The timing of production: on the acquisition of Italian prepositions

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Abstract

This paper investigates the acquisition of Italian prepositions looking at children's early spontaneous speech. With a longitudinal study on the production of fifteen Italian-speaking children aged 1;4 to 3;4, we sought to determine the timing in which different prepositional items emerged in children's speech. Following much acquisition research, the order of emergence is assumed to reveal how syntax develops during acquisition (Rizzi, 1993/1994; Pérez-Leroux & al., 2012; Friedmann, Belletti, & Rizzi, 2020). Our analysis shows that children produced different prepositional items at different stages following the geometry of the syntactic tree proposed in the cartographic literature (Svenonius, 2008, 2010): KP prepositions are acquired before *p*P prepositions which in turn appear earlier than AxPartP prepositions. Our results are in line with the previous findings on French and Spanish (Morgenstern & Sekali, 2009; Stewart, 2015) but diverge from those reported for English (Littlefield, 2009). In this respect, the development of prepositions matches the acquisition of other functional morphemes that differentiates morphologically rich languages from those with a poorer functional inventory.

Keywords: acquisition, preposition, Italian, functional morphemes, emergence.

1. Introduction

Various acquisition studies have investigated the development of syntax, concluding that not all syntactic structures are available to the child in the early stages of acquisition (e.g., Brown, 1973; Rizzi, 1993/1994; Radford, 1995). Syntactic structures have been claimed to develop gradually, following an allegedly universal path across languages. Timing of acquisition is often explained through language external factors such as cognitive readiness, or frequency of use in the ambient language. One language-internal factor assigned a determining role in the timing of acquisition is complexity, according to which complex options are delayed compared to simpler ones, (e.g., Jakubowicz, 2011). By adopting a cartographic approach to syntax, where semantic information is uniformly mapped onto the syntactic tree, syntactic complexity and conceptual complexity proceed in parallel. According to this view, children's developmental stages follow the geometry of the syntactic tree with functional heads encoding more basic features being produced earlier than those specified for additional and more specific features (see Mitrofanova, 2016; Friedmann, Rizzi & Belletti, 2020). Therefore, the order in which elements are produced provides insightful information on how children's syntax develops. This will be the focus of our paper.

As well known, children's early production is characterized by telegraphic utterances, which mainly consist of lexical morphemes and generally lack functional items (Brown, 1973; Radford, 1995; a.o.). Functional morphemes missing from children's early productions include auxiliaries, possessives, verb inflection, determiners, expletive subjects, complementizers. Some studies have shown that functional morphemes emerge in children's production following the sequence of the syntactic functional projections: functional morphemes lexicalizing lower heads in the tree are produced earlier than those lexicalizing higher heads. In the tense-aspect-actionality domain, morphemes expressing actionality are reported to be acquired before aspectual morphemes, which in turn appear earlier than temporal morphemes (e.g., Antinucci & Miller, 1976). Similar results are reported in Friedmann, Belletti, Rizzi (2020) for various structures involving the IP and CP layers. While it is generally accepted that lexical items appear before functional ones, the literature has also shown that the timing in the emergence of functional material varies across languages and correlates with more general morpho-syntactic properties of the language (e.g., Caselli, Casadio, & Bates, 1999). Children acquiring languages that have a rich inventory of functional morphemes, so-called morphologically rich languages, seem to produce functional items earlier than children acquiring languages with a sparse inventory of functional morphemes (Brown 1973; Clark, 2017).

While previous studies have mainly investigated the acquisition of functional categories, such as complementizers and articles, and the acquisition of lexical categories, like nouns and verbs, very little is known on the acquisition of prepositions (Littlefield 2005, 2009; Morgenstern & Sekali, 2009; Stewart, 2015). Prepositions provide an interesting domain to test how early syntax develops because they have a rich internal structure comprising different layers in which lexical and functional items are merged (Svenonius, 2008; Cinque, 2010; Garzonio & Rossi, 2020; a.o.). Our paper explores the timing in which prepositions are acquired in Italian. With a longitudinal

analysis of fifteen Italian-acquiring children ranging from age 1;4 to age 3;4, we sought to determine the timing and the order in which prepositional items emerge. In so doing, we aim at testing whether children's production of prepositional items follow the geometry of syntactic tree as proposed in Svenonius (2008, 2010). Moreover, by comparing our results with those from similar studies on English, German, French, and Spanish, we aimed at verifying whether the difference in the production of functional material found for other phenomena between morphologically rich vs. poor languages also holds for functional prepositions.

The paper is structured as follows. Section 2 provides a brief overview of Italian prepositions and illustrates Svenonius's proposal, according to which we frame our results and discussion. Section 3 summarizes the state of the art on the acquisition of prepositions. Our study is presented in Section 4. Section 5 discusses the results and concludes the paper.

2. The classification of prepositions

2.1. Prepositions in Italian

Italian presents systematic semantic, phonological, and syntactic differences between simple prepositions like *di* 'of', *a* 'to', and lexical or adverbial prepositions like *dietro* 'behind', *dentro* 'inside', *sopra* 'above' (see Rizzi, 1988). Simple prepositions include monosyllabic items and traditionally comprise the following morphemes: *di* 'of', *a* 'at/to', *da* 'from', *in* 'in', *con* 'with', *su* 'on', *per* 'for', *tra/fra* 'between/among'. Lexical items are at least bimorphemic and stressed. Differently from lexical prepositions, simple prepositional items are often fused with the definite determiner, giving rise to forms like *a-lla* 'at/to-the', *da-lla* 'from-the'. Whereas simple prepositions have little semantic import, if any, and constitute a closed class, lexical prepositions form a quite big inventory and are semantically meaningful. The two sets of prepositions also differ with respect to their ability to assign case directly. Most lexical prepositions often require or optionally take one of the functional prepositions *di* 'of', *a* 'at/to' to be linked to their DP complement: *dietro a* 'behind at' (Rizzi, 1988; Cinque, 2010). Cinque (2010) further noticed that only certain simple prepositions behave like heads, require a complement, and resist pied-piping.

