described as ‘beside’ by adults. She suggested that these children’s meaning of the, overextended, preposition is “next-to-and-visible” (1984: 420). The early usage of the preposition ‘behind’, by children learning English, seems to have an additional variable, as it is interpreted as relative size depending on if the object ‘behind X’ is visible for the speaker or not.

In German CDS, mothers tend to activate their child’s background knowledge to help the child to comprehend specific prepositions. Rohlfing (2011) analyzed semantics in mothers’ CDS. In an instruction experiment, mothers instructed their children to put objects in various locations. When general background knowledge was not enough, shared past events was brought up to help the child to comprehend the prepositions ‘on’ or ‘under’. This was beneficial when the instruction was not especially prototypical, e.g. to put an iron under the iron board. Thus, the details of the instruction depended on the typicality of the positioning of the object (2011:12).

To answer if narrative contexts are helpful in the acquisition of prepositions, Nachtragäller, Rohlfing and McGregor (2013) conducted an experiment with forty 1;8-2;0-year-old German children. They found that the preposition unter ‘under’ was comprehended best in a narrative context, compared to children exposed to the preposition in a word string without context. They also found that the children with a more advanced, or richer, productive vocabulary were the children that learned the preposition best with help by the narrative context (p. 915).

Rohlfing and Nachtragäller (2016) investigated if narrative context is enough for comprehension of preposition by presenting pictures to 2;4-year-old toddlers learning German. The experiment focused on the German spatial prepositions hinter ‘behind’ and neben ‘next to’. The results showed that children can acquire the prepositions by looking at pictures and hearing a narrative (2016: 13) even at a delayed posttest at four- to fourteen days later (2016: 6-8).

Prepositions are complicated. The acquisition comes late in development, with the first production during the second year of life. How adults use the prepositions while speaking to a child seems to be of importance to the child’s acquisition of prepositions. Adult language use is probably affecting the order of prepositions learnt, and synonymy and homonymy with other words and/or prepositions can cause delays in correct usage of the prepositions ( Tomasello, 1987, p. 92).

It has been shown that 3-year-old children focus on different things when hearing novel words in different contexts, in order to learn them. Either they interpret the novel word as a noun and they focus on the shape of the object, or they interpret the positioning of an object, focusing on a new preposition (Landau, 1994: 266-7).

### 2.3.2 Spatial prepositions in Swedish child language research

Prepositions are often generally omitted in early language production (Richthoff, 2000). Production of prepositions usually starts around the age of two years. After the onset of a preposition, the child produces the preposition occasionally (Håkansson, 1998). A child first learns to produce a preposition in one context, only to later widen the use of the preposition (1998, p. 89-80).

Three Swedish children’s acquisition of prepositions were studied by Richthoff (2000). She found that the production of prepositions could be divided into three stages: in the first stage, they omitted the prepositions, på ‘on/at’, till ‘to’ and hos ‘at’. In the second stage, the children produced a schwa (ə) to mark a placeholder. In the third stage, the preposition is produced in a more complete manner (2000: 97). When studying the language production of six children, Richthoff (2000) found that function words are present in early child language production but they appear as reduced words that only are used in a small set of contexts (2000: 113). She also found that children produce a reduced form of
function words that can be interpreted as different lexical classes. The uttered word are often polysemous: an uttered ‘ä’ (ä), e.g. the vowel sound in “at”, can stand for the prepositions på ‘on/at’ or i ‘in/at’, or it can stand for a conjunction or a verb etc. (2000: 74-85).

Strömqvist et al. (2001) investigated the language input and output by four Swedish children between the ages of 1:6-3:4 years. På ‘on/at’ is one of the 20 most frequent words in Swedish CDS. In child word production, i ‘in/at’ is one of the most frequently used words. Ambiguity of function words can affect the child’s language acquisition, på ‘on/at’ belong to the lexical class prepositions when unstressed, and when stressed it is a particle (2001: 166-7). It is suggested that the first word forms are produced with stress, and therefore, the child produces particles before prepositions (2001: 174).

Strömqvist and colleagues (1995) studied language acquisition cross-linguistically in Nordic languages, i.e. Danish, Finnish, Icelandic, Norwegian and Swedish. They compared the prosody and the acquisition of spatial relations between the children and found that the children encode these concepts similarly (1995: 11). The result of the first usage of spatial prepositions were similar between Swedish and Danish children and quite similar to Icelandic and Finnish children. The Swedish and Danish children used i ‘in/at’ and på ‘on/at’, that are prepositions that mark location, as particles together with motion verbs (1995: 11). The preposition onset for i ‘in/at’ and på ‘on/at’ for two Swedish children was between 1:10-2:4 years (1995: 10). These studies by Strömqvist et al. (1995) and Strömqvist et al. (2001) used data from the CHILDES data base (see MacWhinney, 1991 or MacWhinney & Snow, 1990), containing the same transcriptions as used by Richthoff (2000).

In a case study, Lange (1976) investigated the acquisition of Swedish prepositions between the ages of 1:0-3:6 years. He found that between the ages of 1:10-2:1 the locative prepositions på ‘on’ and i ‘in’ and bakom ‘behind/back’ were produced. Under ‘under’ was acquired at a later age (2;1-2;4) and, bredvid ‘beside/next to’ was acquired even later (2;6-2;8) (1976: 5-8). Lange (1976) noticed that the child went from almost completely omitting the preposition in all phrases at 1:10 years, to almost never omitting a preposition in any prepositional phrase in just half a year. The preposition usage was not always correct, i.e. one preposition was often used with a widened usage-area for the child that had not acquired all prepositions. For example, the child used the Swedish preposition i ‘in/at’ in sentence constructions where under ‘under’ would be the correct preposition to use. Consequently, although a preposition is used it does not imply that it is fully understood. The acquisition comes gradually over an extended period of time (1976: 7).

Swedish spatial and temporal prepositions are homonyms: på ‘on/at’ is both a temporal preposition ‘på tisdag’ (‘on Tuesday’) and a spatial preposition ‘på bordet’ (‘on the table’), the same goes for i ‘in/at’: i somras’ (‘last summer’) and ‘i korgen’ (‘in the basket’) and for under ‘under’: ‘under veckan’ (‘during the week’), ‘under bordet’ (‘under the table’). Lexical diversity in prepositions can have a delaying effect on the acquisition of prepositions due to confusion in decoding, which can encourage a guessing strategy for the child (Johnston & Slobin, 1979).

Most of the research made on Swedish acquisition of prepositions is in accordance with the complexity-hypothesis (Clark, 1973). However, the existing research on Swedish acquisition of prepositions is based on a very small sample (one-six children) collected long ago, focusing solely on preposition production. This thesis investigates the acquisition of spatial prepositions in 16 Swedish children, in three data collecting methods: parent-child interaction longitudinally, a structured test and, parental reports on passive and active vocabulary longitudinally. Thus, the thesis focuses on both comprehension and production of prepositions in Swedish child language acquisition, during the child’s first three years of life in relation to language ability at four years of age.
3. Aims and research questions

3.1 Aims

The first aim of the thesis is to investigate how the acquisition of spatial prepositions relates to language acquisition. Another aim is to complement previous research on child language acquisition of spatial prepositions. Previous research is on Swedish children’s acquisition is mainly focused on preposition production while this thesis includes both the production as well as the comprehension of spatial prepositions.

3.2 Research questions

The research questions are presented in chunks. Research question 1-3 are based on the interactional data. Question 4 is based on data from the structured test. Questions 5-7 are based on passive/active vocabulary data as reported by parents from 0;9-2;6 years of age (SECDI). Additionally, research question 5 is also based on the structured test data. Communicative ability as reported by parents at 4;0 years is used as measures on child communicative level (SCDI).

1. Does more preposition usage by the parents predict an early onset of preposition production?
2. Does frequent use of prepositions by the children predict communicative ability at 4;0 years?
3. Does more prepositions usage by the parents predict communicative ability at 4;0 years?

4. Does comprehension of prepositions at 2;9 years predict communicative ability at 4;0 years?

5. Is there a difference in preposition comprehension/production between the lower, average, and higher SCDI-score groups?
6. Does comprehension of prepositions (0;9-1;3 years) predict a greater productive vocabulary at 2;6 years?
7. Does production of prepositions (1;6-2;6 years) predict communicative ability at 4;0 years?
4. Method

This section provides the reader with detailed information about the material, data processing and data analysis. The thesis is investigating preposition comprehension and production by the use of three different methods: free parent-child interaction, a structured test and collected data on vocabulary and general communicative level.

4.1 Material

The following section contains details about the data used in the thesis. All material is collected by the MINT project (MAW007) at the Department of Linguistics, Stockholm University.

4.1.1 The MINT project

The MINT project is a longitudinal project focusing on parent-child interaction (Gerholm, 2018). The project has followed 70 families every third month from the children were 0;3 years until now, when the children are 4;6 years old. The families were randomly selected by the Swedish tax authorities, and 2000 families were invited to participate in the project (see Appendix A). The projected started with 85 families. When the children were 3;0 years old 72 families remained and at the 4;0-year recording 70 families remained.

The parent-child interaction was recorded every third month between the ages 0;3-3;0. From the age of 3;0 years, the interaction was recorded every sixth month. Until the children were 1;0 years old, the sessions were approximately 20 minutes long and the parents were instructed to play with the child as they normally would. From the 1;0-year-old session, the last 10 minutes of each session were based on a structured test between a researcher and the child.

The project aimed to capture natural parent-child interaction at several different age points, with control of environment, toys and activities. Cameras and microphones enable coding of gestural-, facial-, eye-, vocal- etc. behaviors and the annotated material will build a multimodal corpus. See more about the coding in section 4.1.6. The sample in the MINT project consists of both monolingual and bilingual children, both children with and without siblings, children with parents who have a higher and median annual income etc.

4.1.2 Studio

The parent-child interaction took place in Stockholm Interaction Lab, Department of Linguistics, in a studio. The studio is a six m² room with three cameras attached on the walls, and a fourth camera is on the parent’s chest, attached to a vest. The room has a condenser microphone, working as a measure to link all video files and two additional microphones that the child and the parent wear.

The studio is decorated with pictures of the stuffed animals, used as toys throughout the project, a carpet and two pillows. The parent and the child are provided with a different set of toys adapted to the age of the children for each session, except for three stuffed animals that remained in the studio at all ages.

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1Funded by Marcus and Amelia Wallenberg foundation.
2For more info about the interaction lab, visit: https://www.ling.su.se/english/photonics-lab/our-facilities/interaction-lab.
3Cameras on walls: Canon HDMI XA10. Camera attached to the parent’s vest: Go Pro Hero 3, Condenser microphone: AKG SE 300 B. And, microphones: Sennheiser eW 100 G2.
4.1.3 Structured testing

The structured tests were performed every third month from the age of 1:0 years. The testing takes approximately 10 minutes. The testing was performed after the free parent-child interaction and was often disguised as a game. For example, it could be to see if the children have learned ritualized behaviors in specific contexts, as in a bed-time ritual, coffee-time ritual, buy-groceries-ritual and more. Some tests, however, were more test-like and the children were asked to point to different pictures describing a specific word or to follow instructions: performing actions as described by the researcher (Gerholm, 2018). This thesis investigates the structured test at the 2:9-year recording, see 4.2.1 Procedure during the structured testing for more information.

4.1.4 SECDI

After the visit at the Baby lab the parents received an online questionnaire to report on their child’s language development from the 0:9 year session. The questionnaire is called Swedish Early Communicative Developmental Inventories (SECDI) (Berglund & Eriksson, 2000a) and is the Swedish version of MacArthur Bates Communicative Developmental Inventories (Fenson et al., 1993). SECDI contains different words and the parents tick the words that their child understands and/or produces. Parental reports are commonly used in research and gives a broad picture on the child’s language abilities, although parents can evaluate their child’s abilities higher or lower than what the child’s ability is (Law & Roy, 2008).

SECDI is divided into three questionnaires. SECDI I – words and gestures, aims to capture early word comprehension and production of words, as well as comprehension and production of gestures. SECDI I is adapted to children between the ages of 0;8-1;4 years (Eriksson & Berglund, 1999). SECDI II – words and phrases, is a questionnaire were the parent tick the words that their child has started producing. SECDI II contains about 710 words and is aiming to capture all words in a child’s repertoire. The words included are based on the vocabularies of two Swedish children, in a Swedish child language corpus (Berglund & Eriksson, 2000a: 178). SECDI II is adapted to children between the ages of 1;4-2;4:0 years. The parental reports in SECDI I&II have been evaluated with a test-retest (Berglund and Eriksson 2000b) and found to be valid. The last questionnaire, SCDI III – communicative development, is a shorter questionnaire with broader questions, e.g. about the child’s syntactic development, as usage of sub ordinate clauses, and words which are context-specific, for example cooking terms and abstract emotion words. SCDI III has also been evaluated and found valid as a measure on language development (Eriksson, 2017).

SECDI I was collected when the children were 0;9, 1;0, and, 1;3 months old. SECDI II was collected every third month between 1;6-2;6 and SCDI III at 4;0 years.

The investigation of child preposition production started when the children were 1;6 years, in both the interactional data as well as from the parental reports on productive vocabulary (SECDI II – words and sentences) and continued until the age of 2;6 years. SECDI-scores from SECDI II, at 2;6 years, and SCDI III, at 4;0 years, are used as measures of language development in this thesis.

4.1.5 Sample subjects

This thesis follows the development of 16 monolingual children’s (8 girls) comprehension and production of Swedish spatial prepositions. The selection of children was based on several criteria: the child must be monolingual, the child must have participated in every session with parent-child interaction investigated, i.e. at 0;9, 1;0, 1;3, 1;6, 1;9, 2;0, 2;6 and 3;0 years. Additionally, SECDI-scores from all three questionnaires must have been reported. Most importantly at age 2;6 and 4;0.

In addition to that, the children examined in the thesis should not have any known developmental disorder. The sample consists of both children with younger/older siblings and children without siblings. At age 2;3 years, all children had started preschool.

15 of the children were chosen based on already annotated files: three children were fully annotated, eight children were annotated for almost all sessions and four had a few files completed. The
annotation order was random, except that the project leader tried to have an even number on girls and boys annotated.

A majority of the families that participate in the MINT project are highly educated; in this sample 14 out of 16 families have at least one parent with a university degree. The other parents have an upper secondary school degree as the highest level of education. Furthermore, the majority in the sample have an annual income of at least 400,000 Swedish Kronas.

4.1.6 Data coding

The annotation of the files was conducted by six different research assistants in the MINT project. All annotators have participated in the project for at least three years. The sessions are annotated in the software ELAN annotation tool (Sloetjes & Wittenburg, 2008). This thesis examines the vocalizations made by both the parents and the children, i.e. the prepositions that are uttered in the material. The vocal tiers in ELAN were therefore of interest. The utterances by the parents and the children are coded manually by the research assistants. The research assistants follow a transcription template that has been developed in the project to mark what has been said and how it was said. See Appendix B to see the MINT projects transcription template (Gerholm, 2018).

Out of the 128 files 63 files were already annotated. The data in this thesis consists of free parent-child interaction, i.e. without a researcher in the room. The files were between 6.5-10 minutes each, except at the 0:9-year session which lasted between 4-10 minutes.

This thesis investigates both the input and output of prepositions. Therefore, both the parent’s vocalizations and the children’s vocalizations at 0;9, 1;0, 1;3, 1;6, 1;9, 2;0, 2;6 and 3;0 years were examined.

4.2 Procedure

4.2.1 Procedure during the structured testing

At the 2;9-year session a structured test was conducted on the child’s comprehension of spatial prepositions. After the 10 minutes of free parent-child interaction a researcher entered the studio. The structured test was inspired by the New Reynell Developmental Language Scales’ (NRDLS) subsection “relating two objects” (Edwards et al., 2011).

The researcher sat down in front of the child with a table placed between them and asked the child to place a teddy bear in different positions in relation to a toy car: på ‘on’, under ‘under’, bredvid ‘beside/next to’, bakom ‘behind’ and framför ‘in front’. Additionally, the child was asked to place a syringe i ‘in’ a box, to hide a patch under ‘under’ a pillow, and to hide Na, one of the stuffed animals, under ‘under’ a blanket. Sometimes Na was unavailable, and the teddy bear was the stuffed animal to be hidden. The test session took approximately 5-6 minutes. The researcher followed a checklist with instructions, such as the test sentences, and a reminder not to use gestures or something else that could give the child a cue on what to do (see Appendix C).

4.2.2 Procedure on the parental reports of child vocabulary (SECDI)

After each session the parents received an email reminding them to fill out the vocabulary questionnaire (SECDI I-II & SCIDI III). The parents ticked each new comprehended word when the children were 0;9, 1;0, and 1;3 years, and if the child had started to produce words, every produced word. When the children were 1;6 years, the parents ticked produced words in SECDI II between 1;6-2;6 years. When the children were older than that, the parents were asked to tick the sentence that corresponded to the child’s sentence structure (SCDI III). The ticked words/sentences were saved in the questionnaire so that the parents could see what words the child used, and they thus had already reported three months before.
4.3 Data processing

4.3.1 Processing of the interactional data

The transcribed vocal tiers were exported from ELAN to Excel. Each parental and child utterance was manually examined at each age-point. Each usage of the prepositions i ‘in/at’, på ‘on/at’, under ‘under’, bredvid ‘beside/next to’, bakom ‘behind/back’ and framför ‘in front’ was saved and noted. The use of the word forms was classified into four classes: spatial preposition, abstract preposition, temporal preposition, and particle verb.

All of the investigated prepositions were counted in the material except those that were used in children’s songs. And for prepositions that was uttered in an interrupted phrase, that is if one preposition was misused and the speaker interrupts the utterance to reformulate with another preposition, only the second one was counted. Also, if the speaker stutters and gets stuck at a preposition, e.g. “on, on, on, on, on the table” only one preposition was counted.

The children’s vocalizations were investigated from the age of 1:0 years, due to the annotations in the MINT project being based on a controlled vocabulary at 0;9 years. The controlled vocabulary consists of a list of words, such as “babbling”, “cooing”, “grunting” and, “screaming/shrieking” (see Appendix B). Even though it is possible that some children have pronounced their first words in the 0;9-year session (first words are usually pronounced around the child’s first birthday, see Kuhl, 2004), it is considered unlikely that a prepositional phrase had been produced at the 0;9-year-session.

4.3.2 Processing of the structured test data

The recorded test sessions were analyzed and ticked for each comprehended preposition for each child. A correct positioning of the teddy bear was interpreted as comprehension of the preposition. The scoring of the comprehended prepositions was either 0, meaning that the child did not understand the prepositions, or 1, meaning that the child did understand the preposition.

The six spatial prepositions that were tested were: i ‘in/at’, på ‘on/at’, under ‘under’, bredvid ‘beside/next to’, bakom ‘behind/back’ and framför ‘in front’; summarizing a total of six points. Though, under ‘under’ was repeated and asked for twice, sometimes three times in the test. Since some children only were asked to perform the action twice, the third under ‘under’, asking the child to “hide the patch under the pillow” is not included to the test-score. Due to the repetitive under ‘under’ the total scoring was 7.

4.3.3 Processing of the SECDI data

The prepositions sections in SECDI I and II were isolated from other sections and lexical classes. The section in the SECDI questionnaire is named “prepositions and locations”. Each of the prepositions under investigation was noted for each child at every different age point.

The preposition section in SECDI I – words and gestures, includes 11 prepositions, 4 of which this thesis investigated: i ‘in/at’, på ‘on/at’, under ‘under’, and bakom ‘behind/back’. The preposition section in SECDI II – words and sentences include 25 prepositions, 5 of the investigated prepositions: i ‘in/at’, på ‘on/at’, under ‘under’, bredvid ‘beside/next to’ and bakom ‘behind/back’.

The parental reported comprehension/production of prepositions were counted for each age point. SECDI I and SECDI II results are handled separately, 0;9-1;3 years and 1;6-2;6 years.

SECDI-results are used from all three SECDIs, words and gestures, words and sentences and communicative development. From the first SECDI – words and gestures, the comprehension of the prepositions under investigation for each child, but one child, was collected (at 0;9, 1;0, and 1;3 years). At age 1:0, parental reports on SECDI data was missing. From the second SECDI – words and phrases, the produced prepositions for each child was collected at 1;6, 1;9, 2;0, 2;3 and 2;6 years. The last SCFI was used as a measure on communicative level at 4;0 years of age.
4.4 Data analysis

4.4.1 Analysis based on the interactional data

A mean preposition usage per minute was calculated for each parent and child at each age-point. The mean value of usage of the spatial prepositions from each age-point was then tested by a linear regression to SCDI-score at 4;0 years.

A linear regression was conducted on parental usage of the prepositions to see if more frequent usage predicted an earlier production of the spatial prepositions. The production of prepositions was based on the age of onset, the first interactional session where a preposition was uttered by the child.

The sample subjects were divided into three groups. The analysis was based on these groups, one with a lower, a second with an average, and, a third with a higher SCDI-score at 4;0 years. The lower- and the higher-score group consisted of five sample subjects, the average-score group consisted of six sample subjects.

The group with average scoring children was based on the average score on the whole group of children from the MINT project at 4;0 years (N=70). The whole group had an average at 108 points at 4;0 years. The children in the average score group had a score on ±10 points, the lower score-group had a score of 10 or less than the average, the higher score group had scored 10 points or more than the average.

A One-way ANOVA was conducted to see if the usage of the prepositions were different between the groups with lower-, average-, and higher, SCDI III-scores, in both input and output.

4.4.2 Analysis based on the structured test data

A linear regression test was conducted to answer if greater comprehension at 2;9 years predicts a further developed communication level at 4;0 years.

A one-way ANOVA was conducted to see if the comprehension of prepositions at 2;9 years differs between the groups with lower, average, and higher SCDI-score.

4.4.3 Analysis based on the SECDI data

One-way ANOVA tests were conducted to see if the three groups differ in preposition comprehension at 0;9, 1;0 and 1;3 years and in preposition production at 1;6, 1;9, 2;0, 2;3 and 2;6 years.

A linear regression test was conducted to answer if greater comprehension of prepositions at 0;9-1;3 years predicts a larger productive vocabulary at 2;6 years.

A linear regression test was conducted to answer if greater production of prepositions at 1;6-2;6 years predicts a further developed communication level at 4;0 years.

4.5 Ethical aspects

The project collects information about the participants birthday, first language(s), health information etc. The ethical aspects of the MINT project are in accordance to The Swedish Data Protection Authority, The Central Ethical Review Board at Karolinska Institutet (Dnr 2011/955-31/1), The Personal Data Act (1998:204), and The Act concerning the Ethical Review of Research Involving Humans (2003:460).