The class of what has been traditionally labeled simple prepositions does not behave as a uniform group for all properties outlined above (see Garzonio & Rossi, 2020). While *di* 'of' and *a* 'at/to' seem to match all the characteristics outlined in the literature for functional morphemes, a classification of the other simple prepositions as either functional or lexical is controversial. On the basis of syntactic tests and diachronic evidence, Franco (2020) argues that within the subset of so-called simple prepositions, the morphemes *su* 'on' and *tra* (*fra*), 'between/among' could be better characterized as lexical items -more precisely as lexical items whose semantic function is the identification of a region in the sense of Svenonius (2008). The morpheme *in* exhibits a quite peculiar behavior not fully captured by the lexical vs. functional divide. It is fused with the definite determiner, it does not allow its complement to be omitted or extracted, but it has a quite fixed lexical meaning. In Old Italian and various Italian dialects, *in* can select a prepositional phrase introduced by *su* and *per* (Andreose, 2010: 626). More complex to formalize is the behavior of the prepositional items *con* 'with', *da* 'from', and *per* 'for', which can be treated as the instantiation of the inverse part-whole relation when behaving as instrumentals (Manzini & Franco, 2016).

In sum, simple prepositions comprise at least two groups of morphemes, with *a* 'to/at' and *di* 'of' being truly functional prepositions and the remaining prepositions as either a hybrid class in-between functional and lexical prepositions or as fully lexical (Garzonio & Rossi, 2020; Franco, 2020; a.o.).

2.2. The syntax of prepositional phrases

Most theoretical research on the syntax and semantics of prepositional phrases has convincingly demonstrated that the structure of prepositional phrases should be decomposed into more abstract syntactic and semantic primitives (e.g., Svenonius, 2010; Cinque 2010). We adopt Svenonius's (2008, 2010) terminology and approach, which will be illustrated through spatial prepositional items.

Prepositional phrases consist of three regions. In the first region the Ground object, i.e., the DP, is mapped onto the region of space occupied by that object (see Zwarts & Winter 2000 '*eigenplace*'). The first region has a dedicated projection labeled KP. Syntactically, the head K^0 assigns case to the DP: prepositions such as French *de* or English *of,* are hosted in the head position of this projection. The second region is based on an axial part-whole decomposition. The *eigenplaces* are mapped onto their subparts based on the axial structure of the Ground object (e.g., *top, bottom, front, back,* etc.). This region is labeled AxPartP. The third region maps the Ground to vector spaces and introduces the Figure object in the region of the Ground. This is labeled *p*P. This *p* is the natural locus of relational notions of containment, attachment, and support.

Hence, spatial PPs have the tripartite structure in (1) (Svenonius 2008).

(1)   [*p*P   *in*   [AxPartP *front*   [KP *of* [DP *the house*]]]]

Importantly, *p*P and KP are taken to be present in the structure of all locative expressions, while AxPartP is present only in those expressions that refer to the axial structure of the Ground object, for instance *under* but not *at*. The different semantic import of the prepositional items is specified as features on the p^0, $AxPart^0$, and K^0 heads. The p^0 head can be specified by more than one feature. For instance, IN and ON relations involve the presence not only of [+location], but also of [+containment] and [+support] features, respectively, on the p^0 head. Further features referring to the axial structure of the Ground object are added to $AxPart^0$. Hence, the three heads involve different feature specifications with K^0 being the least specified and $AxPart^0$ being the most specified.

The tripartite split-PP hypothesis illustrated in (1) with spatial Ps has been applied to other PPs expressing different semantic relations like time, cause, etc. by Roy & Svenonius (2009) and Brugè & Suñer (2009).

In addition, the theoretical literature has also proposed that projections encoding directional meanings precede the projection for locational or stative meanings. In turn, directional spatial expressions should be further decomposed in three distinct projections, denoting source, goal, and path. Hence, above *p*P, we find PathP, GoalP, and SourceP as in (2).

(2)   [SourceP [GoalP [PathP [*p*P   [AxPartP   [KP   [DP]]]]]]]]

We apply Svenonious's classification to the Italian prepositional items discussed in Section 2.1. Various studies have argued that *a* and *di* in locative PPs do not encode locative relations, rather they are structurally related to the DP and serve as its case

marker (Manzini & Franco, 2016; Garzonio & Rossi, 2020). Accordingly, we assume that *a* 'at/to' and *di* 'of' are hosted in the head of the KP projection.

Prepositions like *da* 'from/at', *in* 'in', *con* 'with', *per* 'for' do not make reference to the axial structure of the Ground object -at least they don't do so in any obvious way. Therefore, they are hosted in the head of *p*P. Finally, following Franco (2020), spatial expressions like *su* 'on', *tra/fra* 'between', *dietro* 'behind', *dentro* 'inside', *sopra* 'above' are considered axial prepositions.

On the structure in (1-2) and on this classification, we will base our results and discussion. The approach here presented assumes an interdependence between syntax and semantics (Svenonius, 2012): while features encoding general and basic conceptual notions are realized with smaller portions of the tree, features that are semantically complex involve more structure in terms of functional projections and number of features. Under this view, it is reasonable to expect syntactic and conceptual development to proceed in parallel, with expressions exhibiting more general and basic conceptual and syntactic structure being acquired before expressions with a more complex conceptual and syntactic structure.

3. Previous acquisition studies

Previous studies on the acquisition of prepositions mainly dealing with data from spontaneous speech have reported two general findings: (a) there is a divide between functional and lexical prepositions in their emergence in children's production; (b) the production of lexical prepositions is constrained by the semantic feature hierarchy proposed in Clark (1973), according to which simpler relations are acquired before more complex ones.