Additionally, the families are informed that they can terminate their participation in the project at any time without an obligation of giving an explanation. All families are anonymized. Moreover, the annotators in the MINT project have signed a secrecy contract, preventing them of sharing information gathered in the project to anyone outside the MINT project.
5. Results

This chapter provides the reader with results on all analyses conducted in the thesis. The first section gives results from analyses based on the interactional data. The second subsection contains results from the structured experiment at 2.3 years. The last subsection shows all results from the passive and active vocabulary, as reported by parents (SECDI I & II).

All test results are based on the SCDI-score, communicative level, at 4.0 years. The sample subjects were divided into three groups, one with a lower SCDI-score, one with an average SCDI-score and one with a higher SCDI-score. Table 2 shows the distribution of sample subjects.

Table 2. Values and distribution of the SCDI-score groups at 4;0 years. The table is color-coded, showing the lower (white), average (light grey) and the higher (grey) score groups.

<table>
<thead>
<tr>
<th>Lower SCDI-score</th>
<th>Average SCDI-score</th>
<th>Higher SCDI-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>57</td>
<td>102</td>
<td>137</td>
</tr>
<tr>
<td>85</td>
<td>108</td>
<td>140</td>
</tr>
<tr>
<td>91</td>
<td>111</td>
<td>142</td>
</tr>
<tr>
<td>92</td>
<td>113</td>
<td>143</td>
</tr>
<tr>
<td>97</td>
<td>114</td>
<td>144</td>
</tr>
<tr>
<td></td>
<td>117</td>
<td></td>
</tr>
</tbody>
</table>

5.1 Results from the interactional data

The most common prepositions used by parents and children were i ‘in/at’ and på ‘on/at’, as spatial prepositions. I ‘in/at’ was uttered 430 times, while på ‘on/at’ was uttered 672 times, as spatial prepositions by the parents in the material. The children uttered i ‘in/at’ 40 times and på ‘on/at’ 74 times as spatial prepositions.

I ‘in/at’ and på ‘on/at’ were also the prepositions that were used abstractly by the parents (144 respectively 216 times in the material). I ‘in/at’ was also used 18 times in the sense of a particle verb, and på ‘on/at’ 329 times. It was noted that in the material where the word form på ‘on/at’ should be used twice, both as a particle verb and a preposition, one of the word forms were excluded. Table 3 shows the distribution of the uses of i ‘in/at’ and på ‘on/at’ in the material.

Table 3. Overview of i ‘in/at’ and på ‘on/at’ and the uses of these word forms in Swedish child directed speech in the material. “Spatial” stands for spatial preposition, “abstract” for abstract preposition and “temporal” for temporal preposition, and, “particle” for particle verb. The table gives a total value with a number on the uses of i ‘in/at’ and på ‘on/at’ while the other columns shows a value in percentage of the total.

<table>
<thead>
<tr>
<th>Parents’ use</th>
<th>Total</th>
<th>Spatial</th>
<th>Abstract</th>
<th>Temporal</th>
<th>Particle</th>
</tr>
</thead>
<tbody>
<tr>
<td>i ‘in/at’</td>
<td>609</td>
<td>71%</td>
<td>24%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>på ‘on/at’</td>
<td>1225</td>
<td>55%</td>
<td>18%</td>
<td>1%</td>
<td>27%</td>
</tr>
</tbody>
</table>

Under ‘under’, bredvid ‘beside/next to’ and bakom ‘behind/back’ were not used as frequently as i ‘in/at’ and på ‘on/at’, yet these prepositions were used in a small degree. Bakom ‘behind/back’ was used one time by one child in the material. The data did not contain the preposition framför ‘in front’ at any age point, neither by the parents nor the children.
To answer if more input of prepositions predicts an earlier production of prepositions, a mean preposition usage per minute was calculated. Several linear regressions showed that the parents mean preposition usage per minute did not predict the onset of preposition production.

The children did not produce prepositions as frequently as the parents. At the 1;6 years recording, one child produced på ‘on/at’ six times. At the following recoding, four children produced prepositions. At the 2;0-year recording, six children produced prepositions, at 2;6 years ten children produced prepositions, and, at 3;0 years 15 children produced prepositions. Table 4 shows the produced prepositions by the children during the parent-child interaction, Appendix D contains the same table but specifying which preposition was produced.

Table 4. The number of produced prepositions by the children in the interactional data at age-point 1;6, 1;9, 2;0, 2;6 and 3;0 years. The table is color-coded, lower SCDI-score group (white), average SCDI-score (light grey) and higher SCDI-score (grey).

<table>
<thead>
<tr>
<th>Child</th>
<th>1;6 years</th>
<th>1;9 years</th>
<th>2;0 years</th>
<th>2;6 years</th>
<th>3;0 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>8M0Z</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0M1Z</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1M1Z</td>
<td></td>
<td></td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>6M1Z</td>
<td></td>
<td></td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>5M2Z</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6M2Z</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>7M2Z</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>1M3Z</td>
<td></td>
<td>1</td>
<td>1</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>1M4Z</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5M4Z</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9M4Z</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>7M0Z</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>5M1Z</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>1M2Z</td>
<td>6</td>
<td>10</td>
<td>13</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>2M2Z</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>4M2Z</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

To answer the question if frequent usage of prepositions predicts a further developed communicative level, a mean value of preposition usage per minute at each age point was used. A linear regression showed a significant relationship between preposition output at 2;6 years and communicative level at 4;0 (F (1.14) = 9.245; p < .01, R² = .398), see figure 1.
Figure 1. Significant relationship between child preposition production at 2;6 years and SCDI-score at 4;0 years ($F (1,14) = 9.245; p < .01, R^2 = .398$). The $y$-axis shows the dependent SCDI-score and the $x$-axis shows the number of produced prepositions by the children during the 2;6-year recording.

One Way ANOVAs was conducted to determine if the groups production of prepositions differed significantly. The groups’ production of prepositions at 2;6 years did not differ significantly, however a marginal tendency was evident ($p = .07$).

To answer if more input predicts a further developed communicative level at 4;0 years, a mean value of preposition usage per minute for each parent was calculated. A relationship between parent preposition usage and child communicative level at 4;0 years was found at two age points: 0;9 years ($F (1,14) = 4.847, p < .05, R^2 = .257$), see figure 2, and 2;6 years ($F (1,14 = 5.512, p < 0.05, R^2 = .270$), see figure 3.
Figure 2. Mean preposition input at 0;9 years (x-axis) predicts child communicative level at 4;0 years (y-axis). ($F(1,14) = 4.847, p < .05, R^2 = .257$).

Figure 3. Mean preposition input 2;6 years (x-axis) predicts child communicative level at 4;0 years (y-axis). ($F(1,14) = 5.512, p < 0.05, R^2 = .270$).
Several One-way ANOVAs were conducted to answer if the three groups of parents differed in preposition use at every age point. No significant differences were found between the groups at any age point.

5.2 Results from the structured test

The sample decreased to 14 subjects in the structured test due to missing data points. One of the children refused to perform the actions that the researcher asked for and another child did not participate in the 2;9-year recording. This made the number in both the lower- and the average SCDI-score groups different. The lower SCDI-score group consisted of results from four, instead of five, children and the average SCDI-score group consisted of results from five, instead of six, children. The higher SCDI-score group remained the same, with five children in the group.

In the structured test, the researcher asked the child to perform an action, i.e. to put a teddy bear in different positions in relation to a car. Two children did not move the teddy bear when a comprehended preposition, according to the parental reports, was asked for.

A linear regression shows a strong relationship (R = .745) between preposition comprehension at 2;9 years and communicative level, at 4;0 years (F(1,12) = 14.964; p < .01, R² = .555).

![Figure 4. The comprehension of the spatial prepositions at 2;9 years. The SCDI-score at 4;0 years, y-axis, was strongly dependent of the comprehension of prepositions at 2;9 years, x-axis. (F(1,12) = 14.964; p < .01, R² = .555).](image-url)
Table 5. Distribution of comprehended prepositions at structured test, 2;9 years. The table shows every separate child’s comprehension of the prepositions. The value 1 stands for successful performance and means that the child comprehends the preposition. The table is also color coded to mark the groups with lower (white), average (light grey), and higher (grey) SCDI-score at 4;0 years.

<table>
<thead>
<tr>
<th>Child</th>
<th>i ‘in/at’</th>
<th>på ‘on/at’</th>
<th>under ‘under’</th>
<th>under ‘under’2</th>
<th>bredvid ‘beside/next to’</th>
<th>bakom ‘behind/back’</th>
<th>framför ‘in front’</th>
</tr>
</thead>
<tbody>
<tr>
<td>8M0Z</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1M1Z</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6M1Z</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5M2Z</td>
<td></td>
<td>1</td>
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<td></td>
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</tr>
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<td>6M2Z</td>
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</tr>
<tr>
<td>7M2Z</td>
<td></td>
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<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>9M4Z</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7M0Z</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5M1Z</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1M2Z</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2M2Z</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4M2Z</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Approximately half of the whole group comprehended the first under ‘under’. Table 5 shows the distribution of the comprehended prepositions by the children at 2;9 years. The table shows that all, but one child comprehended the prepositions i ‘in/at’. All but two children comprehended på ‘on/at’. under ‘under’ was asked for twice in the structured test: the first under ‘under’ was comprehended by 9 children, while the second under ‘under’ was comprehended by 12 children.

No child in the lower SCDI-score group comprehended the prepositions bredvid ‘beside/next to’. One child, in the lower SCDI-score group, comprehended bakom ‘behind/back’ and framför ‘in front’ while one child from the average SCDI-score group and three from the higher SCDI-score group understood bakom ‘behind/back’ and framför ‘in front’. One child in the average group comprehended bakom ‘behind/back’ but not framför ‘in front’.

In the group with average SCDI-score two children failed at på ‘on/at’, and, three children failed on the first under ‘under’. All but one child comprehended the second under ‘under’. Two children comprehended bredvid ‘beside/next to’, two the bakom ‘behind/back’ and one child comprehended framför ‘in front’. All children in the higher SCDI-score group comprehended i ‘in/at’, på ‘on/at’, first and second under ‘under’ and bredvid ‘beside/next to’.

A One-way ANOVA was conducted on the comprehension of prepositions between the groups. The ANOVA tested the total preposition comprehension score, to see if the comprehension of the prepositions differed between the groups. A difference was found between the groups (F(2,11 = 7.846, p < .01). A LSD Post Hoc test found that the group with lower SCDI-score differed from the group with higher SCDI-score (p = .005), and that the average SCDI-score group differed from the higher SCDI-score group (p = .007).

It was not tested if the groups differed in comprehension of the preposition i ‘in/at’ and på ‘on/at’, but both under ‘under’, bredvid ‘beside/next to’, bakom ‘behind/back’ and framför ‘in front’ was tested.
No difference was found between groups in comprehension of *under* ‘under’, *bakom* ‘behind/back’ or *framför* ‘in front’. But a difference was found between the groups in comprehension of the preposition *bredvid* ‘beside/next to’ (F(2,11=10.542, p <.05). There was a difference between the group with lower SCDI-scores and the group with higher SCDI-score (p = .001), and, the group with average SCDI-score and higher SCDI-scores (p = .015).

### 5.3 Results from the parental reports (SECDI)

The three groups’ preposition development is presented in figure 5. Figure 5 shows the three groups’ comprehension of prepositions and their production of prepositions.