As for (a), there is a general agreement that children's acquisition of functional prepositions is meaningfully different from that of lexical prepositions. Investigating the spontaneous speech of one English-speaking child from age 1;0 to 2;0, Tomasello (1987) found that spatial prepositions, such as *up, down, on, off, in, out, over*, and *under* were produced much earlier than the grammatical prepositions *with, by, to, for, at,* and *of*. He also found that, when the grammatical prepositions appeared in the child's production, they were optionally produced, while spatial prepositions were usually never omitted. Rice (2003) documented the development of nine English prepositions in the corpora of two English-speaking children on CHILDES. The order in which prepositions were produced was: *in > on > at* between age 1;11-2;7, followed by *for* and *by* between 2;5 and 2;7, and then the prepositions *with*, *from*, and *of* from age 2;5 to 3;5. A similar conclusion is reached in Littlefield (2005). Littlefield found that in the spontaneous speech of two English-speaking children, prepositions with more content such as *in* or *on* were produced earlier and associated with fewer errors than prepositions with less content such as *of*. Content prepositions were first uttered when the children had an MLU value between 1.5 and 1.99. Conversely, function prepositions with little or no content, such as *of*, were not uttered until the children had an MLU between 2.0 and 2.49. Once they were produced, content prepositions were used increasingly steadily and rapidly as the children developed, but function prepositions were used minimally and at a lower rate. In a follow-up study on five more children, Littlefield (2009) showed that lexical prepositions used adverbially, as in *put **down** the coat*, and verb particles, as in *crack **up***, were produced early on, for all children with MLU at 1.5-1.99 and 2.0-2.49 respectively. Lexical prepositions used adverbially were followed by lexical prepositions selecting complements, like *the book is **on** the table*,

for most children with MLU of 2.5-2.99. Finally, the functional preposition *of* was the last to be acquired, for most children with MLU of 3.5-3.99. The author also found that functional prepositions were omitted and that omission of functional prepositions generally preceded their lexicalization in the first stages. In the later stages omission and lexicalization of the same preposition coexisted. Likewise, Grimm (1975) analyzed spontaneous production data from 137 German-speaking children between ages 2;7 to 6;0 and found lexical prepositions were produced earlier than functional prepositions (e.g., *zu*). Similar results hold for Greek-speaking children (Alexaki, Kambanaros & Terzi, 2009).

A different trajectory in the acquisition of functional and lexical prepositions has been reported for children acquiring French and Spanish. Morgenstern and Sekali (2009) compared the development of one English-speaking child to that of a French child. While the English learner used more lexical prepositions than functional ones, the French child exhibited exactly the opposite preference. A similar result was reported in Yánez and Zúñiga (2009) analyzing the spontaneous speech of sixteen children aged 18 to 36 months acquiring Spanish. Likewise, Stewart (2015) found that, while for English children the expression of functional prepositions is relatively delayed until MLU is around 3, Spanish children produce functional prepositions already when the MLU is 1;6 at near-adult rates right from the start of the multi-word speech.

Among lexical prepositions, the cross-linguistic investigation has revealed that content prepositions emerged in a consistent order, both within and across languages. This was especially demonstrated with spatial prepositions: prepositions encoding simpler relations (e.g., *inside, down*, *up*) were produced earlier than prepositions encoding more complex relations (e.g., *on*, *under*, *next to*, *behind*) following the semantic feature hierarchy in Clark (1973) (Brown, 1973; Johnston & Slobin, 1979; Sinha, Thorseng, Hayashi, & Plunkett, 1994; Caselli, Casadio, and Bates, 1999).

Taking these findings together, we can conclude that the divide between functional and lexical prepositions is reflected in their acquisition. In addition, whereas functional prepositions emerge later than lexical ones in English and German, no comparable delay can be found in the acquisition of Spanish and French functional prepositions. This suggests that functional material, among which functional prepositions, is acquired differently in so-called morphologically rich languages than in languages with a more limited functional inventory. Finally, these studies point to the conclusion that the acquisition of lexical prepositions seems to be similar cross-linguistically, in obeyance with the semantic feature hierarchy in Clark (1973). We will add Italian to this picture.

4. Our study: a corpus analysis of child spontaneous speech

We asked in which order prepositional items emerged in children's early spontaneous speech. The rationale behind our study follows the idea that the order in which morphemes and structures are acquired is a window on children's syntactic development (Jakubowicz, 2011; Pérez-Leroux et al., 2012).

We conducted a longitudinal analysis of the spontaneous speech of fifteen typically developing Italian-speaking children aged 1;4 to 3;4. Children's productions were classified according to the ratio of word counts against utterance counts, namely the mean length of utterance (henceforth, MLU), and were accordingly arranged in six groups from the lowest to the highest MLU values. We searched for the prepositional items that children produced or should have produced. As in Littlefield (2009), these

instances were further divided into two groups depending on whether the prepositional item appeared with or without a complement. Accordingly, we formulated four specific research questions:

(Q1) How do the production and the omission of prepositional items develop across MLU Groups?

(Q2) In which order do adverbial prepositional items emerge in children's production?

(Q3) In which order do prepositional items in the context preposition plus complement emerge in children's production?

(Q4) Which prepositional items are omitted by children?

As for (Q1), based on previous studies, we expect production to be a function of the MLU values. We expect the production of prepositions plus complement to increase across the children's MLU values. Conversely, we expect omission to decrease. Finally, since adverbial prepositions are appropriate as one-word productions, adverbial prepositional items should be produced more than prepositions plus complement in children's groups with a low MLU.

As for (Q2-Q3), we expect both adverbial prepositions and prepositions plus complements to be acquired according to their feature specification. Since more fully specified prepositional items involve a range of additional features (Svenonius, 2010), we expect prepositions specified for fewer features to be acquired before fully specified ones. Likewise, for adverbial prepositions we expect simpler concepts like containment to be acquired before relations like support or contact, as was found in previous acquisition studies (see Section 3). Accordingly, we expect no differences between Italian children and previous findings on different languages. As for prepositions plus complement, we expect children to start with the production of KP-prepositions, then to move to pP-prepositions and, only, later to more featurally rich AxPartP-prepositions.

As for (Q4), we expect KP- and pP-prepositions to be omitted since omission has been claimed to target functional material (see Introduction). In turn, since KP-prepositions are less specified in terms of features than pP-prepositions, we expect KP-prepositions to be subject to omission to a greater extent than pP-prepositions. As in previous studies, we expect omission to precede production in a first step and, later, to co-exist with lexicalization, in the so-called optional stage.

4.1. Data collection

We performed a longitudinal analysis of the spontaneous productions by fifteen typically developing monolingual Italian-acquiring children available in the CHILDES database (MacWhinney, 2000). The period in which children's production was recorded covers the ages between 1;4 and 3;4 and varies from child to child. We calculated the total of utterances, words, and MLU. The mlu program was used to obtain the relevant counts, running the command "mlu +t*CHI -t%MOR *.cha" in the CLAN program (MacWhittney, 2000).[1] This search yielded the number of utterances, words, and the MLU produced in each file by each child. Summing up the number of utterances and words in each file, we obtained the total of utterances and words produced by each child. The lowest and the highest MLU values in each child's production provided the MLU range for each child's production. The details are reported in Table 1.