![Figure 5. The figure shows two diagrams with the number of prepositions comprehended over time, and production over time. The comprehension-diagram is presented to the left and the production-diagram is presented to the right. The diagrams show the lower (to the left), the average (in the middle) and, the higher (to the right) SCDI-score groups. The x-axis shows the sample subjects and the y-axis shows number of prepositions. The colors stand for different age points.](image)

SECDI I includes four of the investigated prepositions: *i* ‘in/at’, *på* ‘on/at’, *under* ‘under’, and *bakom* ‘behind/back’. In figure 5, it is evident that one child does comprehend a preposition at 0:9 years, to be specific *i* ‘in/at’ was comprehended. At the second age point, when the children were 1 year old, five children comprehended at least one spatial preposition. All children that comprehend at least one preposition at age 1:0 are children from the average SECDI-score group (N=1) or the higher SCDI-score group (N=4). At age 1:3 years, seven of the 16 children comprehended at least one preposition. There was no child that comprehended *på* ‘on/at’ but not *i* ‘in/at’. The first comprehended preposition for two children was *under* ‘under’.

SECDI II includes five of the investigated prepositions: *i* ‘in/at’, *på* ‘on/at’, *under* ‘under’, *bredvid* ‘beside/next to’ and *bakom* ‘behind/back’. In figure 5, it is shown that one child produces two prepositions at age 1:6 years, a child belonging to the average SCDI-score group. At the second age point, three additional children produced prepositions. All three belonged either to the average or the higher SCDI-score group. At the third age point (2:0 years), four additional children started producing prepositions, one from the lower and the higher and two from the average SCDI-score group. The child from the lower score-group had produced two prepositions, *i* ‘in/at’ and *på* ‘on/at’. The child from the average score-group had started with four prepositions, all but *bredvid* ‘beside/next to’. The child from the higher-score group had started producing all five prepositions. At 2:3 years, four more children had started using prepositions, two from the average score-group and two from the higher-score group. At the last age point, 2:6 years, one child from the lower score-group started producing prepositions. Four children had not started producing prepositions, according to the parental reports that was gathered between the ages of 1:4-2:6 years. One of the children was from the average SCDI-score group, and three from the lower SCDI-score group.

The first onset age was 1:6 years, where a child produced both *på* ‘on/at’ and *under* ‘under’. One child produced *bakom* ‘behind/back’ as his/her first, another *under* ‘under’ as his/her first. Five children
produced *i* ‘in/at’ but not på ‘on/at’, while two children produced *på* ‘on/at’ but not *i* ‘in/at’. At the last age point, 2;6 years, 12 out of the 16 children produced prepositions.

To answer if the groups’ comprehension of prepositions differ at any age point, a One-way ANOVA was conducted. The three groups’ comprehension of the prepositions did not differ at 0;9 and 1;0 years. However, at 1;3 years a significant difference was found (F(2,13 = 8.490, p =.004). An LSD Post Hoc test showed that the group with lower SCDI-score at 4;0 years differed from the group with higher SCDI-score at 4;0 years significantly (p = .002). A significant difference was also found between the group with average and the group with higher SCDI-score at 4;0 years (p = .006). No difference was found between the group with lower and the group with average SCDI-score.

To answer if the groups differ in preposition production a One-way ANOVA was conducted on each age point. No difference was found between the groups at age 1;6, 1;9 and 2;0 years. However, a significant difference was found between all groups at 2;3 years (F (2,13 = 13.488 p = .01), see table 6 below. The table shows an LSD Post Hoc test, all groups differed significantly. There was a significant difference between the lower SCDI-score and the group with the higher SCDI-score (p < .01), between the lower SCDI-score group and the average SCDI-score group (p = .015), and between the group with the average SCDI-score and the group with the higher SCDI-score (p = .021).

### Table 6. A One-way ANOVA analysis, Post Hoc LSD. The table shows a significant difference between all three groups, lower, average and higher SCDI-score groups in preposition production as reported by parents (SECDI II) at 2;3 years.

<table>
<thead>
<tr>
<th>(I) Groups</th>
<th>(J) Groups</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval Lower Bound</th>
<th>95% Confidence Interval Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower</td>
<td>Average</td>
<td>-2.267*</td>
<td>.811</td>
<td>.015</td>
<td>-4.02</td>
<td>-3.51</td>
</tr>
<tr>
<td></td>
<td>Higher</td>
<td>-4.400*</td>
<td>.847</td>
<td>.000</td>
<td>-6.23</td>
<td>-2.57</td>
</tr>
<tr>
<td>Average</td>
<td>Lower</td>
<td>2.267*</td>
<td>.811</td>
<td>.015</td>
<td>.51</td>
<td>4.02</td>
</tr>
<tr>
<td></td>
<td>Higher</td>
<td>-2.133*</td>
<td>.811</td>
<td>.021</td>
<td>-3.89</td>
<td>.38</td>
</tr>
<tr>
<td>Higher</td>
<td>Lower</td>
<td>4.400*</td>
<td>.847</td>
<td>.000</td>
<td>2.57</td>
<td>6.23</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>2.133*</td>
<td>.811</td>
<td>.021</td>
<td>.38</td>
<td>3.89</td>
</tr>
</tbody>
</table>

* The mean difference is significant at the 0.05 level.

Another One-way ANOVA showed a significant difference between the groups preposition production at 2;6 years (F(2,13 = 5.798, p = .016). An LSD Post Hoc test showed that the difference was between the lower and the higher SCDI-score group, p = .005.

The linear regression tests on the children’s comprehension of prepositions at 0;9 and 1;0 years did not show any significant relationship. However, at 1;3 years the linear regression showed a relationship between preposition comprehension and productive vocabulary at 2;6 years (F (1,14) = 7.617; p < .05, R² = .352).
Figure 6. Significant relationship \((F (1,14) = 7.617; \ p < .05, \ R^2 = .352)\). The figure shows number of comprehended prepositions at 1;3 years on the x-axis, and productive vocabulary at 2;6 years, on the y-axis. The linear regression shows that comprehended prepositions at 1;3 years predict productive vocabulary at 2;6 years.

Linear regression tests on the children’s production of prepositions at age 1;6, 1;9 and 2;0 years did not show any relationship with communicative level at 4;0 years. However, the linear regression of preposition production at 2;3 years showed a strong prediction to communicative level at 4;0 years \((F(1,14) = 33.109; \ p < .01, \ R^2 = .703)\).

Figure 7. Statistically significant linear regression analysis of preposition production at 2;3 years predicts communicative level at 4;0 years. The y-axis shows the score on SCDI III and the x-axis shows the amount of produced prepositions. The trend line shows a strong relationship of preposition production at 2;3 years to communicative level at 4;0 years, \((F (1,14) = 33.109; \ p < .01, \ R^2 = .703)\).
At 2;6 years, the children’s preposition production predicted their communicative level at 4;0 years. A linear regression analysis showed a significant relationship ($F(1,14) = 17.764; p < .01, R^2 = .559$), see figure 8.

![Figure 8. Significant linear regression between preposition production by children at 2;6 years, x-axis, and their communicative level score at 4;0 years, y-axis, ($F(1,14) = 17.764; p < .01, R^2 = .559$).](image)

The onset of child preposition production differed between the parental reports (SECDI II) and the interactional data. Table 8 contains the reported onset by parents and the session where one of the prepositions investigated was used for the first time by the child. The table shows the difference in onset of prepositions, independently of which preposition the child uttered, according to the interactional data and according to SECDI II (1;4-2;6 years). When observing table 7, it is evident that the different methods show different onset ages. The column to the right shows the difference in years, with a median value of ±0.3 years. Generally, the difference shows that onset age is different depending on the method used; onset age was never the same. In five out of 16 cases, recorded interaction is capturing earlier onset than in SECDI and vice versa.
Table 7. Onset of the prepositions investigated (‘in/at’, på ‘on/at’, under ‘under’, bredvid ‘beside/next to’, bakom (behind/back), framför ‘in front’) according to parental reports (SECDI II) and in interactional data (full sessions). The values show age of onset from the different methods. ‘-’ indicate that no prepositions has been produced until the age of 2;6 years. The table includes a column named “difference” which show the difference of onset age between the two methods. The table is color-coded, marking the average SCDI-score at 4;0 years in light grey, and chronologically reported, with the lower score-group first (white) and the higher score-group (grey) last.

<table>
<thead>
<tr>
<th>Child</th>
<th>Interaction</th>
<th>SECDI</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>8M0Z</td>
<td>3;0</td>
<td>2;6</td>
<td>-0;6</td>
</tr>
<tr>
<td>0M1Z</td>
<td>3;0</td>
<td>-</td>
<td>N/A</td>
</tr>
<tr>
<td>1M1Z</td>
<td>2;6</td>
<td>-</td>
<td>N/A</td>
</tr>
<tr>
<td>6M1Z</td>
<td>2;6</td>
<td>2;0</td>
<td>-0;6</td>
</tr>
<tr>
<td>5M2Z</td>
<td>3;0</td>
<td>-</td>
<td>N/A</td>
</tr>
<tr>
<td>6M2Z</td>
<td>3;0</td>
<td>-</td>
<td>N/A</td>
</tr>
<tr>
<td>7M2Z</td>
<td>2;0</td>
<td>1;9</td>
<td>-0;3</td>
</tr>
<tr>
<td>1M3Z</td>
<td>2;0</td>
<td>1;9</td>
<td>-0;3</td>
</tr>
<tr>
<td>1M4Z</td>
<td>2;6</td>
<td>2;3</td>
<td>-0;3</td>
</tr>
<tr>
<td>5M4Z</td>
<td>1;9</td>
<td>1;6</td>
<td>-0;3</td>
</tr>
<tr>
<td>9M4Z</td>
<td>1;9</td>
<td>2;0</td>
<td>+0;3</td>
</tr>
<tr>
<td>7M0Z</td>
<td>3;0</td>
<td>2;3</td>
<td>-0;9</td>
</tr>
<tr>
<td>5M1Z</td>
<td>2;0</td>
<td>1;9</td>
<td>-0;3</td>
</tr>
<tr>
<td>1M2Z</td>
<td>1;6</td>
<td>2;0</td>
<td>+0;6</td>
</tr>
<tr>
<td>2M2Z</td>
<td>3;0</td>
<td>2;3</td>
<td>-0;9</td>
</tr>
<tr>
<td>4M2Z</td>
<td>2;0</td>
<td>1;9</td>
<td>-0;3</td>
</tr>
</tbody>
</table>
6. Discussion

This section provides the reader with a discussion on the three conducted methods, and the reliability as well as the validity of the methods. Also, a discussion follows on the results from the three methods. Last, further research is suggested.

6.1 Method discussion

6.1.1 Parent-child interaction

The first research question was if parental preposition usage predicts child preposition production onset. The onset of preposition production was based on the first produced preposition, of the ones investigated, in the interactional data. Linear regressions were performed on each age point, parental mean preposition usage at 0;9, 1;0, 1;3, and, 1;6 years and child preposition onset age, but no agreement was found at any age. This could depend on the values in the analyses. The mean values were often, but not always, below one. It was also noted that the onset in the interactional data and the onset as reported by parents were very different. This, however, is discussed in section 6.1.4 The validity of the methods.

6.1.2 Structured test

The instructions to the NRDLS (Edwards et al. 2011) say that the researcher should be seated next to the child. However, these instructions were not included in the structured test performed by the researchers in the MINT project (Appendix C). Instead, the researcher was sitting in front of the child in all sessions. The researchers sat in front of the child to make sure that the cameras would capture the testing. However, this could have caused confusion for the children. The children have to interpret if it is framför ‘in front’ to the researcher, to the child or to something else. It is possible that the children got confused by this, even though an adult easily comprehends that the positioning of the teddy bear should be in relation to the car, seen from the child’s perspective.