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[1]   By computing MLU in words, we provided a uniform analysis across corpora since only the files in the Tonelli corpus were associated with the morphosyntactic analysis, namely the %mor line. Moreover, utterance segmentation in words, besides being quicker, has been shown to require fewer decisions -and thus less subjectivity-, thereby allowing for an easier replication of the research (Ezeizabarrena & Garcia Fernandez, 2017).

Table 1. Description of the participants' details

Corpus	Children	Age range	Total words	Total utterances	MLU range
Antelmi	Camilla	2;2-3;4	7611	1892	2.6-4.7
Calambrone	Diana	1;8-2;6	7780	2184	1.9-5.5
	Guglielmo	2;2-2;11	5568	1788	1.9-4.7
	Martina	1;7-2;7	7569	3586	1.2-2.6
	Raffaello	1;7-2;11	7335	3109	1.2-3.8
	Rosa	1;7-3;3	14659	6614	1.3-3.2
D'Odorico	Claudia	1;11-2;6	1016	665	1.1-1.8
	Davide	1;6-2;0	561	523	1.3-1.7
	Federica	1;5-2;0	611	410	1-1.7
	Linda	1;4-2;0	1072	738	1-1.8
	Lorenzo	1;10-2;0	1184	755	1-1.5
	Veronica	1;7-2;0	970	547	1.2-2.2
Tonelli	Elisa	1;10-2;1	3332	1090	3-4.9
	Gregorio	1;7-2;0	1715	922	1.4-2.3
	Marco	1;5-2;5	17167	8971	1.1-2.9

To compare children's linguistic development, we divided children's productions into different groups. As in Caprin & Guasti (2009), this division was not based on age to avoid the high variability in the linguistic development among children in the same age range. We choose to group children's productions by MLU. Following Valian's (1992) MLU stages, children's productions were divided into six groups based on MLU in words values.

Table 2. Details of children's productions across MLU groups

Groups	MLU	N utterances	Mean Age months	N Children
Group 1	1.0-1.49	4444	20.8 (SD 2.9)	8
Group 2	1.5-1.99	9777	23.2 (SD=2.5)	12
Group 3	2.0-2.49	4832	26.6 (SD=2.4)	8
Group 4	2.5-2.99	6598	29.9 (SD=3.7)	7
Group 5	3.0-3.49	2688	32.1 (SD=5.4)	5
Group 6	3.5-5.53	3428	32.9 (SD=5.3)	5

4.2. Data coding
The transcribed recordings were read and manually searched for all the obligatory contexts in which prepositions occurred or should have occurred.

Following the classification of prepositional items outlined in Section 2.2, the list of prepositions produced by children comprised: (i) KP prepositions, i.e., *a* 'to/at', *di* 'of'; (ii) *p*P prepositions, i.e., *da* 'from/by', *in* 'in', *con* 'with', *per* 'for'; (iii) AxPartP items, namely *su* 'on', *tra* 'between', *dentro* 'inside', *sopra* 'on/above', *sotto* 'under', *contro* 'against'. In addition, we included AxPartP items followed by KP-prepositions, i.e., *accanto a* 'next to', *sopra di* 'above of', *sotto a* 'under at/to', *dentro a/in* 'inside

at/in', *vicino a* 'next to'. Finally, we included two complex PPs where AxPartP followed by KP-Ps was introduced by Ps, *di sopra di* 'lit. of above of' 'above', *in fondo a* 'lit. in the bottom at' 'at the bottom of'. An example of each preposition is provided in (3).

(3)   a. telefona   **a** zio   Gianni!
          phone.2SG   to uncle Gianni
          'Call uncle Gianni!'   (Marco 2;4, 020413.cha, l.451)

       b. ma quella   deve   venire **con**   me.
          but that   should come   with   me
          'But that one should come with me.' (Elisa 1;10, 011018.cha, l.134)

       c. e   questi erano **dentro** il   baule
          and these   were   inside the   chest
          'and these were inside the chest.' (Camilla 3;4, 030409.cha, l.371)

       d. **dentro a-l**   recinto de-i[2]   cava(lli)
          inside at-the   paddock of-the   horses
          'inside the paddock of the horses' (Marco 2;5, 020524.cha, l.272)

       e. son   là,   **in fondo**   **a**   quella campana
          be.3pl there in bottom   at   that   bell
          'they are there, at the bottom of that bell.' (Diana 2;0, 020017.cha, l.41)

At the same time, we searched for the omission of prepositions. The absence of a preposition was counted as an omission in the obligatory contexts in which it should have appeared. We did not count the absence of a preposition as an omission when the child repeated or completed the adult's utterances as well as when it was a reply to a question, following the conventional guidelines for utterance inclusion and exclusion (Brown, 1973). An example of omitted prepositions is given in (4), where omission is signaled with the expected preposition in capital letters.

(4)   a. salo [: salgo]   **SU**   titetta [: bicicletta]
          jump   ON   bike
       'I jump on the bike' (Marco 1;10, 011012.cha, l.1018)

       b. vanno   **A**   cercare capretti
          go.3PL   to   search kids
       'they go searching for kids.' (Marco 2;4, 020413.cha, l.643)

2604 occurrences in which a preposition occurred or should have occurred were collected and analysed. Table 3 illustrates the number of prepositions produced/omitted across MLU groups, which constitutes our corpus for further analyses.

Table 3. Amount of the occurrences of lexicalized/omitted prepositions across MLU groups

Groups	MLU	N of occurrences
Group1	1.0-1.49	127
Group2	1.5-1.99	364

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[2]   When combined with the definite article, the preposition *di* becomes *de-*.

Group3	2.0-2.49	456
Group4	2.5-2.99	628
Group5	3.0-3.49	328
Group6	3.5-5.53	701

Children's productions were further coded with respect to the context variable, i.e., the syntactic context in which prepositional items appeared. We classified prepositions according to the absence (5a) or presence (5b) of their complement. Prepositional items without a complement are labeled adverbial prepositions.

(5)   a. cado   **dentro**
         fall.1SG   inside
         'I fall inside.' (Marco 2;0, 020027.cha, l.874)

        b. e   queste sono   **de-ll**' ors-etto
         and these are   of-the bear-DIM
         'and these are of the little bear.' (Elisa 1;11, 011004.cha, l.164)

4.3. Results
This section is structured in four subsections according to the four research questions.

4.3.1. The development of production and omission of prepositional items
We address (Q1), namely how the production and the omission of prepositional items develop across MLU Groups. Table 4 provides an overview of the amount and percentages of prepositions plus complement, i.e., P+XP, adverbial prepositions, AdvP, and prepositions that were omitted, i.e., OmittedP, across MLU groups.

Table 4. Overview of the occurrences: P+XP, AdvP, OmittedP across MLU groups

Groups	P+XP	AdvP	OmittedP
Group1	36	67	24
	28.3%	52.8%	18.9%
Group2	206	106	52
	56.6%	29.1%	14.3%
Group3	365	75	16
	80%	16.5%	3.5%
Group4	556	53	19
	88.6%	8.4%	3%
Group5	312	11	5
	95.1%	3.4%	1.5%
Group6	653	45	3
	93.1%	6.4%	0.4%

Table 4 shows that the production of P+XP increases across the MLU groups. Conversely, preposition omission decreases with the increase in the MLU value of the groups. In addition, Table 4 demonstrates that there was no stage in which only one type of prepositional item appeared: already in Group 1 adverbial prepositions appeared together with prepositions plus complement.

We performed an ANOVA with type of production (P+XP, AdvP, and OmittedP) as our dependent variable, and MLU groups as our factor (G1-G6). The analysis revealed that the type of production significantly differed across MLU groups ($F(5)=15.2$, $p=<.001$). We then performed a series of post-hoc comparisons with a

Tukey correction for the main effect of MLU Groups. These comparisons revealed that Group 1 differed significantly from all other groups (all *p*'s <.001). No differences were detected between Groups 2 and 3, which in turn differed from all other groups (*p*'s values: G2 vs G4 =.007; G2 vs. G5 <.001; G2 vs. G6=.012; G3 vs. G4 =.036; G3 vs. G5 =.003; G3 vs. G6 =.049). No differences emerged between Groups 4, 5, and 6 (all *p*'s above .6).

4.3.2. The order of production: adverbial prepositions

This section reports the results on (Q2), i.e., in which order adverbial prepositional items emerge in children's production. We first asked whether the adverbial prepositions produced by children were allowed by the target grammar or whether children extended the adverbial use also to those prepositions that obligatorily appear with their complement in the adult grammar, e.g., *a* 'at/to'. No deviant patterns were observed in children's production of adverbial prepositions. The adverbial prepositional items children produced are allowed in the target grammar: *dentro* 'inside', *su* 'on', *sotto* 'under', *sopra* 'on/above', *contro* 'against'.

We then asked in which order prepositional adverbial items were first produced by children across MLU groups. Since adverbial prepositions can be used in isolation and no clear obligatory contexts can be unambiguously individuated, first use of an adverbial preposition meant the first appearance in the production of at least two children. Table 5 illustrates the details.

Table 5. First appearance of prepositional adverbial items across MLU groups

Groups	Adverbial prepositions (N)
Group1	dentro 'inside', su 'up, above'
Group2	sopra 'above', sotto 'down'
Group3	contro 'against'
Group4	
Group5	
Group6	

Table 5 shows that adverbial prepositions started emerging in MLU Group 1. New adverbial prepositions were produced in MLU Groups 2 and 3. In Group 3 all adverbial prepositions were first produced. No new adverbial prepositions appeared in Groups 4 to 6. Table 5 also demonstrates that adverbial prepositions were produced following an order, which is illustrated in (6), where the > should be read as "followed by" and the / should be read as "and".

(6)   *Order of production: adverbial prepositional items*
         dentro/su 'inside/up' > *sopra/sotto* 'above/down' > *contro* 'against'

To verify whether the order in (6) observed at the group level was mirrored in the production of each child, we performed an individual analysis of the emergence of adverbial prepositions. The results are reported in Table 6.

Table 6. Order of production of the adverbial prepositional items across children

Children	Age range	MLU-Group range	Adverbial items
Camilla	2;2-3;4	G4-G6	dentro/sopra/sotto
Diana	1;8-2;6	G3-G6	dentro > sopra/su
Guglielmo	2;2-2;11	G2-G6	dentro > su/sopra > sotto

Martina	1;7-2;7	G1-G4	dentro/su > sotto/sopra > contro
Raffaello	1;7-2;11	G1-G6	dentro/su > sotto/sopra
Rosa	1;7-3;3	G1-G5	dentro/su> sopra/sotto
Claudia	1;11-2;6	G1-G2	dentro > su/sotto
Davide	1;6-2;0	G2	dentro
Federica	1;5-2;0	G2	dentro > su
Linda	1;4-2;0	G1-G2	dentro > su
Lorenzo	1;10-2;0	G2	dentro
Veronica	1;7-2;0	G1-G3	dentro/su
Elisa	1;11-2;1	G5-G6	dentro/sopra/sotto
Gregorio	1;7-2;0	G1-G3	dentro > su/sopra
Marco	1;5-2;5	G1-G4	dentro/su > sopra/sotto > contro

Table 6 shows that not all children produced the adverbial prepositions listed in Table 5. Every child produced the items *dentro* 'inside'. The items *su* 'up', *sotto* 'down' and *sopra* 'above' were produced by the majority of children. The item *contro* 'against' appeared in Marco's and Martina's production only. Table 6 shows that the order in (6) was replicated in the individual analysis for the majority of children: the items *dentro/su* 'inside/up' appeared before *sotto/sopra/su* 'down/above/without'. Interestingly, in 6 children *dentro* 'inside' appeared before *su* 'up' and 2 children only produced *dentro*. Finally, in Camilla's and Elisa's productions, all adverbial prepositions appeared in the same MLU Group, thereby exhibiting no relative order of emergence. Notice, however, that the order of emergence was detectable in the MLU Groups 1 to 3, while Camilla's and Elisa's MLU ranges were between G4 and G6. Hence, it is conceivable to think that the lack of an order in the emergence of adverbial prepositions may be due to the fact that these items had already appeared before the recordings.