When going through the data, it was noted that the researcher did not use the same objects at all times, sometimes the child was asked to hide the car and sometimes a stuffed animal, the teddy bear or a monkey. All of these are inanimate objects, but the car is “more inanimate” than the teddy bear or the monkey. The change of objects was sometimes because the child was hugging the stuffed animal, and sometimes because the researcher did not see or find the stuffed animal. In a testing session, it is of importance that the researcher is quick enough to maintain the child’s interest. But, since previous research have found that context (Rohlfing, 2011, Nachtigäller et al. (2013), Rohlfing & Nachtigäller, 2016), as well as animacy (Meints et al., 2002), matters for comprehension of prepositions it would have been preferred if the object had been constant throughout the testing sessions.

6.1.3 SECDI

Acquisition of prepositions is slow, according to prior research (Gentner & Bowerman, 2009, Håkansson, 1998, Lange 1976). And, once in use, children do not tend to produce the preposition in all utterances where they are needed (Richthoff, 2000; Lange, 1976). Therefore, it is considered less of a problem when the parental report shows an onset before it is present in the material, than when it is reported several months after. It is possible that their child has used a preposition in a context that is not present in the recorded parent-child interaction. However, the questionnaire on child vocabulary is ticked after the visit at the interaction lab, and the cases were parents have not ticked preposition onset even though the child had produced a preposition in the parent-child interaction, makes one question if this subsection in SECDI can be used. One of the children had not gotten a preposition ticked even after the second visit after the preposition had been produced in the parent-child interaction, i.e. half a year later. However, most of the parental reports reported on a preposition onset before or at the same
age point as it was found in the interactional data, only two children did in fact produce prepositions before it had been reported by their parents.

### 6.1.4 The validity of the methods

The thesis is based on three different methods and therefore three different measurements were used. The interactional session is used to see how much input and output of prepositions the children hears and produces. However, the interactional sessions are very short instances of the child’s life: 4-10 minutes every third month.

When analyzing the interactional data, it was considered that mean values would give a fair picture of the child’s preposition usage. A cut of the sessions length was considered; making a comparison on total amount of preposition usage between the children possible. However, the cut excluded prepositions, causing that some children did not seem to produce any prepositions in a couple of sessions. For instance, the cut of the sessions caused one child to lose all produced prepositions at the 1;6 year-recording. Thus, it highlights a problem in child language acquisition research. Although the sample of this thesis is bigger than samples in previous research on Swedish children’s acquisition of prepositions (Strömqvist et al., 1995; Richthoff, 2000; Strömqvist et al., 2001; Lange 1976), the time that represents the child’s usage of prepositions is not enough. The time that represents the child’s speech in this thesis was 4,5-11 minutes. The sample that was gathered in the child’s speech could have been random, even if it would have been 4,5-10 hours at every age point. The fact that a child could have lost all prepositions during an age point shows that the time that represents the child’s usage of prepositions, or whatever is under investigation, easily can miss a representative moment of the child’s competence. Hence, the chance to capture the child’s production or to capture a representative picture of the child’s production is low.

In the study performed by Lange (1976) on one child’s development of prepositions, Lange excluded prepositions that the child produced that could have been a repetition of an adult. The material in this study did not exclude repetitions of any kind, neither self-repetitions nor if the child repeated his/her parent’s utterance. Repetitions were not excluded because excluding them would not give a natural picture on how much prepositions the child hears/produces.

The results of this thesis could depend on both the length of each of the sessions, or the mean values. That is, details in the method, e.g. the definition of prepositions, what toys that are used and what is included and excluded play a crucial role and can cause large effects in results of child development investigations.

In the structured test, it was interpreted as if a correct positioning of the teddy bear was equivalent with comprehension of the preposition. A correct positioning of the teddy bear generated full scoring; an incorrect positioning of the teddy bear or, no positioning of the teddy bear was equivalent with incomprehension of the preposition. However, that a not-performed action was interpreted as incomprehension is not as convincing as a successfully performed action being interpreted as comprehension. A not-performed action can be because of something else, e.g. being uncomfortable with a testing session or fright of the researcher. Even the child’s mood can affect the child’s cooperation. One child was excluded in the analyses, due to uncertainty of how to interpret his/her behavior. Therefore, the wrong positioning of the teddy was safer to interpret as incomprehension than not placing the teddy bear at all.

Parents can under-/overestimate their child’s understanding/production (Law & Roy, 2008; Eriksson, 2017). But, Berglund & Eriksson (2000b) found that parental reports are consistent by a test-retest. SECDI II and SCDI III have been evaluated (Berglund & Eriksson, 2000b, Eriksson, 2017). Previous research has found that children usually omit prepositions and later mark a placeholder for the prepositions in their utterances before producing full prepositional phrases (Richthoff, 2000). It is possible that an omitted preposition, or a schwa (ə) can have been interpreted as a produced preposition by a parent.

The results from the parental reports and from the interactional data concerning onset of preposition production differed in many cases. The difference in onset does also remind us of that no method is
absolute; the miss-match between parental reports and the child’s production in the interaction-
material highlights the incompleteness of the methods. Therefore, neither of the methods capture the
onset of the child’s preposition usage with certainty.

The thesis uses the scoring on SCIDI III – communicative development, at 4:0 years as a measure on
the children’s communicative level. However, it should be mentioned that this questionnaire does to a
large extent measure in the children’s vocabulary. SCIDI III’s vocabulary part consists of two thirds of
the total scoring and one third is more general questions on the child’s language ability e.g. in form of
sentence structure and pronunciation compared to older children. This thesis has nevertheless based
the linear regression analyses on the subsection containing prepositions in SECDI I & II, to the total
scoring in SECDI II, 2;6 years, and SCIDI III, 4:0 years.

6.1.5 The reliability of the thesis

The thesis is based on three different methods and therefore three different instruments were used. The
material used in this study was transcribed by six different research assistants in the MINT project. All
six of the research assistants had been part of the MINT project for at least three years and were all
used to transcribing infant, child and adult vocalizations and verbalizations. Therefore, the
transcriptions were not double-checked by listening to the audio-files, unless there was something
suspicious about the transcription, or to determine if a preposition or a particle was uttered.

Experienced transcribers are something that has a substantial impact on the annotations; listening
thoroughly and repeating the utterances becomes a habit, which decreases the risk of hearing wrong.

The second method in this thesis was the structured test, where the researchers asked the children to
put a teddy bear in several positions in relation to a car. The structured test was a good instrument for
testing children’s comprehension of prepositions, since the difference in every requested positioning
of the teddy bear was the change of prepositions only.

The third method that this thesis used was the questionnaires with parental reports on child
comprehension (SECDI I), production (SECDI II) and communicative development (SCDI III). Using
parental reports on child passive and active vocabulary as well as communicative level has been
evaluated and found to be a good method for language acquisition research (Berglund & Eriksson,
2000b, Eriksson, 2017, Law & Roy, 2008), even though parents can under- or overestimate their
child’s language abilities (Law & Roy, 2008 Eriksson, 2017). SECDI I/II and SCIDI III gives a broader
perspective on the child’s language ability than any other method, because the questionnaires are filled
by a parent that has interacted with the child in different contexts.

6.1.6 The generalizability of the results

The results from this thesis were based on a sample of 16 monolingual children (8 girls), all living in
Stockholm, Sweden. The parents in the sample had at least an upper secondary degree as their highest
level of education. Adding to that, most of the families had an annual income of at least 400.000
Swedish Kronas. The sample of this thesis was from middle class families and is therefore quite
narrow and homogenous. However, the children in the sample did vary in the sense of their
communicative level at 4:0 years. No child had a known developmental disorder at the time of the
recordings. In addition to that, the children in the sample had started preschool at different ages, all
between the ages of 1:0-2:3 years. Some of the children had older/younger siblings, while others did
not have siblings.

6.1.7 Motivation

Although there is existing research on the acquisition of spatial prepositions, results from previous
research is not enough. The existing research on Swedish children and their acquisition of prepositions
is based on few children, with production of prepositions in focus. Therefore, this thesis aimed to
complement previous research and to fill the research gap on comprehension of prepositions in
Swedish child language acquisition of spatial prepositions.
Six prepositions were included in the investigation. The prepositions were chosen based on the prepositions that were included the structured experiment at 2:9 years.

The questionnaires did not contain the preposition *frånför* ‘in front’. However, the preposition was nevertheless included. It was expected that this would be present in interaction, since it was comprehended in the structured test. It was also considered as if the investigation would be incomplete if it would not be included in the thesis, because of it is antonymous relation to *bakom* ‘behind/back’, and because previous research that include *bakom* ‘behind/back’ had included *frånför* ‘in front’.

Previous research have based their conclusions about the acquisition of prepositions on solely one of the methods that this thesis used. In this thesis, however, it was possible to investigate the acquisition of prepositions by using several methods which is an advantage in language development research. Different methods enable the results to be clearer, since neither one of the methods is all-covering or adequate enough.

### 6.1.8 The division of the groups

The groups with lower, average, and higher SCDI-scores were based on the whole sample group included in the MINT project’s SCDI-score at 4:0 years. The sample of this thesis had a great spread in score in SCDI at 4:0 years. Therefore, the sample was divided into three groups. The group with lower scores than 10 points from the average became the lower SCDI-score group. The group with a score higher than 10 points above average became the higher SCDI-score group.

The division of the average- and the higher SCDI-score groups resulted in a large gap between the highest scoring child in the average group and the lowest scoring child in the higher group. However, the highest scoring child in the lower SCDI-score group and the lowest scoring child in the average scoring group had a difference of only 5 points in scoring (see table 2 in 5.1 Results). The lower and the average SCDI-score groups’ difference is less evident when only observing the highest scoring child in the lower group and the lowest scoring child in the average group. But, the three groups mean values differ from each other.

### 6.1.9 Ethics discussion

This thesis has included results from 16 children and parents from the MINT project. As stated before, the MINT project has been approved to study humans (see section 4.5 Ethical aspects). The children in the project are anonymized, however, the parents have taken part of the anonymized codes of their own child. Therefore, the children that are used in this sample are re-anonymized, making them completely unidentifiable.

### 6.2 Result discussion

#### 6.2.1 Result discussion about the interactional data

Tomasello (1987) and Clark (1973) highlight the fact that the prepositions are homonymous and synonymous to other lexical classes or other prepositions. This thesis found that in the interactional data, *på* ‘on/at’ was uttered as a spatial preposition 672 times, 55% of the total *på* ‘on/at’ usage. It was used as a particle 27% of the times, and a preposition describing something more abstract than spatiality 18% of the times, see Table 2 in Result section, 5.1. Thus, the preposition *på* ‘on/at’ is a preposition that could cause confusion to the child and force him/her to use a guessing strategy to get his/her utterances correct (Johnston & Slobin, 1979). Bolander (2012) claims that the scope of usage has widened for the preposition *på* ‘on/at’. However, this thesis did not investigate how the prepositions were used in the material, except for the categorizations of the use of the word forms *på* ‘on/at’ and *i* ‘in/at’. Therefore, no conclusion can be drawn on whether or not the children overextended the use of the preposition.
The interactional data did not contain any instances of temporal prepositions by the children. This is in accordance with the result of Lange’s (1976) case study, and also to the complexity-hypothesis as suggested by Clark (1973): spatial prepositions are used before temporal prepositions. Despite that some of the prepositions can be used as temporal prepositions (Bolander, 2012, Bennett, 1975), the parents used temporal prepositions rarely; 1-3% (see Table 2 in the Results section).