4.3.3. The order of production: lexicalized prepositions in the P+XP context
We asked which prepositional items first appeared in the syntactic context preposition plus complement (Q3). An item was defined as 'first produced in MLU Group X' if two conditions were met: (i) when in a given MLU Group it was produced by at least two children and (ii) when it occurred with at least two different lexical items as complements in the production of both children. The first condition enabled us to limit the individual variation and to provide an order associated with the MLU group. The second criterion was set to ensure that children had parsed correctly the block preposition plus complement as a constituent made of two independent items and not as an unanalyzed single item. The results are illustrated in Table 7.

Table 7. First appearance of prepositions in the P+XP context across MLU Groups

Groups	P+XP
Group1	*a* 'at/to', *di* 'of'
Group2	*con* 'with', *in* 'in', *per* 'for'
Group3	*da* 'from', *su* 'on', *sotto* 'under', *sopra* 'on/above', *dentro* 'inside'
Group4	*dentro a* 'inside at', *sopra di* 'above of', *vicino a* 'next to', *accanto a* 'next to'
Group5	*dentro in* 'inside in', *sotto a* 'under at'
Group6	*di sopra di* 'on the top of', *fino a* 'till at/to', *in fondo a* 'at the end of', *tra* 'between'

Table 7 shows that all MLU groups were characterized by the emergence of at least one prepositional item in the context P+XP. The first prepositions were KP prepositions, followed by *p*P prepositions, which in turn were followed by AxPartP

prepositions. The last prepositional items produced were complex PPs with the fully-fledged PP structure in (1), i.e. [*p*P [AxPartP [KP [DP]]]]. Interestingly, AxPartP prepositions first appeared without the KP prepositions *a/di* 'at/of', and only in later MLU Groups they were followed by KP prepositions. Finally, in the last MLU Group, complex prepositional phrases composed of three morphemes emerged.

The order of emergence of prepositional items in P+XP contexts is provided in (7).

(7)   *Order of production: prepositional items in P+XP contexts*
         a/di 'at/of' > *con/in/su/per* 'with/in/on/for' > *da/sotto/sopra/dentro* 'from/under/above/inside' > *dentro a/dentro in/sotto a/vicino a/accanto a* 'inside at/inside in/under at/ next to/near to' > *di sopra di/fino a/tra* 'of above of/till at/between'

When comparing the first prepositional items produced in (7) to the adverbial items in (6), we notice that the earlier items produced in the two syntactic contexts differed. Notably, those items that were produced in both contexts appeared first in the adverbial context in Group 1, and only in Group 3 they were produced in the P+XP context.

We then performed an individual analysis. The individual orders for each child are reported in Table 8. In this case, an item was considered 'first produced' when it occurred with at least two different lexical items.

Table 8. Order of production of the prepositional items across children (P+XP context)

Children	Age range	MLU-Group range	Adverbial items
Camilla	2;2-3;4	G4-G6	a/con/da/di/in/per/su > /sopra/dentro/dentro in/accanto a/in fondo a/tra
Diana	1;8-2;6	G3-G6	a/di > con/da/in/per/su > di sopra di
Guglielmo	2;2-2;11	G2-G6	a/di > con/ in/per > su/da/fino/accanto a
Martina	1;7-2;7	G1-G4	a > di > con/in/dentro > accanto a/da/per/su
Raffaello	1;7-2;11	G1-G6	a/di > in/con/da/su > dentro/contro/sopra
Rosa	1;7-3;3	G1-G5	a > di/in/per > da/con/su/dentro > vicino a/dentro a
Claudia	1;11-2;6	G1-G2	a/di
Davide	1;6-2;0	G2	a/di/con/in
Federica	1;5-2;0	G2	-
Linda	1;4-2;0	G1-G2	a/di > in/per
Lorenzo	1;10-2;0	G2	a/di
Veronica	1;7-2;0	G1-G3	a/di > con/in/su
Elisa	1;11-2;1	G5-G6	a/di/in/con/su > da/dentro/sotto/vicino a
Gregorio	1;7-2;0	G1-G3	a/di > in/con/da/per/su > sotto/dentro
Marco	1;5-2;5	G1-G4	a/di > in/con/su/per/sotto > da> dentro/dentro in/sopra/sotto a/tra

Overall, the individual patterns illustrated in Table 8 replicated the order of production observed at the group level in (7). KP-prepositions were produced before the other prepositional items in 11 out of 15 children. KP-prepositions were then followed by *p*P prepositions, which in turn were followed by AxPart items. The AxPart preposition *su* was generally produced before the other AxPart items in the majority of children's recordings. AxPart prepositions first appeared without the KP preposition while only in the later stage(s) they were followed by KP prepositions. In 4 children this

developmental course was not found: Camilla, Elisa, Davide, and Federica. In Camilla and Elisa, KP and *p*P prepositions appeared in the same MLU Group. As for the adverbial items discussed in the previous section, a plausible explanation may reside in the high MLU values of Camilla's and Elisa's productions, while the relative order between KP and *p*P prepositions in (7) was detected at an earlier period, i.e., between the MLU Groups 1 and 2. The lack of the order between KP and *p*P preposition in Davide's productions may receive a similar explanation: we have recordings with P+XP only at G2. For Federica we have no relevant examples: we have two occurrences with prepositions, one with *di* and one with *per*. Hence, since these productions appeared with only one item, *di qua* 'lit. of here' and *per terra* 'lit. for ground', we excluded them according to the criteria previously outlined.

4.3.4. *Omission of prepositions*

We now address research question (Q4), namely which prepositional items are omitted by children. We found preposition omission only in P+XP contexts. This may be an artifact of the data we analyzed: it was indeed almost impossible to unambiguously establish when a preposition was missing when used adverbially. The omitted prepositions were *a* 'to/at', *di* 'of', *da* 'at/to', *con* 'with', *in* 'in', and *su* 'on'.

Preposition omission was a characteristic of the MLU Groups 1 to 3, and to a smaller extent of Group 4 as well (see Table 4). Conversely, only 8 occurrences of preposition omission were detected in the MLU Groups 5 and 6.

Table 9. Omission of prepositions in the P+XP context across MLU Groups

Groups	P+XP
Group1	*a* 'at/to', *di* 'of', *da* 'from', *in* 'in', *su* 'on'
Group2	*a* 'at/to', *di* 'of', *da* 'from', *in* 'in', *su* 'on', *con* 'with', *da* 'from',
Group3	*a* 'at/to', *di* 'of', *da* 'from', *in* 'in', *su* 'on'
Group4	*a* 'at/to', *di* 'of', *in* 'in', *su* 'on'
Group5	*a* 'at/to', *di* 'of', *in* 'in'
Group6	*a* 'at/to'

Prepositional items were omitted by 13 out of 15 children as illustrated in Table 10.

Table 10. Omitted prepositions per child across MLU Groups

Group	Child	Omitted P
Group 1	Gregorio/Rosa	a
	Claudia	a/di/su
	Linda/Marco/Martina	a/di/in/da
Group 2	Federica/Gregorio/Guglielmo	a
	Lorenzo	a/in
	Marco	a/di/in/su
	Martina	a/di/con/in/su
	Raffaello	a/di/da/in/su
Group 3	Gregorio	a/di
	Guglielmo/Marco	a/in
	Martina	a
	Raffaello	di/su
	Veronica	di
Group 4	Diana	a/su
	Marco/Raffaello	a
	Martina	a/da/in

Group		
	Rosa	in
Group 5	Guglielmo	a/in
	Rosa	in
Group 6	Diana/Guglielmo	a

Table 10 shows that the preposition *a* 'at/to' was the item that all children omitted. In addition to *a*, the majority of children omitted the preposition *di* 'of'.

We then tested whether omission preceded lexicalization of the prepositional item. Table 11 illustrates the prepositional items that were omitted and, among them, those that were also lexicalized in each child's production across MLU Groups.

Table 11. Omitted and lexicalized prepositions per child across MLU Groups

Group	Child	Omitted P	Lexicalized P
Group 1	Gregorio/Rosa	**a**	-
	Rosa	a	a
	Claudia/Linda/Marco/Martina	a/di/**in**/**da**	a/di
Group 2	Federica/Gregorio/Guglielmo	a	a
	Lorenzo	a/in	a/in
	Marco	a/di/in/su	a/di/in/su
	Martina	a/di/con/in/**su**	a/di/con/in
	Raffaello	a/di/da/in/**su**	a/di/con/in
Group 3	Gregorio	a/di	a/di
	Guglielmo/Marco	a/in	a/in
	Martina	a	a
	Raffaello	di/**su**	di
	Veronica	di	di
Group 4	Diana	a/**su**	a
	Marco/Raffaello	a	a
	Martina	a/da/in	a/da/in
	Rosa	in	in
Group 5	Guglielmo	a/in	a/in
	Rosa	in	in
Group 6	Diana/Guglielmo	a	a

Table 11 shows that omission precedes lexicalization in the case of *da* 'from', *in* 'in', and *su* 'on' in G1, G2, and G3. Interestingly, in Claudia's, Gregorio's, and Raffaello's productions at G1 and G2, the lexicalized *a* and *in* encoded a stative locative place, while, when omitted, these prepositions encoded a goal relation. In all other cases, omission and lexicalization of the same prepositional item coexisted.

5. Discussion

Children's capacity to produce complex structures develops over time with some structures emerging before others. Timing observations have played an important role in our understanding of language acquisition. Much research has indeed explored the relevance of statements like "Form A appears before Form B", asking what this may reveal about language development and the underlying syntax of the two structures. As in various acquisition studies (Pérez-Leroux et al., 2012), the timing of emergence is here assumed to reveal how syntax develops during language acquisition. We investigated the acquisition of prepositional items in Italian with the aim to determine the order in which prepositional items emerge during development. Assuming a

decomposed structure for prepositional phrases as proposed in Svenonius (2008, 2010), we sought to determine whether children's production of prepositional items followed the geometry and the featural composition of the syntactic tree in (2), here repeated as (8).

(8)   [SourceP [GoalP [PathP [pP [AxPartP [KP [DP]]]]]]]]

In addition, we aimed at verifying whether the traditional distinction between morphologically rich vs. poor languages in the production of functional material, like articles and auxiliaries, can be also found in the prepositional domain.

We conducted a longitudinal analysis of the early spontaneous speech of fifteen typically developing Italian-acquiring children aged 1;4 to 3;4. Four research questions were formulated: (Q1) How do the production and the omission of prepositional items develop across MLU Groups?; (Q2) In which order do adverbial prepositional items emerge in children's production?; (Q3) In which order do prepositional items in the context preposition plus complement emerge in children's production?; (Q4) Which prepositional items are omitted by children?

The development of production and omission of prepositional items

As expected, we found that the production of prepositions plus complement increased across the children's MLU values, while P-omission decreased. This finding is in line with previous studies (e.g., Littlefield, 2009). In addition, we found that adverbial prepositional items were produced more frequently than prepositions plus complement in children's groups with a low MLU. This result was also expected since adverbial prepositions can appear in one-word productions, unlike prepositions plus complement. Furthermore, prepositional items were produced both adverbially and in the preposition plus complement contexts in the same MLU Groups. This finding diverges from the results on English reported in Littlefield (2009). English-acquiring children first produced prepositions adverbially in the MLU range 1.5 to 2.49 and only at MLU 2.5-2.99 they produced prepositions in the context preposition plus complement. On the contrary, no such delay was observable in the Italian acquisition. We will come back to this.

The development of adverbial prepositions

Our analysis revealed that children produced adverbial prepositions in an adult-like fashion. The adverbial use of prepositions was limited to those items that are allowed in the adult grammar. Moreover, adverbial prepositions emerged in children's production following the order in (6), repeated as (9).

(9)   *dentro/su* 'inside/up' > *sopra/sotto* 'above/down' > *contro* 'against'

Dentro 'inside' and *su* 'up' emerged when children's MLU had the values of 1.0-1.49 words per utterance (Group 1). At the second MLU stage ranging from 1.5-1.99 (Group 2), the adverbial prepositions *sopra* 'above' and *sotto* 'down' emerged. Finally, *contro* 'against' appeared at the third MLU stage ranging from 2.0-2.49 words per utterance (Group 3).

The order in (9) does not depend on the syllable length of the items. Both monosyllabic and polysyllabic adverbial expressions, respectively *su* 'up' and *dentro* 'inside', were produced in MLU Group 1. Both items were produced in isolation as well as with at least another word with no detectable differences. Likewise, as noticed by a

reviewer, the order in (9) does not seem to correlate with morphological complexity either. While the later adverbs are monomorphemic, *dentro* is bimorphemic -being composed of *de+entro*-: it is nonetheless the first item that children produced.