Swedish basic prepositions, e.g. på ‘on/at’, can be extended to compound prepositions, e.g. ovanpå ‘onto’ (Bolander, 2012). However, these extended versions of the basic prepositions were rarely used in the parent-child interaction sample. This could be because of the simplifying characteristics of CDS (Snow, 1972). It was noted that in utterances where the word form på ‘on/at’ should be used twice, i.e. once as a particle verb and once as a preposition, one of the word forms were systematically excluded. It could be that one på ‘on/at’ was excluded by the parent to avoid repetitiveness, or to simplify the sentence structure. However, the reason the preposition or the particle verb was excluded was not investigated further due to time limits.

One of the research questions was if parental preposition usage predicted the onset of production by the child. Several linear regressions were conducted on the mean preposition usage at the age points 0;9, 1;0, 1;3 and at 1;6 years, but no significant relationship with preposition onset was found. One suggestion to explain the absence of significant results is that the analyses were based on the values from the sessions separately. Another suggestion is that the mean values of parental preposition production are based on an insufficient amount of time. A third suggestion is that the quantity of parental preposition usage is something that is unimportant to the child’s own production of the preposition. Hence, it could be the quality of the input (Tomasello, 1987), or perhaps the child’s comprehension of the preposition that is of importance. The quality of the prepositions has not been investigated in this thesis due to time limits. However, the children’s comprehension has been investigated, see section 6.2.3 Results on the SECDI-data for further discussion.

The interactional data showed that all children in the sample had started producing prepositions at age 3:6. At the three-year recording all children had started producing prepositions, see table 4 (5.1 Results from interactional data or Appendix D for more details on produced prepositions). The tables show that the children’s production of prepositions at each session was low, only five children produced more than five prepositions during one session.

A linear regression showed that child preposition usage at 2;6 years predicted communicative level at 4;0 years. At the 2;6-year recording, two children from the lower SCDI-score group produced a few prepositions and the majority of the children in the other groups produced prepositions. In the average SCDI-score group, only a few prepositions were produced while in the higher SCDI-score group several prepositions were used. A One-Way ANOVA was conducted to see if the groups differed in preposition usage, however a difference was not significant, although marginally. However, the children belonging to the average- and the higher SCDI-score groups’ usage could mean that once the child has figured out the meaning of the preposition and started using it in a more frequent way, the child has entered a transit in learning the language that s/he is acquiring. However, more research is required validate the results.

In addition to that, parental preposition usage per minute at 2;6 years predicted their child’s communicative level at 4;0 years. Additionally, the parental preposition usage at 0;9 years also predicted their child’s communicative level at 4;0 years. These relationships indicate that parental input does co-varies with the child’s language development both during infancy and toddlerhood. However, when comparing the parents’ preposition usage between the groups with lower, average and higher SCDI-score at 4;0 years, no significant difference was found. The absence of significant results in comparing the parental usage could be due to the analysis being based on the mean values, although a significant relationship was found with these values at the linear regression analyses.

The most frequently used spatial prepositions by the children were på ‘on/at’ and i ‘in/at’, på ‘on/at’ was uttered 74 times while i ‘in/at’ was uttered 40 times in the material. Strömqvist et al., (2001) found that i ‘in/at’ was one of the most frequently used function words by children, yet på ‘on/at’ was not included on that list. However, this thesis focused on the usage of these word forms in the sense of spatial prepositions, which probably explains why the results differ.
The interactional data did not contain any instances of the preposition *främför* ‘in front’. Johnston & Slobin (1979) discusses how *FRONT* is acquired later than *BACK* because of salience in interaction. The preposition was absent in the interactional data in this sample, however, the sample is too small so further conclusions cannot be made. The children barely used *bakom* ‘behind/back’ and *främför* ‘in front’ was never uttered by a child in the data.

### 6.2.2 Result discussion about the structured test data

The structured test included results from 14 children at age 2;9 years. The sample decreased with two children due to one child’s absence in the 2;9 year-recording, while another child was too uncomfortable either with the researcher or the testing situation itself and therefore refused to perform the actions that the researcher asked for.

A difference was found between the lower SCDI-score group and the average SCDI-score group compared to the higher SCDI-score group. That is, the average and the lower SCDI-score groups did not differ significantly.

One child struggled with the positioning of the teddy bear at *bakom* ‘behind/back’ and *främför* ‘in front’. The child solved it by placing the teddy bear on the car facing away from the car to *bakom* ‘behind/ back’ and facing the car for *främför* ‘in front’. This positioning could be an indication that the child got confused, either by the positioning of the researcher, or by the object itself, whether it has a front or not. The positioning is creative, and not completely wrong, although it should be the car that is the reference. It could be the case that the child had difficulty with having the car as reference (Meints et al., 2002).

Another child solved *bakom* ‘behind/back’ in a similar way but placed the teddy bear beside the car when *främför* ‘in front’ was asked for. One suggestion is that the child was confused by the experimental setting, another is that the child did not comprehend *främför* ‘in front’ and guessed what position it could be. Another possible explanation is that the child has overextended the preposition *främför* ‘in front’ to mean what adults would describe as *bredvid* beside/next to or “next-to-and-visible” (Johnston, 1984, Johannes et al., 2016). However, in the scoring of the structured test, “close-to-correct” answers were not considered, but the prepositions were scored as comprehended only if the positioning was correct, as an adult would have placed the teddy bear.

The second *under* ‘under’ that were asked for in the structured test was understood by three more children compared to the first *under* ‘under’. This was probably due to the instruction to *hide* and not just to *put* as the in the instruction to the first ‘under’. The verb “hide” is giving the children additional information about what they should do. Rohlfing (2011) found that mothers activated their child’s background knowledge to help their child to understand the prepositions that the child did not understand without the background knowledge (2011: 16).

In the structured test, the researcher’s use of *göm* ‘hide’, helped the child to comprehend the preposition *under* ‘under’, and therefore the child positioned the teddy bear under the blanket. The children that did understand the ‘under’ in the first, atypical instruction, had a widened comprehension of ‘under’ and more atypical examples were comprehended (Meints et al. 2002). In the instruction with ‘hide’ included, three more children positioned the teddy bear correctly, which is interpreted as they used the semantics to interpret correctly (Rohlfing, 2011, Nachtigäller et al. (2013), Rohlfing & Nachtigäller, 2016).

### 6.2.3 Result discussion about the SEDCI-data

The structured test became an evaluation of the child’s comprehension of prepositions as reported by the parents (SECDI I). There were two children that did not perform an action, even though this had been reported as an understood preposition by their parents. One child did not understand *under* ‘under’ in the sentence without the cue, however with the cue, i.e. “*hide* the teddy bear under the blanket”, the child did comprehend. The other child did not understand the preposition *bakom* ‘behind/back’, even though the parents reported this as a comprehended preposition at age 1;0. Even if the parents reported on their child’s comprehension of *bakom* ‘behind/back’ in a narrow context, one
would expect that the comprehension had developed to a broader usage 1;9 years later. This goes for the other child’s comprehension on *under ‘under’* as well. But, since the second *under ‘under’* was comprehended, it could be the case that parents based their child’s comprehension on a narrower context (Meints et al., 2002, Rohlfing, 2011, Håkansson, 1998), possibly with help from background knowledge or shared past events as previous research has found (Rohlfing, 2011). This, however, indicates that parents are more generous in reports of their child’s language ability (Eriksson, 2017, Law & Roy, 2008). Contrary to that, the parental reports on preposition production could be independent of the child’s comprehension of the preposition, i.e. the parents could have reported on their child’s use of a preposition without a thought of if the preposition was used correctly. A preposition could have been used by the child even though it was not fully understood (Lange, 1976). However, because only two children failed on two scores that their parents had reported as comprehended, it is not considered as a problem. Thus, the children did not fail in the sense that they put the teddy bear in a *wrong* position relative to the car; they did not put the teddy bear anywhere.

The first research question in this thesis was to answer whether child preposition onset depends on parental preposition usage or not. To answer this, a mean preposition usage was calculated and no agreement between parental usage and child onset was found (see 6.1.4 The validity of the methods). The onset of preposition usage was not depending on parental preposition usage (see 6.2.1 Result discussion on the interactional data). However, it was noticed that the parental reports on child onset of produced prepositions differed from what the analyses had been based on, i.e., the onset of prepositions in the interactional data. Table 8 in chapter 5 shows difference on preposition onset. The difference is partly due to the productive vocabulary questionnaire (SECDI II) stopped being collected at 2;6 years and got exchanged to the communicative development-questionnaire (SCDI III). The parental reports on onset of prepositions and the onset of prepositions in the interactional data differed, sometimes with half a year. It is worth mentioning that although the sample families to a greater extent consist of parents with a higher education, the parents may not have linguistic knowledge or interest. It could be the case that the child had to use the preposition a few times before the parent actually notices that the child does know a preposition. Previous research on Swedish child language acquisition of preposition shows that children often omit them at first (Håkansson, 1998 Richthoff, 2000, & Lange, 1976). This could be why there was a difference in onset when comparing the interactional data and the produced prepositions as reported by parents. The results could have been affected by the choice to use the onset in the interactional data in the analyses.

Previous research states that prepositions belong to a lexical class that is acquired late in the child’s language development (Meints et al., 2002; Tomasello, 1987; Lange, 1976). The parental reports, as well as the interactional data, show that one child produced a preposition at age 1;6 years. This is four months earlier than Strömqvist and colleges (1995) who found that the two Swedish children started to produce the prepositions *‘in/at’* and *pa ‘on/at’* between the ages of 1;10-2;4 years. Furthermore, the parental reports do also show that some children have not started to produce prepositions at age 2;6 years. The data from this thesis shows that children learning prepositions in Swedish, can have an onset earlier than 1;10 years and later than age 2;4 years.

Neither the first nor the second SECDI contained the preposition *framför ‘in front’*. Since the SECDI’s did not include the word, and the word was never used in the interactional data, this thesis can only confirm that the preposition does have a low salience in interaction in this sample (Johnston & Slobin, 1979). Although, the children from the higher SCDI-score group did comprehend the preposition, which is interpreted as if the children will or may have produced it before.

The parental reports on produced prepositions showed that children start using prepositions in the latter part of their second year of life. The results showed that the usage of prepositions had a positive relationship to communicative level-scores at 4;0 years. This could depend on the productive vocabulary, if a child knows and uses many words from different lexical classes, the child can combine the words to more complex sentences than a child that does not know or use as many words in different lexical classes. Eriksson (2017) found that word count correlates to syntax, that is, sentence complexity and sentence constructions. But, the analyses have also shown that comprehension of prepositions have a positive relationship to vocabulary size, in SECDI II, as well. This indicates that a greater comprehension of prepositions could predict a greater vocabulary, which
in turn could predict further developed communicative level, (SCDI III). Although, it should be noted that SCDI III, this thesis’ measure on communicative level, primarily focuses on lexicon (see 6.1.4 The validity of the methods). Furthermore, if comprehension of prepositions at 0;9, 1;0 and 1;3 years could predict a further developed communicative level-score (SCDI III) was not tested.

The interactional data found that all children produced prepositions at age 3;0, indicating a wider time-span of preposition onset in Swedish children than Strömqvist and colleges (1995) found. Based on the parental reports, this thesis found that the onset of producing prepositions is typically between the ages of 1;9 and 2;3 years. This is where 10 out of the 16 children started producing spatial prepositions, but the onset could come a few months earlier for some children (1 child in the sample) or later (5 children in the sample).