The order in (9) mirrors the hierarchy proposed in Clark (1973), according to which items encoding more general spatial relations are acquired before items encoding more specific relations. The emergence of prepositions reflects the way in which discriminations among spatial relations are acquired, with containment being the earlier acquired spatial relation (Brown, 1973; Johnston & Slobin, 1979; Johanson & Papafragou, 2014). Containment is followed by the spatial relation of support without contact. Support is followed by contact, in turn, followed by goal, which is then followed by source, and then by more complex relations encoding path. In Svenonius's proposal, these semantic features are encoded in the functional heads of the split-PP in a cumulative fashion (see (2)). Hence, the conceptual development patterns with the syntactic development. The order in (9) illustrates the gradual transition from underspecified or less specified locative structures to prepositional phrases encoding additional features and thus, more complex relations.

The development of prepositions in P+XP contexts

We found that in the context preposition plus complement children acquire prepositional items at different stages following the order in (7), repeated as (10).

(10)   *a/di* 'at/of' > *con/in/su/per* 'with/in/on/for' > *da/sotto/sopra/dentro* 'from/under/above/inside' > *dentro a/dentro in/sotto a/vicino a/accanto a* 'inside at/inside in/under at/ next to/near to' > *di sopra di/fino a/tra* 'of above of/till at/between'

The prepositional items *a* 'at/to' and *di* 'of' emerged at the first MLU stage (Group 1). The prepositions *con* 'with', *in* 'in', *su* 'on', and *per* 'for' appeared at the second MLU stage (Group 2). At the third MLU stage (Group 3), *da* 'from' and a series of other prepositions, *sotto* 'under', *sopra* 'above', and *dentro* 'inside', emerged. When the MLU value was 2.5-2.99 (Group 4) and 3.0-3.49 (Group 5), the combination of two prepositional morphemes appeared in children's production. Finally, in the last stage with the MLU value 3.5-5.53, more complex prepositions were produced consisting of three morphemes. The order in (10) shows that the length of the lexical items does not determine the order of appearance. Although it is true that monosyllabic prepositions appeared earlier than longer prepositional items, the relative order between monosyllabic prepositions remains to be explained. In addition, notice that the monosyllabic preposition *tra* emerges in the late MLU group.

We believe that the order in (10) may receive a more exhaustive explanation when we adopt the approach in Svenonius (2008, 2010, 2012) (Section 2.2). According to his classification of PPs, children start with the production of KP prepositions, then move to pP prepositions and, only later, AxPartP prepositions appear. Our results show that the order in which prepositional items are acquired does not necessarily follow the linear order of the syntactic projections, as proposed in the maturational accounts (e.g., Rizzi, 1993/4; Radford, 1995). Although AxPartP is the complement of p^0, the prepositional items lexicalizing p^0 were produced earlier than those lexicalizing the AxPart^0 head. Rather, the timing in which the items were produced matches the featural incremental decomposition of the relevant heads as suggested in Svenonius's works (see also Mitrofanova 2016 for a similar conclusion).

The developmental course KP > *p*P > AxPartP we found in Italian is similar to the order of production reported for French and Spanish (Yánez and Zúñiga, 2009; Morgenstern & Sekali, 2009; Stewart, 2015), while it diverges from that reported on English, German, and Greek (Littlefield, 2005, 2009; Grimm, 1975; Alexaki, Kambanaros & Terzi, 2009). English children produced AxPartP prepositions in the preposition plus complement contexts at MLU 2.5-2.99, whereas KP-prepositions appeared at MLU 3.5-3.99.

Our results further revealed that the early prepositions produced in the preposition plus complement contexts differed from those produced adverbially. Also in this respect, our developmental path matches the one reported for French and Spanish, while it differed from the one observed for English in Littlefield (2005, 2009). In English those prepositions that were produced adverbially were also the first ones appearing in the preposition plus complement contexts and KP prepositions were found much later than adverbial and *p*P items. Notice that while English has particles in addition to adverbial prepositions, Standard Italian lacks them -or has a very limited distribution of particles (see Garzonio & Rossi 2020). Hence, the heavier use of AxPartP prepositions reported for English may be due to their double nature: besides being used adverbially, AxPartP prepositions can also be employed as particles, a syntactic use not available in Italian (see also Littlefield, 2009).

In sum, our findings suggest that, as in the case of other functional morphemes, the acquisition of prepositional items is different depending on whether the target language has a rich or a scarce inventory of functional morphemes (Clark, 2017).

Preposition omission

P-omission was found in the majority of children's productions, especially in the early MLU Groups, G1 to G3. Our investigation revealed that all children omitted KP-prepositions, especially *a* 'at/to'. We found stages in which both omission and lexicalization of the same prepositional item coexisted in the child's productions. In this respect, our finding matches what was reported in the literature for functional elements, e.g., articles, auxiliaries (e.g., Caselli et al., 1999), and for prepositions (e.g., Mitrofanova 2016): there are stages in which functional material is optionally produced.

In addition, we found that *da* 'from', *in* 'in', and *su* 'on' were first omitted, and only in a later MLU Group were produced. Likewise, in the case of *a* and *in* the lexicalized version encoded stative locative relations, while the omitted ones encoded a goal locative relation. In these cases, omission of the morpheme preceded its lexicalized version. We may interpret these findings as evidence for an incomplete acquisition of the *p*P and directional layer of the structure in (2).

In conclusion, prepositional phrases are acquired in an incremental way following the geometry of the syntactic trees and the feature decomposition proposed in Svenonius (2008, 2010). Moreover, the acquisition of prepositional items has a different trajectory depending on whether the target language has a rich or a scarce inventory of functional morphemes (Clark, 2017). Further research, crucially with experimental settings, is needed to verify the robustness of the proposed orders of emergence. Although our analysis suffers the limitation intrinsic to corpus searches and thus our data should be taken with caution, our findings suggest that early stages correspond to small portions of the adult syntactic tree, which gradually grows during development. The developmental path observed in our data shows that the acquisition of syntactic structures proceeds in an incremental fashion from the lower layers encoding fewer and more basic features to more featurally-specified and higher projections.

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