6.2.4 General result discussion

In Swedish child preposition acquisition, the results suggest that ‘in’, ‘on’, ‘under’ are prepositions that are acquired before ‘beside’, ‘behind’ and ‘in front’, as the complexity hypothesis, as formulated by Clark (1973) predicts. When investigating the antonymous pairs ‘in front’ and ‘behind/back’ the complexity hypothesis (Clark 1973) predicts ‘in front’ to be acquired before ‘behind/back’. The only method that could show a tendency in which preposition would be acquired first in Swedish language acquisition was the structured test. In the results from the structured test, only one child comprehended bakom ‘behind/back’ and not framför ‘in front’. This suggests that ‘behind’ could be acquired before ‘in front’, as suggested by Johnston and Slobin (1979), since it was present in the interactional data, contrary to ‘in front’. However, because of the absence in SECIDI as well as in production by the children in the interactional data, no conclusion on acquisition order of framför ‘in front’ and bakom ‘behind/back’ can be drawn.

Prior research has investigated preposition acquisition order. It is claimed that the acquisition of prepositions comes in stages: ‘in’, ‘on’, ‘under’ and ‘beside’ are acquired before ‘in front’ and ‘behind’ (Johnston & Slobin, 1979), or more specifically that ‘in’ and ‘on’ are the first prepositions acquired (Johnston & Slobin, 1979, Clark, 1973). At the 3;0-year recoding, all children had started producing prepositions. This could mean that the children that had not produced prepositions before 3;0 years of age focused on acquiring other lexical classes at first. But prior to the 3;0-year recording started focusing on prepositions (Landau, 1994). However, this was not investigated further. The acquisition order of prepositions seems to be depending on what method was used. The following paragraphs in this section of the discussion demonstrate why.

The interactional data showed that preposition production by the children was low. The children produced på ‘on/at’ to a total of 74 times and i ‘in/at’ to a total of 40 times, as spatial prepositions, all together in the sessions. The first produced preposition in the interactional data differed between age 1;6-3;0 years, and the communicative development was dependent on the production at age 2;6 years. However, what preposition that was first produced differed from child to child. Three of the 16 children produced both på ‘on/at’ and i ‘in/at’ at their onset age, seven children produced either på ‘on/at’ or i ‘in/at’ at the onset age. Consequently, four children in the sample produced another preposition, or på ‘on/at’ or i ‘in/at’ combined with a different preposition at their onset age. One child produced bredvid ‘beside,next to’, another bakom ‘behind/back’ as his/her first preposition in the material, see appendix D. The interactional data does, therefore, indicate that no general Swedish preposition production order is present. However, the child preposition production does indicate that the prepositions that express containment and support are more easily acquired (Clark, 1973; Johnston & Slobin, 1979), or at least easier to produce, than others. Accuracy of the uses of spatial prepositions has not been investigated in this thesis. However, the children did produce på ‘on/at’ and i ‘in/at’ to a greater extent than any other spatial preposition.

The ANOVA results on the structured test-data showed that the groups differed in comprehension of the preposition bredvid ‘beside,next to’. This was the only preposition that was comprehended by all children in the higher SCDI-score group and not comprehended by any child in the lower SCDI-score group. Therefore, the structured test results indicate that Swedish children understand the prepositions i ‘in/at’, på ‘on/at’ and under ‘under’ before the other prepositions. But, when it comes to framför ‘in
front’ and bakom ‘behind/back’ there is no clear pattern showing what preposition is understood first or if both of them are comprehended before or after bredvid ‘beside/next to’ in general. When examining Table 4 and focusing on the higher SCDI-score group, it does seem as if the preposition is acquired before framför ‘in front’ and bakom ‘behind/back’. But if focus is shifted to the lower SCDI-score group, it is clear that some children do comprehend framför ‘in front’ and bakom ‘behind/back’ before bredvid ‘beside’. The results from the structured test on comprehension of prepositions are therefore not clear enough to declare an acquisition order of Swedish preposition. However, almost all children comprehended i ‘in/at’ and på ‘on/at’, indicating that these prepositions are easier than others. Under ‘under’ was comprehended by more than half of the sample indicating that this preposition comes after i ‘in/at’ and på ‘on/at’ in acquisition of Swedish prepositions.

In the parental reports, the acquisition order is not clear when it comes to comprehension of prepositions by Swedish children. It is stated in previous research on acquisition of prepositions in children learning English that prepositions expressing containment are comprehended before prepositions that express support (Casasola & Cohen, 2002, Casasola et al., 2003). In this thesis’ sample, two children comprehended bakom ‘behind/back’ and i ‘in/at’ before the other prepositions. Two other children comprehended under ‘under’ before any other preposition. One child comprehended all three of these before på ‘on/at’. The parental reports were collected every third month, and therefore some children had more than one preposition at their onset age. However, there was no child that did not comprehend i ‘in/at’ but comprehended på ‘on/at’, but there were children that comprehended i ‘in/at’ but not på ‘on/at’, which indicates that containment is learnt before support, in Swedish children as well (Casasola & Cohen, 2002, Casasola et al., 2003). The production of prepositions was similar: one child produced under ‘under’ as his/her first preposition, another bakom ‘behind/back’ and i ‘in/at’ at the same age point. The suggestion that ‘in’ and ‘on’ are the first prepositions to be acquired by children does not seem to hold for Swedish children, when studying the parental reports.

This thesis has analyzed differences between the groups with lower, average, and higher communicative level preposition usage in several ways. Differences have been tested in both the production in the interactional data, the comprehension in the structured test, and comprehension and production as reported by parents. Out of these analyses, only one found a difference between all the groups, i.e. preposition production as reported by parents at 2;3 years. None of the other showed a difference in comprehension or production of prepositions between the lower and the average SCDI-score group.

Consequently, the results of the acquisition order as well as the onset age of production of spatial prepositions is method dependent. This thesis results can confirm that på ‘on/at’ and i ‘in/at’ are the spatial prepositions that are most frequently used by children between the ages of 0;9–4;0 years, these are also the prepositions that usually is comprehended at age 2;9 years. However, because of varying results from the methods, it is safer to say that in Swedish spatial preposition acquisition, either på ‘on/at’ or i ‘in/at’, or under ‘under’, combined or separately together with another preposition, are commonly acquired first.

6.3 Future research

This thesis found that the preposition på ‘on/at’, one of the first spatial prepositions to be acquired by a child (Clark, 1973; Johnston & Slobin, 1979; Gentner & Bowerman, 2009; Richthoff, 2000; Strömqvist et al., 2001; Strömqvist et al., 1995; Lange, 1976), is frequently used as a spatial preposition in parent-child interaction, in parental output. However, the preposition is also frequently used as a particle, and as an abstract preposition. Even though the distribution of på ‘on/at’ and its uses in interaction was shown, no analysis has been made on how the distribution effects the child’s acquisition of the prepositions. Future research need to focus on this.

The material contained several occasions where the parent excluded either the particle verb or the preposition in an utterance where both should be included. What lexical class that was excluded was
not examined in detail and therefore, future research could investigate how parental input appears in utterances with sentence structures including both.

This thesis has only investigated the quantity of the spatial prepositions in parent-child interaction, future research could therefore investigate the quality of the input of the word form på ‘on/at and i ‘in/at’, and the output of the prepositions. This thesis has visualized the distribution on group level and as a total for all eight sessions. Therefore, future research is encouraged to continue investigating this subject.
7. Conclusions

This thesis has investigated the comprehension and production development of prepositions over the child’s first 4;0 years of life. To investigate the preposition acquisition, three different methods were chosen to capture the development and to give an extensive description of the acquisition. The research questions that were formulated in section 3.2 Research questions, are written in italics. The following research questions were investigated:

Does more preposition usage by the parents predict an early onset of preposition production?

Linear regression analyses did not find any significant agreement between parental mean preposition usages per minute, at any age point, with child preposition production onset. However, the onset-time as reported by parents and in the interactional data differed with 0;3-0;9 years. The onset time in the linear regression was based on the onset in the interactional data. It was discussed how this could have affected the results on the analysis.

Does frequent use of prepositions by the children predict communicative ability at 4;0 years?

A linear regression showed a significant positive relationship between produced prepositions by the children at 2;6 years and their communicative level at 4;0 years.

Does more prepositions usage by the parents predict communicative ability at 4;0 years?

A linear regression showed that parental mean preposition production at 0;9 and 2;6 years predicted child communicative level at 4;0 years.

Does comprehension of prepositions at 2;9 years predict communicative ability at 4;0 years?

A linear regression showed a strong relationship between preposition comprehension at 2;9 years and communicative level at 4;0 years.

Is there a difference in preposition comprehension/production between the lower, average and higher SCDI-score groups?

One-way ANOVAs at the different age points showed differences between the group with lower SCDI-score and the group with higher SCDI-score, and between the average SCDI-score group and the higher SCDI-score group in comprehension at 1;3 years. A difference in production of prepositions was shown between all groups at age 2;3 years. At 2;6 years, the lower and higher score groups differed significantly. Another One-way ANOVA found that the group with lower SCDI-scores and higher SCDI-score groups differed significantly at age 2;9 in comprehension of the total amount of prepositions, and when comparing the three groups’ comprehension of the preposition bredvid ‘beside/next to’.

Does comprehension of prepositions (0;9-1;3 years) predict a greater productive vocabulary at 2;6 years?

A linear regression showed a significant relationship between child preposition comprehension at 1;3 years and their productive vocabulary at 2;6 years.

Does production of prepositions (1;6-2;6 years) predict communicative ability at 4;0 years?

A linear regression showed a significant relationship between child preposition production at 2;3 and 2;6 years and their communicative level at 4;0 years.

This thesis has investigated the acquisition of spatial prepositions in Swedish child language acquisition. Both the comprehension and production of prepositions was investigated. One of the aims of the thesis was to complement previous research on the topic, and it was found that, similarly to previous research, the onset of prepositions comes late in language acquisition. Another aim was to examine if preposition acquisition is related to language acquisition, and it was found that frequent
usage by the child himself/herself predicts later communicative skills. Parental prepositions usage at 0;9 and 2;6 years was also found related to their child’s communicative level at 4;0 years.

Furthermore, wider comprehension of prepositions in toddlerhood predicts both active vocabulary at 2;6 years and a further developed communicative level at 4;0 years. Additionally, greater production in toddlerhood does also predict a further developed communicative level at 4;0 years. In addition, the thesis has also found that groups of children with lower, average and higher scoring in communicative level at 4;0 years differ in both comprehension (at 1;3 years) and production of prepositions (2;3 and 2;6 years).

Lastly, this thesis used three different methods to investigate the acquisition of prepositions and found that the results on acquisition order of prepositions depended on the method used. That is, one method is not enough when investigating child language acquisition because of the coverage of each method. Therefore, the result of this thesis underlines the importance of using several methods in an investigation of child language acquisition.
References


Bästa föräldrar!
Vill ni delta med ert barn i ett forskningsprojekt om barns språkutveckling? Med detta brev vill vi presentera vårt forskningsprojekt ”MINT - Modellering av interaktion” vid Institutionen för lingvistik, Stockholms universitet (Frescati).


Trots att resultaten är av stort vetenskapligt intresse kan vi inte ersätta er ekonomiskt för deltagandet. Däremot kan vi erbjuda kopior av alla ordlistor som ni fyller i som en dokumentation av ert barns ordförråd. Vi hoppas att dessa, och även våra kontinuerliga kontakter, ska kunna ge värdefull insikt i ert barns språkutveckling.

Nedan följer mer omfattande information om projektet, metoden och informationsbehandlingen, samt detaljerad information om hur ni hittar till oss på Stockholms universitet.Om ni är intresserade av att delta i vårt projekt anmäler ni ert intresse genom att fylla i och skicka den medföljande anmälningsblanketten. När vi fått blanketten, kontaktar vi er för tidsbokning och eventuellt ytterligare information per telefon. Vill ni komma i kontakt med oss går det bra att lämna ett meddelande på vår telefonsvarare, tel. nr 08-16 19 32, så ringer vi upp, alternativt via e-post: eevak@ling.su.se.
Information om forskningsprojektet MINT

I forskningsprojektet undersöks olika aspekter av barns tidiga utveckling av språk. Undersökningarna utförs av personal och studenter under handledning vid institutionen för lingvistik, Stockholms universitet. Ansvariga för projektet är Tove Gerholm och Eeva Klintfors.

Studiens syfte

Under de första levnadsåren börjar barnet förstå att ord refererar till olika föremål eller situationer i omgivningen. Föräldrar och andra vuxna i barnets omgivning är delaktiga i denna process genom att interagera och samtala med barnet. Projekets syfte är att studera barnets inlärning av ord, joller- och språkutveckling, samt samspelet mellan föräldrar och barn.

Etiska aspekter och sekretess

Följande personuppgifter ingår i undersökningen: barnets namn och kön, beräknat och faktiskt födelsedatum, födelsevikt, föräldrars namn, adress och telefonnummer, språk som talas hemma hos barnet, antal äldre och yngre syskon samt eventuell förekomst av öroninflammation. Ni har rätt att när som helst och utan vidare förklaringar ta del av informationen eller begära att era personuppgifter tas bort. Vid bearbetning och presentation av resultaten i vetenskapliga sammanhang kommer materialet att vara avidentifierat och sammansättligt per åldersgrupp.

Hur visar jag mitt intresse?

Är ni intresserade av att delta med ert barn i denna undersökning anmäler ni er genom att fylla i medföljande blankett och skicka den till oss i det bifogade förfrankerade kuvertet. Vi kommer att kontakta er så fort som möjligt för att boka in tid och kan då svara på eventuella frågor. Om ni kommer med bil får ni ett särskilt tillstånd för fri parkering av oss.

Välkomna till vårt fonetiklaboratorium och ett stort tack för att ni hjälper oss inom forskningen om tidig språkutveckling!

Tove Gerholm  Eeva Klintfors
FD  FD

## Appendix B. Transcription template to annotators in the MINT project.

<table>
<thead>
<tr>
<th>Label</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>[??]</td>
<td>A message from the annotator to have the tag checked, e.g. word [??]</td>
</tr>
<tr>
<td>?</td>
<td>Question intonation, placed after the intended word/phrase</td>
</tr>
<tr>
<td>(?)</td>
<td>Unsure transcription</td>
</tr>
<tr>
<td>( )</td>
<td>Swallowed/omitted sounds, e.g. &quot;den h(år) (het)te Mo&quot;; &quot;vi(lk)en fin&quot;</td>
</tr>
<tr>
<td>&amp;</td>
<td>Interrupted (word), e.g.: &quot;och &amp;ko kolla här då&quot;</td>
</tr>
<tr>
<td>&amp;(phrase)</td>
<td>Interruption(phrases), e.g.: &quot;det har vi sagt &amp;(för att han hela tiden) eftersom han alltid dreglar på fjärrkontrollen&quot;</td>
</tr>
<tr>
<td>xxx</td>
<td>One or more unknown/unaudible words, e.g.: &quot;ta den då ta xxx bollen&quot;</td>
</tr>
<tr>
<td><em>a-z</em></td>
<td>Nonwords with communicative function, e.g. “huh?”; imitation or vocal illustration (“nam nam nam” för att äta), or sound effects (“hå!”), e.g.: <em>nam nam nam</em></td>
</tr>
<tr>
<td>:</td>
<td>Extended sounds are marked with colon, e.g.: “hå:”</td>
</tr>
<tr>
<td>Ex ee</td>
<td>Filled pauses are transcribed as the sound, e.g.: &quot;Ee mm hm aa öh&quot;</td>
</tr>
<tr>
<td>-</td>
<td>Continuation intonation, e.g.: &quot;Ja ska gå å:“</td>
</tr>
<tr>
<td>-</td>
<td>Disfluency due to hesitation, e.g.: “jijja det tror jag”, “neejj” are marked as “j_a det tror jag”, “ne_j”</td>
</tr>
<tr>
<td>‘</td>
<td>Markes typical (or atypical) reductions, e.g: “har’u”, “är’e”, “var’e”</td>
</tr>
<tr>
<td>CAPITAL</td>
<td>Speech clearly louder than the surrounding speech.</td>
</tr>
<tr>
<td>.word.</td>
<td>Speech clearly softer than the surrounding speech. Not whispering.</td>
</tr>
<tr>
<td><strong>#VI</strong></td>
<td>Whispering, e.g.: Den e [#VI jättefin]</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>{word}</strong></td>
<td>A child’s deficit pronunciation for a word or when the child imitates the intonation of a word, e.g.: ‘appa’ but it is evident in the context that the target word is “lampa” → {lampa}</td>
</tr>
<tr>
<td><strong>“word/sound”</strong></td>
<td>Irritation/anger</td>
</tr>
<tr>
<td><strong>%word/sound%</strong></td>
<td>Distorted speech (changed intonation pattern, sudden use of (other) dialect, cartoon figure speech, etc.)</td>
</tr>
<tr>
<td>~</td>
<td>Creaking voice, marked on both sides of the word/phrase, e.g.: hon kom <del>så</del> långt</td>
</tr>
<tr>
<td>+</td>
<td>Paus &lt;0,5 sec</td>
</tr>
<tr>
<td>(h:)</td>
<td>Audible in or out breathing</td>
</tr>
<tr>
<td>﹪word/sound﹫</td>
<td>Crying/whining voice. For children 3 months CV is applied instead. Crying/whining adults (imitation?), use approximate spelling, e.g.: ﹪uhhhhhh﹫</td>
</tr>
<tr>
<td>!word/sound!</td>
<td>Excited speech, screaming etc.</td>
</tr>
<tr>
<td>/approximation of sound/</td>
<td>Used for coughs, humming, panting, whistling, kissing sounds, etc. /grunting x 2/ = repeated sound Also used for other sources of sounds than vocal, e.g. /clapping sound/ Also used for /sound/ for 12 month olds (and older) sounds in-between babbling and words proper.</td>
</tr>
<tr>
<td>#word/sound#</td>
<td>Laughter Put # around the utterance produced while laughing, e.g.: #ja det va de värsta# ja varit med om When only laughter: ####</td>
</tr>
<tr>
<td>´word/sound´</td>
<td>Singing, humming</td>
</tr>
<tr>
<td><strong>#VR</strong></td>
<td>Adult directed speech (usually in interaction with experimental leader); child directed speech is unmarked/standard. Place [ ] around the utterance, e.g.: [#VR ska jag läsa i boken?] ja ska vi läsa?</td>
</tr>
<tr>
<td><strong>#IN</strong></td>
<td>Ingressive speech Place [ ] around the utterance if it is part of a longer sequence: [#IN ja de vore ju] en nåd att stilla bedja om</td>
</tr>
<tr>
<td><strong>#LA</strong></td>
<td>Word or phrase in other language than Swedish. [#LA the thing] du vet If you can’t identify the language [#LA xxx]</td>
</tr>
<tr>
<td><strong>#FS</strong></td>
<td>Formulaic Speech (frozen phrases). A FS could be an idiom like “better late than never”, but also (in CDS) expressions that recur among many parents and that you recognize, e.g. “titta lampa”, ”kossan säger… [#FS å hur låter kossan/vad säger kossan?]</td>
</tr>
<tr>
<td><strong>#UG</strong></td>
<td>Ungrammatical or unsemantic utterances: [#UG_utterance]. Exempel: [#UG_den va in hons hand]; [#UG_ni har två många]; [#UG_nelly hon ramla bakom på stolen]; [#UG_fast ja har långt hår för ja e ju blond]; [#UG_ja kunde skriva de själv utan å stava]; etc</td>
</tr>
<tr>
<td><strong>CV VOCAL TIER</strong></td>
<td>Grunting; Panting; Cooing; Babbling; Laughing; Whining/Crying; Screaming/Shrieking; Other. (children 3, 6 and 9 months)</td>
</tr>
</tbody>
</table>
Appendix C. Instructions to structured test

TESTBLANKETT, SPRÅKFÖRSTÅELSE och SIFFERREPETITION, MINT 33 månader, maj-juni 2016

<table>
<thead>
<tr>
<th>Testledare</th>
<th>Datum</th>
<th>Tid</th>
<th>Kod</th>
</tr>
</thead>
</table>

Instruktion: Titta på barnet och säg (utan att peka eller använda andra ledtrådar):

<table>
<thead>
<tr>
<th>lägg nalle på bilen</th>
<th>ja</th>
<th>nej</th>
<th>Anteckning</th>
</tr>
</thead>
<tbody>
<tr>
<td>lägg nalle bredvid bilen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lägg nalle under bilen</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>lägg nalle framför bilen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lägg nalle bakom bilen</td>
<td></td>
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</tbody>
</table>

Relatera två objekt, 1. Material: doktorsväska med innehåll samt apan/Mo, Na och Li.
Instruktion: ta ut alla saker ur väskan och lägg dem (och väskan) i en rad som inte matchar ordningen på hur de benämns av testledaren. Titta på barnet (i de fall där testledare vill ha något ska även handen sträckas fram – annars inga andra ledtrådar och säg:

<table>
<thead>
<tr>
<th>ge mig sprutan och plåstret</th>
<th>ja</th>
<th>nej</th>
<th>anteckning</th>
</tr>
</thead>
<tbody>
<tr>
<td>lägg sprutan i väskan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>göm plåstret under kudden</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ge mig kudden och väskan</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>göm Na under filten</td>
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<tr>
<td>gör så att medicinen springer</td>
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</tbody>
</table>
### Appendix D. Produced prepositions at 1;6, 1;9, 2;0, 2;6 and 3;0 years.

Table 8. Produced prepositions in each session by the children. The table shows each preposition at age point 1;6 (white), 1;9 (light-light grey), 2;0 (light grey, 2;6 (grey) and 3;0 (dark grey) years. The ages are separated with thick black lines. The three groups are color-coded, on the top of the table is the lower SCDI-score group (white background), in the middle is the average SCDI-score group (light grey background) and at the bottom is the higher SCDI-score group (grey background).

<table>
<thead>
<tr>
<th>Child</th>
<th>'on/at'</th>
<th>'in/at'</th>
<th>'under'</th>
<th>'behind/back'</th>
<th>'on/at'</th>
<th>'in/at'</th>
<th>'under'</th>
<th>'beside/next to'</th>
<th>'on/at'</th>
<th>'in/at'</th>
<th>'under'</th>
</tr>
</thead>
<tbody>
<tr>
<td>8M0Z</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td></td>
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<tr>
<td>0M1Z</td>
<td>4</td>
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<tr>
<td>1M1Z</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1</td>
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<tr>
<td>6M1Z</td>
<td>1</td>
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<td>5M2Z</td>
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<td>1M3Z</td>
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<td>1M4Z</td>
<td>1</td>
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<tr>
<td>9M4Z</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
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<tr>
<td>7M0Z</td>
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<td>5M1Z</td>
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<tr>
<td>2M1Z</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td></td>
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<tr>
<td>2M2Z</td>
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<tr>
<td>4M2Z</td>
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</table>

Note: The numbers represent the count of prepositions used by each child in each session.